

Seedling Morphology of (*Euterpe precatoria* MART.) under Levels of Irradiance

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Abstract

The *Euterpe precatoria* Mart. palm. (Acai-do-Amazonas) has been investigated with the aim of sustainability. The palm that is mainly used for basic nutrition of local populations, could also form the basis for models of self-sustained technological and industrial development. The extractive exploitation mainly in riverside communities, where its use is essential in food, it presents insufficient to attend a business model in isolated communities. Therefore, the study was based on obtaining knowledge and its potential applicability in the production of seedling, by increasing levels of irradiance in order to evaluate its growth in diameter, height and number of leaves. In the analysis of growth in different irradiation levels *E. precatoria* Mart. showed no significant difference in height, the diameter had high development in seedlings subjected to higher levels of irradiance and the number of leaves was higher in the environment with lower irradiance index. The behavior exhibited by the species suggests that *E. precatoria* tolerates environments with different levels of irradiance.

Keywords: Amazon, growth, monocot, shade, substrate, tropical

1. Introduction

Euterpe precatoria Mart. is distributed throughout the Amazon region (Miranda et al., 2001), one of the most widespread and common species of the family and gender, in the Neotropics (Henderson, 1995). This species are spread by seed, by the fact that it has no tillers, as *Euterpe oleracea*. The germination is generally characterized by difficulties, which vary from the morphological characteristics of the seeds to the physiological peculiarities of the germination process, hindering the production and subsequent establishment of the seedlings (Cunha & Garden, 1995).

That research, relating to growth of seedling, showed that the seed are very important in commercial practice, as the palm trees, mostly, are propagated through the seeds, especially those who do not have tillers. Miranda et al. (2008) argue that descriptive studies of palm trees seed germination are important to the full knowledge of the germ and basic process for efficient technical development of seedling production. Regarding this aspect, we highlight the work of Jordan (1970), Pinheiro Neto and Araújo (1985), Queiroz (1986), and Belin and Queiroz (1987).

The installation of sustainable plantations of *E. precatoria* under natural conditions require more studies related to large-scale adaptability of planting, as studies related to monitoring germination and seedlings. Most likely, this would provide greater possibility of perpetuation of the species, favoring the establishment of progeny. Thus, this study aims to evaluate the performance germination and early growth of seedlings (Miranda, Barbosa, Rabelo, & Santiago, 2008).

2. Materials and Methods

2.1 Location of Study

The study was conducted at the Laboratory of Palms - LabPalm, Biodiversity Coordination (CBIO) of the National Institute of Amazonian Research (MCTI - INPA), located in Manaus, AM, Brazil.

2.2 Experimental Installation for Monitoring the Seedlings

Seedlings of *Euterpe precatoria* were selected in the nursery of the Laboratory of studies in Palms, INPA (LABPALM), for uniformity of size and plant sanity. The experiment was mounted in suspended benches and the experimental design was completely randomized in 4 treatments with 7 repeats (seedlings):

T1 = 30% (200 to 400 $\mu\text{mol photons m}^{-2} \text{ s}^{-1}$);

T2 = 50% (500 to 700 $\mu\text{mol photons m}^{-2} \text{ s}^{-1}$);

T3 = 70% irradiance (800 1000 $\mu\text{mol photons m}^{-2} \text{ s}^{-1}$);

T4 = full sun (1300-1800 $\mu\text{mol photons m}^{-2} \text{ s}^{-1}$).

It is noteworthy that the bands of light may vary depending on the time of year. The plants studied were packed in polyethylene bags (initially 500 g, later 2 kg and 5 kg) containing black earth and vermiculite.

2.3 Parameters Assessed

The analysis parameters were taken every 15 days during a period of 8 months. The following quantitative and qualitative parameters were: height (cm), diameter (mm), number of leaves, sanity (for viewing), mortality and survival of seedlings.

2.4 Survival and/or Mortality

The survival was calculated by the formula:

$$S (\%) = ((N - n) / N) \times 100 \quad (1)$$

Used by (Moreira, 2011), where:

S (%) Survival rate species; N: Number of individuals of the species planted; n: number of dead plants of the species.

2.5 Statistical Analysis

The results were submitted to analysis of variance and means were compared with each other by 5% Tukey test, considering the normality we used the Kruskal Wallis test in the analyse of diameter (Zar, 1974) using the Program ASSISTAT - Assistance Statistics (version 7.7 Beta) UFCG - Campina Grande-PB (Silva & Azevedo, 2009).

3. Results and Discussion

The plant growth is dependent change in the physiology which can be assimilated by the measurement rate and/or the morphology of the plant (Hunt, 1982). In this work we were studied morphological parameters, measured the diameter, height and number of leaves.

As for the time there were no significant differences between treatments (Table 1). Meirelles (2007) evaluated the increase in palm-raffia height under different shading screens and concluded that there was no difference in the development of seedlings; this result supports the results of this work.

Table 1. Height of palm açai seedlings (*Euterpe precatoria* Mart., Arecaceae) in 4 treatments

Time (days)	Irradiance				F
	30%	50%	70%	Full sunlight	
15	15,88571	15,20000	14,35714	14,88571	1.6501 ^{ns}
30	16,47143	15,91429	14,54286	15,44286	2.2557 ^{ns}
45	16,94286	16,55714	14,54286	15,97143	0.8246 ^{ns}
60	17,40000	16,87143	17,17143	16,72857	0.2075 ^{ns}
75	18,31429	17,40000	18,07143	19,42857	1.7530 ^{ns}
90	19,40000	18,21428	17,97143	20,34286	2.4376 ^{ns}
105	20,42857	19,17143	19,54286	21,20000	1.8451 ^{ns}
120	20,85714	20,38571	20,11429	21,54286	0.9272 ^{ns}
135	21,38571	20,82857	20,90000	22,01429	0.6254 ^{ns}
150	21,95714	21,05714	21,21428	22,74286	1.0025 ^{ns}
165	22,15714	21,21428	22,37143	23,91429	1.4409 ^{ns}
180	22,62857	21,30000	22,75714	24,38571	1.6120 ^{ns}
195	23,24286	21,97143	23,10000	24,81429	1.4873 ^{ns}
210	23,88571	22,27143	23,64286	25,01429	1.4388 ^{ns}
225	24,84286	22,91429	24,24286	25,50000	1.1710 ^{ns}

Note. Critical F: 3.0088; CV < 30; ns: no significant differences ($p < 0.05$).

Regarding the number of leaves, significant differences with higher averages were observed in shaded treatments not continuous analysis (Table 2). The plants were at higher irradiance greater variation in reduced number of plant leaves in shading conditions, meaning that this condition was greater falling leaves resulting in an increase in diameter.

Table 2. Number of açai palm leaves (*Euterpe precatoria* Mart., Arecaceae) in 4 treatments

Time (days)	Irradiance				F
	30%	50%	70%	Full Sunlight	
15	3,42857	3,71429	3,85714	3,57143	2,7000
30	3,57143	3,85714	4,00000	3,85714	2,4184
45	3,57143	3,85714	4,00000	3,85714	2,4184
60	3,71429	4,14286	4,00000	3,85714	1,5577
75	3,71429	4,57143	4,57143	4,42857	6,0239
90	4,00000	4,57143	4,57143	4,42857	3,9284
105	4.14286°	4.71429a	5.00000a	4.85714a	8,8094*
120	4.14286°	4.71429a	5.00000a	4.85714a	8,8094*
135	4,57143	4,71429	5,14286	4,85714	4,5604
150	4,71429	4,71429	4,85714	4,71429	0,5238
165	4,85714	4,85714	5,14286	4,57143	3,3884
180	5,00000	4,85714	5,14286	4,71429	2,1039
195	5.14286°	4.85714ab	5.00000ab	4.28571b	7,7193
210	5.28571°	4.85714ab	5.14286ab	4.57143b	8,2047*
225	5,14286	5,00000	4,71429	4,57143	4,3068

Note. Critical H: 7,8147; ns: no significant differences ($p < 0.05$).

Significant differences were found in diameter at 210 days by F test, however the difference was not sensitive to the Tukey test. This case is provided in the literature, F can approach but not reach significance and yet the Tukey

test can find significant difference between the highest and the lowest average or the reverse may also occur also occurs with other comparison tests It should not be understood as an error in the analysis (XX ASSISTAT). To 225 days, plants under full sunlight showed statistically on average diameters greater than those shaded by Tukey test ($P > 0.05$) (Table 3).

Table 3. Diameter of palm açai seedlings (*Euterpe precatoria* Mart., Arecaceae) under different levels of irradiance

Time (days)	Irradiance				
	30%	50%	70%	Full Sunlight	F
15	7,26286	7,28286	6,81857	7,03571	1.2485 ^{ns}
30	7,42143	7,51714	7,14429	7,24286	0.7007 ^{ns}
45	7,54000	7,87143	7,83286	7,51571	0.8681 ^{ns}
60	7,88429	8,11571	8,26429	8,15429	0.4850 ^{ns}
75	8,27429	8,38000	8,51143	8,77143	0.5802 ^{ns}
90	8,45571	8,80857	9,01714	8,99143	0.8183 ^{ns}
105	8,59857	9,24286	9,61000	9,20429	1.8157 ^{ns}
120	8,84429	9,38143	9,84572	9,46286	1.6289 ^{ns}
135	9,09714	9,48571	10,19714	9,75143	2.2177 ^{ns}
150	9,24571	9,61857	10,44714	10,17571	2.8777 ^{ns}
165	9,78000	9,76429	10,76143	10,54143	2.7591 ^{ns}
180	9,88143	9,98429	10,81571	10,96714	2.6020 ^{ns}
195	10,12857	10,15286	11,07286	11,24000	2.6020 ^{ns}
210	10,13429	10,39286	11,16571	11,49857	3.3246*
225	10.33571 ^b	10.61000 ^{ab}	11.32429 ^{ab}	11.85286 ^a	3.4215*

Note. Critical F: 3.0088; CV < 30; ns: no significant difference ($p < 0.05$); *: significant at 5% probability ($p < 0.05$).

A similar result was completed by Claussen (1996), *Euterpe edulis* palm seedlings subjected to environments with more light had higher development. According to Coelho, Miranda, Melo, and Barbosa (2015), *Euterpe precatoria* seedlings showed increase in their photosynthetic apparatus to the largest accumulation of chlorophyll b in order to maximize light gathering for acclimatization in shaded environments. Plants submitted the conditions of higher irradiance needed not this amendment to the maintenance of their metabolism, possibly it could invest more energy in development, expressed a greater diameter than the others.

The occurrence of mortality was not found meaning 100% survival of seedlings.

4. Conclusion

Through the results of this work can be inferred that the species *E. precatoria* are tolerance to environments with different irradiance levels, however presented a better developing diameter plants that are in full sun, perhaps it can be due not invest in a compensatory effect for obtaining necessary light. The time required for this response to occur with greater diameter growth by plants in full sunlight was 210 days. This behavior is a favorable feature for the production of sustainable seedlings for purposes of use in the production chain of açai.

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