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Quality assessment of jabuticaba seeds when subjected to different temperatures

Avaliação da qualidade das sementes de jabuticaba quando submetidas a diferentes temperaturas

Evaluación de la calidad de semillas de jabuticaba cuando se someten a diferentes temperaturas

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Abstract
Jabuticaba is a typically Brazilian fruit, which can be found from the extreme south to the extreme north of the country, it can be used for various purposes, its commercialization ranges from in natura, industrial, pharmaceutical and cosmetics. In view of the above, this work aims to evaluate the influence of the size of jabuticaba seeds of the rajada variety, its germination potential, total seedling size, root and shoot length and seedling emergence, using different treatments. The extraction of the seeds was carried out by manually kneading the fruits against a flat and firm surface of a bench, so that they broke and exposed their seeds, soon after the mucilage was removed manually as well. After pulping, disinfestation was carried out using 1% sodium hypochlorite for three minutes, then triple washing with distilled water and arranged on paper towels, where they remained for 48 hours in the shade to remove excess moisture, separated according to diameters. To seeds to carry out the germination tests and the emergence speed index, when submitted to different treatments. In which it can be concluded that the size of the seed increases the germination potential of jabuticaba seeds, where larger seeds originate more vigorous seedlings, and should preferably be used for seedling production. The best treatment is the refrigerated one with a temperature of 5°C, as it presented a greater amount of seedlings throughout the days.
Keywords: Fruit; Propagation; Force; Seedlings.

Resumo

A jabuticaba é uma frutífera tipicamente brasileira, podendo ser encontrada desde o extremo Sul até o extremo Norte do País, pode ser utilizada para diversos fins, a sua comercialização vai desde a forma in natura, industrial, farmacêutica e de cosméticos. Diante do exposto, este trabalho tem como objetivo, avaliar a influência do tamanho das sementes de jabuticaba da variedade rajada, o seu potencial germinativo, tamanho total de plântulas, comprimento de raiz e parte aérea e a emergência de plântulas, utilizando diferentes tratamentos. A extração das sementes foi realizado o amassamento manual dos frutos contra uma superfície plana e firme de uma bancada, de modo que os mesmos se rompessem e expusessem suas sementes, logo após foi realizada a retirada da mucilagem manualmente também. Após a despolpa foi feita a desinfestação, utilizando hipoclorito de sódio a 1% por três minutos, posteriormente realizado a tríplice lavagem com água destilada e dispostas em papel toalha, onde permaneceram durante 48h à sombra para retirada do excesso de umidade, separas conforme os diâmetros a sementes para realizar os testes de germinação e o índice de velocidade de emergência, quando submetidos a diferentes tratamentos. Na qual pode-se concluir que o tamanho da semente, aumenta o potencial germinativo das sementes de jabuticaba, onde sementes maiores originam plântulas mais vigorosas, devendo ser preferencialmente utilizadas para produção de mudas. O melhor tratamento e o refrigerado com uma temperatura de 5°C, pois apresentou maior quantidade de plântulas ao longo dos dias.

Palavras-chave: Frutífera; Propagação; Vigor; Plântulas.

Resumen

La jabuticaba es una fruta típicamente brasileña, que se puede encontrar desde el extremo sur hasta el extremo norte del país, puede ser utilizada para diversos fines, su comercialización va desde in natura, industrial, farmacéutica y cosmética. En vista de lo anterior, este trabajo tiene como objetivo evaluar la influencia del tamaño de semillas de jabuticaba de la variedad rajada, su potencial de germinación, tamaño total de plántulas, longitud de raíces y brotes y emergencia de plántulas, utilizando diferentes tratamientos. La extracción de las semillas se realizó amasando manualmente los frutos contra una superficie plana y firme de una banca, de manera que rompieran y expusieran sus semillas, al poco tiempo también se eliminó manualmente el mucílago. Luego del despulpado, se realizó una desinfestación con hipoclorito de sodio al 1% durante tres minutos, luego triple lavado con agua destilada y dispuestos sobre toallas de papel, donde permanecieron por 48 horas a la sombra para eliminar el exceso de humedad, separados según diámetros a semillas a realizar las pruebas de germinación y el índice de velocidad de emergencia, cuando se someten a diferentes tratamientos. En el cual se puede concluir que el tamaño de la semilla aumenta el potencial de germinación de las semillas de jabuticaba, donde las semillas más grandes originan plántulas más vigorosas, debiéndose utilizar preferentemente para la producción de plántulas. El mejor tratamiento es el refrigerado con una temperatura de 5°C, ya que presentó mayor cantidad de plántulas a lo largo de los días.

Palabras clave: Fruta; Propagación; Fuerza; Plántulas.

1. Introduction

The jabuticabeira (*Myrciaria cauliflora Berg*.), a fruit tree belonging to the *Myrtaceae* family, of the genus *Myrciaria*, is typically Brazilian, originating in the Center-south, and can be found from the extreme south to the extreme north of the country (Parise, 2014). Among the most cultivated jabuticabeira varieties, 'Rajada' stands out, with a large size, high production capacity, tanned green, large and sweet fruits, and medium maturity (Danner et al., 2007).

The production of jabuticaba is very important because it generates employment and income for family farmers, according to data in 2016, more than 2,471 tons of jabuticaba were sold in the state of São Paulo alone (Ceagesp, 2017). The commercialization of jabuticaba can be done in natura, through products in the food, pharmaceutical and cosmetics industry (Donadio, 2000).

The main propagation method used for jabuticabeira is basically through seeds, which makes it difficult to propagate on a large scale (Martins et al. 2008). However, other propagation methods such as cuttings or layering can be used, and they are still little used because this fruit-bearing species is considered a species of difficult rooting (Oliveira, 2022).

It is known that jabuticabeira fruits have seeds with different shapes and sizes, reaching up to four seeds per fruit (Costa et al., 2017; Gomes et al., 2016; Silva et al., 2005). (Alves, 2021) states that the size of the seed, in many species, is indicative of its physiological quality. Thus, within the same lot, small seeds have lower seedling emergence and vigor than medium and large seeds (Rodo et al., 2001). (Tillman et al., 2012) stated that, within the same batch of seeds, those considered small may have lower seedling emergence and vigor than seeds considered medium and large.

However, studies on the influence of seed size present divergent results regarding the percentage and speed of emergence of their seedlings (Martinelli-Seneme et al., 2001). In addition to size, other aspects such as the conservation and storage of seeds of this species are considered recalcitrant, not tolerating natural desiccation, which makes it difficult to store them for long periods of time at room temperature (Garay et al., 2022). In this way, there is a need to seek some alternatives that promote the maintenance of their viability and greater longevity (Hoosel et al, 2019).

The conservation of the viability of recalcitrant seeds is basically focused on keeping them with high moisture content at low temperatures (Filho, 2005). The high moisture content can have a negative influence and the seeds are kept at room temperature, as the germination process may start during storage or even fungal contamination may occur, a fact that can compromise the viability of all seeds in a batch (Fior et al. al., 2010).

Therefore, this work aimed to evaluate the influence of jabuticaba (Myrciaria cauliflora Berg) seed size on germination potential, total seedling size, root and shoot length and seedling emergence, using different treatments.

2. Methodology

The experiment was carried out in the phytotechnics department of the Seed Analysis Laboratory "Flávio Farias Rocha" at the Federal University of Pelotas-RS. The seeds used were extracted from ripe fruits of the Jabuticabeira Rajada variety. The fruits for the extraction of the seeds were collected in the municipality of Bento Gonçalves-RS in October 2021. For the extraction of the seeds, the fruits were manually kneaded against a flat and firm surface of a bench, so that they if they broke and exposed their seeds, soon after, the mucilage was removed manually as well. After pulping, disinfestation was performed using 1% sodium hypochlorite for three minutes, followed by triple washing with distilled water and placed on paper towels, where they remained for 48 hours in the shade to remove excess moisture.

After processing, the seeds were separated into three size classes: > 10 mm, 6 to 10 mm and < 6 mm.

The physiological quality of the seeds was evaluated using the germination test on germitest paper, as described in the Rules for Seed Analysis (Brasil, 2009).

Germination test (G%): it was conducted with four subsamples of 50 seeds, with three sheets of germitest paper, moistened with distilled water equivalent to 2.5 times the dry paper mass, as substrate. The seeds were kept in a germination chamber at 25 °C. The seedlings considered normal were evaluated at eighteen days, obtaining the values of the first germination count, and at forty days after sowing to obtain the percentage of total germination. As recommended by the Rules for Seed Analysis (Brasil, 2009). To avoid moisture loss after assembling the paper rolls, the treatments were placed in a plastic bag.

Concomitant to the germination test, evaluations were made regarding the total size of the seedlings, the size of the roots and also the aerial part, with the aid of a graduated ruler, expressed in cm. Seeds that had seedlings with shoot length equal to or greater than 2 mm were considered germinated. The germination speed index (GVI) was determined, being calculated according to the equation of (Maguire, 1962), in which: IVG= G1/D1 + G2/D2 + ... Gn/Dn. Where: IVG= Germination Speed Index G1, G2, ..., Gn= number of emerged rootlets, observed in the interval of the 1st , 2nd , ..., last count; D1, D2, ..., Dn= number from sowing days to 1st , 2nd , ..., last count.

Emergence speed index: 25 seeds were sown, 4 per repetition, so 10 jabba seeds of the cultivar rajada rajada 0 mm in diameter (> 100 mm and sand of different 6 mm), in sand and < 6 mm Ambient environment (25°C), cold chamber (12°C) and refrigerator (5°C), in which every 15 days was performed as estimates, until the delivery of a constant number of seedlings.

The experiment data were compared with Duncan's test, at 5% probability, using the SISVAR statistical program (Ferreira 2011).

3. Results and Discussion

Significant differences were observed in seed germination according to the treatment tested. Seed size influenced germination, total length, shoot length and root length (Table 1).

Table 1- Germination potential and germination speed index of jabuticaba seeds, separated by size.

Tamanho das sementes	Germinação (%)	Comprimento total (cm)	Comprimento Raiz (cm)	Comprimento P.A (cm)	IVG
< 6MM	45c	3,99 c	2,79b	1,2b	0,50b
6-10 MM	73b	5,15 b	2,9b	2,25b	1,95[a]
>10MM	88[a]	7,50 a	4,1[a]	3,40[a]	2,15[a]
CV (%)	7,53	18,2	17,5	15,56	6,6

* Different letters in the same column differ significantly at the 5% probability level by Duncan's test. Source: Authors.

Analyzing the germination data and total seedling length, root and shoot length, it is possible to observe that the seeds with the largest size, being them greater than >10mm, presented better results than the others, in relation to the germination speed index, the sizes (>10mm) presented the highest result, followed by size (6-10 mm). Thus, noting that the seeds of the sample that germinated more quickly, that is, that presented the highest percentage of normal seedlings in this count, were the seeds with the largest size.

The seed is the structure that shelters and nourishes the embryo, and its reserves are responsible for ensuring the supply of nutrients at the beginning of germination, as the size of the seed reflects in the amount of reserve to be made available in the initial stages of plant development, larger seeds will provide more favorable conditions for their germination and growth (Bezerra et al., 2004) and plants that show good development have their origin in seeds that provided favorable conditions for the growth of the embryo and this is reflected in the speed and uniformity of root emission, in root and shoot length and interferes with the chances of plant survival in the field. The greater amount of reserve increases the probability of successful seedling establishment (Haig & Westoby, 1991), as it allows for a longer survival in adverse conditions.

According to the results presented, it can be observed that there was a small statistical difference in the results for the emergence of jabuticaba seedlings as shown in (Table 2)

Table 2. Emergence of jabuticaba seedlings of the rajada variety, according to the storage environment and seed size.

Emergência de Plântulas (%) – sementes < 6mm

	0 dias	15 dias	30 dias	45 dias	60 dias
Ambiente	48 a	47ª	39bc	35c	22d
Câmara fria	46ab	42b	42b	35c	25d
Refrigerador	51 a	48ª	45ab	34c	28d
CV (%)	5,56	8,84	6,68	5,88	4,85

Emergência de Plântulas (%) – sementes 6 – 10 mm

	0 dias	15 dias	30 dias	45 dias	60 dias
Ambiente	75 a	68ª	61b	55c	38d
Câmara fria	77 a	69ª	60b	53c	49d
Refrigerador	71 a	70ª	64b	57c	52cd
CV (%)	6,22	6,15	8,1	8,23	11,2

Emergência de Plântulas (%) – sementes >10mm

	0 dias	15 dias	30 dias	45 dias	60 dias
Ambiente	80 a	77ª	72b	56ab	42c
Câmara fria	88 a	82ª	80 a	77 a	66ab
Refrigerador	85 a	86ª	81 a	80 a	72b
CV (%)	7,81	9,21	8,88	8,54	15,2

* Different letters in the same column differ significantly at the 5% probability level by Duncan's test. Source: Authors.

Observing the emergence data of jabuticaba seedlings of different diameters, we can verify that the emergences with seeds with a diameter of < 6mm, only (0 days), had a difference in the results for both treatments used, in relation to seeds with >10mm, there was a difference at 30, 45 and 60 days for both treatments used. Regarding seeds with a diameter of 6-10mm, there was no difference in the results when submitted to different treatments. But when you look at the time of emergence, as the days went by and counting how many seedlings emerged, you can see that the number of seedlings that emerged when subjected to the different treatments decreased.

According to (Hossel et al, 2019), when comparing the emergence of jabuticaba seedlings of the cultivar Plinia cauliflora (DC), he also observed similar results for seedling emergence when subjected to different temperatures, which corroborates this work.

According to (Ferreira & Borghetti, 2004), longevity is influenced by storage conditions, in addition to water content and temperature. Because all the mechanisms associated with the initiation and continuity of the germination process are associated with the water content in the cells and tissues of the seed. In this sense, for a seed to complete its germination, it is necessary that it reach sufficient water content for the activation of the chemical reactions of metabolism, for root expansion to occur (Schwember; Bradford, 2010).

As they are recalcitrant seeds, a reduction in temperature is necessary, as it causes an increase in the conservation time of the seed, provided that this reduction is carried out with adequate humidity, since the association of these two factors will reduce the expense of reserves and the deterioration inside the seeds. seeds (Martins et al., 2012). The use of low temperatures and different storage times was observed for seeds of recalcitrant species such as camu-camu at a temperature of 5 to 10 °C for six months in plastic bags with humidity maintained at 45% (Yuyama et al., 2011); grumixameira at 7 ºC for six months without affecting seed viability (Kohama et al., 2006).

4. Conclusion

The size of the seed increases the germination potential of jabuticaba seeds, where larger seeds (≥ 10mm) give rise to more vigorous seedlings, and should preferably be used for seedling production. The best treatment is the refrigerated one with a temperature of 5°C, as it presented a greater amount of seedlings throughout the days.

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