

SHORT COMMUNICATION

Overcoming dormancy and storage of sapoti seeds

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ABSTRACT

The objective of this study was to overcome dormancy and germination capacity in sapoti seed storage. The study was conducted at IFES Seed Laboratory from January to December 2015. The experimental design was completely randomized with four replications of 25 seeds, in a split plot. The plots were represented by combinations of treatments of seeds: seeds without treatment; seeds stored for 24 hours in a refrigerator (8-10 °C); seeds immersed in ice water for 30 min (0 °C) and seeds stored permanently in a refrigerator at a temperature between 8-10 °C. The subplots comprised the following storage period of the seeds: 0; 30; 60; 90; 120; 180; 270 and 360 days, at room temperature between 20-26° C. After each storage period were evaluated germination (%), germination speed index and average germination time. Treatment with ice for 30 min. showed the best germination. Permanent storage in refrigerator (8-10° C) presented the best-preserved viability. Heat treatment with ice for 30 min and/or permanent storage in the refrigerator can be used to break dormancy of sapoti seeds.

Keywords: *Achras zapota* L.; Germination; Viability; Force

INTRODUCTION

The sapoti tree (*Achras zapota* L.) is commercially exploited, particularly, in India, Philippines, Sri Lanka, Malaysia, Mexico, Venezuela, Thailand, Indonesia, Brazil and countries of Central America and the Caribbean (Silva Junior et al., 2014). In Brazil, we can observe differences in the shape of the fruit, most of which are oval and round.

It is the best known fruit species of the family Sapotaceae, being cultivated, mainly, for the production of fruits consumed in natura. Its bark is thin and the pulp is tender and very sweet, containing a gelatinous substance that gives it a unique aroma (Silva Junior et al., 2014).

Despite its wide acceptance, the sapoti is rare outside of the tropics, which is partly due to its high perishability (Damasceno et al., 2008).

The sapoti is considered climacteric and very perishable fruit, and under natural conditions can be stored for up to 15 days (Morais et al., 2006), its maturity is fast, making difficult its conservation and marketing

(Oliveira et al., 2011), as well as obtaining seed for propagation.

When removing seeds from ripe fruits of the sapoti tree, and germinated no additional treatment, there is good germination percentage and speed emergence (Matos et al., 2003), however, as well as several forest species, the sapoti tree has numbness in their seeds, and a long germination.

The use of thermal treatment to break dormancy is usually used in seeds that have difficulty in germination, especially when talking about integument dormancy, where we can consider that the efficiency of the treatment will depend on the species to be studied, water temperature and time used for the seeds.

Azerêdo et al. (2002) cite that sapodilla seeds exhibit a higher percentage and emergence speed index when subjected to a lateral cut to the embryo, without imbibition. The cutting of seeds, followed by imbibition for 24 hours, is not efficient to accelerate the emergence and its speed index, in sapodilla seedlings and immersion in water at 60 ° C as it should not be recommended as a pre-

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germinative treatment of sapodilla seeds, for not having a positive effect on the germination of these seeds, showing the need for studies that expand the knowledge about the germination of these seeds, showing the need for studies that expand the knowledge about the germination of these seeds, mainly related to immersion times and temperatures.

Considering that the sapodilla seed germination occurs slowly and late and that the seeds must, at first, be the primary object to be studied, considering mainly the potential and the possibilities for exploitation of this fruit, the study is justified if its seeds regarding germination potential and storage capacity.

The research was carried out with the objective of evaluating the existence of dormancy and storage capacity in the germination of sapoti (*Achras zapota* L.) seeds.

MATERIAL AND METHODS

The research was conducted in the Seeds Laboratory of the Federal Institute of Espírito Santo (IFES), Campus Santa Teresa-ES, from January to December 2015. Sapoti seeds, harvested manually from mature fruits, from plants located in the region institute, and selected 3500 seeds of which 2700 were stored in plastic containers at room temperature between 20-26 °C and 800 were stored in plastic containers in the refrigerator at a temperature between 8-10 °C. For this, it was used a completely randomized design, with four replicates of 25 seeds, in a subdivided plot scheme. The plots were represented by combinations of seed treatments: seeds without treatment (control); seeds stored for 24 hours in a refrigerator (8-10 °C); seeds immersed in ice water for 30 min (0 °C) and seeds stored permanently in a refrigerator at a temperature between 8-10 °C. The subplots consisted of the storage periods of the seeds in plastic pots: 0; 30; 60; 90; 120; 180; 270 and 360 days, at room temperature between 20-26 °C. The germination test was

conducted on a germitest type paper roll, moistened with water equivalent to three times the mass of the dry paper, kept in plastic boxes with a water slide of approximately one centimeter, in germination chambers type BOD with a temperature of 25 °C with light 12/12 hours.

During 30 days after germination of the first seed, the germination speed index (GSI) and the average germination time (AGT) in each storage period were evaluated. After 30 days, germination (%) was evaluated in all storage periods. Data were submitted to analysis of variance and regression test, and the means of each characteristic were compared by the Tuckey test at 5% probability level (Cruz, 2013).

RESULTS AND DISCUSSION

In this study, developed under laboratory conditions, it was verified that the germination occurred in a relatively short time of three weeks, in contrast to the studies conducted by Matos et al. (2003), who report that the germination occurred slowly and late, and that normally the onset of field emergence occurs after one month of sowing. In sapotiaba seeds (*Sideroxylon obtusifolium* - Sapotaceae), germination begins on day 12 and may be terminated in 21 days after sowing (Silva et al., 2012). For seed *Chrysophyllum amazonicum* and *Chrysophyllum priurii*, both belonging to the Sapotaceae family, germination begins between 6-9 and the end of 22-19 days to meadura respectively (Pinto et al., 2012). The untreated sapoti seeds and those stored in the refrigerator for 24h presented germination of 58% and 56%, respectively (Table 1A).

Azerêdo et al. (2002) observed in untreated seed sapoti emergence of 15%, and those submitted to a cut in the integument lateral to the embryo 81%. This indicates the mechanical impediment provided by the seed coat of this species. However, Matos et al. (2003) observed in

Table 1: Germination and germination speed index (GSI) of sapoti seeds (*Achras zapota* L.) after different treatments and storage periods

Germinação (%)									
(A)	Armazenamento (dias)								
Trat	0	30	60	90	120	150	180	270	360
1	58 ^b	58 ^b	44 ^b	30 ^c	22 ^c	34 ^b	32 ^b	16 ^b	6 ^b
2	56 ^b	52 ^b	46 ^b	28 ^c	24 ^{bc}	32 ^b	32 ^b	18 ^b	8 ^b
3	90 ^a	54 ^b	44 ^b	54 ^b	28 ^b	32 ^b	32 ^b	16 ^b	8 ^b
4	-	72 ^a	86 ^a	88 ^a	74 ^a	62 ^a	62 ^a	42 ^a	40 ^a
(B)	Índice de velocidade de germinação (IVG)								
1	0,85 ^b	1,21 ^{ab}	0,87 ^b	0,90 ^c	0,30 ^c	0,41 ^b	0,44 ^{bc}	0,18 ^{bc}	0,09 ^c
2	1,22 ^{ab}	0,89 ^b	0,83 ^b	0,56 ^d	0,41 ^{bc}	0,38 ^b	0,38 ^c	0,21 ^b	0,11 ^b
3	1,58 ^a	1,28 ^a	0,81 ^b	1,60 ^b	0,50 ^b	0,35 ^b	0,47 ^b	0,18 ^c	0,11 ^{bc}
4	-	1,39 ^a	1,59 ^a	1,73 ^a	1,08 ^a	0,86 ^a	0,83 ^a	0,56 ^a	0,87 ^a

*Means followed by the same letter in the column do not differ by Tukey test at 5% probability. Caption: Treat. 1=control; Treat. 2=24 hours in refrigerator; Treat. 3=30 minutes on ice; Treat. 4=stored in refrigerator.

untreated seeds of sapodilla 68% of emergency, which did not differ statistically from scarified with sandpaper N° 100, followed by soaking in water for 24 h, and submitted to immersion in water at 60° C with emergency of 72%. It is verified that the differences found in sapoti seeds without treatment by Azerêdo et al. (2002), by Matos et al. (2003), and in the present work may be related to the environmental conditions where the work was conducted and the distinction between the genotypes.

Freshly harvested sapoti seeds immersed in ice for 30 min were the treatments that provided the highest percentage of germination (90%) (Table 1A) and germination speed (1,58) (Table 1B) (Fig. 1).

Environmental signals (thermal shock and light) can induce the synthesis of gibberellins and block the expression of germination repressor genes, promote the degradation of their products or promote the synthesis of hydrolytic enzymes that weaken the integument and allow germination (Peng and Harberd, 2002).

In some species, as in wheat seeds, refrigeration tolerance is induced by preconditioning in solutions of 0.01 mM sodium nitroprusside (SNP), which is a nitric oxide-NO donor, and 5 µM of gibberellic acid (GA_3) (Li et al, 2013). These authors observed increased respiratory rate, increased amylase activity and starch degradation in wheat seeds. In addition, it is possible to observe that the antioxidant systems are activated by NO, and with that the concentration of malondialdehyde (MDA) and hydrogen peroxide (H_2O_2) reduced.

According to Bailly and Kranner (2011), reactive oxygen species and antioxidants, along with plant hormones and other reactive species, such as reactive nitrogen species, are responsible for regulating the development, maturation, germination, dormancy, aging of seeds and establishment of seedlings. This is an indication that the thermal shock given to sapoti seeds in this work may have triggered some enzymatic system to remove the reactive oxygen species and, consequently, to be beneficial, increasing the germination of sapoti seeds.

As for the storage of sapodilla seeds, those kept in refrigerator (8-10 ° C) for 30 to 360 days showed the highest germination percentages, with 72% (30 days), 86% (60 days), 88% (90 (120 days), 72% (150 days), 62% (180 days), 42% (270 days) and 40% (360 days) (Table 1A), germination speed (Table 1B) (Fig. 1) and mean germination time (Fig. 2).

Caesalpinia echinata Lam. (Brazil wood) stored at -5 and -18 ° C for 24 months did not change in germination (83.6 and

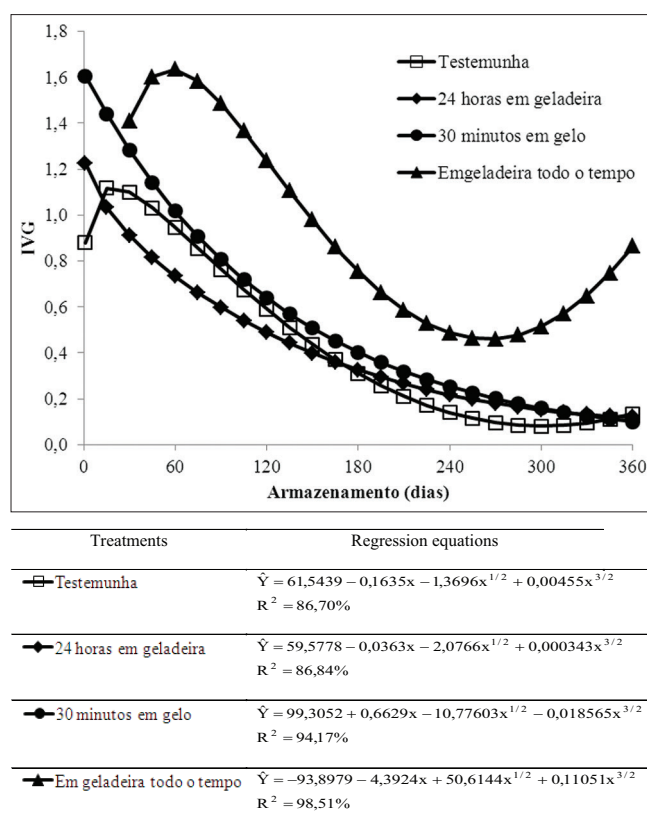


Fig 1. Speed Index of sapoti seed germination (*Achras zapota* L.) after different treatments and storage periods.

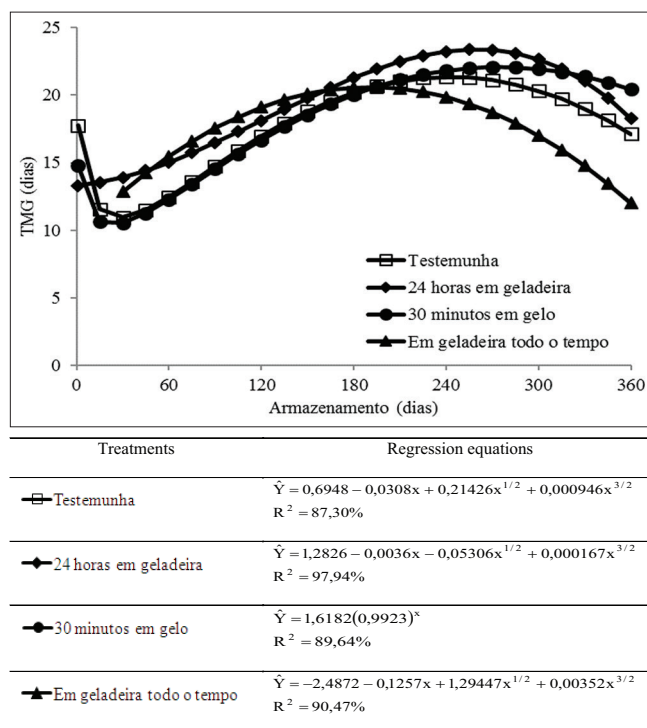


Fig 2. Mean germination time (MGT) of sapoti seeds (*Achras zapota* L.) after different treatments and storage periods.

82.7%, respectively) (Helmann et al., 2006). However, for sapoti seeds after 360 days of storage it is verified that the

untreated seeds; the only kept in the refrigerator for 24 hours and immersed in ice for 30 min showed 6; 8 and 8% germination, respectively (Table 1A).

The behavior during storage shows that the sapoti seeds when stored in the refrigerator (8-10 °C) for 30 to 360 days was the treatment that best preserved the viability (Figs. 1 and 2). For the seeds of *Tabebuia caraiba* recommended storage in cold chamber (8 ± 2 °C) (Guedes et al., 2012). According to Lima, Dutra and Camille (2014a) and Lima, Dutra, Bridges and Bezerra (2014b), sesame and sunflower seeds remain viable for 12 months when stored in a cold room (10 °C and 55% RH), respectively.

Custard apple seeds (*Annona squamosa* L.), up to 12 months stored in paper bags in a refrigerator (6-8 °C), maintained emergency approximately 60%, as opposed to packed in plastic bags, which in linear decreases very probably due to the deterioration determined by high humidity values of seeds (Morais et al., 2014).

In seed without treatment (control); Seeds stored for 24 hours in a refrigerator (8-10 °C) and seeds immersed in ice water for 30 min (0 °C) there was a more pronounced reduction in germination over time (Fig. 1). Mainly because the maintenance of the seeds in natural environment exposes them to environmental variations and the temperature increases, which induce oxidative stress. Purkacka and Ratajczak (2014) observed in *Fagus sylvatica* L. that non-dormant seeds showed greater sensitivity to storage than the dormant. According to these authors, those stored at 20 °C showed increased production of reactive oxygen species, especially in non-dormant, compared to the stored at 3 °C. According to the authors, the membrane non-dormant seeds are exposed to a higher oxidative stress during storage, due to the higher levels of unsaturation (unsaturated fatty acids, especially 18: 3) and lower α -tocopherol, the primary antioxidant that protects the membrane against the attack of free radicals. According to Barreto et al. (2013), vitamin E can be used as a reliable indicator of growth in macaúba embryo (*Acrocomia aculeata*). During the seed storage period, the peroxidation of unsaturated fatty acids occurs due to increased lipoxygenase activity (LOX) and, which leads directly to the reduction in seed vigor (Gayen et al., 2014).

CONCLUSION

Treatment of sapoti seeds (*Achras zapota* L.) with ice for 30 minutes is the most recommended to increase the percentage of germination.

The permanent storage of sapoti seeds (*Achras zapota* L.) in the refrigerator (8-10 °C) is effective for the preservation of their viability.

Heat treatment ice for 30 min and/or permanent storage in the refrigerator can be used as practical to break dormancy of seeds sapoti (*Achras zapota* L.).

The data provided in this research contribute to assist the seedling producers class with minimizing costs and presenting an easy to apply methodology with a view to improving the quality of the seedlings produced.

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