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Effect of seeds storage coffe (*Coffea arabica* L. var. Catuai amarillo) on emergence

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Abstract

The aim of this research was to determine the storage effect of the coffee seeds on the emergency. To obtain this, seeds were packed in packages of sisal and white poliethilene, during periods of 0, 2, 4, 6, 8 and 10 months, under three temperature conditions and relative humidity: condition 1 (20ºC and 78% HR); condition 2 (26ºC and 65% HR) and condition 3 (10ºC and 55% HR). It could be seen that at the time that passed the storage time, a percentage reduction of the emerged plantlet was produced, resulting significantly affected by the storage conditions and by the used package. However, during the first 6 months of seeds storage in condition 1 and 2, the emergency was high (91.1 and 92,2 respectively), compare to conditions 3 that had 5.8% four months after the storage. At the end of the evaluations (10 months), the emergency percentages were of 58.1; 31.4 and 2.2% for conditions 1, 2 and 3 respectively. Being condition 1 (20ºC with 78% HR) and the sisal package the most favorable to keep the physiological quality of seeds for a maximum period of 10 months.
Key words: temperature, relative humidity, time of storage, packings.

Introduction

The crop of coffee (*Coffea arabica* L.) has a great economical and social importance for Venezuela and other tropical countries (9). The marked damage that seeds of this product have during the storage plus the few information available justifies the purpose of doing investigations with the aim of giving more information about the production of this crop (3, 10, 11).

The agriculture labors done in the crop of coffee, as well as the collection and post-crop processing are very important in the obtaining of seeds with high physiological and sanitary quality (7, 11), which selection constitutes a step for the coffee selection, since this must represents and guarantees the genetically pureness of the selected material (8). For this reason,

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producers and investigators have been interested in preserving, in a longer period, the germination characteristics and viability of seeds of this crop (4).

It is important to keep the viability of coffee seeds during storage, for the commercialization, the interchange of genetically material and the germplasm conservation programs, among others (1, 3, 13). In this matter, Barbosa and Herrera (4) mention that coffee seeds are recalcitrant and require intermediate temperatures and high humidity contents to preserve for a longer period of time its germinative power. However, Vossen (18) could preserve coffee seeds for a period of 24 months, drying them until obtaining a humidity content from 10 to 11%, and storing them at 15ºC, though he mentions that the germinative power was higher in seeds with high humidity content (41%). Investigations done about the damage of seeds during the storage allow to deduce that even though there are factors that acts on the germination and emergency of seeds, it is attributed higher importance to the effects of the temperature and relative humidity (14). Therefore, the handle of seeds must be oriented towards the perfection of obtaining and storing methods, besides the application of physiological techniques after the collection of fruits or post-crop, that would keep the viability and initial vigor of these (15).

In Venezuela there are not established norms that indicate how to store coffee seeds with the aim of keeping them viable for a longer period of time to use them at any moment (9). Considering all these aspects and due to the limited information in our country about the storability of coffee and the fast damage that these experienced in store conditions.

The objectives of this investigation were: to evaluate the effect of the storage period, storage conditions (temperature and relative humidity) and the type of package used on the emergency of coffee plantlet.

Materials and methods

This investigation was done at the Postgrado de Agronomía of the Universidad Centroccidental Lisandro Alvarado, located at the «Héctor Ochoa Zuleta» area, in Tarabana, Palavecino municipality, Lara state.

Coffee fruits were collected (*Coffea arabica* L. Catuai Amarillo variety) in a ripening phase, which were pulped mechanically once fermented for a period of 12 hours, then it was proceeded to wash seeds with abundant water to eliminate the mucilage, subsequently were air dried until reaching approximately from 25 to 30% humidity. Later, grains that were damaged, broken, rounded, triangle and too big were discharged (4, 12 and 16). Ochoahjijij

Seeds, once dried and selected, were put in sisal and white

polyethylene packages which were previously washed and disinfected with commercial chloride (5.25%) putting a kilogram of seed per package (2500 – 3000 seeds), later were stored under three temperature and relative humidity conditions, for six storage periods: condition 1, temperature of 20 ± 2°C and 78% approximately of relative humidity; condition 2, environmental temperature (being the mean temperature and relative humidity during the storage period of 26 ± 2°C and 65% of relative humidity), condition 3, temperature of 10ºC and 55% relative humidity approximately.

A randomized statistical design was used with a split plot design 2 (type of package) x 3 (storage conditions) x 6 (storage periods), with three replications.

In order to evaluate the emergency, 60 seeds were taken by replication. Evaluations of the germination were done every two months (0, 2, 4, 6, 8 and 10) for a total of 6 periods per evaluations during all the essay, including the initial evaluation. The obtained information was analyzed using the statistical software SAS. V,12; with a previous verification of the analysis.

For the emergency tests, aluminium trays were used with 25 cm length, 15 cm width and 20 cm height, as a substrate washed sand of river was used, which was previously sterile with high temperatures (100ºC) for 12 hours.

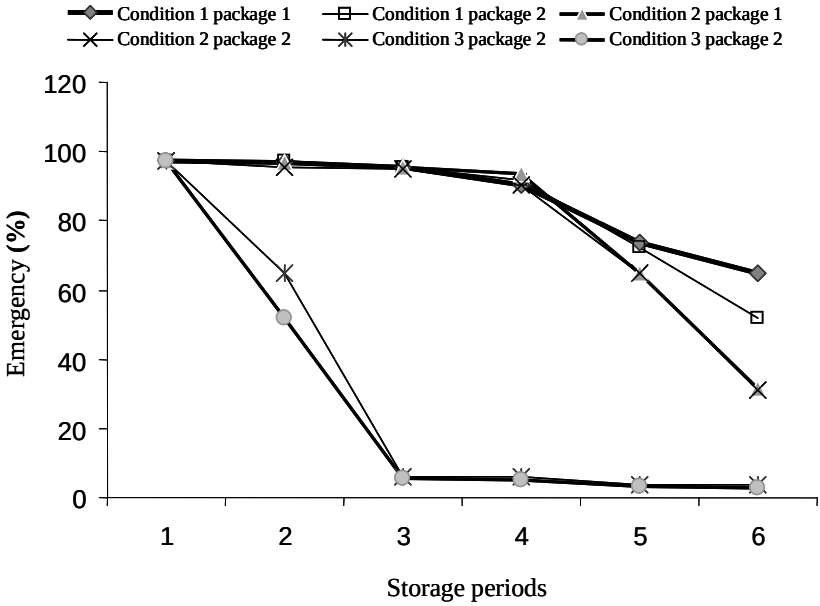
The emergency was evaluated using the following criteria: it was considered as normal plantlet the one that once passed 60 days of put in the substrate showed all its parts well developed, that is, with only one straight stem, well developed cotyledonary leaves, visible primary and secondary roots with a proportional growth in the aerial area (6, 12, 13).

Results and discussion

According to the results obtained in this investigation, it was observed that the emergency percentage resulted to be statistically affected by the storage period, the type of package and by the storage conditions.

In figure 1 is observed that once passed the time the emergency percentage reduced, being affected by the storage conditions as well as by the package used. Seeds had a high percentage of initial emergency (97.5%) which agrees with the results obtained by other investigators (12, 14, 17), proving the good quality of seeds.

The emergency percentage reduces after the second month of storage, reducing at 0.26% in condition 1 (20ºC and 78% of relative humidity), 1.03% in condition 2 (26ºC and 65% of relative humidity) and 37.44% in condition 3 (10ºC and 55% of relative humidity) compare to the initial emergency (97.5%) reaching 58.05, 31.35 and 3.2% in conditions 1, 2 and 3 respectively, once finished the



Condition 1 (20°C and 78% HR); condition 2 (26°C and 65% HR) and condition 3 (10°C and 55% HR)
Package 1: sisal; package 2: white polyethylene

Figure 1. Effect of the time, type of package and of the storage conditions of coffee seeds on the emergency.

evaluation period. In figure 2 the results of the evaluations of the emergency percentage are presented when storing coffee seeds for a period of even 10 months under three storage conditions, where is seen that the storage time had a negative effect on the emergency, however, as it is seen in the figure this effect is mainly due to the storage in condition 3, considered this as unfavorable for the conservation of the physiological quality of seeds. On the contrary, stored seeds under conditions 1 and 2 reached 91.1 and 92.2% of emergency respectively, six months after had been stored, in condition 3 only obtained 5.78% passed 4 months and at the end of the essay only 3.2% of plants emerged.

It is also seen in figure 2 that in condition 1 the quality of seeds is observed much better, keeping an acceptable emergency percentage until the end of the essay. It is important to see that for each storage condition the emergency is different in magnitude, though these follow a similar tendency (figure 1 and 2).

Ortuño and Echandi (14) found similar results storing coffee seeds for 22 weeks, mentioning that germination and the vigor of seeds reduced from 80 to 90%, situation that

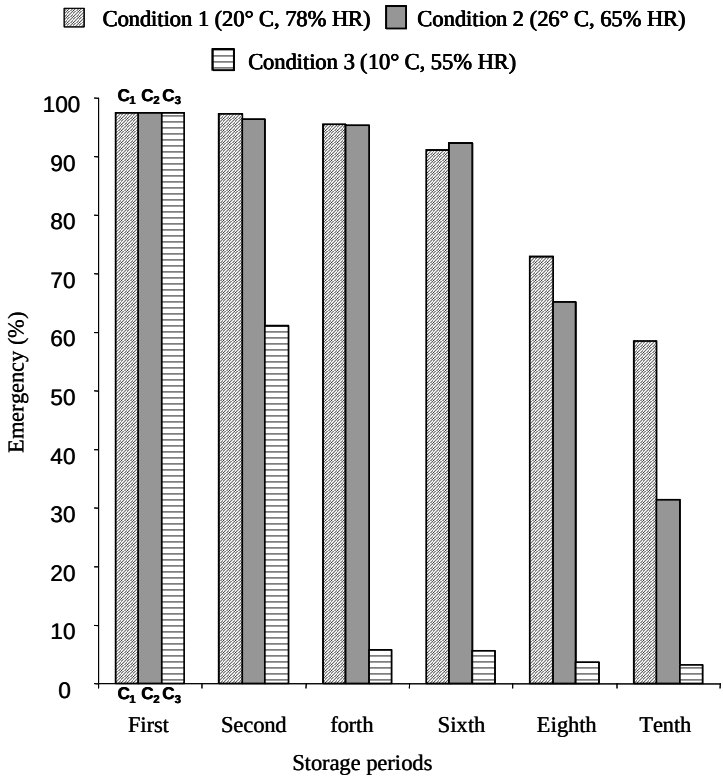


Figure 2. Effect of the time and the storage conditions of coffee seeds on the emergency.

repeated in all the essayed storage conditions (10, 20 and 30ºC; relative humidity of 25.2, 51.7 and 96.2%. However, Aguilera and Goldbach (1) found that at temperatures lower of 20ºC coffee seeds are preserved adequately only if the relative humidity keeps high (70 – 90 %). It must be mentioned that in the results obtained in this research, the emergency was highly affected when preserving seeds at relatively low temperature and humidity (10ºC and 55%), which agrees to the observed by Ortuño and Echandi (14), Vossen (18) and Alizaga and Herrera (2).

The previous answer might be due to the dehydration process of seeds, specially of the embryo, since the lost of the germinative capacity is less evident to the relative humidity of 78 and 65% compare to the 55% of humidity. Levy *et al.*, (10) using coffee seeds of the Guarani cultivars showed that when string them on environmental temperature (20ºC) the germination percentage kept high until were 7 months old. The same authors obtained high germination of seeds of the Canephora variety when

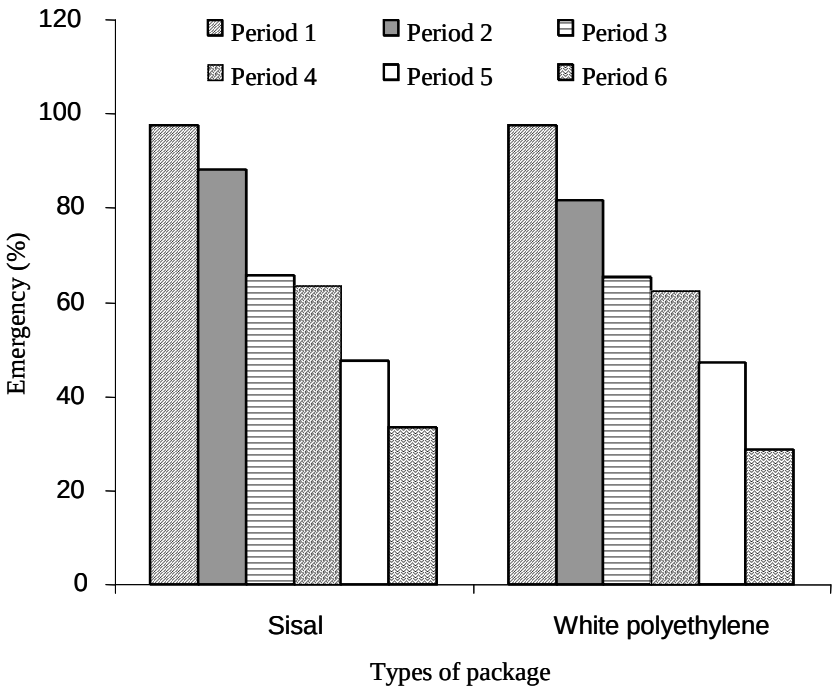


Figure 3. Effect of the time and type of the package used in the storage of coffee seeds on the emergency.

storing them at 20ºC, for a maximum period of 10 months. Similar results were reported by Soto *et al*., (17) when storing seeds of Caturra variety in environmental temperature (23ºC) during 270 days, obtaining values of approximately 90% of germination, though as well as the other mentioned authors the relative humidity of the storage place was not reported.

Studying the interaction, was observed that the used packages (sisal and white poliethylene) affected the emergency once passed the storage time (figure 3). It is also seen in the same figure that even though in both packages a similar tendency was presented, the stored seeds in the sisal had a superior emergency percentage compare to the stored in the one of white poliethylene in all the evaluated periods. This implicates that the sisal package might be used at the moment of doing the storage of coffee seeds.

Different results to the presented in this investigation were reported by Soto *et al*., (17) storing seeds of Caturra variety in black polyethylene bags closed hermetically, and in fabric bags found 89% of germination passed nine months of storage, using closed bags of black polyethylene against 40% of germination in fabric bags. These authors say that even though seeds

had the same content of internal initial humidity (25-30%) the package of black polyethylene kept the same values during a long storage period; instead, when were stored in fabric bags the initial content lowered drastically (11%), because this package allows interchanges with the environment. Braccini *et al.*, (5) reported similar results but using plastic, paper and cotton bags; likewise Levy *et al.*, (10) say that when coffee seeds are stored in plastic bags these have a better germination percentage until 7 months, but using paper bags the germination decreases.

Under the essay conditions, sisal and white polyethylene packages were not hermetically closed as in the cases previously mentioned, which allowed the gaseous interchange to the environment by its porosity condition which might had affected the emergency in both packages.

Conclusions

During the storage of coffee seeds, the percentage of emerged plantlets was affected by the storage conditions and the type of package used, being condition 1 (20ºC with 78% HR) and the sisal package the most favorable to keep the physiological quality of seeds for a period of until 10 months.

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