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Post-harvest studies on chemical parameters in different sapota varieties under ambient storage conditions

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Abstract
The current investigation was undertaken to study the physico-chemical changes in different sapota varieties at ambient storage conditions. Analysis was done in terms of chemical characteristics of sapota fruits. The chemical parameters with respect to total soluble solids, total sugars, reducing sugars and non-reducing sugars were recorded at different intervals. Among ten different varieties of sapota, Pala showed significant maximum total soluble solids, total sugars, reducing sugars and non-reducing sugars compared to other varieties. Main objective is to study the quality parameters of sapota varieties under ambient conditions.

Keywords: Sopata, TSS, storage conditions, varieties and non-reducing sugars

1. Introduction
Sapota fruit ((*Manilkara zapota* (L.) P. Royen) is a good source of nutrients including calcium and iron as well as digestible sugar, which ranges from 12 to 20 percent. The fruits are rich in protein, fat, fibre, phosphorus, beta-carotene, and vitamin C. Additionally, it contains a lot of bio-iron, which is necessary for the synthesis of haemoglobin (Hiremath and Rokhade, 2012) [6]. Gallic acid, catechin, chlorogenic acid, leucodelphinidin, leucocyanidin, and leucopelargonidin are among the phenolics that are abundant in it as well (Anand *et al*., 2007) [2].

Sapota is used for the preparation of numerous indigenous medicines. Because fruits contain more tannin content, the decoction made by boiling of sapota fruits is used to reduce diarrhea. Young fruits and flowers were included in an infusion that was consumed to treat lung problems.

Presently, there are only few known cultivars that are now being grown commercially are Kalipatti, Cricket Ball, DHS-1, DHS-2, CO-1, CO-2, Calcutta Round, Oval and Pala. Each variety performs differently and has both strengths and weaknesses. For long-distance transportation and marketability, it is therefore necessary to find suitable varieties or hybrids with desirable characteristics like good keeping quality and shelf life.

Sapota is a highly perishable fruit and has very short storage life at ambient conditions. It is also sensitive to cold storage (Sudha *et al*., 2007) [15]. The post-harvest losses of fruit are high in tropical country like India and vary from 25-30% (Kishore *et al*., 2013) [7]. Physiologically, sapota fruits exhibits a climacteric behavior after harvesting (Lakshminarayana, 1966) [9]. Ripening occurs rapidly and significant increase in the respiration rate and ethylene production. All of which describe it as a highly perishable fruit with a very short shelf life, which makes commercialization more challenging. Depending on the variety and the agroclimatic conditions of production, the fruit ripens at 26°C between 8 and 10 days after harvesting (Morais *et al*., 2006) [12]. Any increase in the shelf-life of this fruits, would contribute to an improvement in its commercialization.

2. Material and Methods
Current experiment entittled post-harvest studies on chemical parameters in different sapota varieties under ambient storage conditions was undertaken in Department of Fruit Science at Sri Konda Laxman Telangana State Horticultural University, Rajendranagar, Hyderabad. The above mentioned sapota varieties were procured from Horticultural Research Station, Mallepally, Nalgonda district of Telangana. Different sapota varieties, including T1 (Kalipatti), T_2 (Cricket Ball), T_3 (Badami), T_4 (Kirtibarathi), T_5 (Guthi), T_6 (Pala), T_7 (Pakala),

T_8 (PKM-2), T_9 (Gorayya) and T_{10} (Singapore) were harvested at optimum stage of maturity from Horticultural Research Station, Mallepally, Nalgonda district of Telangana. Fruits of uniform size, shape and maturity, free from any visible damage, scratch and decay were manually selected for the experiment to maintain the uniformity. Further the fruits were washed in solution containing 0.2 per cent sodium hypochlorite for five minutes to remove the dirt and micro-flora present on the surface of the fruits. The sanitized fruits were surface dried under electric fan and those fruits were used for further experimentation. The fruits were assessed for physical parameters like fruit weight, fruit diameter, fruit length, number of seeds/fruit, weight of seeds/fruit, weight of pulp/fruit, weight of peel/fruit, pulp: seed ratio and pulp: peel ratio initially and shelf life was also recorded. The experimental data was analyzed in factorial completely randomized block design with three replications.

2.1 Total soluble solids (ºBrix)

The juice extracted by crushing the pulp of the sapota and strained through muslin cloth was used for measuring total soluble solids. Total soluble solids was determined at regular intervals by using a Hand Refractometer (Erma Japan) 0 to 32 per cent range and expressed as ºBrix.

2.2 Reducing sugar (%)

The percentage of reducing sugars in the sapota fruit was determined by Dinitro-salicylic acid (DNSA) method (Miller, 1972). A known volume of alcohol extract was allowed to evaporate the alcohol completely. Clear solution was taken for the estimation of reducing sugar using DNSA reagent by following the above method and values were expressed in percentage.

2.3 Total sugars (%)

The total sugar content was estimated by the same method as in case of reducing sugar after inversion of the non–reducing sugar using dilute hydrochloric acid (Anon., 1984). The values obtained were expressed as per cent.

2.4 Non-reducing sugar (%)

The per cent non- reducing sugars were obtained by subtracting the value of reducing sugar from that of total sugar and multiplied by a factor 0.95.

Non-reducing sugar (%) = [Total sugar – Reducing sugar] × 0.95

3. Result and Discussion

3.1 Experimental design and data analysis

The data recorded on the physico-chemical and organoleptic parameters were subjected to statistical analysis in completely randomized design and factorial completely randomized design. Interpretation of the data was carried out in accordance with Panse and Sukhatme (1985) [17]. The level of significance used in 'F' test was p=0.05. Critical difference values were calculated wherever 'F' test was significant.

3.2 Total soluble solids (ºB)

The observations on total soluble solids as influenced by different sapota varieties under ambient condition are presented in table 1. The data reveals that there was a significant difference among the varieties with respect to TSS during storage intervals. Among the varieties, significantly maximum TSS was recorded in the treatment Pala (19.88°B) followed by Singapore (18.48°B) and Pakala (18.12°B), whereas minimum initial TSS content was recorded in Guthi (17.12°B) followed by Cricket Ball (17.38°B), Kalipatti (17.59°B), Kirtibarathi (17.61°B) and Badami (17.62°B).Whereas, After 4 DAS, significantly maximum TSS was recorded in the varieties Gorayya (23.07°B), Kalipatti (21.72°B) and Pala (21.23°B). In contrary, significantly maximum TSS was noticed in the variety Cricket Ball (22.63°B). After 10 days of storage, all varieties were spoiled except Kirtibarathi, whose TSS was 20.67°B.

The increase in soluble solid content during ripening of sapota is partly due to the hydrolysis of starch into sugars since they found that the level of starch in the flesh was reduced from 14 to 5% (Casas, 1977) [5]. The difference of variation in the TSS and sugars content among the cultivars is probably due to differences in their varietal character and prevailing climatic condition of the area. Similar observations were also reported by Mone, 1989 [11]; Rokhade *et al*. (1989) [13]; Lakshmi (1980) [8]; Amol and Abhishek (2013) [1] who reported that the different varieties of sapota exhibited varying level of TSS and sugars. This observation was similar with the results obtained by other researchers who noted that total soluble solid content of mature sapota reached values between 13°B and 25°B, depending on variety and area where the sapota were grown (Lakshminarayana and Subramanyam, 1966; Shanmugavelu and Srinivasan, 1973) [9, 14].

3.3 Total sugars (%)

The observations on total sugar as influenced by different sapota varieties under ambient condition are presented in table 1. Total sugars content increased as the storage period progressed and then decreased. Significantly highest total sugar was recorded in Pala (9.04%) at initial stage of observation. Whereas, significantly lowest total sugar was recorded in Guthi (7.09%) which was on par with Cricket Ball (7.29%). After 4 DAS, significantly maximum total sugar was noticed in Pala (10.11%) followed by Kalipatti (9.82%) and Pakala (9.76%) whereas significantly minimum total sugar was observed in Cricket ball (8.30%) which was on par with Guthi (8.46%). After 10 days of storage, all varieties were spoiled except Kirtibarathi, whose total sugar was 10.55%. Increase in total sugar content in all the varieties as the storage period progressed was noticed.

In the present experiment, there was a general increase in the total sugars content of sapota up to 8 DAS and then a gradual decrease was observed. The starch content in sapota decreases as fruit ripens with a concomitant and significant increase in the level of sugars. Sucrose is the predominant sugar in the flesh. The difference of variation in total sugars content among the cultivars probably due to differences in their varietal character and prevailing climatic condition of the area. Similar observations were also reported by Mone, 1989 [11]; Rokhade *et al*., 1989 [13]; Lakshmi, 1980 [8]; Amol and Abhishek, 2013 [1], who reported that the different varieties of sapota exhibited varying level of total sugars.

Table 1: Total soluble solids and total sugars of different varieties of sapota under ambient storage condition

Varieties	Total soluble solids						Total sugars (%)					
	Days after storage (DAS)						Days after storage (DAS)					
	Initial	2	4	6	8	10	Initial	2	4	6	8	10
T_1	17.59	19.36	21.72	23.57	*	*	8.06	9.35	9.82	10.58	*	*
T_2	17.38	18.48	20.44	22.75	22.63	*	7.29	7.71	8.30	8.83	8.40	*
T_3	17.62	18.12	19.78	21.07	20.80	*	8.13	8.58	9.43	10.04	9.84	*
T_4	17.61	18.81	19.23	20.70	21.33	20.67	8.17	8.78	9.36	10.14	10.74	10.55
T_5	17.12	18.22	19.77	21.30	20.73	*	7.09	7.62	8.46	9.77	9.56	*
T_6	19.88	20.57	21.23	20.53	*	*	9.04	9.49	10.11	10.05	*	*
T_7	18.12	19.19	20.05	19.53	19.16	*	8.41	9.24	9.76	9.52	9.26	*
T_8	17.93	18.80	20.93	22.20	21.60	*	8.23	8.63	9.14	9.76	9.56	*
T_9	17.99	19.11	23.07	24.20	*	*	8.39	9.02	9.61	10.35	*	*
T_{10}	18.48	19.27	20.37	21.22	20.63	*	8.58	8.68	9.23	9.75	9.62	*
Mean	17.97	18.99	20.65	21.70	20.98	-	8.14	8.71	9.32	9.88	6.69	8.14
SEm±	0.19	0.17	0.14	0.14	0.10	-	0.08	0.11	0.13	0.12	0.06	-
C.D. at 5%	0.56	0.52	0.41	0.41	0.29	-	0.25	0.31	0.40	0.34	0.17	-

T_1- Kalipatti T_2- Cricket Ball T_3- Badami T_4- Kirtibarathi T_5- Guthi T_6- Pala T_7- Pakala T_8- PKM-2 T_9- Gorayya T_{10}- Singapore
*No observation was recorded as the fruits lost their keeping quality.

3.4 Reducing sugar (%)

The observations on reducing sugar as influenced by different sapota varieties under ambient condition are presented in table 2. The data on reducing sugars content indicated significant differences among the varieties. The reducing sugar increased linearly as the storage period increased. At initial stage, significantly maximum reducing sugar was recorded in Pala (4.76%) followed by Singapore and Pakala (4.36% and 4.18%) respectively. In contrary, significantly minimum reducing sugar was recorded in Cricket Ball and Guthi (2.00% each) which was parity with Kirtibarathi, Kalipatti and Badami. After 2 DAS, significantly highest reducing sugar was recorded in Pala (4.96%) followed by Kalipatti and Pakala (4.76% and 4.52%). Whereas, significantly lowest reducing sugar was recorded in Guthi (3.94%) which was on par with Cricket Ball (4.12%). After 10 days of storage, all varieties were spoiled except Kirtibarathi, whose reducing sugar was 5.23%. The starch content in sapota decreases as fruit ripens with a concomitant and significant increase in the level of sugars. Sucrose is the predominant sugar in the flesh. More than 70% of the sugar content corresponds to non-reducing sugars and a low proportion to reducing sugars, mainly glucose and fructose (Arriola *et al*., 1976; Casas, 1977; Villanueva *et al*., 2000) [4, 5, 16].

Table 2: Non reducing sugars and reducing sugars of different varieties of sapota under ambient storage condition

Varieties	Non reducing sugars (%)						Reducing sugars (%)					
	Days after storage (DAS)						Days after storage (DAS)					
	Initial	2	4	6	8	10	Initial	2	4	6	8	10
T_1	4.00	4.36	4.46	4.72	*	*	3.84	4.76	5.13	5.60	*	*
T_2	3.36	3.40	3.65	3.88	3.60	*	3.75	4.12	4.45	4.74	4.52	*
T_3	4.01	4.07	4.38	4.25	4.20	*	3.90	4.29	4.81	5.56	5.41	*
T_4	4.03	4.37	4.41	4.53	4.77	5.11	3.92	4.24	4.71	5.36	5.68	5.23
T_5	3.17	3.49	3.91	4.72	4.52	*	3.75	3.94	4.33	4.80	4.56	*
T_6	4.06	4.27	4.52	4.59	*	*	4.76	4.96	5.35	5.21	*	*
T_7	4.01	4.47	4.80	4.74	4.69	*	4.18	4.52	4.70	4.53	4.32	*
T_8	3.98	4.17	4.18	4.41	3.64	*	4.03	4.27	4.74	5.11	4.96	*
T_9	3.99	4.30	4.82	5.02	*	*	4.14	4.49	4.53	5.07	*	*
T_{10}	3.99	4.02	4.38	4.66	2.53	*	4.36	4.51	4.64	4.85	4.25	*
Mean	3.86	4.09	4.35	4.55	2.79	-	4.06	4.41	4.74	5.08	3.37	-
SEm±	0.09	0.11	0.14	0.12	0.05	-	0.07	0.07	0.05	0.05	0.04	-
C.D. at 5%	0.29	0.34	0.40	0.36	0.15	-	0.20	0.21	0.16	0.14	0.12	-

*No observation was recorded as the fruits lost their keeping quality.
T_1- Kalipatti T_2- Cricket Ball T_3- Badami T_4- Kirtibarathi T_5- Guthi T_6- Pala T_7- Pakala T_8- PKM-2 T_9- Gorayya T_{10}- Singapore

3.5 Non reducing sugar (%)

Significantly minimum non reducing sugar was recorded in Guthi (3.17%) which was parity with Cricket Ball (3.36%). In contrary, significantly maximum non reducing sugar was recorded in Pala (4.06%) at initial stage of observation (Table 2). After 2 DAS, significantly lowest non reducing sugar was recorded in Cricket Ball (3.40%) which was on par with Guthi (3.49%). However, significantly highest non reducing sugar was recorded in Kirtibarathi (4.37%). After 4 DAS, significantly minimum non reducing sugar was observed in Cricket ball (3.65%) which was on par with Guthi (3.91%) whereas, significantly maximum non reducing sugar was noticed in Gorayya (4.82%). After 8 DAS, Kalipatti, Pala and Gorayya varieties were spoiled. Among the 7 varieties, significantly lowest non reducing sugar was recorded in Singapore (2.53%), whereas, significantly highest non reducing sugar was recorded in Kirtibarathi (4.77%) which was equivalence with Pakala (4.69%). After 10 days of storage, all varieties were spoiled except Kirtibarathi, whose non reducing sugar was 5.11%. The starch content in sapota decreases as fruit ripens with a concomitant and significant increase in the level of sugars. Sucrose is the predominant sugar in the flesh. More than 70% of the sugar content corresponds to non-reducing sugars, mainly glucose and

fructose (Arriola *et al*., 1976; Casas, 1977; Villanueva *et al*., 2000) [4, 5, 16].

4. References

1. Amol SN, Abhishek S. Varietal evaluation of sapota for resistance to Oriental fruit fly, *Bactrocera dorsalis* (Hendel). Pest Management in Horticultural Ecosystems. 2013;19(2):164-168.
2. Anand PK, Policegoudra RS, Aradhya SM. Chemical composition and antioxidant activity of Sapota (*Achras sapota* Linn.) fruit. Journal Food Biochemistry. 2007;31:399-414.
3. Anonymous. Official Method of Analysis. Ed. Sidney Williams, Association official Analytical Virginia, 14th Edition; c1984. p. 424-462.
4. Arriola MC, Mench JF, Rolz C. Caracterizaci´on y almacenamiento de algunas frutas tropicales. Instituto Centroamericano de Investigation and Tecnology Industrial. Guatemala; c1976.
5. Casas AN. Cambios Fisiolo gicos y Bioquı´micos Durante la Maduracio´n del Mamey (Calocarpum mammosum). B. Sc. Thesis, Escuela Nacional de Ciencias Biolo´ gicas, Instituto Polite´cnico Nacional, Me´xico; c1977.
6. Hiremath JB, Rokhade AK. Preparation of sapota candy. International Journal of Food, Agriculture and Veterinary Sciences. 2012;2(1):107-112.
7. Kishore KYN, Nirujogi BC, Venkata R, Veeranna GP. Effects of growth regulators on quality of sapota (*Manilkara achras* (Mill.) Fosberg) cv. Kalipatti. Plant Architecture. 2013;13(2):893-896.
8. Lakshmi NS. Sapodilla and prickly pear. Nagy, S. and Shaw, P. E., (eds.) Tropical and subtropical fruits. Composition, properties and uses. Westport, CT: AVI; c1980. p. 415-441.
9. Lakshminarayana S, Subramanyam H. Physical, chemical and physiocological changes in sapota fruit (*Achras sapota* L.) during development and ripening. Food Science and Technology. 1966;31:151-154.
10. Miller. Use of di-nitro salicylic acid reagent for estimation of reducing sugar. Analyses Chemistry. 1972;31:426-428.
11. Mone SV. Studies on growth and productivity of sapota (*Manilkara acharas* (Mill.) Fasberg) varieties. M. Sc. (Agri.) Thesis, University of Agriculture Sciences., Dharwad; c1989. p. 1-88.
12. Morais PLD, Oliveira LC, Alves RE, Alves JD, Paiva A. Amadurecimiento de sapoti (*Manilkara zapota* L.) submetido ao 1- metilciclopropeno. Rev. Bras. Frutic. (Jaboticabal). 2006;28:369-373.
13. Rokhade AK, Nalawadi UG, Farooqui AA. Evaluation of promising hybrids in sapota (*Manilkara achras* (Mill.). Fosberg) at Dharwad-1 Fruit characters. Karnataka Journal of Agriculture Sciences. 1989;2:286-290.
14. Shanmugavelu KG, Srinivasan G. Proximate composition of fruit of sapota cultivar (*Achras sapota* L.). South Indian Horticulture. 1973;21:107-108.
15. Sudha R, Amutha R, Muthulaksmi S, Baby RW, Indira K, Mareeswari P. Influence of pre and post harvest chemical treatments on physical characteristics of Sapota (*Achras sapota* L.) var. PKM 1. Research Journal of Agriculture and Biological Sciences. 2007;3(5):450-452.
16. Villanueva A, Evangelista LR, Arenas OS, Diaz PM, Bautista BSJC. Cambios bioqu´ımicos y f´ısicos durante el desarrollo y postcosecha del mamey (*Pouteria sapota* (Jacq.) H. E. Moore & Stearn. Rev. Chapingo Serie Horticultura. 2000;6:63-72.
17. Panse VG, Sukhatme PV. Statistical methods for agricultural research. ICAR, New Delhi. 1985;8:308-318.