

CHARACTERISTICS OF POSTHARVEST QUALITY IN REGIONAL FRUITS TREATED WITH IONIZING RADIATION

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ABSTRACT

In order to investigate the effects of irradiation on the main characteristics of quality postharvest of three cultivated species of the Northeast Region of Brazil, experiments with cashew (*Anacardium occidentale* L. var. Nanum), sapodilla (*Manilkara sapodilla* (L) Van Royen) and mangaba (*Hancornia speciosa* Gomes) have been performed. Cashew peduncles stored for fourteen days under 6.5 °C had presented best results in the sensorial analyses for external appearance, flavour and aroma when irradiated with 1 kGy. Sapodillas irradiated with doses of 300, 600 and 900 Gy have not displayed harmed sensorial qualities when stored under 20 °C during twelve days. Doses up to 800 Gy had not harmed the external and internal appearance of mangabas after being stored for a fortnight under 13 °C. Chemical characteristics of TSS, TTA, pH and solid/acidity ratio have not been affected significantly by the different doses applied to the three studied species. Amount of ascorbic acid was lower in the irradiated fruits, with significant differences for the species *Anacardium occidentale* L. var. Nanum and *Hancornia speciosa* Gomes.

1. INTRODUCTION

Regional fruits are widely appreciated due to their nutritional value and organoleptic characteristics, and the interest for the consumption of so-called exotic species *in natura* has increased in recent years. This has social and economic importance, as fruit production is the sole source of income for many families.

Brazil's Northeast has a great potential for the culture of cashew (*Anacardium occidentale* L. to var. Nanum), sapodilla (*Manilkara sapodilla* L, Van Royen) and mangaba (*Speciosa Hancornia* Gomes). These species have shown great adaptation to dry and hot weather and high luminosity prevalent in the region [1]. However, the culture of these species is still largely extractivist, with a few areas where rational planting is applied. One way or another,

the production as a whole lacks more refined technology, with special regard to postharvest, which could dramatically improve fruit quality and increase the producers' income [2, 3, 4, 5].

Application of new postharvest technologies will make possible the opening of new markets for these fruits, so far restricted almost exclusively to Brazil's Northeast. The knowledge on postharvest quality will complement research that is being carried through with the objective of filling supermarket shelves with good quality fruits. Use of ionizing radiation as method of conservation of foods is considered one emergent technique of the 21st century, and has been justified on the basis of constant losses of agricultural products such as cereals and fruits, besides the interest of health authorities in reducing the amount of chemicals used in postharvest for conservation during transport, storage and commercialization [6].

In the present work the main characteristics of postharvest quality of regional fruits after application of different doses of ionizing radiation have been investigated.

2. METHODOLOGY

Dwarf-precocious cashew (*Anacardium occidentale* L. to var. Nanum), sapodilla (*Manilkara sapodilla* L, Van Royen) and mangaba (*Hancornia speciosa* Gomes), cultivated in the Northeast Region of Brazil, and harvested with complete physiological maturation, had received the following treatments: Dwarf-precocious cashew: doses of 1.0, 2.0 and 3.0 kGy and stored during fourteen days under 6.5 °C and 50% of RH; sapodilla: doses of 0.3, 0.6 and 0.9 kGy and stored during twelve days under 20 °C and 57% RH; mangaba: doses of 0.4, 0.8 and 1.2 kGy and stored during fifteen days under 13 °C and 58% of RH. They were afterwards analysed sensorially and chemically. All species had been conditioned in Styrofoam trays and covered with a 12 µ-thick PVC film. The fruits were irradiated with Cobalt-60 source with dose rate of 7,853 kGy/h.

2.1. Sensorial analyses.

A test of acceptability with use of a nine-point hedonic scale (9=like very much) was performed. Small pieces of the fruits were randomly served in appropriate cabins. All fruits were individually analysed with external and internal appearance.

2.2. Total soluble solids (TSS): It was determined by refractometry. An Atago refractometer was employed, with the results expressed in percentage of °Brix, as recommended by the Adolpho Lutz Institute [7].

2.3. Total Titratable Acidity (TTA): Determined by electrometric procedure, as specified by the Adolpho Lutz Institute [7]. Results are expressed in percentage of citric acid in the pulp.

2.4. (Soluble solids):(titrable acidity) ratio: Calculated as the quotient between the two parameters above.

2.5. Potential of hydrogen (pH): Determined by means of a digital pH meter with a glass electrode dipped in the solution containing the triturated pulp.

2.6. Amount of vitamin C: Determined with the methodology specified by Carvalho et al. [8], having as reacting main the solution of 2,6-dichlorophenolindophenol. Results expressed as mg of ascorbic acid per 100g of pulp.

2.7. Statistical Delineation: It used a fully casualised delineation, and the found values were submitted to the analysis of variance (test F) and comparison of the averages for the test of Tukey, in accordance with Gomes [9].

3. RESULTS AND DISCUSSION

The best dose for the dwarf-precocious cashew was of 1.0 kGy (Table 1), whereas doses of 3.0 and 2.0 kGy have harmed the external appearance and reduced the firmness of the pulp, thus favouring the development of phytopathogens.

Significant differences were not found in the sensorial analyses of sapodilla, with marks equal to or higher than 6.6 for all variables studied in a scale of 1 to 9 (Table 1). However, at the end of the experiment control fruits showed a higher degree of maturation and lower firmness of the pulp to the touch. Besides, internal appearance of the pulp, in the majority of the fruits, was darker than that of the irradiated fruits. This, however, did not affect the general flavour of these fruits, that were greatly appreciated by the appraisers. On the other hand, the succulence and the texture of the pulp have been favoured by doses of 0.60 and 0.90 kGy.

For mangaba, control fruits also displayed greater firmness of the pulp to the touch, as tests with the penetrometer could not be carried out. For this species, some 50% of control fruits showed “wrinkling”, a condition that affected only 24% of those that received 0.40 kGy. It was observed that doses above 1.20 kGy harmed the external appearance of the fruits, causing darkening of the rind.

Chemical analyses of total soluble solids (TSS), total titratable acidity (TTA), soluble solids/total acidity ratio and hydrogen potential (pH) did not result in significant differences between the different doses applied for the three studied species, which indicates little influence of the ionizing radiation on quality characteristics of these fruits, as had been observed by other researchers [10,11]. However, the amount of vitamin C was affected by ionizing radiation in the species *Anacardium occidentale* (L) and *Hancornia speciosa* Gomes (Table 2), with lower figures in the fruits that had received the highest doses, when compared with control fruits.

Table 1. Statistical results of the sensorial analyses of two regional species submitted to different doses of ionizing radiation.

<i>Anacardium occidentale</i> (L)*						
<i>Dose (kGy)</i>	<i>External appearance</i>	<i>Internal appearance</i>	<i>Aroma</i>	<i>Flavour</i>		
0.00	7.30 a	7.20 a	6.20 a	5.40 ab		
1.00	7.70 a	6.90 a	6.60 a	6.30 a		
2.00	5.0 b	6.90 a	4.40 ab	4.10 ab		
3.00	4.70 b	5.60 a	3.50 b	3.70 b		
<i>Manilkara sapodilla</i> (L)#						
<i>Dose (kGy)</i>	<i>External appearance</i>	<i>Internal appearance</i>	<i>Sweetness</i>	<i>General flavour</i>	<i>Texture</i>	<i>Succulence</i>
0.00	8.30 a	6.60 a	6.80 a	7.2 a	7.30 a	7.30 a
0.30	8.30 a	7.20 a	7.40 a	6.80 a	7.20 a	6.70 a
0.60	7.90 a	7.00 a	6.90 a	6.80 a	8.20 a	7.40 a
0.90	8.30 a	6.90 a	6.80 a	6.60 a	8.00 a	7.60 a

*Stored during fourteen days under a temperature of 6.5 °C. # Stored during twelve days under 20 °C. Averages followed by the same letter in the vertical line do not differ statistically for the test of Tukey (P< 5%). Note scale: 1= bad; 5= good; 9= very good.

Table 2. Statistical results of the chemical analyses of three regional species submitted the different doses of ionizing radiation.

<i>Anacardium occidentale</i> (L)*					
<i>Dose (kGy)</i>	<i>TSS (°Brix)</i>	<i>TTA (% citric acid in juice)</i>	<i>Ratio TSS/TTA</i>	<i>pH</i>	<i>Vit. C (mg ascorbic acid/100ml)</i>
0.00	10.72 a	0.24 a	44.66 a	4.29 a	206.63 a
1.00	10.49 a	0.25 a	42.52 a	4.26 a	192.38 ab
2.00	10.27 a	0.20 a	50.96 a	4.45 a	181.69 ab
3.00	10.41 a	0.22 a	48.69 a	4.48 a	133.00 b
<i>Manilkara sapodilla</i> (L) #					
	<i>TSS</i>	<i>TTA (% citric acid in juice)</i>	<i>Ratio</i>	<i>pH</i>	<i>Vit. C (mg)</i>

	<i>(°Brix)</i>	<i>acid in juice)</i>	<i>TSS/TTA</i>		<i>ascorbic acid/100ml</i>
0.00	22.30 a	0.14 a	158.28 a	5.00 a	3.32 a
0.30	21.67 a	0.15 a	149.62 a	4.70 a	2.85 a
0.60	20.49 a	0.13 a	155.22 a	5.01 a	3.33 a
0.90	22.32 a	0.17 a	133.48 a	4.97 a	3.80 a

<i>Hancornia speciosa</i> (Gomes) •					
<i>Dose (kGy)</i>	<i>TSS (°Brix)</i>	<i>TTA (% citric acid in juice)</i>	<i>Razão TSS/TTA</i>	<i>pH</i>	<i>Vit. C (mg ascorbic acid/100ml)</i>
0.00	17.28 a	1.91 a	9.06 a	3.15 a	159.47 a
0.40	16.67 a	1.91 a	8.81 a	3.20 a	127.27 ab
0.80	17.25 a	1.77 a	9.75 a	3.20 a	125.73 ab
1.20	17.83 a	1.69 a	10.52 a	3.22 a	93.53 b

* Stored during fourteen days under a temperature of 6.5 °C. # Stored during 12 days under 20° C.

• Stored during fifteen days under a temperature of 13 °C. Averages followed by the same letter in the vertical line do not differ statistically for the test of Tukey (P< 5%).

4. CONCLUSION

- ionizingradiation had more effect on the sensorial characteristics that on the chemical characteristics of the studied species, with exception of the amount of vitamin C.

- As all species studied are not well known with respect to postharvest physiology, more research must be carried through with use of this technology so that its effects are fully understood.

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