



TEMPORAL SCALE AND PRACTICES FOR PRODUCTION OF *POCHOTA FENDLERI* SEEDLINGS: COMPARISON BETWEEN METHODOLOGIES

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ABSTRACT

Objective: This study aimed to describe a methodology that involves obtaining a temporal scale in days, along with the technical information necessary to obtain maximum vigor of *Pochota fendleri* seedlings when sown in containers and/or Gerbox boxes, as well as their quality.

Method: The experimental design was completely randomized, with four replicates, composed of 25 seeds of medium size and light brown color.

Result and conclusion: Emergence of *Pochota fendleri* seedlings grown from freshly harvested seeds of medium size and light brown color sown was 97% at 10 DAS, with emergence speed index of 13.2. Freshly harvested seeds of medium size and light brown color sown are recommended for the production of *Pochota fendleri* seedlings.

Research implications: Obtaining knowledge that guides appropriate practices and the temporal scale is essential for the production of seedlings of native forest species. These seedlings can enhance the success of planting forest stands for timber or non-timber purposes, besides ensuring the establishment and survival to programs for restoration of degraded areas.

Keywords: Cedro Doce, Seeds, Methodology, Forest, Alternative Substrate.

ESCALA TEMPORAL E PRÁTICAS PARA PRODUÇÃO DE MUDAS DE CEDRO DOCE: COMPARAÇÃO ENTRE METODOLOGIAS

RESUMO

Objetivo: Este estudo teve por objetivo descrever uma metodologia que envolve a obtenção de uma escala temporal em dias, juntamente com as informações técnicas necessárias para obter o máximo vigor de plântulas na semeadura em recipientes e/ou gerbox e bem como a qualidade das mudas de cedro doce.

Método: O delineamento experimental utilizado foi o inteiramente casualizado, com quatro repetições, compostas de 25 sementes de tamanho médio e de coloração marrom clara.

Resultado e conclusão: A emergência de plântulas oriundas de sementes recém colhidas de tamanho médio de coloração marrom clara semeadas de *Pochota fendleri* a emergência de plântulas foi de 97% aos 10 DAS com índice de velocidade de emergência de 13,2. Sementes de *Pochota fendleri* recém colhidas, de tamanho médio com coloração marrom clara são recomendadas para produção de mudas da espécie em estudo.

Implicações da pesquisa: A obtenção de conhecimento norteador de práticas adequadas e bem como a obtenção da escala temporal é imprescindível no que se refere a produção de mudas de espécies florestais nativas. Estas poderão potencializar o sucesso da implantação de povoamentos florestais com fins madeireiros ou não madeireiros, e também garantir o estabelecimento e sobrevivência para programas de recuperação de áreas degradadas.

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Palavras-chave: Cedro Doce, Sementes, Metodologia, Floresta, Substrato Alternativo.

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1 INTRODUCTION

The acquisition of knowledge that guides appropriate practices and the achievement of the time scale is essential for the production of native forest seedlings. These can enhance the success of forest stand deployment for timber and non-timber purposes, and also ensure the establishment and survival of degraded area recovery programs.

This is because, when adjusted for a given plant species, they can enhance the superiority in the initial growth characteristics of the seedlings, such as incrementing and robustness (ALENCAR et al., 2018), both aimed at by the forest seedling sector (SOUZA et al., 2020).

The species *Pochota fendleri* (Seem.) W.S Alverson & M. C. Duarte], commonly known as sweet cedar, is a deciduous species, 25 to 35 m tall and up to 2.0 m in diameter at breast height (NAVARRO & MARTINEZ, 1988; CATIE, 1991; ARCO-VERDE & MOREIRA, 2002; CORDERO & BOSHIER, 2003, PEDROZO et al., 2018), has been the target of recent research for presenting economic potential (provides wood of diverse noble uses) and also contributes to the recovery of degraded areas (AQUINO et al., 2019).

Although with the recognized importance of the sweet cedar, it is worth highlighting that all its wood marketed in Roraima is still coming from the exploitation in natural areas, a fact that can be considered as a risk for the species.

Thus, for the development of forest stands and obtaining greater productivity, it is necessary to make appropriate use of cultivation practices, techniques and management. Low quality and/or low quality forest seedlings can lead to failure of the establishment to the field and forest stands (SOUZA et al., 2020).

One of the ways of improving the quality of the forest cuttings and the reduction of time in obtaining them is to create and use practices and management favorable to the growth and development of the plant, both in the increase of the aerial part and the diameter.

In addition to the preparation of substrate mixtures, it is recommended to pay attention to efficient techniques in the production of forest seedlings as well as shorter stay time in nurseries. Whereas substrate mixtures are most often prepared according to materials available in the region of Boa Vista-RR (SOUZA et al., 2020) which may represent low cost.

Currently, the addition of organic matter-based mixtures has been frequently used, which contributes not only to the supply of nutrients but also to the physical characteristics of the growing environment.

2 THEORETICAL FRAME

The forest-based sector can be described as an important component of the Brazilian economy, as it contributes significantly to the generation of products, taxes, jobs and income. The growing expansion of this sector has driven forest investors to opt for the cultivation of native species (ABAF, 2016), and in this scenario, the challenge arises to supply the demand for seedlings of high quality standard and adequate nutritional status for the installation of reforestation for economic purposes.



Potential species for reforestation in northern Brazil include sweet cedar [*Pochota fendleri* (Seem.) W. S. Alverson & M. C. Duarte] (SILVA et al., 2013; **ESPITIA-CAMACHO et al., 2017**; SMIDERLE et al., 2017), which has been prioritized due to the ability to easily adapt regardless of soil and climate conditions (DURIGAN et al., 1997). In addition, the sweet cedar presents rapid growth and wood of excellent quality and added value, factors that enhance and guarantee the future commercialization at local, national and international level (**ESPITIA-CAMACHO et al., 2017**).

The successful implementation and maintenance of reforestation requires the use of seedlings of a high standard of quality and adequate nutritional status, which will ensure higher survival rates, initial establishment in the field (JACKSON et al., 2012), as well as the guarantee of return on capital invested.

To do so, it is necessary to use substrates with adequate chemical characteristics, which provide for the maximization of the growth of the seedlings, allowing for a good formation of the root system and of the aerial part of the plants (WENDLING et al., 2002).

Various materials can be used as substrates for the production of seedlings of forest species, exclusively or in combination, such as sand, soil, expanded clay, vermiculite, sawdust, rice husk, Pinus husk, coconut bark fiber, among others (LIMA FILHO et al., 2019).

According to Marques et al. (2018), when compared to exclusive use, the combination of different materials can lead to satisfactory results, especially in terms of maximizing the growth of seedlings, a fact possibly related to the combination of factors that provide favorable conditions for the availability, absorption, translocation and use of nutrients by plants.

Substrates that ensure the demand for macronutrients and provide greater efficiency in absorption, and consequently, translocation and use of these, should be prioritized for allowing reduction in nutritional fertilization practices, thus ensuring better utilization of nutrients by the plant, thereby reducing production costs and environmental impact, caused by the possible leaching of fertilizers (PINTO et al., 2011; FONTES et al., 2013; SMIDERLE et al., 2022).

Since seedlings with better nutritional status, rusticity and intake will require less investment in fertilizers and maintenance of fertility in the initial stage of reforestation installation, for ensuring high rates of catch, initial grubbing up and survival in the field.

Besides showing superiority in nutritional efficiency, due to the high capacity of converting nutrients into biomass, and allowing reductions in fertilization with macronutrients, the suggested substrate will propose destination for the urchin shell of Brazil chestnut crushed, organic waste, produced in large quantities in the North region and that has low cost of obtaining, as well as sand.

3 MATERIAL AND METHODS

The methodology employed in this study involves obtaining a timescale in days, along with the technical information necessary to obtain maximum emergence of seedlings in sowing in containers and/or gerbox.

The present study was conducted at the Seed Analysis Laboratory. The species used in the present research was sweet cedar [*Pochota fendleri* (Seem.) W. S. Alverson & M. C. Duarte], whose seeds (Image 1 C), for the formation of seedlings, were collected in plants of origin (Mucajaí-RR), implanted in an experimental area installed in September 2008, in the Experimental field Serra da Prata, belonging to Embrapa Roraima and located in the municipality of Mucajaí - RR. The recently harvested seeds of *Pochota fendleri* of medium size of light brown color were selected and uniformized as to the mass presented (average size those that passed through the sieve of 4 mm diameter of holes and with individual average mass of 0.035 g, presenting 13% moisture).

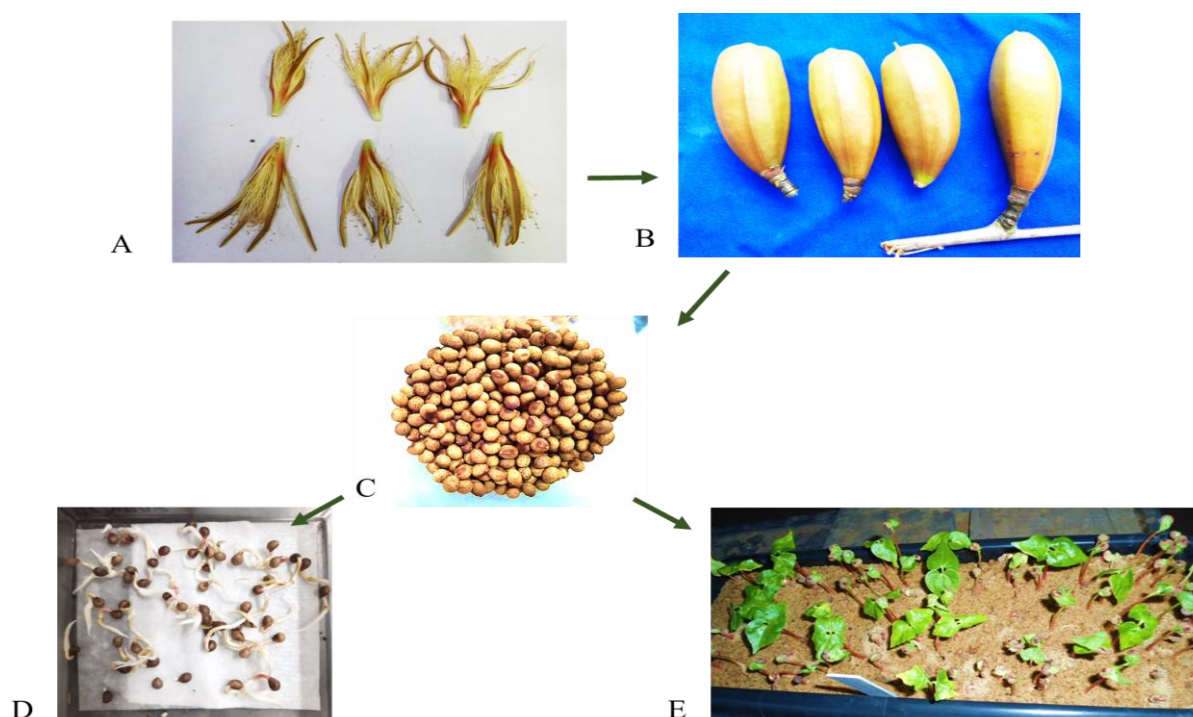


Image 1. Visualization of sweet cedar flowers (A); fruits (B); freshly harvested seeds of medium size of light brown color (C); germination in gerbox (D); and emergence in sand in plastic gardener container (E).

Source: Photos and organization: Smiderle e Souza, 2023

The variables studied were the germination and/or emergence of seedlings in percent, the rate of emergence of index seedlings and the time needed for seedlings to reach the point of repication in days, and the average increase in height (cm) and seedlings diameter (mm).

Thus, to obtain the vigor of sweet cedar seeds the experimental design used was the entirely casualized, with four repetitions, composed of 25 medium sized seeds and light coloring. In order to complement and elucidate the results of the present research, sweet cedar seeds were sown in medium grain sand, at a depth of 1.0 cm in plastic gardeners kept in the home of vegetation. The average temperature in the evaluation period was 27 ± 5 °C and relative air humidity was 60% to 70%.

Thus, a chronological structure was established with results published in the literature comparing with the results of the present study. It is worth highlighting, that the present research is coming from the research and development project, Type I, of SEG Embrapa, number: 10.19.03.005.00.00 - Technologies for the production of seedlings from seeds and plant growth, aiming at planting forest species in Roraima, whose established objective was to generate technologies for forest planting from seedlings obtained from seeds and to indicate forest species for planting in Roraima.

The results were displayed in the form of images, designed for better understanding and visualization. In these images, the point (time) of replanting of seedlings was indicated, as well as the time needed to obtain seedlings suitable for the field, in less time of sowing in the nursery, starting from sowing until the production of seedlings in good condition/ quality for planting in the field measured by the Dickson seedlings quality index (IQD - Dickson et al., 1960).

This result will be of paramount importance for the planning of future mixed or isolated plantations of sweet cedar. This made it necessary to organize and summarize the information in a concise manner, generating a data set that is easily accessible to readers, researchers, nurserymen and academics.



4 RESULTS AND DISCUSSION

The use of seeds with high physiological quality is important for the seedling production process to serve the forestry sector (SMIDERLE et al., 2018). In addition, Alves et al. (2014), evaluating the morphological characteristics and germination of seeds of *Pochota fendleri* collected in an experimental area of Embrapa Roraima, found that newly harvested medium sized seeds started germination at 5 days after sowing (DAS), in which the gerbox germination test, containing filter paper moistened 2.5 times the paper weight, lasted 14 DAS with maximum germination of 60% at 9 DAS (Image 2).

In contrast Souza et al. (2022), characterizing two classes of mass and the coloring of the seed integument of *Pochota fendleri* in order to obtain the vigor of newly harvested seeds, found that it was independent of the size of light seeds and dark seeds. It was verified by gerbox germination test (containing filter paper moistened 2.5 times the weight of the paper), at 14 DAS with the maximum germination obtained for seeds of integument of light coloring with 100% at 14 DAS (Image 2). The rate of emergence of medium-sized seeds (ALVES et al., 2014) when compared with light-colored seeds (SOUZA et al., 2020) showed a difference of 68.6% (Image 2).

In the present research, it was found that the emergence of seedlings originating from newly harvested seeds of *Pochota fendleri*, medium size with tegument of light brown coloring sown in gardeners containing medium sand substrate in vegetation house ambience. Seedling emergence was 97% at 10 DAS with an emergency velocity index of 13.2 (Image 2). It is worth noting that the transpiration point was reached at 30 DAS (Image 2).

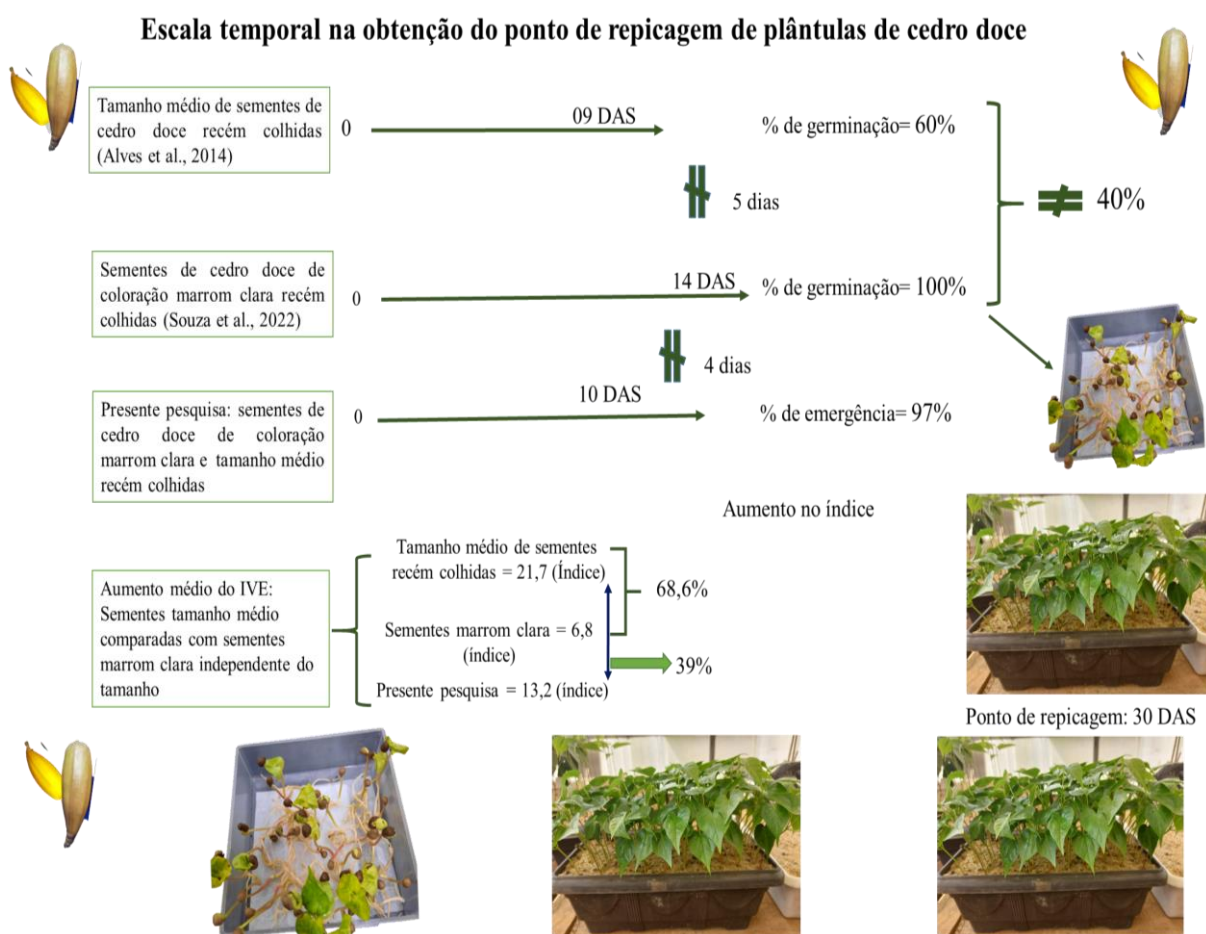


Image 2. Visualization of the time scale in obtaining germination and/or emergence, rate of emergence of sweet cedar seedlings, and the point of replication (10 cm high).

Source: Photos and organization: Smiderle e Souza, 2023



In addition to this, the results of the present research as well as of the research obtained in the national literature reinforce the importance of knowing the time scale in the vigor of sweet cedar seeds.

Alencar et al. (2017) accompanying the growth of sweet cedar seedlings as a function of the evaluation time in nursery, in polyethylene bags in the dimensions of 25 cm x 16 cm, containing soil + sand + carbonized rice husk (S+A+C; volumetric ratio of 2:1:1, per 180 DAT (Image 3). According to the aforementioned authors, the initial growth of the aerial part (number of leaves, height and diameter of the neck) of the sweet cedar at four months of age showed satisfactory quality for field planting.

Escala temporal na produção de mudas de Cedro doce aptas para campo

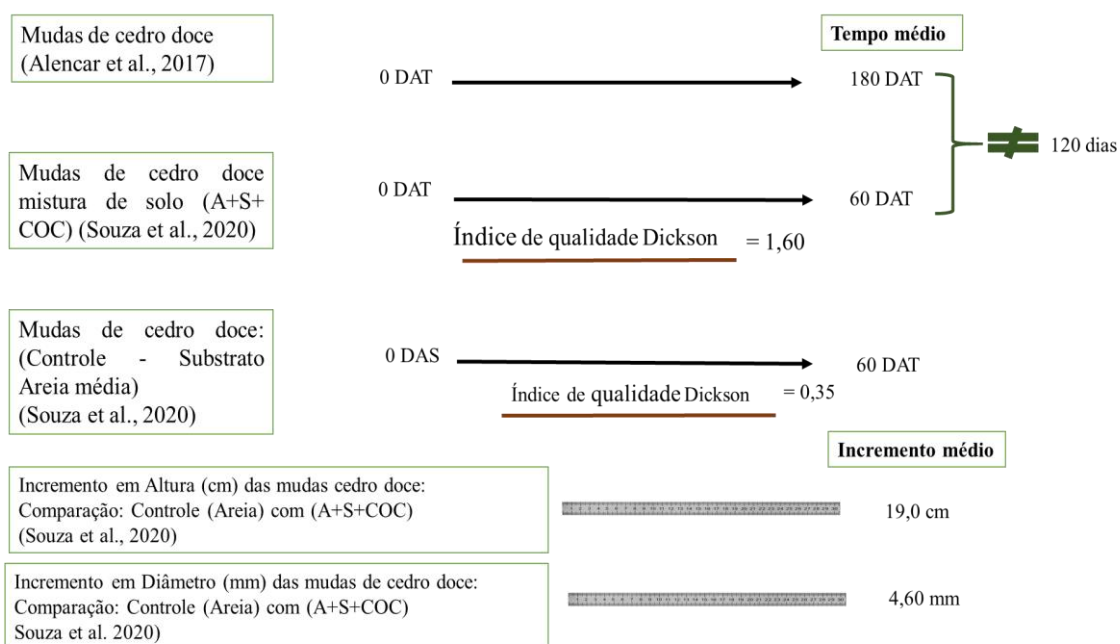


Image 3. Visualization of the time scale (days) in obtaining sweet cedar seedlings, Dickson seedlings quality index, average increment in height and stem diameter.

Source: Photos and organization: Smiderle e Souza, 2023

Souza et al. (2020) working with mixtures of substrates in the volumetric ratio of 1:1:1 of Sand + Soil + Hedgehog shell of chestnut Brazil crushed (A+S+COC) in Embrapa Roraima's roofing nursery, to determine the chemical characteristics of substrate mixtures and the absorption of macronutrients in seedlings of *Pochota fendleri* concluded that the use of the volumetric ratio of 1:1:1 of A+S+COC, ensured positive influence on the morphological characteristics of seedlings at 60 DAT, better quality in the seedlings produced, making them attractive for commercial reforestation. In contrast, the control treatment composed of the medium sand substrate in the research developed by Souza et al. (2020), mentioned above, found that seedlings of *Pochota fendleri* were influenced by the mixture of substrates or only by a single substrate used, both in the initial growth and as well as in the increase in height and diameter of the seedlings stem.



According to Image 3, sweet cedar seedlings grown in the A+S+COC substrate promoted mean increment in seedling height of 19.0 cm in relation to control and as well as average increment in stem diameter of 4.60 mm in relation to control (Image 3). The IQD in the mixture of A+S+COC substrates was 1.60, while for sweet cedar seedlings grown only in sand (Control) under the same conditions, the IQD obtained was only 0.35 (Image 3) at 60 DAT.

Fonseca (2002) points out that this index (IQD) is a good indicator of the initial survival of seedlings in the field, because it weighs important characteristics for the evaluation of the quality of the seedlings to be transplanted, considering their robustness and the balance of the distribution of the mass in the whole plantule (Part aerial + roots).

The chemical characterization of the substrate mixture (A+S+COC) used in Souza et al. (2020) is described in Table 1.

Table 1. Available levels of macronutrients and chemical characteristics of the substrate formulated for the production of sweet cedar seedlings (*Pochota fendleri*)

Substrate	pH	M.O.	K	P	Ca	Mg	Al	H+Al	CTC
	H ₂ O	dag/kg			cmol/dm ³				
A+S+COT	4,70	5,55	1,49	11,73	1,24	1,64	0,30	1,97	6,34

TOC: chestnut hedgehog shell of Brazil crushed.

Source: Souza et al. (2020)

Wendling et al. (2002) mentioned that a material used as a substrate in an isolated manner, hardly meets all the desired chemical characteristics necessary for the growth and development of the seedlings, allowing good formation of the root system and the aerial part of the plants, corrupting with the results of superiority for all the growth characteristics displayed by the sweet cedar seedlings (Image 4) produced in a substrate composed of the mixture of three materials (A+S+TOC). However, it should be noted that this substrate presented the lowest pH value (approximately 4.7), reinforcing that one cannot generalize the fact that substrates with pH below 5, are inadequate and that affect the growth of plants.



Image 4. Visualization of growing sweet cedar seedlings on the countertops in the roof nursery.

Source: Photos and organization: Smiderle e Souza, 2023.

According to Silva et al. (2013), the sweet cedar [*Pochota fendleri*] is a forest species native to the state of Roraima, a region characterized by naturally acidic soils, allowing to infer that the A+S+TOC mixture, as a substrate for the production of seedlings, is within the acceptable pH range to provide adequate chemical conditions and favor the availability of nutrients for the growth of plants of this species.



According to Fontes et al. (2013) the ability of a plant to exhibit high growth rates and increased accumulation of biomass occurs for several reasons, which are related to the availability of nutrients in the substrate, a factor that influences the absorption, transport and use of these by plants.

5 FINAL CONSIDERATIONS

The comparison between methodologies for sweet cedar seeds and the relationships between seed vigor and seedling growth recorded in this study, in a joint way, can contribute to the improvement of the system of production of sweet cedar seedlings, under nursery conditions. However, comparative studies with the literature, considering the vigor of seeds and the production of seedlings, should be carried out, in order to guarantee reliability and repetitiveness of the results obtained.

The practice of the sowing season staggering is not yet carried out by the producers of sweet cedar seedlings, but this method, if scientifically based, can add positively in the seedling production sector, making it possible to produce seedlings at different periods throughout the year, as well as providing seedlings with a differentiated quality standard, depending on the investment capacity of the producer.

The detection of the differential ability of the average increment in height and diameter of the stalk of the saplings, for being very related to intrinsic aspects of the species, emphasizes the need to identify the species that may be indicated for reforestation, recovery of degraded areas and forest stands for the state of Roraima.

Finally, it should be noted that these and other research cited in the present study subsidize information for the improvement of the traditional system of production of seedlings of forest species in the North of Brazil. This requires investments and conceptual, managerial and technical changes in the nurseries for their real adoption, such as, for example, the requirement on the part of the producers for seedlings with a recognized genetic identity and seedlings with a nutritional and morphological standard suitable for commercial plantations.

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