

Full Length Research Paper

Effect of temperature and pre-germination treatments on seed germination of juerana branca (*Stryphnodendron pulcherrimum*)

Camila Andrade Silva^{1*}, Aleksandro Lara Teixeira², Rodrigo Oliveira Rocha¹,
Airton Campos Baptista¹ and Aline Aparecida Smychniuk da Silva¹

¹Faculdade de Rondônia (FARO), Porto Velho, RO, Brazil.

²Embrapa Rondônia (CPAFRO), Porto Velho, RO, Brazil.

Received 7 May, 2014; Accepted 22 January, 2015

Aiming to define simple and effective methods to accelerate and standardize the germination of juerana branca (*Stryphnodendron pulcherrimum*) (white juerana), seeds of this species were subjected to four types of pre-germination treatments, testing at temperatures of 25 and 30°C. The treatments were: immersion in sulfuric acid for 15 min, immersion in water at 80°C for 5 min, immersion in water at 80°C for 10 min, and control (no treatment). The experiment was based on weekly observations and analysis of the seed germination process. A completely randomized experimental design with three replications was used. According to the results obtained, treatment with hot water at 80°C for 10 min is not recommended for germination of juerana branca seeds. The pre-germination treatment that could be recommended for pre germination treatment of juerana branca seeds is immersion in sulfuric acid for 15 min at 25°C.

Key words: *Stryphnodendron pulcherrimu*; barbatimão; dormancy.

INTRODUCTION

Stryphnodendron pulcherrimum, which belongs to the *Fabacea Mimooideae* family, has various popular names, such as barbatimão, jubarbatimão, juerana-branca, paricá, paricazinho and caubi. The tree has an average height of 4 to 8 m and a broad, flattened and low canopy. The fruit is a pod which is indehiscent, apiculate, straight or curved and glabrous from 6 to 10 cm length, with 10 to 18 hard seeds (Lorenzi, 1992).

According to Lorenzi (1992), juerana branca is a pioneer species that occurs preferentially in younger or older secondary forests of higher lands or well-drained

sandy or clayey lands with medium fertility. This species annually produces a good quantity of seeds and is also recommended for reforestation. Emergence occurs within two to three weeks and the germination rate is generally low.

The species grows in the Amazon region and the south of Bahia in the Amazon and Atlantic rain forests. It is also present in the Guianas, Venezuela and Colombia. Its wood is moderately heavy, softwood of medium texture not highly resistant and with low natural durability. The tree is quite ornamental when in bloom and may be

*Corresponding author. E-mail: camilaagro01@yahoo.com.br. Tel: (69) 81460088.

Author(s) agree that this article remain permanently open access under the terms of the [Creative Commons Attribution License 4.0 International License](http://creativecommons.org/licenses/by/4.0/)

successfully used in tree landscaping. The species is also recommended for ecological reforestation (Lorenzi, 1992).

Seed dormancy is a characteristic process for delayed germination when seeds do not germinate, even under favorable conditions. Around two-thirds of arboreal species have some type of dormancy and this phenomenon is common both in species of a temperate climate and in plants of a tropical climate (Vieira and Fernandes, 1997). Among the most common processes for overcoming seed dormancy are chemical scarification, mechanical scarification, cold and hot-cold stratification, thermal shock, exposure to intense light, immersion in hot water and soaking in cold water (Kramer and Kozlowski, 1972; Fowler and Bianchetti, 2000). For most tropical species, optimum germination temperature is from 15 to 30°C. Maximum temperature ranges from 35 to 40°C and the minimum may arrive at the freezing point. In general, temperatures below the optimal range reduce speed of germination resulting in alteration of uniform emergence perhaps due to increase in time of exposure to pathogen attack. In contrast, temperatures above the optimal range increase the speed of germination, although only the most vigorous seeds manage to germinate (Nassif et al., 1998). Because of the potential usefulness of *Juera* *branca*, it is important to identify simpler and more effective means for its germination and development. Therefore, the aim of present study was to define simple and effective methods to accelerate and standardize *Juera* *branca* (*S. pulcherrimum*) seed germination.

MATERIALS AND METHODS

The experiments were conducted in the Seed Analysis Laboratory of the Faculdade de Rondônia – FARO, located on highway BR 364 at Km 6.5 in the city of Porto Velho, state of Rondônia, Brazil. The seeds of *Juera* *branca* were collected from a species that is found at the Batalhão de Polícia Ambiental – BPA/PM (Environmental Police Battalion), located in the municipality of Candeias do Jamari, RO, Brazil. Collection was made in July 2012. 480 seeds of *Juera* *branca* were selected and subjected to four types of pre-germination treatments as follows:

Treatment 1: Control (seeds without application of pre-germination treatment);

Treatment 2: Immersion in concentrated sulfuric acid (H₂SO₄) for 15 min, later washing with running water and drying;

Treatment 3: Immersion in water at 80°C for 5 min, later washing with running water and drying;

Treatment 4: Immersion in water at 80°C for 10 min, and later washing with running water and dry.

120 seeds were used for each pre germination treatment. Half of the seeds of each treatment were placed to germinate at a temperature of 25°C, and the other half at the temperature of 30°C for the purpose of evaluating germination at different temperatures (240 seeds for each temperature). Two BOD type germinators were used for that purpose. Each treatment was represented by three replications with 20 seeds each. To accommodate the 20 seeds of each replication, "gerbox" boxes were used and as substrate, "germites" paper moistened with distilled water. Seeds were immersed in 2% chlorine bleach solution for a period of 5 min for sanitization. The seeds were then washed in distilled water and

dried on a paper towel to subsequently set up the experiments. Evaluations were made up to 28 days after setting up the experiments. Data were collected in the following manner:

- 1) First germination count = Corresponding to the percentage of seeds germinated on the 14th day after setting up the experiment;
- 2) Total germination percentage = Corresponding to the total percentage of seeds germinated up to the 28th day after setting up the experiment;
- 3) Primary root length = Measurement of the root in centimeters on the last day of the experiment.
- 4) Dry matter = At the end of the experiment, the seedlings of each replication within each treatment were subjected to drying in a laboratory oven regulated at 100°C for 24 h, with the results being expressed in dry matter (g) per treatment;

The experimental design used for data analysis was completely randomized design in a 2x4 factorial arrangement, with two temperatures and four pre-germination treatments, with distribution in three replications of 20 seeds each. The GENES statistical software was used for statistical analysis of the data (Cruz, 2006). Mean values were compared by the Tukey test at 5% probability level.

RESULTS AND DISCUSSION

The results of analysis of variance and test of mean values for all the treatments at the two temperatures evaluated are shown in Table 1. By means of significance of the mean square for all the variables evaluated, the occurrence of differences among the treatments tested was verified.

First germination count (1°GC)

According to the information presented in Table 1, the treatment with sulfuric acid at 25°C (25°C T2) obtained an expressive result in its first count (1°GC) which was 45% of seeds germinated. It may also be noted that the same treatment at 30°C had a good result: 23.33% germinated. Nevertheless, this is much less expressive than that at 25°C.

In the two pre germination treatments in which the seeds were subjected to immersion in hot water, both for the temperature of 25°C and for 30°C, there was no emergence up to the first count except for the 30°C T3 treatment which had 8.33% of the seeds germinated. The controls for both temperatures had statistical results similar to those obtained with the hot water treatments; the 25°C T1 treatment resulted in 1.67% germinated seeds.

Figure 1 show the bar graph in relation to the first germination count comparing the four treatments performed at temperatures of 25 and 30°C. It is evident that treatment 2 (with sulfuric acid), for both temperatures showed good performance in relation to the others.

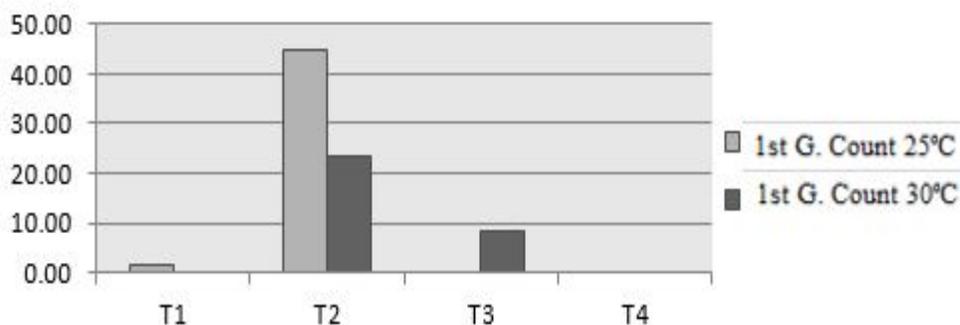
Total germination (G)

After 28 days, we have total germination and the results

Table 1. Mean values in reference to the first germination count (1stGC), total germination (G), dry matter (DM) and primary root length (RL) of juerana branca (*Stryphnodendron pulcherrimum*).

Interaction	1 st GC (%) [14 days]	G (%) [28 days]	DM (g) [28 days]	RL (cm) [28 days]
(25°C T1)	1.67 ^{bc1/}	1.67 ^b	0.00 ^c	0.00 ^c
(25°C T2)	45.00 ^a	65.00 ^a	1.75 ^a	12.20 ^a
(25°C T3)	0.00 ^c	0.00 ^b	0.00 ^c	0.00 ^c
(25°C T4)	0.00 ^c	0.00 ^b	0.00 ^c	0.00 ^c
(30°C T1)	0.00 ^c	3.33 ^b	0.21 ^c	2.73 ^{bc}
(30°C T2)	23.33 ^{ab}	55.00 ^a	0.98 ^b	3.52 ^{bc}
(30°C T3)	8.33 ^{bc}	13.33 ^b	0.41 ^c	5.18 ^b
(30°C T4)	0.00 ^c	0.00 ^b	0.00 ^c	0.00 ^c
Mean Square	803.42 ^{**}	2164.14 ^{**}	1.22 ^{**}	53.89 ^{**}

^{1/}Mean values followed by the same letter in the columns do not differ among themselves by the Tukey test at 5% probability of error. ^{**}Significant by the F test at the level of 1% probability.

**Figure 1.** Comparison of the percentages of seeds germinated in the first count at the two temperatures evaluated (1stGC). T1=immersion in sulfuric acid for 15 min; T2=immersion in water at 80°C for 5 min; T3=immersion in water at 80°C for 10 min, and T4=control (no treatment).

presented in Table 1 show that the treatment with sulfuric acid continued its good performance; the 25°C T2 treatment reached 65% germinated seeds and the 30°C T2 treatment, 55%. In the latter, it may be seen that there was a notable leap in germination in relation to the first count – from 23.33 to 55% (+31.67%). However, the 25°C T2 treatment in its first count showed a more accelerated germination rate, with 45% (1stGC), therefore passing from 45 to 65% (+20%). The treatments with hot water for a temperature of 25°C and treatment 4 (T4) at 30°C were not successful up to those points. Only treatment T3 at 30°C continued giving results: 13.33% of germinated seeds. Varela et al (1991), tested hot water at a temperature of 90°C for the time of 5, 10 and 15 min and the seeds did not germinate. Those results are thus similar to the results obtained in this study.

In regard to the controls, the germination rate was low. In the 25°C T1 treatment, 1.67% of the seeds germinated after 28 days of the experiment. The 30°C T1 treatment led to 3.33% germinated seeds.

According to Lorenzi (1992), the species *S. pulcherrimum* has a generally low germination rate, which is corroborated by these results. In Figure 2, it may be noted that the treatments with sulfuric acid (T2) for the two temperatures (25° and 30°C) showed good performance after 28 days of the experiment. Treatment 2 at the temperature of 25°C stood out, with 10% more germination as compared to the temperature of 30°C. The controls treatments showed a low germination rate up to the end of the experiment. of the treatments with hot water, the 30°C T3 treatment was the only one in which there was germination.

Dry matter (DM)

In Table 1, in the DM column are the results in regard to weight in grams of the dry matter of the seedlings. The 25°C T2 and 30°C T2 treatments stood out, exhibiting 1.75 and 0.98 g respectively. For the other treatments,

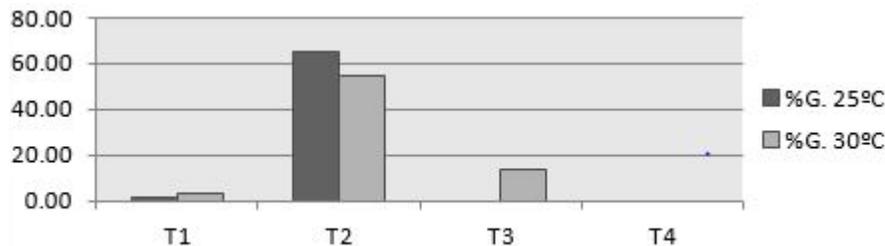


Figure 2. Comparison of the percentages of germinated seeds in the last count at the two temperatures evaluated. T1=immersion in sulfuric acid for 15 min; T2=immersion in water at 80°C for 5 min; T3=immersion in water at 80°C for 10 min, and T4=control (no treatment).

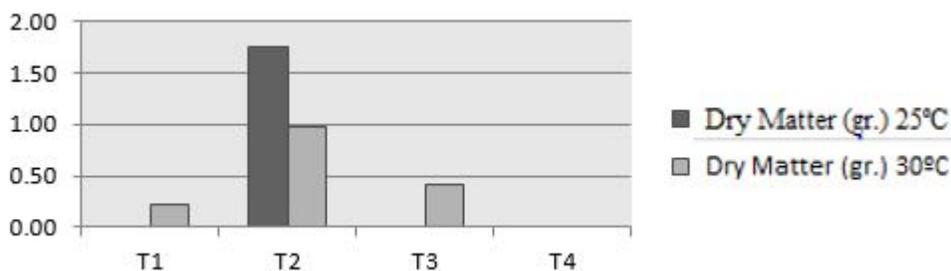


Figure 3. Comparison of the values for dry matter at the two temperatures evaluated. T1=immersion in sulfuric acid for 15 min; T2=immersion in water at 80°C for 5 min; T3=immersion in water at 80°C for 10 min, and T4=control (no treatment).

there was no statistical difference. It was observed that at the temperature of 25°C, the treatment with sulfuric acid provided for greater values of dry matter. Comparing the data for T2 dry matter indicates that there was considerably more development in the experiment at 25°C. It should also be noted that this treatment germinated 10% more than at 30°C (Figure 3).

Primary root length (RL)

In the RL column of Table 1, it may be observed that the 25°C T2 treatment obtained a high mean length in relation to the others, reaching 12.20 cm. Although the 30°C T3 treatment had an apparently higher result than the 30°C T2 treatment. It may not be considered as a better index since the percentages of germination between them are quite different and the quantity of germinated seeds is reflected in the final mean value. Comparing the mean value of primary root growth between the treatments with sulfuric acid at 25 and 30°C, it may be noted that the roots did not develop very much in the 30°C T2 treatment, maintaining a standard short length. Statistically, the 30°C T1 and 30°C T2 treatments obtained similar mean values for primary root growth and

within the treatments at 30°C considering the percentage of germination and dry matter of the 30°C T2 treatment, it may be affirmed that it exhibited better results.

In Figure 4, the big difference among the mean values of primary root length in T2 may be better observed. This is due to the fact that the roots of the treatment at 25°C had better development. From the results presented, it was observed that the treatment with hot water at 80°C for 10 min is not recommended for the two temperatures because it caused death of the seeds. Although, the treatment with hot water at 80°C for 5 min did not show results when subjected to the temperature of 25°C, there was more significant germination for the seeds subjected to 30°C if compared to the results obtained from the controls. However, there was no statistical difference. The pre-germination method that gave the best result was immersion in sulfuric acid for 15 min at 25°C. A good germination rate was observed in this method with considerable seedling development greatly stimulating primary root growth.

Conclusion

The treatment of hot water at 80°C for 10 min is not

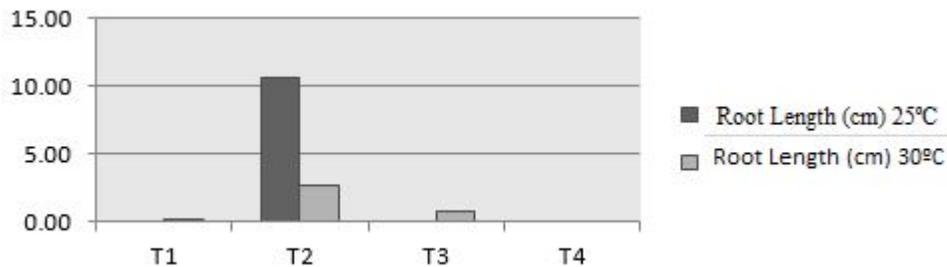


Figure 4. Comparison of the values for primary root length at the two temperatures evaluated. T1=immersion in sulfuric acid for 15 min; T2=immersion in water at 80°C for 5 min; T3=immersion in water at 80°C for 10 min, and T4=control (no treatment).

recommended for germination treatment of juerana branca seeds. The pre-germination treatment most recommended for germination of juerana branca seeds is immersion in sulfuric acid for 15 min at the temperature of 25°C.

Conflict of Interest

The authors have not declared any conflict of interest.

ACKNOWLEDGMENT

The authors thank the Faculdade de Rondônia – FARO for financial support to develop this study.

REFERENCES

- Brasil (2009). Ministério da Agricultura, Pecuária e Abastecimento. Regras para Análise de Sementes – RAS. Secretaria de Defesa Agropecuária. Brasília: Mapa/ACS. Cap 05.
- Cruz CD (2006). Programa Genes: Biometria. Editora UFV. Viçosa (MG). P. 382.
- Fowler JAP, Bianchetti A (2000). Dormência em Sementes Florestais. Colombo: EMBRAPA-Florestas, doc. P. 40.
- Kramer PJ, Kozlowski T (1972). Fisiologia das Árvores. Lisboa: Fundação Calouste Gulbenkian. P. 745.
- Lorenzi H (1992). Árvores brasileiras: manual de identificação e cultivo de plantas arbóreas nativas do Brasil. Nova Odessa: Instituto Plantarum. P. 352.

Nassif SML, Vieira IG, Fernandes GD (1998). Fatores Externos (ambientais) que Influenciam na Germinação de Sementes. Piracicaba: IPEF/LARGEA/LCF/ESALQ/USP, Informativo Sementes IPEF, Abr-1998.

Varela VP, Brocki E, Sá ST (1991). Tratamentos Pré Germinativos de Sementes de Espécies Florestais da Amazônia: IV. Faveira Camuzê–*Stryphnodendron pulcherrimum* (Willd). Hochr Leguminosae. Rev. Bras. Sementes 13(2):87-90.

Vieira IG, Fernandes GD (1997). Métodos de Quebra de Dormência de Sementes. Piracicaba: IPEF/LARGEA/LCF/ESALQ/USP, Informativo Dormência de Sementes, Nov-1997.