Different Substrates for Seedling Production from Passion Fruit (*Passiflora edulis* var. flavicarpa)

Abstract

Research has been conducted with the yellow passion fruit crop, with emphasis on different formulations of substrates for seedling production, with good results. The appropriate substrate should present good physical, chemical, and biological characteristics, enabling, thus, the rapid growth of the seedling, a good dry matter content in the aerial and root parts, among other characteristics. This study aimed to evaluate the effect of different substrates on the viability and vigor of passion fruit seeds. Brs Giant yellow passion fruit seeds were used to this end (*Passiflora edulis* var. flavicarpa) directly from the fruits, which were collected in a property located in the municipality of Peixe in the southern region of the state of the Tocantins in Brazil. After the installation of the experiment, the process of evaluation and data collection was initiated. The highest values of root length and aerial part of seedlings were obtained when the seeds were sown in the moss substrate of Earthworm Humus, intermediate values in substrates 50% Wood Sawdust + 50% Washed Sand and 50% Black Soil + 50% Cattle Manure. It was also observed that the highest dry mass values of the root and shoot were obtained in the Earthworm Humus, intermediate values in substrates 50% Wood Sawdust + 50% Washed Sand, and 50% Black Soil + 50% Cattle Manure. The first emergency and emergence count of seedlings, due to the different substrates once again the substrate of Earthworm Humus stood out. Intermediate results were obtained in the substrates Washed Sand and 50% Black Soil + 50% Cattle Manure. The Earthworm Humus substrate of worm provided the highest values of viability and vigor in passion fruit seeds, followed by the mixture 50% Black Soil + 50% Cattle Manure. For the experiment, five types of substrates were evaluated: Washed Sand, Black soil, Wood Sawdust + Washed Sans + Black Soil + Cattle Manure, and substrate Earthworm Humus.

Keywords: Physiological quality, passion fruit, seeds, substrates.

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1. Introduction

The yellow passion fruit (*Passiflora edulis* var. flavicarpa), the fruit of the passion fruit, is a climbing plant of the family of Passifloráceas, can be grown in most tropical and subtropical regions, therefore a tropical fruit tree native to, whose cultivation has evolved very rapidly in Brazil. The genus *Passiflora* has a large number of species, more than 400, of which are about 120 natives [1].

Despite this, the commercial crops of the country are based on a single species, the yellow passion fruit or sour (*Passiflora edulis* var. flavicarpa), representing more

than 95% of orchards due to the quality of their fruits, vigor, productivity and juice yield [2].

Research has been carried out with the yellow passion fruit crop, with emphasis on different substrate formulations for seedling production [3, 4] with getting good results. The substrate used for seed germination has a great influence on seedling emergence and subsequent seedling formation. In the seedling production process, the study of an appropriate substrate that provides favorable conditions for seedling development, it is necessary, because the quality of the seedling is fundamental in the implementation of a productive orchard.

The substrate with good chemical and organic composition, of utmost importance, because it influences the nutritional status of seedlings [5]. The appropriate substrate should present good physical, chemical, and biological characteristics, enabling, thus, the rapid growth of the seedling, a good dry matter content in the aerial and root parts, among other characteristics.

For seedling production, substrates are usually prepared by producers themselves using various pure materials or in mixtures, taking into account, mainly, the regional availability. The best substrates for seedling formation should present some important characteristics, such as availability of acquisition and transport, absence of pathogens, richness in essential nutrients, adequate pH, texture, and structure [6].

This study aimed to evaluate the effect of different substrates on the viability and vigor of passion fruit seeds.

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2. Material and Methods

The experiment was conducted in a greenhouse at the Federal Institute of Education, Science, and Technology of Tocantins, Gurupi/TO city from Brazil, August 5 to November 5, 2016. Brs Gigante yellow passion fruit seeds were used to this end (*Passiflora edulis* var. flavicarpa) directly from the fruits, which were collected in the same period and obtained from a small passion fruit production property, located in the municipality of Peixe. The harvested fruits were selected and submitted to pulping for seed removal and treatment of the seeds. After this process, the seeds were disinfected with sodium hypochlorite solution in the proportion of 2 spoons (soup) shallow in 2 liters of water, then scattered on paper towel remaining in the shade for 24 hours, for the removal of excess water.

For the experiment, five types of substrates were evaluated: Washed Sand (WS); Black Soil (BS) + Wood Sawdust (WSD) + Washed Sand (WS), Black Soil (BS) + Cattle Manure (CM) and substrate Earthworm Humus (EHW).

All trays with the substrates already sown were submitted to two irrigations daily until the end of the process. After the installation of the experiment, the process of evaluation and data collection was initiated.

The following characteristics of the:

- **Root Length (RL) and Shoot Length (SL):** Normal seedlings were removed from trays and cotyledons removed. The length of root and shoot was measured with the aid of a ruler graduated in centimeters, measuring themselves from apical yolk 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 for [7].
- **Dry weight of Root (DWR) and dry weight of shoot (DWS):** Seedlings, after being removed from the substrates were properly cut and separated into roots and shoots, placed in paper bags, carried to a regulated greenhouse with forced air circulation at a temperature of 55º C, where they remained until they reached a constant weight. The results were expressed in grams by repetition, according to recommendations [7].
- **First emergency count (FEC):** The first emergency count was performed at 40 days after sowing. The collected data were corresponding to the cumulative percentage of normal seedlings, with values recorded for each substrate.
- **Seedling emergency (SE):** 100 seeds were used, distributed in four replicates of 25 seeds. The count of the number of germinated seeds started from the first emerged plant and extended to the stabilization of emergence in all substrates. The criterion used was that of normal seedlings that presented the perfect essential structures [8], and the results expressed as a percentage.

The data were submitted to variance analysis and the means compared by the Tukey test, using the statistical program R® [9].

3. Results and Discussion

The results obtained were descriptively analyzed. According to the data present in Table 1, it was observed that the highest values of root length and aerial part of seedlings were obtained when the seeds were sown in the EHW (17.9 cm and 19.6 cm),

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intermediate values in substrates 50% WSD + 50% WS and 50% BS + 50% CM (11.0 cm, 17.3 cm, and 11.2 cm, 11.4 cm), respectively and low on the substrates WS and BS (5.2 cm, 5.0 cm, and 6.5 cm, 5.5 cm). It was also observed that the highest dry mass values of the root and shoot were obtained in the EHW (8.2 g and 7.9 g), intermediate values in substrates 50% WSD + 50% WS and 50% BS + 50% CM (1.02 g, 3.14 g, and 2.85 g, 2.05 g), respectively and low on the substrates WS and BS (0.11 g, 0.16 g, and 0.32 g, 0.15 g). [10] 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. [11] also mention that the Earthworm Humus, because it is rich in phosphorus, calcium, and potassium, maybe part of the composition of substrates for seedling production.

Data on the first emergency and emergence count of seedlings, depending on the different substrates are shown in Table 1. Once again stood out the EHW (98% and 100%). Intermediate results were obtained in the substrates WS and 50% BS + 50% CM (67%, 77% and 62%, 83 %), respectively. The lowest vigor results first emergency count and seedling emergence were obtained in the mixtures of BS and 50% WSD + 50% WS (54%, 60 %, and 37 %, 50 %), respectively.

Table 1. Root Length, air part Shoot Length, Dry Weight of Root and Dry Weight of Shoot, First Emergency Count, and Seedling Emergence of passion fruit seeds on different substrates.

Treatments	RL (cm)	SL (cm)	DWR (g)	DWS (g)	FEC (%)	SE (%)
WS	5.2c	5.0c	0.11c	0.16c	67b	77b
BS	6.5c	5.5c	0.32c	0.15c	54ab	60bc
50% WSD + 50% WS	11.0 b	17.3a	1.02bc	3.14b	37c	50c
50% BS + 50% CM	11.2 b	11.4b	2.85b	2.05b	62b	83b
EHW	17.9a	19.6a	8.20a	7.91a	98a	100a
C.V (%)	12.7	14.6	7.89	7.54	19.2	15.1

Highlight that in addition to exercising the function of supporting plants, the substrate should provide adequate water and air supply to the root system, be free of phytopathogens, easy to handle, low cost, high availability, and have a long durability, characteristics observed in the EWH [12].

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4. Conclusion

The Earthworm Humus substrate of worm provided the highest values of viability and vigor in passion fruit seeds, followed by the mixture 50% Black Soil + 50% Cattle Manure.

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