ACCELERATED AGING EFFECTS ON THE GRAIN QUALITY OF STORED CARIOCA BEAN

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INTRODUCTION: In Brazil, the common bean production need to be stored to ensure its supply in all regions of the country, avoiding shortages in dry season and reducing the fluctuation of market prices (Brackmann et al., 2002). However, it is known that during storage, grain exposure to uncontrolled conditions such as light, moisture and temperature, causes changes in its technological quality which depreciates its commercial value. The browning process of bean tegument has been referenced by various authors to the presence of intense ultraviolet light (Junk-knievel; Vandenberg; Bett, 2007). For research purposes, the accelerated aging of bean grains is one of the options available for the optimization of lab experiments in the evaluation of quality traits. Through an artificial aging simulator chamber of radiation it is possible to accelerate the aging process that occurs naturally, to predict and control the degree of darkening. This research evaluated the effect of the solar radiation simulator chamber on the technological characteristics of carioca bean grains, such as color and cooking time.

MATERIALS AND METHODS: Carioca bean, cv. Pérola, was grown at Embrapa Rice and Beans (Feb/2011). The grains were naturally dried until they reached the humidity around 13%. It was built a chamber to accelerate the aging of grains by simulating solar radiation (80 x 45 x 25 cm (L x W x H) and features two UV lamps Philips TL 40W Actinic BL-K, 60 cm). The temperature increase within the chamber was minimized by the use of 5 hoods (Saron et al., 2000). Half of the sample (500g) was submitted to storage for two months in the dark at room temperature (control bean – CB) and the other half (artificial aged bean – AAB) was submitted to the accelerated aging on the solar radiation simulator chamber (SRSC) at the same period. Samples were evaluated every three or four days for changes in grain tegument color by the CIELab color system (L*, a*, b*), using D65/10° illuminant in a ColorQuest XE (Hunter Lab), and every month for changes in cooking time, using a Mattson cooker (Proctor; Watts, 1987). Quantitative data were evaluated by ANOVA and means were compared by Tukey test ($p<0.05$) using SAS (2003).

RESULTS AND DISCUSSION: Data revealed that the solar radiation simulator chamber was effective for aging bean grains, once their luminosity decreased and the red and yellow colors intensified (Figure 1). The L mean value was different for CB (41.73) and AAB (36.30). It was observed that the mathematical model with a quadratic effect is significant ($p<0.05$), although it had a better data adjustment ($R^2 = 0.66$) for beans submitted to accelerated aging. The mean intensity of a* was also statistically different for CB (10.45) and AAB (12.74). It seems that the mathematical model with linear effect is significant ($p<0.05$), and similarly to the luminosity, the model fits better to AAB data ($R^2 = 0.78$). The mean intensity of b* was statistically different between the two storage conditions (17.92 for CB and 18.69 for AAB), however, the mathematical model was not significant ($p>0.05$). Although the correlation coefficients obtained were low, the mathematical models generated can be used to predict the darkening of common bean cv. Pérola. The exposure of the grain to solar radiation at the SRSC was able to accelerate the darkening process of AAB at 53 days when compared to CB. Results are in agreement with literature, showing that the darkening should be due to oxidation of phenolic compounds present in the seed coat, where solar radiation acts as a powerful catalyst in the reaction (Beninger et al., 2005; Junk-knievel; Vandenberg; Bett, 2007). Regarding cooking time, the sample stored under ambient conditions for 34 days was the most difficult to cook, requiring 51.76 min, although it did not differ from the CB stored for 62 days or from sample stored in SRSC for 34 days. The samples submitted to SRSC for the longest period (62 days) had the lowest cooking time (35.76 min), equivalent to the freshly harvested grain. This shows that UV light did not affect directly the hardening process in cv. Pérola. Differently, prolonged storage (30 and 60 days) of black beans under adverse conditions (41 °C / 75% RH) has shown to accelerate the aging process (Ribeiro; Prudencio-Ferreira; Miyagui, 2005), and to make grains harder and more resistant to cook. It is important to notice that the darkening process is not necessarily associated to the higher grain hardness, as the CB samples had the lower luminosity and the highest cooking time and the AAB were darker and less resistant to cook (Table 1).

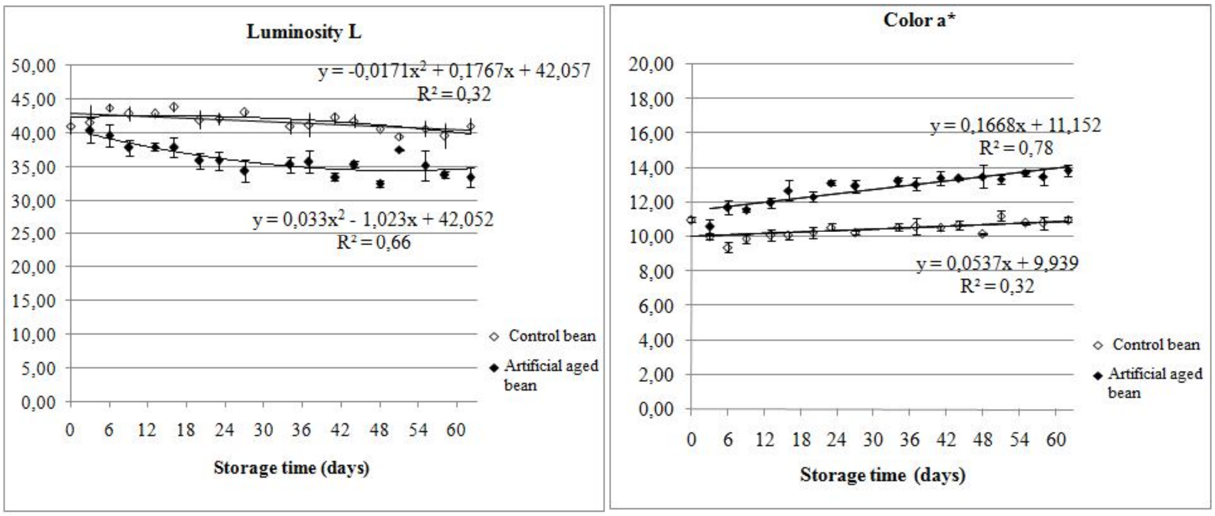

Figure 1 – Luminosity (L) and chroma a* of carioca bean (cv. Pérola) during storage under ambient conditions (control) and in the solar radiation simulator chamber (artificial aged beans).

Table 1 – Cooking time of carioca bean (cv. Pérola) stored under different conditions.

Storage time (days)	Storage condition	Cooking time (min)
0	-	$40.17^{bc} \pm 3.06$
34	Control	$51.76^{a} \pm 3.53$
	Aging Chamber	$47.51^{ab} \pm 0.04$
62	Control	$49.22^{ab} \pm 1.71$
	Aging Chamber	$35.76^{c} \pm 1.82$

Means ± SD (n = 3). Values (within columns) with same letter are not significantly different (p>0.05).

CONCLUSION: The aging chamber was efficient to accelerate the carioca bean darkening, except hardening. Thus, it should be applied to distinguish slowly from fast darkening beans. A deep investigation is still necessary to elucidate UV light effects on hardening or the real relationship between darkening and hardening in carioca beans.

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