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***Influence of three pregerminative treatments in the germination of
Ochroma seeds pyramidale (Cav. ex Lam.)***

*Influencia de tres tratamientos pregerminativos en la germinación de las semillas de
Ochroma pyramidale (Cav. ex Lam.)*

*Influência de três tratamentos pré-germinativos na germinação de sementes de Ochroma
pyramidale (Cav. ex Lam.).*

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ABSTRACT

The present study was carried out the Amazonian State University during the month of June, with the objective of evaluating the influence of three pregerminative treatments in the germination of *Ochroma pyramidale* (Cav. ex Lam.) seed. An experiment was established to determine the germination percentage and germination speed of *O. pyramidale* seeds, subjected to the following treatments: boiling the seed in water at a temperature of 100°C for 20 seconds, sanding the seeds until they lose their natural shine, immersion in 30 % hydrochloric acid for 32 minutes and a control treatment. A completely randomized design was done where four treatments were set up with three replicates and 30 units to be observed, giving a total of 120 units observed. The germination percentage, germination speed index and germination dynamics were evaluated. The treatments T2 (boil in 100°C water for 20 seconds) and T4 (immersion in 30 % hydrochloric acid for 32 minutes) were the ones with the best behavior, reaching a germination percentage of 97 and 96 % respectively, reaching the maximum germination peaks starting eight days after the treatment was applied.

Keywords: pregerminative treatments, germination, seed, germinative power.

RESUMEN

El presente estudio se realizó en la Universidad Estatal Amazónica durante el mes de junio, con el objetivo de evaluar la influencia de tres tratamientos pregerminativos en la germinación de la semilla de *Ochroma pyramidale* (Cav. ex Lam.). Se estableció un experimento para determinar el porcentaje de germinación y la velocidad de germinación de las semillas de *O. pyramidale* sometidas a los siguientes tratamientos: hervir la semilla en agua a una temperatura de 100°C durante 20 segundos, lijado de las semillas hasta que pierda su brillo natural, inmersión en ácido clorhídrico al 30 % durante 32 minutos y un tratamiento control. Se realizó un diseño completamente al azar donde se montaron cuatro tratamientos con tres réplicas y 30 unidades a observar, dando un total de 120 unidades observadas. Se evaluó el porcentaje de germinación, índice de velocidad de germinación y la



dinámica de germinación. Concluyendo que el tratamiento T2 (hervir en agua 100 °C durante 20 segundos) y T4 (inmersión en ácido clorhídrico al 30 % durante 32 minutos) fueron los de mejor comportamiento alcanzando un porcentaje de germinación de 97 y 96 % respectivamente, alcanzando los picos máximos de germinación a partir de los ocho días después de aplicado el tratamiento.

Palabras clave: tratamientos pregerminativos, germinación, semilla, poder germinativo.

RESUMO

O presente estudo foi realizado na Universidade Estadual do Amazonas durante o mês de junho, com o objetivo de avaliar a influência de três tratamentos pré-germinativos na germinação de sementes de *Ochroma pyramidale* (Cav. ex Lam.). Foi estabelecido um experimento para determinar a porcentagem e velocidade de germinação de sementes de *O. pyramidale* submetidas aos seguintes tratamentos: fervura da semente em água à temperatura de 100°C por 20 segundos, lixamento das sementes até perderem o brilho natural, imersão em Ácido clorídrico 30 % por 32 minutos e tratamento controle. Foi realizado um delineamento inteiramente casualizado onde foram montados quatro tratamentos com três repetições e 30 unidades a serem observadas, totalizando 120 unidades observadas. Foram avaliados a porcentagem de germinação, o índice de velocidade de germinação e a dinâmica de germinação. Concluindo que os tratamentos T2 (fervura em água a 100°C por 20 segundos) e T4 (imersão em ácido clorídrico 30 % por 32 minutos) foram os de melhor desempenho, atingindo percentual de germinação de 97 e 96 % respectivamente, atingindo os picos máximos de germinação começando oito dias após a aplicação do tratamento.

Palavras-chave: tratamentos pré-germinativos, germinação, semente, poder germinativo.



INTRODUCTION

Tropical ecosystems host the greatest biological diversity on the planet in almost all forms of life, due to the geographical, environmental conditions and ecological complexity (Ríos *et al.*, 2021). For this reason, the variety of plant and animal species that these ecosystems house favor the maintenance of life (Ríos *et al.*, 2021).

At a global level, natural ecosystems are being threatened by anthropogenic extractive activities (Agus *et al.*, 2020), such as deforestation, livestock, mining and human settlement, which imply change in land use (Agus *et al.*, 2020). These activities generate landscape transformation, loss of ecosystem services and pollution (Patnaik, 2018). This problem arouses interest in the development of research focused on demonstrating the effects of economic activities on the environment and its components, as well as proposing management alternatives (Torres *et al.*, 2018). A mitigation alternative has been and continues to be the recovery of ecosystems through forest species with restorative potential (Ríos *et al.*, 2021).

However, there are species that have seeds with a hard cover, which makes it difficult to accelerate their germination, as occurs with *O. pyramidale*. The tree is native to the American tropics; It is frequently found in intervened and degraded areas (Jiménez *et al.*, 2017). This species belongs to the Malvaceae family, it grows wild in the Amazon jungle, it is very commercial due to the high resistance and low density of its wood. The balsa is a tree with a warm and humid climate, which can grow to more than 30 meters with a diameter of $D_{1.30}$ m of 40 centimeters or more (Doumet-Parraga *et al.*, 2021).

O. pyramidale wood is very light which is suitable for making crafts, toys, insulating material, and airplane manufacturing; boats; hulls and decks of high-speed motorboats and is used in the blades of wind energy turbines in the People's Republic of China. Due to the great demand of the Asian country for the Ecuadorian raft, many of the forests have been affected, which is why it is necessary to reforest this species in areas where 90% of the trees of this species have been extracted (Jiménez *et al.* 2017).



However, this species has a low germination capacity and so far in the bibliography consulted it is not confirmed that treatments are implemented to improve the germination percentage and the growth capacity of the species, understanding that the mechanisms that regulate the beginning of germination are under selective pressures, where there are seeds that, due to the physical and chemical characteristics of the seed coat, have a compact structure and consistency that is impermeable to water and gases, mechanically and chemically inhibiting germination (Ríos *et al.*, 2021). The germination time of seeds also represents a problem for entities that seek to optimize their production in more accelerated cycles and periods of time; these characteristics limit their propagation (Serna-Mosquera *et al.*, 2020).

Despite the multiple investigations that exist on the topic, information is still required on the variation in germination capacity in different treatments and under different environmental conditions (Toledo-González *et al.*, 2019). Taking into account the above, the objective is proposed to evaluate the influence of three pregerminative treatments in the germination of *Ochroma pyramidale* seed.

MATERIALS AND METHODS

Description of the scenarios used in the research

The research took place in the facilities of the Experimental Center for Amazonian Research and Production (CEIPA) of the Amazonian State University, which is located in the province of Napo, in the Arosemena Tola canton, on the Puyo-Tena highway kilometer 44 and consists of an area of 2,848.20 ha, which is divided into primary forest (2000 ha⁻¹), pastures (300 ha⁻¹) and infrastructure (25 ha⁻¹).

The CEIPA coordinates are the following:

- Latitude: (EGS 84) 9862962.58 m S.
- Length: (WGS 84) 178847.24 m E.



Selection of experimental material

The origin of the seeds used for the research were obtained from the seed bank of the logging company Plantaciones de Balsa Plantabal SA, which were previously selected for the largest size and dimensions by using a metal mesh sieve, to extract the impurities, after this process they were submerged in a 250 mm beaker, in order to physically separate the good quality seeds by decanting and floating the infertile material and impurities.

Pregerminative treatments

Pregerminative treatments and a control were evaluated, boiling the seed in water at a temperature of 100 °C for 20 seconds, sanding the seeds until they lose their natural shine, Immersion in 30% hydrochloric acid for 32 minutes in the experiment, temperature values ranged between 20 -27 °C and humidity 27 w were taken into account in a completely randomized design (Figure 1).

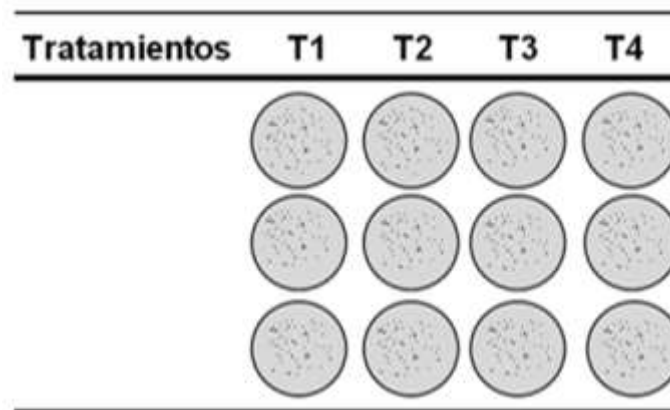


Figure 1. - Germination design in Petri dishes

- Treatment 1 (T1)- Control.
- Treatment 2 (T2)- Boil in 100°C water for 20 seconds.
- Treatment 3 (T3)- Sand the seeds until they lose their natural shine.
- Treatment 4 (T4)- Immersion in 30% hydrochloric acid for 32 minutes.



In the experiment, a quantity of 10 seeds were evaluated per Petri dish with three replicates for each treatment, which gives a total of 120 seeds evaluated, coinciding with what was proposed by (Ríos *et al.*, 2021), who carried out this same type of experiment with treatments. pregerminants in *Ochroma pyramidale* seeds.

In this experiment, the amount of germinated seeds was evaluated from 4-11 days after applying the treatments since in that period the highest percentage of germination (97%) of the seeds studied was reached, with which the percentage of germination and the germination speed index using the following formulas (Equation 1 and Equation 2).

$$PG (\%) = \frac{P}{S} \times 100 \quad (1)$$

$$IVG = \frac{P_1}{t_1} + \frac{P_2}{t_2} + \dots + \frac{P_n}{t_n} \quad (2)$$

Legend: (P) number of germinated seeds, (S) total seeds, (t) hours elapsed from germination to counting $x_1, x_2 \dots x_n$. (X) total germinated seeds in count x_n .

Statistical analysis

The pregerminative treatments were analyzed using descriptive statistics and analysis of variance, using Duncan's multiple range test for the comparison of means with a 95% confidence level.

RESULTS AND DISCUSSION

The germination percentage 11 days after applying the treatments shows higher means for treatments T2 and T4, which consisted of seeds boiled in water at 100°C for 20 seconds, immersion in 30% hydrochloric acid for 32 minutes with a value of 97 % and 96 % with respect to absolute control which reached a value of 73 %. 11 days has been considered as an evaluation criterion since it was when the highest germination values were reached (Figure 2).



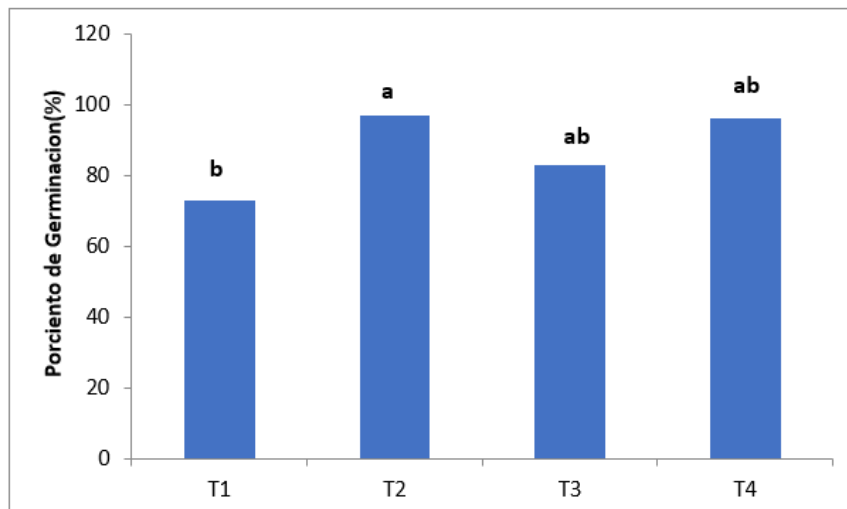


Figure 2. - Percentage of germinated seeds of *Ochroma pyramidale* 11 days after the treatments

Equal letters in the bars do not show significant differences by Duncan's test for $P \geq 0.05$. EE standard error: (T1=3.98), (T2=7.39), (T3=5.46), (T4=6.53). Standard deviation DS: (T1=8.88), (T2=16.53), (T3=12.21), (T4=14.60).

The highest percentage (97 %) was observed in T2 (100°C water for 20 seconds). These values are higher than those reported by González *et al.* (2019), which observed among seven treatments, percentages between 62 and 69% in treatments that included hot water (100°C) with different exposure times (three and ten seconds) being the highest percentages with statistically significant differences with respect to the other treatments evaluated. González *et al.* (2019) indicate that, although the germination percentages of *O. pyramidale* vary between 60 and 84%, and can be affected by the quality of the seed. Other report like Jiménez *et al.* (2017) showed that at 80°C with exposure for three minutes, the percentage is 8.76 % and 19.14 % for seeds exposed to 100°C during 15 seconds. On the contrary, González *et al.* (2019) point out that at 100°C for three seconds the percentage is 64%. Additionally, the impermeability of the cover, intrinsic factors such as water, gases, type of substrate and light can also have an influence on germination variations Jiménez *et al.* (2017). Consequently, González *et al.* (2019) confirm that boiling treatments facilitate the breaking of the seed coat as a result of the impact of temperature, which positively favors germination.



In Figure 3, the dynamics of germination from 4 days after applying the treatments shows a higher average for seeds treated with soaking in water at 100 °C for 20 seconds, immersion in 30% hydrochloric acid for 32 minutes. compared to the absolute control which 11 days after starting the evaluations reached 73% germination (Figure 3).

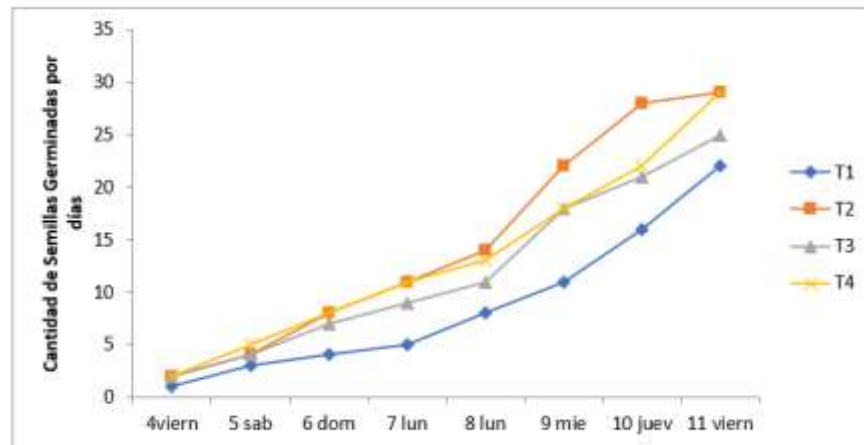


Figure 3. - Germination dynamics of *Ochroma* seeds *pyramidale* 4-11 days after the treatments are applied

Germination occurred on the fourth day after sowing in all treatments and control with some differences in the number of germinated seeds between treatments. These results are similar to those reported by Camacho *et al.*, (2018), who report germination in all treatments four days after sowing, that coincides with Ríos *et al.* (2021), who evaluates several treatments (gibberellic acid 0, 100, 200 and 300mg L⁻¹, and potassium nitrate 0.04, 0.8 and 1.2mg L⁻¹, water at 80°C (0, 1, 2, and 3 minutes), and at 40° C (0, 24, 48 and 72 hours) obtaining 68% germination through boiling treatments, this being the highest percentage obtained compared to the rest of the treatments.

In Figure 4, the germination speed index reached higher values in the treatments evaluated such as soaking in 100 °C water for 20 seconds, immersion in 30% hydrochloric acid for 32 minutes. showing maximum peaks from 8 days after the evaluation began, compared to the control which shows them from 11 days onwards.



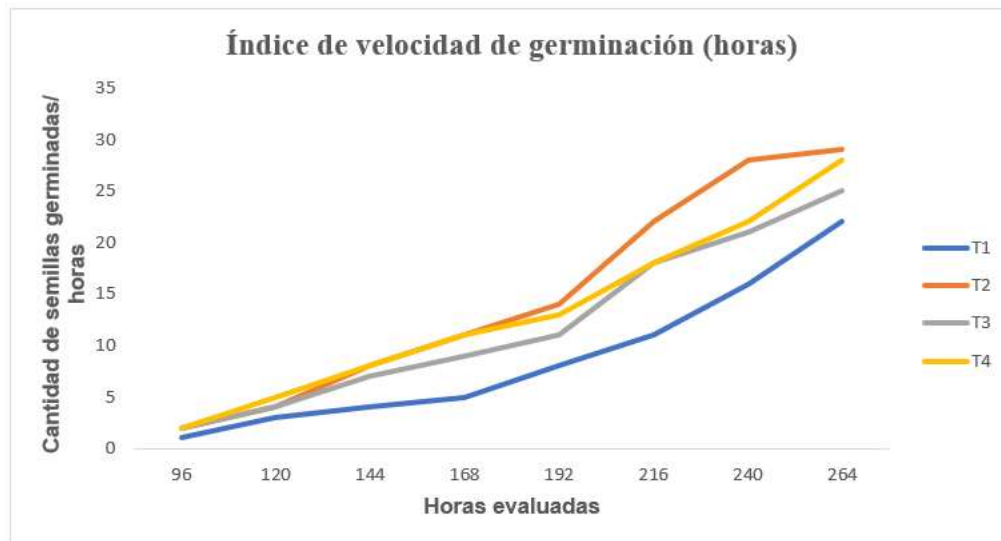


Figure 4. - Germination speed index by hours evaluated after applying the treatments

The germination speed was higher for treatments T2 and T4, which showed their maximum peaks from 192 h after application with maximum values of 14 and 13 respectively, which coincides with what was stated by Ríos *et al.* (2021) that soaked the seeds into hot water at 80°C until the seeds get cool (T1) and soaking them in 1% HCl hydrochloric acid for 1 minute (T5). The seeds reached the highest germination speed and dispersion with 9 and 11 seeds respectively. In relation to the above (Morocho and Leiva, 2019) they found that in seeds treated with biostimulants the speed of germination and average germination time significantly increased compared to the control.

CONCLUSIONS

The treatment (T2), boiling the seed in water at 100 °C for 20 seconds, favors germination dynamics in *Ochroma* seeds by 97%. *pyramidale*.

The treatments (T2 and T4) used in the research favor the germination speed index at 192 hours after application.



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Conflicts of interest:

The authors declare not to have any interest conflicts.

Contribution of the authors:

The authors have participated in the writing of the work and analysis of the documents.



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