European Journal of Medicinal Plants

33(1): 57-60, 2022; Article no.EJMP.76961
ISSN: 2231-0894, NLM ID: 101583475

Physiological Quality of Badea Seeds (*Passiflora quadrangularis* L.) with and Without Storingon 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 VDGM and LBAC wrote the protocol and wrote the first draft of the manuscript. Authors MSQ and LBDO managed the study analyzes. Finally, authors RAL, PVGS and BHDNN managed the bibliographic searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/EJMP/2022/v33i130446

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/76961

Original Research Article

Received 15 November 2021
Accepted 19 January 2022
Published 22 January 2022

ABSTRACT

Badea is known for the size and shape of the fruit, or as giant passion fruit. The propagation of passifloraceas is mainly done by means of seeds. Seed conservation is one of the main steps in seedling production that makes it possible to guarantee the maximum quality of theseed for a given period oftime and can be done through refrigeration.The experiment was conducted in the greenhouse of the Federal Institute of Education, Science and Technology of Tocantins, city of Gurupi/TO, from March 17 to August 10, 2020. After fruit harvesting, pulping was performed using running water and light friction in the nylon sieve with sand to facilitate the separation of the seed and pulp. Then the seeds were placed on a paper towel for 24hours, partly storedin the refrigerator for 10 days, and another part is sownimmediately. The seeds of passion fruit melon, without storage, sowed in the commercial substrate, showed greater viability and vigor.

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Keywords: Badea seeds; substrates; stored.

1. INTRODUCTION

The family *Passifloraceae* is composed of 17 genera, with 630 species. The genus *Passiflora* has approximately 400 to 530 species [1], among these 150 to 200 originates in Brazil and can be used as food, medicines, and decoration, of which they have multiple uses [2]. *Passiflora quadrangularis* is a species of the Family *Passifloraceae*, of Brazilian origin,and is found in all regions of Brazil, with greater frequency in the north, northeast, and midwest [3].

In Brazil, *P. quadrangularis* is often known as Badea, by the size and shape of the fruit, or as giant passion fruit.It is a tall vine, with whole leaves, large, large measuring 10 - 20 centimeters long by 8 - 10 centimeters wide. The flowers are detached, alvas and purpura [3,4]. Some authors think that the species is native to the Amazon and northern South America, cultivated throughout tropical America. [5] consider this variety one of the most distributed along the tropics. The fruits are yellow in color when ripe, large, 10 - 30 centimeters long and 10 - 18 centimeters wide.The pulp around the seeds is aromatic, little acidic and pleasant taste. The reproductive efficiency of this species is formidable when the flowers are manually pollinated [6].

The propagation of passifloraceas is mainly done by means of seeds and, second [7], the germination of passion fruit seeds is low and uneven, which hinders the formation of quality seedlings. Seed germination is influenced by the presence of a gelatinous covering, rich in pectin, which completely envelops the seeds. This can constitute a physical barrier, and also contain growth-regulating substances, which can contribute to uneven germination. Thus, the cover must be removed properly so as not to interfere with the germination process, or serve as a substrate for the development of microorganisms that impair the quality of the seed [7].The substrate has the task of supplying the needs of moisture seeds and providing favorable conditions for germination and successively the development of seedlings, and should maintain an adequate proportion between water availability and aecization and thus avoiding the formation of an aqueous film on the seed, which prevents the entry of oxygen and favors the propagation of pathogens [8]. When opting for a substrate, some issues should be considered, such as seed size, need for moisture and light, the ease it offers during installation, counting and seedling evaluation [9].

Seed conservation is one of the main steps in seedling production that makes it possible to ensure maximum seed quality for a given period of time, and can be done through refrigeration where seeds are stored at low temperature and relative humidity [10].

Therefore, the objective of this work was to evaluate the viability and vigor of melon passion fruit seeds with and without storage in different substrates.

2. MATERIALS AND METHODS

The experiment was conducted in the greenhouse of the Federal Institute of Education, Science and Technology of Tocantins, city of Gurupi/TO, from March 17 to August 10, 2020. To perform the experiment, melon passion fruit *(Passiflora quadrangularis)*seeds of harvested fruits were used in the rural region of Gurupi in March 2020. After fruit harvesting, pulping was performed using running water and light friction in the nylon sieve with sand to facilitate the separation of the seed and pulp. Then the seeds were placed on paper towel for 24hours, part stored in the refrigerator for 10days and another part sown immediately.

Three types of substrates were used to perform the experiment: Black soil, Commercial Substrate and Washed Sand. Both seed treatments (with and without storage) were soed on each substrate. Being used 100 seeds for each treatment, divided into 4 replications with 25 seeds each. All trays with the substrate already soed were submitted to two irrigations per day throughout the seedling formation period.

After the installation of the experiment, the methodology of evaluation and data collection was carried out. The following characteristics were evaluated:Root length (RL) and length of aerial part (LAP): the seedlings were removed from the trays and with the aid of a ruler graduated in centimeters, measured from the apical yolk to the end of the apical root, and measuring from the neck to the apex of the seedling.The results were expressed in centimeters, according to recommendations of Nakagawa [11]; Number of leaves (NL): after the

seedlings were removed, the number of leaves was counted. The results were expressed in a unit; First emergency count (FEC): the first emergency count was performed at 30 days after sowing. The data collected were corresponding to the accumulated percentage of normal seedlings, with values recorded for each substrate andseedling emergence (SE): 100 seeds were used, distributed in four replicates of 25 seeds. The count of the number of germinated seeds started 6 days after sowing and extended to emergence stabilization in all substrates.The criterion used was that of normal seedlings that presented the perfect essential structures [12], and the results expressed in percentage.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 between substrates and higher physiological quality for badea seeds without storage (Table 1), where the highest values, with and without storage, of root and shoot length, were obtained when the seeds were soed in the commercial substrates (6.4 centimeters; 8.9 centimeters) and (23.4 centimeters; 29.5 centimeters), respectively, and lower in the substrate washed sand (3.8 centimeters; 5.0 centimeters) and (8.5 centimeters and 9.5 centimeters), respectively. [13], working with pine root stockalso, they also found that the commercial substrate was the one that provided the best root development, due to its higher fertility. [14] highlight that the substrates of higher fertility, because they present better chemical, physical and biological attributes of the soil, should be used for seedling production. [15] also mention that substrates rich in phosphorus, calcium and potassium, can be part of the composition of substrates for seedling production.

The number of leaves was not an efficient characteristic in differentiating viability and vigor, since there was no significant difference both for seeds with and without storage and between substrates.

Data regarding the first count of seedling emergence and emergence, as a function of storage and the different substrates are found in Table 1. Once again, the seeds without storage showed greater viability and vigor.Probably, the lack of temperature control in refrigerators affected the physiological quality of badea seeds. [16], it also found a reduction in theviability and vigor of araucaria seeds when stored in refrigerators.Where the highest values, with and without storage, were obtained when the seeds were soed in commercial substrates (62.8 %; 86.9 %) and (75.9 %; 95.8 %), respectively, and lower on the substrate washed sand (52.2 %; 77.2 %) and (59.3 %; 90.2 %), respectively. [17] highlight that in addition to supporting plants, the substrate should 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, characteristics observed in the commercial substrate.

Table 1. Root length (centimeters), aerial part length (centimeters), number of sheets (units), first emergency count (%) and seedling emergence (%) of badea seeds, with and without storage, on different substrates

Treatments	RL	APL	NS	FEC	SE
With Storage					
Black earth	4,0 Bb	11,1 A b	4Aa	56,1 Bab	65,1 Bb
Commercial substrate	6,4 Ba	23,4 Ba	4Aa	62,8 Ba	75,9 Ba
Washed sand	3,8 Bb	8,5A c	3Aa	52,2 Bb	59,3 Bbc
No Storage					
Black earth	5,5Ab	11,7Ab	4Aa	86,3Aa	94,2Aa
Commercial substrate	8,9Aa	29,5Aa	5Aa	86,9Aa	95,8Aa
Commercial substrate	5,0Ab	9,5Ac	4Aa	77,2Ab	90,2Ab
C.V (%)	3,6	15,9	2,4	7,5	7,6

CV- Coefficient of variation

Averages followed by the same upper and lower case in the column do not differ from each other by the Tukey test at 5%

4. CONCLUSION

The seeds of passion fruit melon, without storage, sowed in the commercial substrate, showed greater viability and vigor.

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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