TAVARES AR; RAMOS DP; AGUIAR FFA; KANASHIRO S. 2008. Jussara palm seed germination under different shade levels. *Horticultura Brasileira* 26: 492-494.

Jussara palm seed germination under different shade levels

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ABSTRACT

Jussara palm (*Euterpe edulis*) is a native plant of the Atlantic rainy forest, with large economic interest. The species is shade-tolerant and currently it is restricted to certain areas of difficult access. The most effective way to reintroduce it into the environment or increase the population density for conservation and commercial exploitation is promoting seed propagation. Considering that the jussara palm is an ombrophylous species, this experiment aimed to simulate forest conditions, with different shade levels, to analyze its influence on seed germination. After processing the seeds (depulping), 500 seeds were sown in containers (20 x 30 x 8 cm) filled with forest ground and grown in five shade levels (0, 20, 40,60, and 80%, simulated using black shadenet). The experimental design was blocks at random, with four 25-seed replications. We evaluated the percentage of seed germination and the Emergence Speed Index (ESI). Seed germination started 103 days after sowing. Although the percentage of germinated seeds in the different treatments varied between 53 (0% shade) and 72% (60% shade), there was no significant shade influence over percentage of seed germination and ESI.

Keywords: *Euterpe edulis*, Arecaceae, emergence speed index, germination percentage.

RESUMO

Germinação de sementes de palmiteiro jussara sob diferentes níveis de sombreamento

O palmiteiro jussara (*Euterpe edulis*), planta nativa da Mata Atlântica, apresenta grande importância econômica. Atualmente, sua ocorrência é restrita a algumas áreas de difícil acesso. A forma mais eficaz de reintroduzi-lo no ambiente ou de adensar suas populações com fins de conservação e exploração comercial é através das sementes. Sendo o palmiteiro uma espécie esciófila, este experimento visou simular condições de mata com diferentes níveis de sombreamento e analisar sua influência na germinação das sementes. Após o beneficiamento (despolpamento), 500 sementes foram postas para germinar em terra vegetal contida em caixas (20 x 30 x 8 cm) e distribuídas em cinco níveis de sombreamento (0, 20, 40, 60 e 80% de sombra, simulado com sombrite preto). O delineamento experimental adotado foi blocos casualizados, com quatro repetições de 25 sementes. Avaliaram-se a porcentagem de germinação e o Índice de Velocidade de Emergência (IVE). As sementes iniciaram sua germinação 103 dias após a semeadura. Apesar da porcentagem de sementes germinadas nos diferentes tratamentos ter variado entre 53 (0% de sombra) e 72% (60% de sombreamento), não houve efeito significativo do sombreamento sobre o percentual de germinação e tampouco sobre o índice de velocidade de emergência.

Palavras-chave: *Euterpe edulis*, Arecaceae, índice de velocidade de emergência, porcentagem de germinação.

(Recebido para publicação em 17 de março de 2008; aceito em 30 de outubro de 2008)
(Received in January 9, 2007; accepted in September 30, 2008)

The jussara palm (*Euterpe edulis* Martius), also known as heart palm or simply jussara, is native from Brazil and belongs to the Arecaceae family. It has a characteristic straight, slender, and single stipe, without tillers, superficial adventitious roots, and pinnate and curved dark green or olive leaves (Henderson, 2000). The vegetative knob is formed by the leaf sheath, which can be green, nut-brown or reddish (Reitz, 1973). The plant reaches up to 15 m height, with 15-cm stem diameter (Aguiar, 1986). It is present almost exclusively at the Atlantic rainy forest, ranging from South Bahia to North Rio Grande do Sul. Abundant on the past, nowadays jussara palm populations are fragmented and concentrate in natural reserves with difficult access, located in areas of irregular landscape, unsuitable for agriculture (Reis *et al.*, 2000).

Jussara palm raises large economic and ecological interests due respectively to the extraction of the palm heart and to its potential as a biological indicator, consequence of its ombrophylous behavior: once jussara palm demands shadow to grow, its absence might indicate the need to restore the original vegetal cover (Reis *et al.*, 2000). Although the heart of palm is the focus of economic exploitation, Aguiar (1986) and Reitz (1973) mention the use of the stipe as laths and rafters in construction and corrals, manufacture of agglomerates, and even as fuel for brickkilns. Leaves are used as house roof, while leaflets are employed in braiding. Due to its nice appearance and elegance, jussara palm is used also in gardening as an ornamental plant (Aguiar *et al.*, 2005). In addition, Reitz (1973) cites the jussara palm fruit juice as a rich nutrient source, comparable to chocolate, and the young stem juice, as useful for healing wounds.

Jussara palm has immature fruits all year round, while ripen fruits are found from May to November. Fruits, when ripen, are spherical and nearly black or bright black-wine (Reitz, 1973). Considering that they are well appreciated by the native fauna, some animals play an active role in seed transportation and, therefore, on the species dispersal. This behavior confers

to jussara palm a relevant ecological and economic potential to restore and enrich flora in secondary forests (Reis & Kageyama, 2000).

Queiroz (2000) states that fruits and seeds are the only effective way to assure both reintroduction and increase on plant density, aiming at conservation and exploitation. However, seed germination is affected for several factors, which jeopardizes the success of reintroduction. Jussara palm seeds are sensitive to water losses (recalcitrants) and, therefore, germinate only in environments with a minimal humidity level, between 15 and 30% (Andrade & Pereira, 1997). Bovi (1978) affirms that 13% humidity is already low enough to hamper germination. It is likely that shade also has some influence over germination. Chazdon (1986, apud Paulilo, 2000) says that variations in the amount of photosynthetic active radiation that reaches the soil due to movements in the sun and canopy, and the fall of branches and trees, might have an relevant influence on plant photosynthesis, growth, and regeneration. Nevertheless, species of initial successive phases seem to be more resistant to these variations than species that appear only on later phases (Bazzaz, 1979, apud Paulilo, 2000).

Considering that jussara palm (*Euterpe edulis*) is ombrophyla, we tried to find out in this experiment if the percentage of seed germination and plantlet emergence speed index are susceptible to different shade levels.

MATERIAL AND METHODS

The experiment was carried out at the Botanic Institute of São Paulo State, in São Paulo. The climate is temperate, with wet summers and dry winters. The average temperature is 19.1ºC; the average annual air humidity is 81.1%; and the average annual rainfall is 1,539.9 mm (climatologic normal from 1976 e 2000) (Marques & Funari, 2002). The experiment started at May 20 and seed germination lasted from September 09 to November 10, 2003.

We collected 500 visually uniform ripen fruits in jussara palms grown at the Agriculture Secretary of São Paulo State. Upon harvest, fruits were immersed in water for 96 hours, renewing water every day. After, fruits were depulped in running water, by scraping them against a steelnet sieve. Seeds were dried in the shadow for 24 hours and then (40% of water content) sown (2 cm deep) in containers (20 x 30 x 8 cm) with forest ground and sprinkling irrigation, for germination.

Seeds were sown with 0, 20, 40, 60, and 80% shade, in a screenhouse under black shadenet. We assessed the percentage of germination according to the standard established by Borghetti & Ferreira (2004), who considered as germination the uprising of the first vigorous plantlet; and the plantlet emergence speed index (ESI), assessed according to Maguire (1962), who estimated the daily average number of emerged plantlets.

The experimental design was blocks at random, with four 25-seed replications, adding up 100 seeds per treatment. We performed analysis of variance, using the F Test at $p<0.05$ and the Tukey test, also at $p<0.05$, to compare treatment means.

RESULTS AND DISCUSSION

Germination started 103 days after sowing. Lorenzi (1992) first postulated a 30 to 70-day period and, later (Lorenzi, 1996), from three to six months for jussara palm seeds to start germinating. Matthes & Castro (1987), also working with jussara palm, reported an interval between 14 and 88 days for seed germination. In greenhouse conditions, Aguiar (1990) observed germination of jussara palm seeds already 29 days after sowing.

Table 1. Percentage of seed germination and plantlet emergency speed index of jussara palm under different shades levels (germinação e índice de velocidade de emergência de sementes de palmiteiro submetidas a diferentes níveis de sombreamento). São Paulo, Instituto de Botânica, 2003.

Shade levels (%)	Germination (%)	Plantlet emergence speed index
0	53.0 a	0.115 a
20	64.0 a	0.134 a
40	70.0 a	0.136 a
60	72.0 a	0.154 a
80	66.0 a	0.136 a
CV (%)	35.41	38.34

Means followed by the same letter in the column do not differ significantly from each other, Tukey´s test, $p<0.05$ (médias seguidas de mesma letra nas colunas não diferem significativamente entre si, teste de Tukey, $p<0,05$).

Although the percentage of seed germination ranged from 53% (no shade) to 72 (60% shade) in the different treatments, there was no significant effect of shade nor over percentage of germination, neither over the emergence speed index (ESI) (Table 1). The coefficients of variation of the present data are relatively high. Nevertheless, the values are similar to those observed by Martins *et al*. (2007) when working with the red palm heart (*Euterpe espiritosantensis* Fernandes) and, later (Martins *et al*., 2003), with king palm (*Archontophoenix alexandrae* Wendl. & Drude). It should be stressed that jussara palm is a native non-domesticated species and therefore possess a larger genetic variability than usually found in horticultural plants. The lowest germination level (53%) observed in this experiment, carried out under variable climatic conditions, was similar to and higher than what was reported by Aguiar (1990), respectively in a seed germinator, with 12-hour photoperiod and 25ºC, and in greenhouse (10% germination).

Shade influence over seed germination is very characteristic to each species. Klein (1989) noticed that the germination of stored seeds of four out of five weeds of cotton fields were significantly affected by shade. Tasselflower (*Emilia sonchifolia*) and peppergrass (*Lepidium virginicum*) had

significant variation both at the percentage of germinated seeds and in the emergence speed index (ESI), while small-flower galinsoga (*Galinsoga parviflora*) and the Mascarene Island leaf-flower (*Phyllantus corcovadensis*) showed variation only at the ESI. The remaining fifth species, hyssop-leaf sandmat (*Euphorbia brasiliensis*) did not experience significant variations in seed germination due to shade, similarly to the observations in jussara palm in the current work. Among palm trees, shade influence over germination is also variable. Aguiar *et al.* (2003), when studying lady palm seeds (*Raphis excelsa*) observed that the percentage of germination increased with shade level, reaching the highest values, 60.5%, with 80% shade, whilst the lowest percentage (2%), resulted from plain sun. Instead, Bulbovas (2000), in a report about pollution influence over the germination of jussara palm seeds in Cubatão County, noted 75% of seed germination in the control treatment in both glades and untouched forest areas, which matches with the results currently reported.

In opposition to seed germination, survival of jussara palm plantlets is significantly influenced by luminosity. According to Paulilo (2000), jussara palm plantlets undergo morphological and physiological alterations in response to light intensity, tolerating from 20 to 70% of indirect insolation, but being extremely sensitive to direct sun beam. Tsukamoto Filho *et al.* (2001) presented data from an intercropping using jussara palm and Nicaraguan pine (*Pinus caribaea* Morelet var. *hondurensis* Barr. et Golf.), in which the low relative luminosity, associated to good humidity levels, favored jussara palm development. In coconut (*Cocos nucifera*), plantlets developed out of seeds germinated under 50% shade were taller and heavier (Faria, 2002), apparently reacting to light just like jussara palm plantlets. Nakazono *et al.* (2001) state that jussara palm plantlets exposed to either strong insolation or shade are less competitive, although intermediate insolation levels, equivalent to a 400 m^2 glade in the canopy, have been advantageous to plant growth.

Results presently reported point to no significant interference of shade with percentage of seed germination and plantlet emergence speed index in jussara palm.

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