DIFFERENCES IN STABILITY OF COMMON BEAN GENOTYPES TO DARKENING AND HARDENING PROCESS DURING STORAGE

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INTRODUCTION: The rapid loss of technological quality of common beans (*Phaseolus vulgaris* L.) is a challenge for its commercial market, making it very unstable. During storage the beans tend to darken the seed coat and become more resistant to cook, especially if stored under adverse conditions of temperature and relative humidity, as occurs in the main producing regions of this grain (BRACKMANN et al., 2002). The search for common bean cultivars with technological characteristics of grain quality is of great importance in breeding programs and to the supply chain. Consumers associate the darkening of the seed coat to its aging and thus to the hardening process. However, there is evidence that not all the old grains are hard and/or dark. The objective of this study was to evaluate whether there is variation between cooking time and color of different genotypes during storage in order to identify the most stable cultivars in relation to these characteristics.

METHODS: Samples of five carioca bean genotypes were grown at Embrapa Rice and Beans. Afterharvest (September/2009) the grains weredriednaturally to 13% moisture, packed in polyethylene bags and storedfor 180days under ambient conditions.The samples wereevaluated for cookingtime(PROCTOR; WATTS, 1987)at 0,90th and180th days, and monthly for the colorof the seed coatthrough readinginthree-dimensional system(L, a*, b*), using a colorimeter (ColorQuest XE, Hunterlab).

RESULTS AND DISCUSSION: The beans of different genotypes showed variation in their seed coat color during the storage period (Table 1). There was a trend of decreasing luminosity (L) in all cultivars, indicating that all grains darkened with storage. The red (a*) and yellow (b*) values oscillated during the storage period, showing no tendency. We could also observe that the grains had different color between each other, both in the beginning and at the end of the storage period, indicating that the genotypes have variability in color when freshly harvested, probably due to genetic characteristics, and they are all prone to darken throughout the storage period. However, some genotypes have lower levels of darkening after harvest, which should be due to the presence of a gene responsible for production of proanthocyanidins (BASSET, 1996). Among the cultivars, BRSMG Madrepérola was the one that stood out, due to its higher luminosity and yellow values, lasting throughout the storage period (180 days), in contrast to BRS Pontal which was darker in the whole period of study. Unlike color, all varieties showed statistically similar cooking time at the initial time of storage and tendency to hardening (Table 2). Genotypes Pérola, CNFC10467 and BRSMG Madrepérola were more stable than the others up to 180 days, showing the lower cooking times. BRS Requinte and BRS Pontal proved to be fairly stable until 90 days, but after this period had their cooking time abruptly increased. Relating the darkening to the hardness, it was observed that the genotypes BRSMG Madrepérola and CNFC10467 were the least darkened and kept low cooking time. Pérola and BRS Requinte darkened in the same proportion, but the last was more difficult to cook. BRS Pontal is the one that darken and harden with the storage period.

Table 1 – Changes in seed coat color of different bean grain genotypes during storage time under ambient conditions.

Genotypes	Storage time (days)						
	0	30	60	90	120	150	180
	L (luminosity)						
Pérola	52.60^{ab}	50.42^{b}	50.89^{ab}	49.32^{ab}	46.17^{b}	45.73^{b}	44.69^{b}
CNFC10467	54.00^{a}	53.06^{a}	51.29^{ab}	50.49^{ab}	50.25^{a}	50.08^{a}	49.59^{a}
Madrepérola	53.93^{a}	52.67^{a}	52.06^{a}	51.36^{a}	50.78^{a}	50.50^{a}	49.08^{a}
Requinte	51.72^{b}	49.73^{b}	48.85^{bc}	43.32^{b}	46.10^{b}	46.00^{b}	45.01^{b}
Pontal	51.33^{b}	48.99^{b}	48.02^{c}	46.67^{ab}	45.60^{b}	44.42^{c}	40.76^{c}
	a*						
Pérola	8.13^{b}	9.20^{b}	8.89^{c}	10.16^{ab}	9.81^{b}	10.30^{ab}	10.86^{a}
CNFC10467	8.42^{b}	8.71^{c}	10.49^{a}	10.33^{a}	10.74^{a}	8.94^{c}	10.18^{b}
Madrepérola	8.97^{a}	9.86^{a}	9.35^{bc}	9.27^{b}	8.86^{c}	9.78^{b}	9.17^{c}
Requinte	7.01^{c}	8.67^{c}	9.57^{b}	9.40^{b}	10.26^{ab}	9.96^{b}	10.71^{ab}
Pontal	8.15^{b}	8.55^{c}	8.99^{bc}	9.76^{ab}	10.27^{ab}	10.88^{a}	9.36^{c}
	b*						
Pérola	14.65^{c}	14.65^{c}	14.54^{c}	14.79^{bc}	13.78^{b}	13.78^{c}	13.73^{b}
CNFC10467	15.52^{b}	15.52^{b}	16.46^{b}	16.20^{ab}	16.35^{a}	14.93^{b}	16.12^{a}
Madrepérola	17.95^{a}	17.95^{a}	18.05^{a}	17.12^{a}	17.13^{a}	17.49^{a}	16.67^{a}
Requinte	13.33^{d}	13.33^{d}	14.42^{c}	13.84^{cd}	13.95^{b}	13.62^{c}	13.70^{b}
Pontal	13.53^{d}	13.53^{d}	12.93^{d}	12.84^{d}	13.15^{b}	13.53^{c}	10.71^{c}

Results are the mean of three repetitions ± SD. Within columns, means with same superscript are not significantly different by Tukey test ($p>0.05$).

Table 2 – Mean cooking time (min) of different carioca bean genotypes during storage time under ambient conditions.

Genotype	Storage time		
	0 days	90 days	180 days
Pérola	25.93^{a} ±0.35	39.79^{a}±0.19	45.20^{c}±1.03
CNFC 10467	28.95^{a}± 3.96	40.35^{a}± 0.96	44.30^{c}±0.95
VC3	32.86^{a}±0.37	42.41^{a}±2.49	49.00^{cb}±2.36
BRS Requinte	29.63^{a}±1.41	34.03^{b}±0.56	52.47^{b}± 1.65
BRS Pontal	31.42^{a}± 0.43	39.73^{a}± 0.67	75.96^{a} ±2.51

Results are the mean of three repetitions ± SD. Within columns, means with same superscript are not significantly different by Tukey test ($p>0.05$).

CONCLUSION: There is a trend of darkening and hardening during storage, but these two events occur at different intensities in each genotype. BRSMG Madrepérola and CNFC10467 are the most stable to the darkening and hardening process, and thus are more recommended for marketing under the technological aspect.

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