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Vigor and Viability of Cagaita (*Eugenia dysenterica* DC.) Seeds Subjected to Different Substrates

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Authors' contributions

This work was performed in collaboration among all authors. Authors HVN and DIB designed the study and performed the statistical analysis. Authors JPPS, KRSO and BAB wrote the protocol and wrote the first draft of the manuscript. Authors BHNN, RFN and GHAC managed the study analyzes. Finally, authors CPM, KCLV and LBO managed the bibliographic searches. All authors read and approved the final manuscript.

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ABSTRACT

Cagaita originates from the Brazilian Cerrado and belongs to the Myrtaceae family. It is a fruit tree and widely disseminated in the Brazilian Cerrado, and can reach up to 10 meters high. To obtain quality seedlings it is necessary to use substrates that have physical and chemical properties suitable for plant development. Also, the quality of the substrate is directly related to the proportions and the material that makes up the mixture. The experiment was conducted in a greenhouse at the Federal Institute of Education (IFTO), Science and Technology of Tocantins, Gurupi/TO city, from

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November 1, 2017, to February 26, 2018. Cagaita (*Eugenia dysenterica* DC.) seeds taken directly from the fruit were used to perform the experiment, which was collected in the urban region of Peixe - To in October 2017. Six types of substrates were used for the installation of the experiment, which was: Washed Sand; Washed Sand + Coconut Shell + Black Soil + Poultry Manure; Black Soil; Pine Bark + Poultry Manure + 25% Commercial Substrate Plantmax®; Earthworm Humus + Black Soil + 25% Commercial Substrate Plantmax®; 25% Commercial Substrate Plantmax® + Poultry Manure + Black soil + washed sand. The substrates of earthworm humus + Black Soil + 25% commercial substrate Plantmax® and 25% Commercial Substrate Plantmax® + Poultry Manure + Black Soil + Washed Sand provided the highest values of viability and vigor in Cagaita seeds.

Keywords: Cerrado; germination; fertility; Eugenia dysenterica; plantmax®.

1. INTRODUCTION

Tropical fruits each year evolve a lot in the preference of the most demanding consumers, especially in the case of aroma and flavor, indicating a growing trend in the national and international market. Among the exotic tropical fruits, Cagaita (*Eugenia dysenterica* DC.) stands out for having unparalleled nutritional qualities. Due to its pleasant aroma and slightly acidic flavor, the fruit pulp is mainly used in the manufacture of soft drinks, ice cream, jellies, and sweets, besides also being used to obtain vinegar and alcohol [1].

Cagaita originates from the Brazilian Cerrado and belongs to the family Myrtaceae, according to [2], which occurs in higher density in the red-yellow latosol and where the average annual temperature ranges from 21°C to 25°C. It is a fruit tree and widely disseminated in the Brazilian Cerrado, and can reach up to 10 meters high. Its fruit is a berry-shaped, with pale yellow color and can measure from 2 to 3 centimeters in diameter, containing from 1 to 3 seeds wrapped in a slightly acidic pulp [3]. It also states that the bark, in addition to serving the tannery industry, is used in folk medicine as an antidiarrheal [4], also highlight that these fruits when immature can be used as fodder for cattle.

The leaves and bark of this species are used in folk medicine for the treatment of diarrhea, diabetes, and jaundice. Cagaita fruits are naturally processed and processed into liqueur, ice cream, juice, or jam. They are sources of vitamin B, vitamin C, and niacin, as well as amino acids and proteins. They have a wide variety of antioxidant substances, phenolic compounds, and carotenoids that can reduce the risk of various diseases. Its leaves are already used in folk medicine as antidiarrheals, for heart problems, in the treatment of diabetes and jaundice. Its oil has antifungal activity, assisting in the control of *Cryptococcus neoformans* [5].

To obtain quality seedlings it is necessary to use substrates that have physical and chemical properties suitable for plant development. Also, the quality of the substrate is directly related to the proportions and material that composes the mixture [6]. The use of a good substrate is essential for the production of seedlings, as it ensures the establishment of planting, reduces the time of formation and losses in the field. The substrate is responsible for the fixation of the plant and its quality should remain the same for a long period so that the cultivation system is standardized [7].

Thus, the objective of this work was to evaluate the effect of different substrates on the viability and vigor of Cagaita seeds.

2. MATERIALS AND METHODS

The experiment was conducted in a greenhouse at the Federal Institute of Education, Science and Technology of Tocantins, Gurupi/TO city, from November 1, 2017, to February 26, 2018. Cagaita (*Eugenia dysenterica* DC.) seeds taken directly from the fruit were used to perform the experiment, which was collected in the urban region of Peixe–TO in October 2017. The harvested fruits were submitted to pulping for seed removal (with an abundant presence of mucilage). The seeds were removed from healthy and ripe fruits, washed in running water, and macerated in a sieve to facilitate the separation of the seed from the pulp. Then disinfected with 0.5% sodium hypochlorite solution and spread on paper towels, remaining in the shade for 12 hours.

Six types of substrates were used for the installation of the experiment, which was: Washed Sand (WS); Washed Sand + Coconut Shell + Black Soil + Poultry Manure (WS + CS + BS + PM); Black Soil + Pine Bark + Poultry Manure + 25% Commercial Substrate Plantmax® (BS + PB + PM + CS); Earthworm Humus +

Black Soil + 25% Commercial Substrate Plantmax® (EWH + BS + CS); 25% Commercial Substrate Plantmax® + Poultry Manure + Black Soil + Washed Sand (CS + PM + BS + WS). We used 100 seeds per treatment (substrate), divided into 4 replicates with 25 seeds each. The sowing was held on November 1, 2017, in the greenhouse of the IFTO campus. All trays with the substrates already sown were submitted to two irrigations in the first 30 days and then once a day in the rest of the seedling formation period.

After the installation of the experiment, the evaluation and data collection procedure were initiated. The following characteristics were evaluated:

- **Root Length (RL) and Length of the Aerial Part (LAP):** The seedlings were removed from the trays and with the aid of a ruler graduated in centimeters, it was measured from the apical bud to the end of the root and apical bud to the apex of the seedling, respectively.
- **Root Dry Mass (RDM) and Shoot Dry Mass (SDM):** The seedlings, after being removed from the substrates were cut and separated into roots and shoots, placed in paper bags, taken to a regulated greenhouse with forced air circulation at a temperature of 65°C, where they remained until they reached weight as long as. The results were expressed in grams per repetition, according to recommendations of [8].
- **Number of Sheets (NS):** After removal, the number of leaves of each seedling was counted.
- **First Emergency Count (FEC):** The first emergency count was performed 21 days after sowing.
- **Seedling Emergence (SE):** The count of the number of germinated seeds stabilized 42 days after sowing, about the maximum visual length, which presented the perfect essential conditions [9].

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 when indicating differences in substrate quality (Table 1), where the highest values of RL, were obtained when seeds were sown on the substrates of EWH + BS + CS (12.8 cm),CS + PM + BS + WS (11.1 cm), intermediate substrates WS + CB + BS + PM (8.9 cm), BS (8.8 cm) and low in substrates WS (7.4 cm) and PB + PM + CS (7.7 cm) [10], working with pine rootstock also verified that the CS was the one that provided better root development, due to its higher fertility. It was also observed that the highest values of SL were obtained in the substrates of EWH + BS + CS (12.2 cm), CS + PM + BS + WS (12.6 cm), intermediate in the substrates WS + CS + BS + PM (10.0 cm), BS (9.9 cm) and low substrates WS (7.9 cm) and PB + PM + CS (8.1 cm) [11], highlight that EWH is an excellent fertilizer, capable of improving chemical, physical and biological attributes of the soil, and should be used for seedling production. [12], also mention that EWH, because it is rich in phosphorus, calcium, and potassium, can be part of the composition of substrates for seedling production.

Regarding the highest values of RDM and SDM (Table 1), the substrates of EWH + BS + CS (1.3 g and 1.9 g) and CS + PM + BS + WS (1.2 g and 1.9 g), respectively, were obtained from the substrates of the root mass of the root and shoots intermediate values in the substrates WS + CS + BS + PM (0.5 g and 1.0 g) and BS (0.6 g and 1.0 g) Respectively. [4], suggests that the best substrate for seedling production should have a balance between mineral material, organic matter, air and water.

The data regarding the number of sheets, depending on the different substrates (Table 2), even with small variation (7.3 to 9.1 un.), the substrates of EWH + BS + CS (8.9 cm), CS + PM + BS + WS (9.0 cm) and WS + CS + BS + PM (9.1 un.) stood out. Regarding the FEC of seedling and SE, once again the substrates of EHW + BS + CS (63.1% and 94.1 %) and CS + PM + BS + WS (61.6% and 91.5%), respectively. According to [13], Cagaita seeds can present a germination rate of up to 95%, however, it presents a lot of uniformities.

Under natural conditions, germination occurs at the beginning of the rainy season, with no ecological impediments to germination, although the presence of growth inhibitor, which is quite weak in the embryo, has already been reported [14]. The intermediate results were obtained in the substrates WS + CS + BS + PM (41.7% and 87.7%) and BS (45.2% and 85.7%), respectively. And lower in the substrates WS (29.4 % and 55.9 %) and PB + PM + CS (21.3% and 64.7%), respectively. [15], highlight that in addition to

Table 1. Root length (cm), the aerial part (cm), dry root mass (g) and shoot dry mass (g) Cagaita seedlings submitted to different substrates

Treatment	RL	LAP	RDM	SDM
WS	7,4c	7,9 c	0,4b	0,5c
WS + CS + BS + PM	8,9b	10,0 b	0,5b	1,0b
BS	8,8 b	9,9 b	0,6b	1,0b
PB + PM + CS	7,7c	8,1 c	0,5b	0,6c
EWH + BS + CS	12,8a	12,2a	1,3a	1,9a
CS + PM + BS + WS	11,1a	12,6a	1,2a	1,9a
CV (%)	5,8	4,6	0,8	1,3

CV= Coefficient of variation

Averages followed by the same letter in the column do not differ from each other by the Tukey test to 5%

Table 2. Number of sheets (un), first emergency count (%) and seedling emergence (%) Cagaita seeds submitted to different substrates

Treatment	NS	FEC	SE
WS	7,3 b	29,4 c	55,9 c
WS + CS + BS + PM	9,1a	41,7 b	87,7 b
BS	7,1 b	45,2 b	85,7 b
PB + PM + CS	6,6 b	21,3 c	64,7 c
EWH + BS + CS	8,9a	63,1a	94,1a
CS + PM + BS + WS	9,0a	61,6a	91,5a
CV (%)	2,5	11,9	15,8

CV = Coefficient of variation

Averages followed by the same letter in the column do not differ from each other by the Tukey test to 5%

performing the function of supporting plants, the substrates must provide adequate water and air supply to the root system, be free of phytopathogens, easy to manage, low cost, high availability and have long durability.

4. CONCLUSIONS

The substrates of Earthworm humus + Black Soil + 25% commercial substrate plantmax® and 25% commercial substrate Plantmax® + Poultry Manage + Black Soil + Washed Sand provided the highest values of viability and vigor in Cagaita seeds. These substrates play a fundamental role in increasing root production, being fundamental for nutrient absorption and consequent development, and initial vigor of the seedling.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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