Original Research Article

VIABILITY AND VIGOR OF *Annona squamosa*, L. SEEDS IN DIFFERENT SUBSTRATES

ABSTRACT

The *Annona squamosa* belongs to the Annonaceae family and is native to Tropical Americas and the West Indies. Its fruit can be consumed fresh, but it is also used in various foods such as purees, ice creams, mousses, yogurts, and traditional juices. For this reason, its economic relevance in Brazil has been significant, driven by the growing demand in the consumer market.The production of quality seedlings depends on various factors, with substrate composition being of great importance. The germination of seeds, root initiation, and rooting are directly linked to the chemical, physical, and biological characteristics of the substrate. The experiment was conducted at the Federal Institute of Education, Science, and Technology of Tocantins, in the city of Gurupi - TO, between March 4, 2022, and August 22, 2022. Seeds of *Annona squamosa* were taken from the fruit itself and sown in the following substrates: Washed sand; Commercial substrate + rice husk + chicken manure; Black soil; Black soil + coconut shell powder + commercial substrate. The substrate black soil + coconut shell powder + commercial substrate provided higher viability and vigor values in *Annona squamosa* seeds.

Keywords: Substrate, germination, quality

INTRODUCTION

The *Annona squamosa*, L. belongs to the Annonaceae family and originated in the tropical regions of the Americas, specifically on Trindade Island and the West Indies. In Brazil, it was introduced by Count “Miranda” in the year 1626 [1]. Its fruit can be consumed fresh or used in various foods such as purees, ice creams, mousses, yogurts, and traditional juices.

In different regions of Brazil, the fruit is called by distinct names. For example, in the states of Pará, Maranhão, and Ceará, it is known as "Ata," while in the states of Bahia, Pernambuco, Paraíba, and Alagoas, it is called "pinha". In the states located in the South and Southeast regions of the country, it is known as "fruta-do-conde" [2]. It thrives in warm and dry climates, being sensitive to extreme cold temperatures [3, 4].

The tree of the species (*Annona Squamosa*, L.) is small, measuring from 4 to 6 meters in height. It is highly branched, with lanceolate-shaped leaves, approximately 6 to 7 centimeters long. Its fruit is a rounded syncarpous with a diameter of 5 to 10 centimeters, relatively heavy, weighing from 150 to 650 grams. The fruit has prominent carpels with green tuber-like protrusions. Its pulp is creamy and translucent, with a white color and small black seeds. This Annonaceae presents fruits with a very pleasant taste, rich in minerals and vitamins, making it a good dietary supplement. Additionally, chemical compounds, such as acetogenins and alkaloids with insecticidal and medicinal activities, have been isolated from different parts of the plant [1].

There are many recommendations regarding the ripeness of the fruits for the extraction of seeds used in the propagation process. Observing the ripeness stage is crucial for preserving the germinative power of the seeds, considering that factors such as seed nature and environmental conditions affect their germinative power [5, 6, 7].

The primary propagation technique employed in this species is grafting, with the rootstock being generated from seeds [8]. The sugar apple tree is robust, growing and producing in different types of soils. However, for optimal performance, it requires well-drained soils of good depth, with medium to high fertility, and does not tolerate excessive water around its trunk [9].

In seedling production, the type of substrate plays a significant role in the entire germination process and plant growth. As mentioned by Ramos et al. (2002) [10], one of the functions of the substrate is to create ideal conditions for the germination and development of the seedlings' root system. Moreover, as highlighted by Oliveira et al. (2012) [11], the type of substrate plays a crucial role in seedling formation, being essential to ensure satisfactory results in their production.

Despite advances in seed technology research in Brazil, there is still much to be

explored concerning fruit species. The lack of basic technological knowledge limits the practice of seed analysis, making it challenging to obtain information that truly reflects physical and physiological quality [12].

The objective of this research was to evaluate the viability and vigor of *Annona squamosa* seeds in different substrates.

MATERIALSAND METHODS

The experiment was conducted in a greenhouse at the Federal Institute of Education, Science, and Technology of Tocantins, located in Gurupi - TO, during the period from March 4th to August 22nd, 2022. To experiment, seeds of *Annona squamosa* L. were used, directly taken from the fruit, which were harvested in the urban area of Gurupi in March 2022.

The collected fruits underwent a pulping process to remove the seeds. The seeds were extracted from fruits that were in good and ripe condition. Subsequently, the fruits were washed with running water and mashed through a sieve, making it easier to separate the seeds from the pulp. Afterward, the seeds were spread on paper towels for a brief period to lose excess water and then stored in sanitized plastic bags for conservation.

For the experiment, four types of substrates were used: Washed sand (WS), Commercial substrate + rice husk + chicken manure (CS + RH + CM), Black soil (BS), Commercial substrate + Black soil + Coconut shell powder (CS + BS + `CSP). One hundred seeds per substrate were selected, and divided into 4 repetitions of 25 seeds each. Trays with the sown substrates submittedtwo irrigations in the first 30 days, followed by daily irrigation during the remaining period of seedling formation.

Size, water content, dry mass content, germination, and vigor are the most relevant characteristics in seed maturation studies [13]. However, Carrasco and Castanheira (2004) [14] warned that external visual characteristics such as color, smell, and texture of fruits and seeds are good practical indicators in the field to help determine the ideal point for seed harvest.

With the experiment set up, data collection and analysis processes began, evaluating the following characteristics:Root length (RL) and aerial part length (APL): After removing the seedlings from the trays, the root and aerial part lengths are measured with a ruler marked in centimeters.For root length, was measured from the apical bud to the end of the root, and for the aerial part, it was measured from the apical bud to the apex of the seedling.Number of leaves (NL): With the seedlings removed and after the initial data analysis, the count of the number of leaves per seedling was performed.First emergency count (FE): The first emergency count was conducted 21 days after sowing.Seedling emergence (SE): The count of germinated seeds began 21 days after sowing and continued until the stabilization of emergence in all substrates. The

criterion adopted was to select healthy seedlings that exhibit fundamental structures in an ideal state [15].

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

RESULTS AND DISCUSSION

In general, the evaluated characteristics showed sensitivity in indicating differences among the substrates assessed (Table 1), where the highest values for root length and aerial part length were obtained with seeds sown in the substrate black soil + coconut shell powder + commercial substrate (21.0; 18.4 cm), black soil (12.6; 9.2 cm), commercial substrate + rice husk + chicken manure (11.2; 10.6 cm), respectively, and the lowest in the washed sand substrate (8.1; 7.3 cm), respectively.

Likely, the more fertile substrates provided better development of these characteristics. Notaro et al. (2012) [16], working with pine rootstocks, also observed that the commercial substrate provided the best root development, owing to its higher fertility.

According to the study by Gomes et al. (2002) [17], measuring the aerial part length of seedlings offers a convenient and meaningful way to assess the morphological quality of seedlings, as this measure is easily obtained and plays a relevant role in determining quality.

Table 1. Root length (cm), aerial part length (cm), number of leaves (units), (%), and seedling emergence (%) of *Annona squamosa*, subjected to different substrates, IFTO - TO, 2022.

Treatments	RL	APL	NL	PE	SE
WS	8,1 b	7,3 b	4,3 b	2,0 b	12,0 b
CS + RH + CM	11,2ab	10,6ab	8,9ab	4,0ab	24,0a
BS	12,6ab	9,2ab	8,3ab	2,0 b	16,0ab
CS + BS + `CSP	21,0a	18,4a	10,5a	5,3a	24,0a
C.V (%)	12,5	11,2	5,1	3,1	9,3

CV = Coefficient of variation. Means followed by the same letter in the column are not intense relative to each other by the Tukey test at 5%.

Regarding the number of leaves, there was a significant variation (4.3 to 10.5 units), with higher values for seeds sown in the commercial substrate + black soil+ coconutshell powder (10.5 units), black soil (8.3 units), commercial substrate + rice husk+ chicken manure (8.9 units), respectively, and lower in the washed sand substrate (4.3 units) (Table 1). This variation likely occurred due to the higher fertility of some substrates and a low germination percentage.

In general, the results obtained for the first emergence count (Table 1) were low but allowed differentiation of seeds in vigor levels, meaning they were influenced by the

substrates used. The seeds were more vigorous when sown in the substrate black soil + coconut shell powder + commercial substrate (5.3%) and commercial substrate + rice husk+ chicken manure (4.0%), and lower in the washed sand and black soil substrates (3.0%; 2.0%), respectively. Godoy and Farinácio (2007) [18] emphasize that the substrate should serve as support for seedlings, provide adequate water and air supply, be free of phytopathogens, easy to manage, low cost, highly available, and longlasting.

Regarding seedling emergence, once again, the values were low, with the substrate black soil + coconut shell powder + commercial substrate (24.0%) and commercial substrate + rice husk+ chicken manure (24.0%) standing out, and lower in the washed sand substrate (12.0%), respectively. Nunes et al. (2002) [19], working with cagaita seeds, found that substrates consisting of worm castings + black soil + commercial substrate and commercial substrate + chicken manure + black soil + washed sand provided the highest viability and vigor values in cagaita seeds. Aquino and Loureiro (2004) [20] highlight that substrates with higher fertility, due to better chemical, physical, and biological soil attributes, should be used for seedling production. Araújo Neto et al. (2009) [21] also mention that substrates rich in phosphorus, calcium, and potassium can be part of the composition of substrates for seedling production.

Substrates containing sand stood out, highlighting the importance of aeration and avoiding waterlogging. Godoy and Farinacio (2007) [18] emphasize that, in addition to supporting plants, the substrate should provide an adequate supply of water and air to the root system, be free of phytopathogens, easy to manage, low cost, highly available, and have long durability.

CONCLUSION

The substrate black soil + coconut shell powder + commercial substrate provided higher values of viability and vigor in *Annona squamosa* seeds.

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