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RESPONSE OF POST-HARVEST TREATMENTS OF CHEMICAL AND PLANT GROWTH REGULATORS ON BIOCHEMICAL CHARACTERISTICS OF SAPOTA FRUIT CV. KALIPATTI

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ABSTRACT

The sapota fruits were subjected to various post-harvest chemical and plant growth regulators treatments, *viz.*, $CaCl_2$ 5000 and 10000 mg/L, GA_3 150 and 300 mg/L, kinetin 100 and 200 mg/L, ethrel 1000 and 2000 mg/L and control (no chemical). $CaCl_2$ 5000 and 10000 mg/L were found to be best since they have the highest amount of TSS (22.78 °Brix, 23.00 °Brix), total sugars (17.13%, 17.24%), reducing sugar (9.59%. 9.89%) and non reducing sugar (8.01%, 8.26%). The level of acidity and ascorbic acid decreased with advancement of storage period, however ascorbic acid (11.47 mg/100g pulp, 12.40 mg/100g pulp) was found maximum in fruit treated with $CaCl_2$ 5000 and 10000 mg/l. From the above values, $CaCl_2$ 10000 was found best for maintaining quality of sapota fruits up to 12 days at normal temperature with proper ventilation.

INTRODUCTION

Sapota, popularly known in India as chiku, is native to tropical America. Sapota [*Manilkara achras* (Mill.) Forsberg] is a tropical fruit, belongs to family Sapotaceae. In India, sapota ranks fifth in both production and consumption next to mango, banana, citrus and grape. India is considered to be the largest producer of sapota in the world. Various chemicals have been used to improve and maintain quality by slowing down the metabolic activities of fruit. Among various chemicals, calcium has received considerable attention in recent years due to its desirable effect in delaying ripening and senescence, increase in firmness, vitamins C and phenolic contents, reduced respiration, extending storage life and reduces the incidence of physiological disorders and storage rots (Sharma *et al.* 1996). Growth regulators are an integral component of tree fruit production. These regulators can be used as post harvest treatments for fruits to increase various physical and biochemical properties so as to enhance its keeping quality. Generally, gibberellic acid is known for its anti-senescing properties which results in delaying ripening of fruits. In sapota, kinetin regulated ripening was reported by Chundawat and Rao (1981). Therefore, it is needful to subject sapota fruits to chemical and growth regulators treatment to evaluate their response on biochemical characteristics during storage under ambient temperature.

MATERIALS AND METHODS

The study was carried out in the P.G. Laboratory of the Department of Horticulture, B.A. College of Agriculture, Anand Agricultural University, Anand during April, 2012. Fruits of uniform size, colour and free from injuries were selected for the study. The fruit of sapota cv. Kalipatti were harvested at optimum stage of maturity. The fruits were dipped for 5 min. in solution of calcium chloride (5000 and 10000 mg/L) and ethrel (1000 and 2000 mg/L), GA_3 (150 and 300 mg/L) for 10 minutes, kinetin (100 and 200 mg/L) for 20 minutes and the fruits kept under control were dipped in distilled water for 5 minutes.

Fruits were than air dried and packed in corrugated fibre board (CFB) boxes and kept at room storage. The experimental data was analyzed in completely randomized design with four repetitions. Data were recorded periodically and analyzed statistically following the complete randomized design as outlined by Panse and Sukhatme, 1967. TSS was determined by Hand Refractrometer and expressed in ºbrix, acidity of fruits by AOAC method (Anon, 1984), total sugars, reducing and non reducing sugar and, acidity and ascorbic acid content of fruits were recorded by a method as suggested by Ranganna (1979) and the observations were recorded at 4th, 6th, 8th, 10th and 12th days of storage (Madhavi *et al.*, 2005, Vijayalakshmi *et al.*, 2004, Gautam and Chundawat, 1989).

RESULTS AND DISCUSSION

From the investigation it was recorded that Total soluble solids (TSS) of fruits as influenced by different treatments of chemical and growth regulators during storage studies was found highest in ethrel 2000 ppm (25.00°brix) at beginning of storage than $CaCl_2$ 10000 ppm (23.00°brix) treated fruits at the subsequent days (Table 1). This may be due to the increase in soluble solids content and total soluble sugars caused by hydrolysis of polysaccharides like starch, cellulose and pectin sub-stances into simpler substances. These results are in line with the findings of Ingle *et al.* (1982), Madhvi *et al.* (2005) who reported an increase in the TSS content of sapota fruits from harvest until ripening and later a decrease in TSS as the fruits started senescing. A similar view was also shared by Gautam and Chundawat (1990) in sapota fruits and Reshi *et al.* (2013) in litchi fruits.

The accumulation of total sugars during the process of ripening is a consequence of starch hydrolysis. In present study, accumulation of sugars was gradually increased in fruits treated with chemical and growth regulators throughout the storage periods, being significantly highest with $CaCl_2$ 10000 ppm (17.24%) and $CaCl_2$ 5000 ppm (17.13%) as compared to control (Table 1). As the fruit advances towards ripening, starch, hemi cellulose and organic acids get converted into various forms of sugar. These changes are largely dependent upon the condition of storage such as temperature, time and on the physical status of fruits. These findings on the total sugar are in line with the report of Sanjay (1996), who noticed an increasing trend with respect to total sugar content with advancement of storage period in sapota cv. Kalipatti under ambient storage. A similar finding was revealed by Mahajan *et al.* (2011) in guava fruits.

Reducing sugars was gradually increased in fruits with a slight decline at the end of storage periods, being significantly highest with $CaCl_2$ 10000 ppm (9.89%) as compared to rest of the treatments (Table 2). The initial increase in reducing sugars might be due to the conversion of starch into reducing sugar and later on reduction could possibly might be due to utilization of sugar in the process of respiration. The percentage of reducing sugar increased slowly during storage period upto 10th day and declined thereafter. The increase in reducing sugar might be due to increased rate of starch degradation by amylase activity. The present findings is in agreement with Singh (2007) in strawberry. The increase in the total reducing sugar content is in line with the findings of Ingle *et al.*, (1982) who reported an increase in reducing sugar content of sapota fruits during ripening. However, decrease in reducing sugar content (%) was also observed due to over ripening of fruits which was utilize during respiration process.

It was observed that the accumulation of non reducing sugar (%) showed significant difference with respect to treatments and ripening stages of fruit, with a slight decline at over ripe stage being significantly highest with $CaCl_2$ 10000 ppm

Table 1: Effect of different levels of post harvest treatments of chemical and growth regulators on TSS (°brix and total sugars (%) of sapota fruits cv. Kalipatti

Tr. No.	Post harvest treatments	TSS (°brix) No. of days (Storage period)					Total sugars (%) No. of days (storage period)				
		4th	6th	8th	10th	12th	4th	6th	8th	10th	12th
T_1	GA_3 150 mg/L	22.00	24.25	25.00	24.50	22.00	16.10	18.51	19.55	17.13	16.04
T_2	GA_3 300 mg/L	21.25	22.50	24.13	23.13	20.38	16.05	18.35	19.70	17.21	16.41
T_3	Kinetin 100 mg/L	22.25	24.75	25.00	22.50	20.25	17.10	18.37	16.07	16.05	15.07
T_4	Kinetin 200 mg/L	20.25	23.25	24.25	21.25	19.00	17.13	18.21	16.17	16.14	15.16
T_5	Ethrel 1000 mg/L	24.33	25.00	24.33	21.70	18.00	18.32	16.17	15.22	14.30	13.63
T_6	Ethrel 2000 mg/L	25.10	24.00	23.98	20.75	17.00	18.38	16.05	15.09	14.22	13.52
T_7	$CaCl_2$ 5000 mg/L	22.78	22.50	24.53	23.53	22.78	15.26	18.25	19.77	18.34	17.13
T_8	$CaCl_2$ 10,000 mg/L	20.50	22.00	26.25	25.25	23.00	15.05	18.12	19.84	18.47	17.24
T_9	Control	21.00	21.25	22.00	20.50	17.50	17.24	18.41	17.13	15.14	14.21
S.Em. ±		0.85	0.88	0.76	0.72	0.99	0.11	0.12	0.10	0.09	0.10
C.D. (0.05 %)		2.46	NS	NS	2.10	2.88	0.32	0.34	0.29	0.25	0.29
CV %		7.6	7.5	6.3	6.4	9.9	1.3	1.3	1.2	1.1	1.3

Table 2: Effect of different levels of post harvest treatments of chemical and growth regulators on reducing and non reducing sugar (%) of sapota fruits cv. Kalipatti

Tr. No.	Treatments	Reducing sugar (%) No. of days (Storage period)					Non reducing sugar (%) No. of days (Storage period)				
		4th	6th	8th	10th	12th	4th	6th	8th	10th	12th
T_1	GA_3 150 mg/L	7.32	9.94	10.11	9.49	8.29	8.77	8.69	9.44	7.64	7.58
T_2	GA_3 300 mg/L	7.25	9.51	10.65	9.86	8.77	8.80	8.71	9.40	7.36	7.16
T_3	Kinetin 100 mg/L	9.86	10.30	9.29	8.36	7.15	7.25	8.07	6.79	7.69	7.54
T_4	Kinetin 200 mg/L	9.73	10.10	9.82	8.72	7.57	7.41	8.11	6.36	7.59	7.57
T_5	Ethrel 1000 mg/L	11.69	9.41	8.56	6.44	5.14	6.63	6.76	6.67	7.87	7.72
T_6	Ethrel 2000 mg/L	12.10	9.89	8.35	6.25	5.03	6.41	6.22	6.74	7.98	7.52
T_7	$CaCl_2$ 5000 mg/L	6.44	8.88	11.31	10.01	9.59	8.82	9.73	8.47	8.34	8.01
T_8	$CaCl_2$ 10,000 mg/L	6.03	8.42	11.71	10.52	9.89	8.69	9.70	8.23	8.32	8.26
T_9	Control	7.27	10.40	9.28	7.27	6.34	9.97	8.01	7.85	7.87	7.49
S.Em. ±		0.14	0.13	0.17	0.11	0.10	0.19	0.20	0.16	0.16	0.17
C.D. (0.05 %)		0.40	0.39	0.48	0.33	0.30	0.54	0.58	0.48	0.46	0.48
C.V. %		3.2	2.8	1.3	2.7	2.8	4.7	4.9	4.2	4.1	4.3

Table 3: Effect of different levels of post harvest treatments of chemical and growth regulators on acidity (%) and ascorbic acid (mg/100g pulp) of sapota fruits cv. Kalipatti

Tr. No.	Treatments	Acidity (%) No. of days (Storage period)					Ascorbic acid (mg/100g pulp) No. of days (Storage period)				
		4th	6th	8th	10th	12th	4th	6th	8th	10th	12th
T_1	GA_3 150 mg/L	0.18	0.17	0.15	0.14	0.12	20.15	18.23	13.60	11.63	9.20
T_2	GA_3 300 mg/L	0.19	0.18	0.16	0.15	0.13	20.46	18.60	14.16	12.10	10.24
T_3	Kinetin 100 mg/L	0.16	0.15	0.14	0.12	0.10	18.29	15.50	13.23	10.07	7.47
T_4	Kinetin 200 mg/L	0.17	0.16	0.15	0.13	0.11	18.91	15.59	14.00	11.12	8.43
T_5	Ethrel 1000 mg/L	0.15	0.14	0.12	0.11	0.09	15.81	12.71	11.79	10.09	6.16
T_6	Ethrel 2000 mg/L	0.16	0.15	0.13	0.10	0.08	15.50	12.40	9.12	8.54	5.48
T_7	$CaCl_2$ 5000 mg/L	0.20	0.19	0.18	0.17	0.15	22.32	20.19	15.15	14.95	11.47
T_8	$CaCl_2$ 10,000 mg/L	0.22	0.20	0.19	0.18	0.16	22.94	20.61	16.50	15.07	12.40
T_9	Control	0.17	0.16	0.12	0.10	0.07	16.12	13.64	10.93	9.04	6.55
S.Em. ±		0.01	0.01	0.01	0.01	0.01	0.81	0.70	0.52	0.46	0.27
C.D. (0.05 %)		0.03	0.02	NS	NS	0.02	2.35	2.03	1.52	1.34	0.80
C.V. %		10.2	6.6	5.5	6.9	11.0	8.6	8.6	8.0	8.1	6.4

(8.26%) which was at par with $CaCl_2$ 5000 ppm (8.01%) as compared to rest of the treatments (Table 2). The increase in the non-reducing sugar might be due to the hydrolysis of starch and conversion in the pectin substances from water insoluble to water soluble fractions. These results are in accordance with the findings of Hiwale and Singh (2003) and Kumar *et al.* (2012) in guava.

Titrable acidity of sapota fruits declined with the advancement of ripening process of post-harvest treatments. However, the trend of decline varied with the treatments being most rapid in control and the slowest in GA_3 and $CaCl_2$. On 12th day of estimation the acidity was the lowest with control (0.07%) followed by ethrel 2000 ppm (0.08%) (Table 3). The decrease in the total titrable acidity might be due to increase in the total sugars content of the fruits. At the time of maturity, fruits will be having higher amount of acidity, but as the fruits advance towards ripening, acid content will decrease. These results are in line with findings of Ingle *et al.* (1982) who observed a decrease in acidity during ripening of sapota fruits. The acidity in sapota fruits generally decreases with advancement of storage period (Vijayalakshmi *et al.* 2004). Decrease in acidity might be attributed to conversion of acids into sugars during respiration. These results elucidate the findings of Gohlani and Bisen (2012) in custard apple, Kardum (2004) in fig and Kaundal *et al.* (2000) in plum fruits.

Table 3 revealed that $CaCl_2$ 10000 ppm (12.40 mg/100g pulp) and $CaCl_2$ 5000 ppm (11.47 mg/100g pulp) treatments had a significant effect on retaining ascorbic acid content in sapota fruit. This might be because higher concentrations of $CaCl_2$ delayed the rapid oxidation of ascorbic acid (Gautam and Chundawat 1989). Ruoyi *et al.* (2005) also stated that ascorbic acid content of peaches was stable for fifty days storage period with the application of 0.5% $CaCl_2$. Similar observation was recorded by Akhtar *et al.*, in loquat (2010) and Gohlani and Bisen (2012) in custard apple.

From the present study, it is concluded that post-harvest treatment to sapota fruits with $CaCl_2$ 5000 ppm and $CaCl_2$ 10000 ppm resulted in good maintenance of quality such as TSS, total sugar, reducing and non reducing sugar and ascorbic acid content upto 12 days of storage as compared to untreated fruits (control).

REFERENCES

Akhtar, A., Akhtar, N. A. and Hussain, A. 2010. Quality characteristics of loquat fruit during storage. *Pakistan J. Bot.* **42:** 181-188.

Anon. 1984. Official Methods of Analysis. Association of official Analytical Chemists (AOAC), 14th edition, Washington D.C. U.S.A.

Chundawat, B. S. and Rao, D. V. R. 1981. Effect of certain plant growth regulators and waxol on ripening of sapota (*Manilkara achras* (Mill.) Forberg). *Paper presented at symposium on recent Advances in fruit Development, Ludhiana.*

Gautam, S. K. and Chundawat, B. S. 1989. Post-harvest changes in sapota cv. 'Kalipatti' : I-Effect of various post-harvest treatments on biochemical changes. *Indian J. Hort*. **46:** 310-315.

Gautam, S. K. and Chundawat, B. S. 1990. Post harvest changes on sapota cv. Kalipatti. Effect of post harvest treatments on physicochemical attributes. *Indian. J. Hort.* **47:** 264-269.

Gohlani, S. and Bisen, B. P. 2012. Effect of different coating material on the storage behavior of custard apple (*Annona squamosa* L.). *The Bioscan.* **7:** 637-640.

Hiwale, S. S. and Singh, S. P. 2003. Prolonging the shelf life of guava (*Psidium guajava* L.). *Indian J. Hort.* **60:** 1-9.

Ingle, G. S., Khedkar, D. M. and Dabhade, R. S. 1982. Effect of growth regulator on ripening of sapota fruit (*Achras zapota* L.). *Indian Fd. Pack*. **36:** 72-77.

Kardum, R. C. 2004. Studies on extending the shelf life of fig (*Ficus corica* L.) fruits cv. Deanna and Conadria. *M.Sc.(Agri.) Thesis,* MPKV, Rahuri.

Kaundal, G. S., Khalid, P. P. S., Minhas and Bat, J. S. 2000. Effect on the storage behaviour of plum (*Prunus salicina* L.). *J. Research Punjab Agricultural University.* **27:** 48-55.

Kumar, R., Lal, S. and Mishra, K. K. 2012. Effect of post harvest calcium treatments on shelf life of guava cv. Sardar. *Hort. Flora Research Spectrum.* **1:** 344-347.

Madhavi, M., Srihari, D. and Babu Dilip, J. 2005. Effect of post-harvest ethrel treatment on ripening an quality of sapota cv. Pala fruits. *Indian J. Hort.* **62:** 187-189.

Mahajan, B. V. C., Ghuman, B. S. and Bons, H. K. 2011. Effect of post harvest treatment of Calcium Chloride and Gibbrellic Acid on starage behavoiur and quality of guava fruits. *J. Hort. Sci. and Ornamental Plants.* **3:** 38-42.

Panse, V. G. and Sukhatme, P. V. 1967. Statistical Methods for Agricultural Workers, *ICAR Publication,* New Delhi, pp. 167-174.

Ranganna, S. 1979. Manual of analysis of fruit and vegetable products.

Tata McGraw Hill Publishing Company Ltd., New Delhi.

Reshi, M., Kaul, R. K., Bhat, A. and Sharma, S. K. 2013. Response of post harvest treatments on nutritional Characteristics and shelf life of litchi (cv. Dehradun). *The Bioscan.* **8:** 1219-1222.

Ruoyi, K., Zhifang, Y., Zhaoxin, L. Z. 2005. Effect of coating and intermittent warming on enzymes, soluble pectin substances and ascorbic acid of (*Prunus persica* cv. Zhonghuashoutao) during refrigerated storage. *Food Res. Int.* **38:** 331-336.

Sanjay, G. 1996. Effect of post harvest treatments on keeping quality of sapota (*Manilkara achras* (Mill). Foserg) Cv. Kalipatti fruits. *M.Sc.(Agri.) Thesis,* University of Agricultural Sciences, Dharwad.

Sharma, R. M., Yamdagni, R., Gaur, H. and Shukla, R. K. 1996. Role of calcium in horticulture - a review. *Haryana J. of Hort. Sci.* **25:** 205-212.

Singh, A., Singh, J. N. and Srivastava, A. K. 2007. Effect of chemicals and packaging on shelf life and fruit quality of strawberry (*Fragaria* × *Ananassa Duch.*). *Agri. Sci. Digest.* **27:** 119-121.

Vijayalakshmi, D., Bangarusamy, U. and Vijayakumar, R. M. 2004. Post-harvest treatments to extend the shelf-life of sapota fruit cultivars 'CO1' and 'CO2'. *Crop Res.* **27:** 219-26.