Original Article

POTENTIAL PHYSIOLOGICAL SEED *Clitoria fairchildiana* HOWARD IN TIME FUNCTION AND DRYING TEMPERATURE

POTENCIAL FISIOLÓGICO DE SEMENTE DE Clitoria fairchildiana *HOWARD EM FUNÇÃO DO PERÍODO E DA TEMPERATURA DE SECAGEM*

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ABSTRACT: The species *Clitoria fairchildiana* Howard, native to the Amazon region, by a rustic species and be of rapid growth, has been useful in heterogeneous reforestation for the reclamation of degraded areas, used in the planting of streets, public squares, roads and parking lots, due to its wide, leafy canopy and its rapid growth. The work was developed in the Laboratory of Analyses of Seeds of Centro de Ciências Agrárias of Universidade Federal da Paraíba. Thus, this study aimed to evaluate the physiological potential of *C. fairchildiana* seeds submitted to different drying times. The experimental design completely randomized, with treatments distributed in a factorial 4 x 5 (temperatures and periods of drying). It was evaluated to determine the water content after the drying processing for each period (0, 6, 12, 18 and 24 hours). For the evaluation of the effect of temperatures (35, 40, 45 and 50 °C) were performed the following tests: water content, germination, germination speed index (IVG), as well as length and dry mass of roots and aerial portion of seedlings. Drying of seeds of *C. fairchildiana* is recommended at the temperature of 35 °C, within drying 6 hours without compromising the physiological quality of seeds.

KEYWORDS: Sombreiro. Forest species. Desiccation. Water content.

INTRODUCTION

The forestal species *Clitoria fairchildiana* R.A. Howard commonly known as sombreiro, faveira, palheteira, belongs to the Fabaceae family. Its distribution is mainly in dense ombrophilous forest in Amazonia in secondary formations and features clear preference for fertil soils and high humidity, due to its wide, leafy canopy and its fast growth. It is widely used in urban and rural restation in degraded areas and reconstruction of permanent preservation (LORENZI, 2009).

The desiccation tolerance of many seeds is important to ensure their physiological quality during storage. It also enables the anticipation of the harvest, depending on the moisture levels that each species requires or allows for your seeds, because depending on the way in which it is held, this operation may be detrimental to the maintenance of the seed quality, making it infeasible during storage (CARVALHO; NAKAGAWA, 2012).

During the process of seed formation and maturation the water plays an important role, working initially in the expansion and cell division and later as a vehicle for production of photosynthesis. At the end of the seed development the water content still remains high, normally above 40% of the wet weight (MARCOS FILHO, 2005).

According to the level of the seed tolerance the desiccations of them are generally classified as recalcitrant, intermediate and orthodox. The orthodox seeds can be dewatered at low moisture levels, generally on average 5%. The seed longevity of these seeds increases with the reduction of moisture content under low temperatures and relative humidity. The orthodox seeds can be stored for many years without any significant loss in viability, while on in other hand quickly loses of viability can be find if recalcitrant seeds are dried to a very low water levels making the longevity be relatively short (ROBERTS, 1973). Also there is the seeds that show intermediate behavior and can survive under moderate drying, usually between 7 and 10% of the water content.

The drying process occurs by the transference of water from the surface of the seed to the surrounding air, otherwise occurs with the movement of water from the inside of the seed to the surface (CARVALHO; NAKAGAWA, 2012).

That way this study aimed to evaluate the physiological potential of *C. fairchildiana* seeds submitted to different drying times.

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MATERIAL AND METHODS

The present study was conducted at the Laboratório de Análise de Sementes (LAS) from the Departamento de Fitotecnia e Ciências Ambientais of the Universidade Federal da Paraíba, in Areia, PB.

The fruits of *C. fairchildiana* were collected directly from trees matrices, with a minimum distance of 20 meters between them, and forwarded to the laboratory for processing through manual threshing of pods for withdrawal of seeds, which the ones that were badly formed, and with damage were eliminated. The seeds before being used for the evaluations were treated with the fungicide Captan® at the concentration of 240 g to 100 Kg^{-1} of seeds.

After processing, four replicates of 25 seeds were removed and placed to germinate in paper roll of germination type test (the zero period without drying). The treatments with different levels of water were obtained by drying the seeds in the oven (at the temperatures of 35, 40, 45 and 50 °C) for four periods of six hours. The samples were dried were taken for determination of water content, germination, germination speed index, first count of germination, length and dry mass of seedlings.

Water content was determined before and after each drying period using a four repetition of 10 seeds for each drying period by the method of oven at 105 ± 3ºC for 12 h, following the recommendations of (BRASIL, 2009).

Germination was conducted in a germination test paper moistened with distilled water the amount equivalent of 3.0 times the weight of the paper. The seeds were distributed on a double sheet of paper and covered by a single one, in four repetitions of 25 seeds. Subsequently were made rolls and put in plastic bags, which were placed in germination type *Biochemical Oxigen Demand* (B.O.D.) at a temperature of 30 °C. The count of seedlings was performed on 9 day after installation of the experiment, the criteria used for ratings was the normal seedling, the ones that showed previously root and epicotyl.

For determining the germination speed index it was made daily counts of normal seedlings, at the same time, whose index has been calculated according to the Maguire formula (1962).

The length and seedling dry mass at the end of the emergency and germination test was measured previously the normal seedlings evaluating with the help of a graduated ruler and the results were expressed as centimeter per seedling. Immediately after the measurements the normal seedlings had their cotyledons removed and were kept in paper bags and taken to the oven which was set up at temperature of 65 °C until them got the constant weight. After that they were weigthed on an analytical scale accurated to 0.001 g according to Nakagawa (1999).

The statistical design was completely randomized with the treatments distributed in a 5 x 4 factorial scheme, represented by five drying periods (0, 6, 12, 18 and 24 h) and 4 temperatures (35, 40, 45 and 50 °C), at four repetitions. The data was subjected to analysis of variance and polynomial regression by means with the *software* SISVAR version 4.6. for Windows.

RESULTS AND DISCUSSION

The water content of seeds of *C. fairchildiana* decreased continuously over the period tested independently of the temperatures tested. It was verified that when the seed dispersion was found with a water content of around 23% in both the temperature from this point there was a reduction (9%) for the seeds exposed at a temperature of 50 °C (Figure 1). According to Oliveira et al. (2006) seeds are hydroscopic sensitive and have the ability to absorb, yield and even retain water and its moisture content is mainly influenced by the relative humidity and temperature of the air. The initial moisture content of the quixabeira's seeds (*Bumelia obtusifolia* Roem et Schult.) was 25%, which reduced to approximately 5% in 24 h at a greenhouse environment. However when dried in a laboratory environment the moistore content found was 10%, then decreased to 8% after 48 h of drying (NASCIMENTO, 2013). The water content of jenipapo's seeds (*Genipa americana* L.) 36 h of drying was around 30% of water content in a laboratory and environment roof condition, according to Oliveira et al. (2011). Carvalho and Nakagawa (2012) said that increasing water content help increase the temperature of the seed in due to the respiratory processes and higher microorganisms activity.

The highest percentage of *C. fairchildiana* seeds germination achieved the maximum at the temperature of 45 °C reaching values (95%) within 12 h and then starting to decline to 76% in 24 h after drying. The temperatures 35 and 40 °C it did not fit the polynomial regression model, with averages of 95 and 96%, respectively, when the seeds were subjected at a temperature of 50 °C continuously decreased throughout the drying period, the maximum percentage (91%) of germination were achieved with 6 h of drying, and then began to

reduce to values of 66% after 24 h of drying. However, the seeds of sucupira (*Bowdichia virgilioides* Kunth.) that were freshly harvested showed 10.63% humidity (MATHEUS et al., 2009). A study was conducted with seeds of ipê amarelo (*Tabebuia chrysotricha* (Mart. ex A. DC.) Standl.) found that the water content was acceptable in seeds stored at 20 °C with water levels of 13.6% and 11.9% for 60 and 120 days, respectively Martins et al. (2009). Santos et al. (2010) found that seeds of mangaba (*Hancornia speciosa* Gomes) are sensitive to drying in high temperature locations, particularly when the period is extended, resulting in a fast loss germination. According to Oliveira et al. (2011) studying the quality of seeds of jenipapo (*Genipa americana* L.) found that drying favored the emergency percentage in lab environment with (92%) during the period of 12 h of drying.

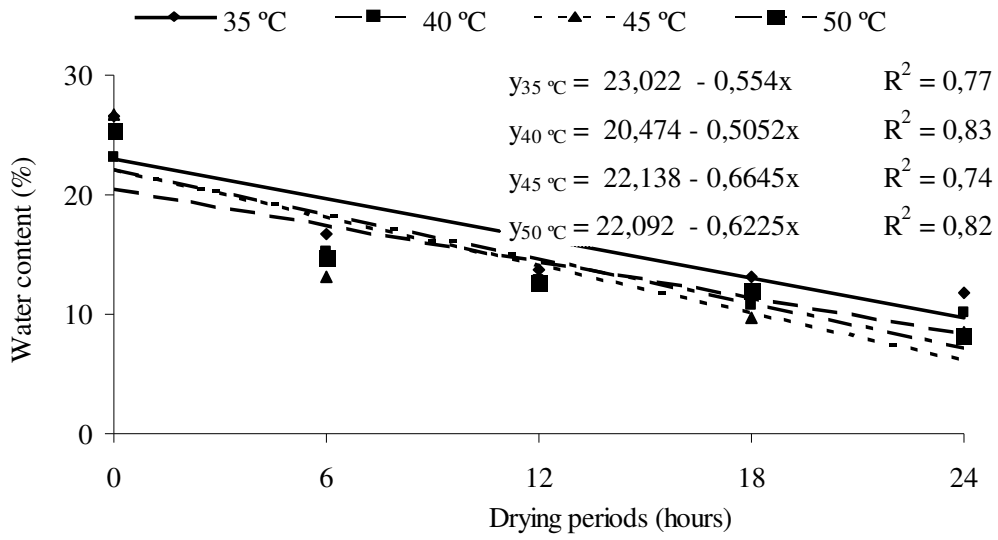

Figure 1. Seed water content of seeds of *Clitoria fairchildiana* submitted to different drying periods and temperatures.

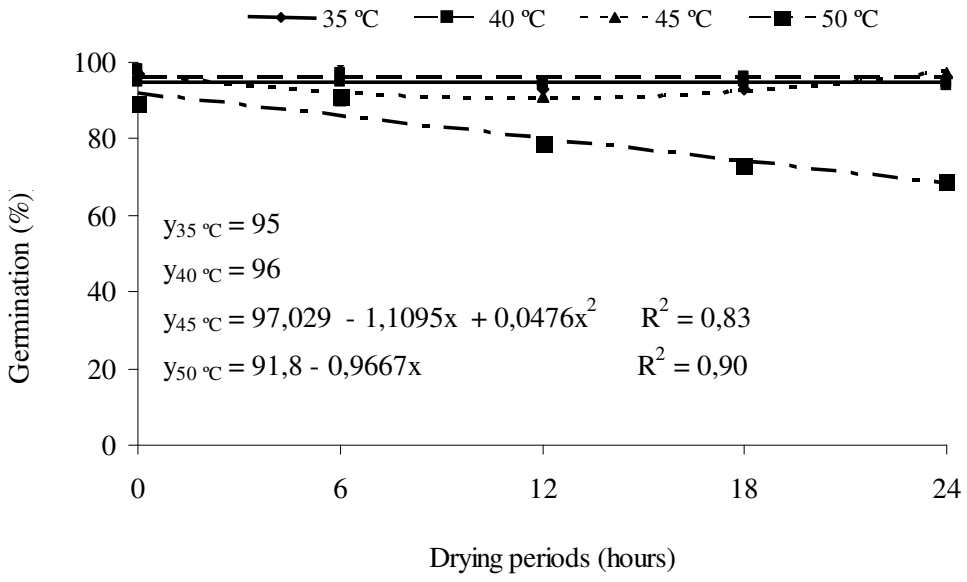

Figure 2. Germination of seeds of *Clitoria fairchildiana* submitted to different drying periods and temperatures.

When evaluating the data on the first count, it appears that the data did not fit the polynomial regression models when the seeds were subjected to drying at temperatures of 35, 40 and 45 °C, averaging results of 90, 83 and 82% for the first count of germination. However, for those dried at 50 °C the first count of germination decreased as increased drying time (Figure 3).This test indirectly evaluates the speed of germination, and a high percentage of germination in the first count means that some seeds germinated more rapidly than the other (NAKAGAWA, 1999). Therefore, one can see that the seeds are sensitive to lost of water, and it has likely caused damage to vital tissues such as the embryo, which dramatically reduces the germination of seeds after drying periods. Similar to what was presented in this study, the drying was also damaging to the seeds of other species as an example the species of mangaba (*Hancornia speciosa* Gomes) whose the drying period reduced the seed germination (BARROS et al., 2010). The percentage of seedlings in the first count of emergency was 67% after the first 4 h, after that period a significant decrease has occurred and, at 144 h the percentages of emergence of seedlings were nulls (OLIVEIRA et al., 2011).

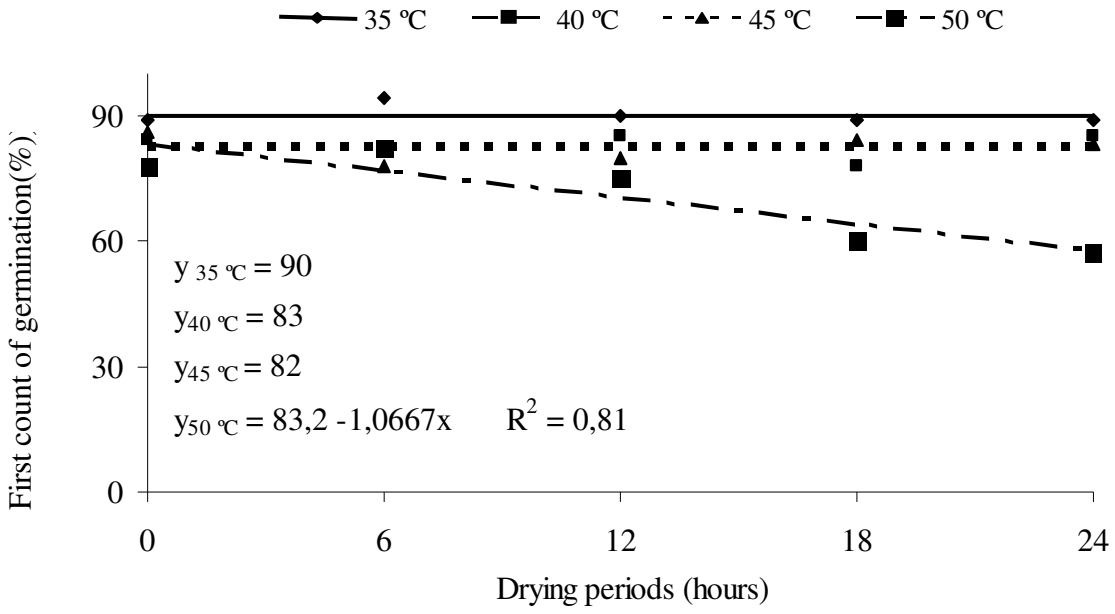

Figure 3. First seed germination of seeds of *Clitoria fairchildiana* submitted to different drying periods and temperatures.

For seed germination speed index of (IVG) *C. fairchildiana*, depending on the different drying temperatures, it was affected by the drying temperature of 35 and 40 °C did not adjusted to the polynomial regression model with mean of 2.56 and 2.5 respectively. The temperature of 45 °C favored highest values (12.33) was recorded after 0h, (witness). The temperature of 50 °C did not favored the (IVG), which decreasing linearly as the drying period increased (Figure 4). The force of the seeds is the reflection of a set of characteristics that determine its physiological potential, being recognized as a variable that indicate lots with greater or lesser likelihood of success after sowing in the field or during storage in different environmental conditions (MARCOS FILHO, 2005). For Oliveira et al. (2011) evaluating the jenipapo (*Genipa americana* L.) observed that the seeds can be dried in greenhouse environment (33 °C and 70%) during 12 h and in the laboratory (28 °C and 75%) for up to 48 h without compromising the physiological quality of the same. The germination speed index of quixabeira in the greenhouse (*Bumelia obtusifolia* Roem et Schult.) environment was higher than in the lab environment, in periods of 24 and 120 h (NASCIMENTO, 2013).

The root growth of seedlings of *C. fairchildiana* (Figure 5) was also affected by the drying period, evidenced in the germination, first count and germination speed index. The greatest length of primary roots achieved values of 13.58 cm after drying for 12 h, and reducing to 8.72 cm in 24 h of drying time at the temperature of 35 °C. When

the seeds were put to dry at temperatures of 40 to 45 °C there was no adjustment to any polynomial regression model, whose average was 11.53 and 10.99 cm respectively. However, when the seeds were placed to dry at 50 °C, there is a reduction in root length of 7.5 cm to 12 cm within 24 h of drying. The results obtained can be seen that the seeds of this species are sensitive to desiccation, probably committed the seeds tissues, which is mainly reserve, resulting in lower transfer to the seedling growth (CARDOSO et al., 2015).

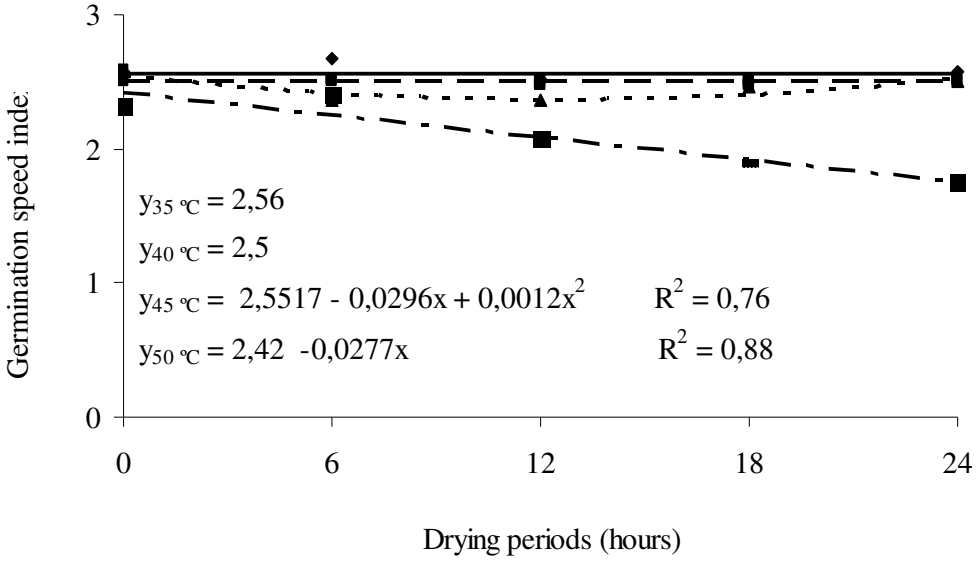

Figure 4. Germination speed index of seedlings of *Clitoria fairchildiana* submitted to different drying periods and temperatures.

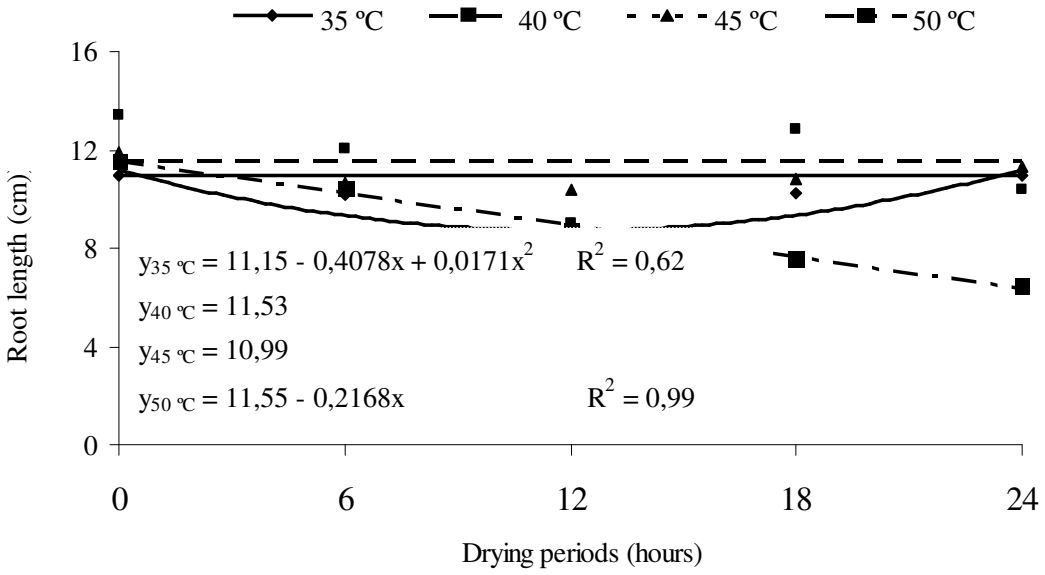

Figure 5. Primary root length of seedlings of *Clitoria fairchildiana* submitted to different drying periods and temperatures.

The length of the seedlings aerial part derived from seeds of *C. fairchildiana* submitted to different periods of drying (Figure 6) initially there was an increase in shoot length (8.67 cm), at 35 °C and decreased to (4.64 cm) after 14 h of drying, while in the temperature of 40 °C was achieved a

length (6.68 cm) after 6 h of drying. At the temperature of 45 °C, when the seeds dried for 13 h obtained (5.22 cm) of shoot length. About the 50 °C, the length of aerial parts linearly reduced as it was prolonged the period of drying. For the shoot length of mangaba (*Hancornia speciosa* Gomes) seedlings grown from seeds subjected to different periods of drying initially there was an increase in shoot length (4,96 cm), corresponding to 56 h of drying; after this period there was a reduction in the size of seedlings, reaching approximately 144 h values of 3.5 cm (SANTOS et al., 2010). The length of the seedlings of jenipapo (*Genipa Americana* L.) can be subjected to drying in lab environment for up to 31 h, while in the greenhouse environment until 12 h (OLIVEIRA et al., 2011).

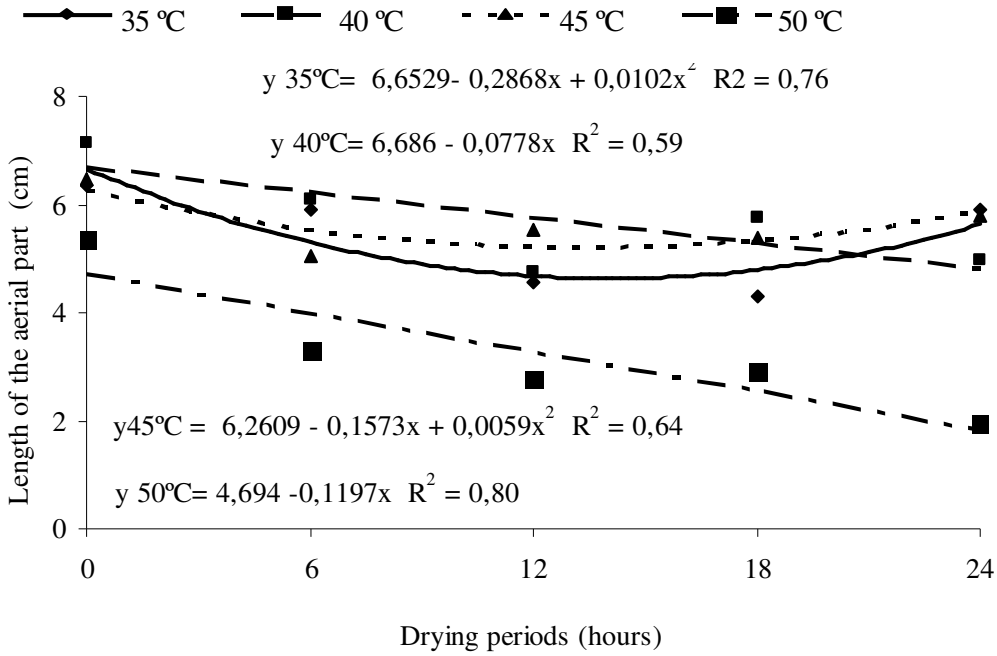

Figure 6. Length of the aerial part of seedlings of *Clitoria fairchildiana s*ubmitted to different drying periods and temperatures.

Figure 7 shows that the results for dry matter content of *Clitoria fairchildiana* seedling roots at the temperature of 35 °C showed the highest content of root dry weight with 0.0333 g. At temperatures of 40 and 45 °C it did not fit the polynomial regression model, averaging values of 0.0242 and 0.0243 g respectively. At 50 °C after 24 h of drying the highest content was 0.0182 g.

The behavior of seeds can be considered as a result of the natural selection process that they are embedded in the environment, in accordance with the environmental conditions of the regions of origin of the species (MARCOS FILHO, 2005). The dry matter content of seedlings from seeds of ameixa-do-pará (*Bunchosia armênica* Cav.) plantlets were tolerant to desiccation for a period greater than 12 h (SILVA et al., 2012).

As observed previously in the emergence tests, seedling length and mass results of the aboveground part of seedlings (Figure 8) decreased similarly over the period of drying. Thus, it was found that drying for a period of 6 h was responsible for a maximum dry matter content (0.0766 g) at 35 °C. When the seeds were submitted to 40 °C it was not adjusted to the regression model with mean (0.0777 g), but at a temperature of 45 °C it was found that the greatest shoot dry weight of seedling at 6 h of drying. At the temperature of 50 °C the values decreased linearly when was increased the drying time. The mass of the dry matter of seedlings was found that the seeds of jenipapo (*Genipa Americana* L.) may be exposed to drying, in the laboratory for 43 h, while those subjected to drying in greenhouse reduced drastically after 12 h (OLIVEIRA et al., 2011).

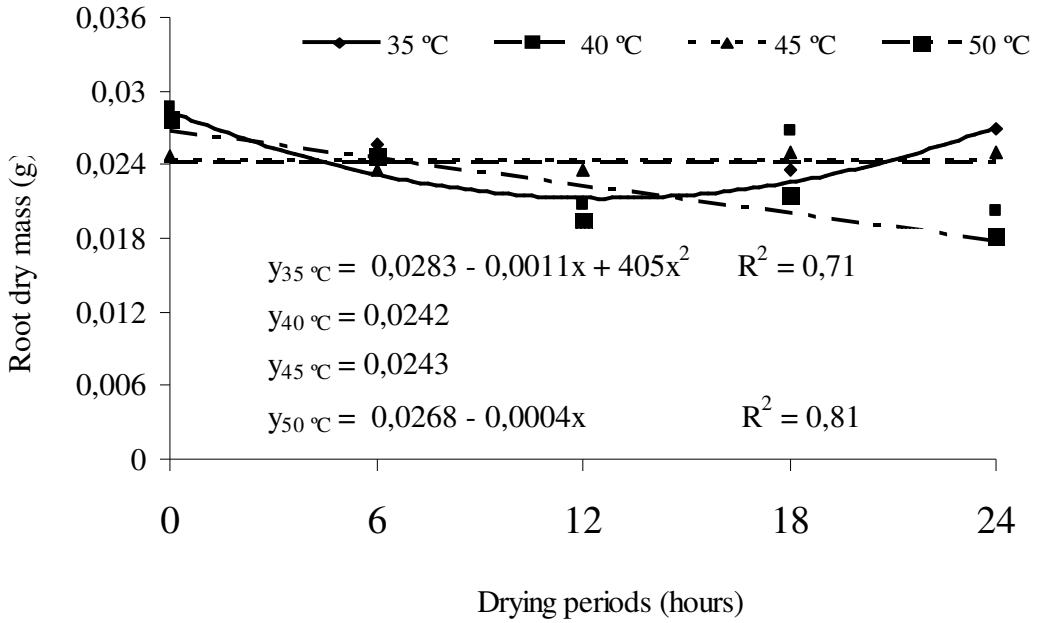

Figure 7. Root dry mass of seedlings of *Clitoria fairchildiana* submitted to different drying periods and temperatures.

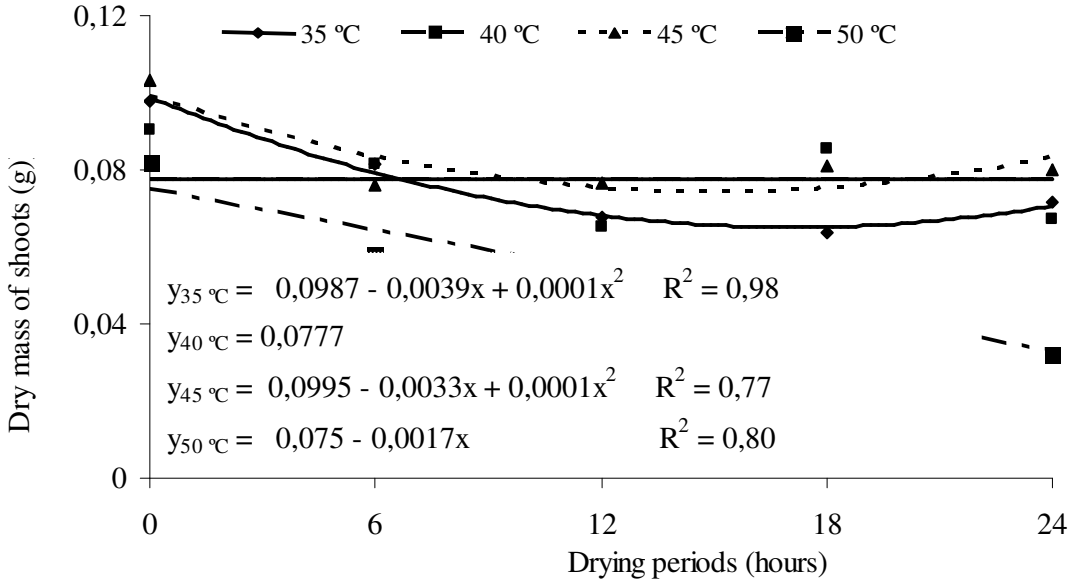

Figure 8. Aboveground dry weight of seedlings of *Clitoria fairchildiana* submitted to different drying periods and temperatures.

CONCLUSION

Drying of seeds of *Clitoria fairchildiana* is recommended at the temperature of 35 °C, within 6 hours drying in order to not compromise the physiological quality of seeds.

RESUMO: A espécie *Clitoria fairchildiana* Howard, nativa da região amazônica, por se trata de uma espécie rústica e de rápido crescimento, tem sido utilizada nos programas de reflorestamentos heterogêneos destinados à recuperação de áreas degradadas com potencialidade para arborização de ruas, praças, rodovias e estacionamentos, devido

à sua copa larga e frondosa. O presente trabalho foi conduzido no Laboratório de Análises de Sementes do Centro de Ciências Agrárias da Universidade Federal da Paraíba. Dessa forma, objetivou-se avaliar o potencial fisiológico de sementes de *C. fairchildiana* submetidas a diferentes períodos de secagem. O delineamento experimental utilizado foi inteiramente ao acaso, com os tratamentos distribuídos em arranjo fatorial 4 x 5,(temperaturas e períodos). Preliminarmente determinou-se o teor de água das sementes para cada período de secagem (0, 6, 12, 18 e 24 horas). Para a avaliação do efeito das temperaturas (35, 40, 45 e 50 °C) foram realizados os seguintes testes: teor de água, germinação, índice de velocidade de germinação (IVG), bem como comprimento e massa seca de parte raízes e parte aérea das plântulas. Para a secagem de sementes de *C. fairchildiana* é recomendada à temperatura de 35 °C por até 6 horas de exposição à secagem sem comprometer a qualidade fisiológica de suas sementes.

PALAVRAS - CHAVE: Sombreiro. Espécie florestal. Dessecação. Teor de água.

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