

# Pre-harvest spray of different sources of calcium to improve the physiological qualities of sapota fruits (*Manilkara achras* (Mill) Forsberg) cv. KALIPATTI

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## ABSTRACT

Among the all pre-harvest treatments, physiological loss in weight (%) was observed significantly minimum on all days of storage in pre-harvest treatment of calcium chloride 1.0 per cent. While firmness was maximum in pre-harvest treatment of calcium chloride 1.0 per cent. Considering to the shelf life of sapota fruits was found significantly maximum in pre-harvest spray of calcium chloride 1.0 per cent and rotting was observed minimum in pre-harvest treatment of calcium chloride 0.5 per cent.

**Key words :** Pre-harvest spray, Calcium, Spota

## INTRODUCTION

India is considered to be the largest producer of sapota in the world. Sapota was introduced from Mexico to Asian countries like India, Srilanka, Indonesia and Myanmar etc. It was reported that for the first time the sapota cultivation was started during 1898 in a village called Golwad in Maharashtra. The several varieties are grown in India, of which Kalipatti is one of the most popular and commercially important variety grown in Maharashtra, Karnataka and Gujarat states. South Gujarat is a horticultural belt which Kalipatti variety is grown on large area. However, sapota is highly perishable, the post harvest life is very short. Being a climacteric fruit, sapota ripens within 4 to 7 days after harvest and soon after full ripened stage, rapid bio-chemical changes reduced the shelf life. To increase the shelf life through pre-harvest treatment is considered one of the major attempts in sapota cultivation. The effect of pre-harvest treatments on post-harvest life of sapota fruit was studied by several workers with promising results. However, under South Gujarat agro-climatic conditions of moderate to high temperature and relative humidity (RH), different pre-harvest treatments of calcium was carried out to study on post harvest life of sapota fruits cv. KALIPATTI.

## MATERIALS AND METHODS

An aqueous solution of calcium chloride ( $\text{CaCl}_2$ ), calcium sulphate ( $\text{CaSO}_4$ ) and calcium nitrate ( $\text{Ca}(\text{NO}_3)_2$ ) containing 0.5, 1.0 and 1.5 % calcium were sprayed on sapota in the orchard at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari and then after the fruits were tested in the Pomology Laboratory (P.G.) of ASPEE College of Horticulture and Forestry, Navsari

Agricultural University, Navsari, during the year 2007. The experiment was laid out in Randomized Block Design (RBD) with three replications and ten treatments including control were sprayed 21 days before expected harvesting date. The observations of physiological characters like physiological loss in weight (PLW), firmness, rotting, shelf life were recorded including organoleptic evaluation of the fruit in respect of colour, texture, flavour, taste and overall acceptance during the storage period.

## RESULTS AND DISCUSSION

The results obtained from the present investigation are summarized below :

### *Physiological weight loss (PLW %) :*

The observation on physiological loss in weight was recorded periodically during storage. The per cent loss in weight in fruits was increased with increase of storage period irrespective of any pre-harvest treatment. Calcium chloride ( $\text{CaCl}_2$ ) 1.0 per cent pre-harvest spray recorded significantly lowest physiological weight loss (10.71%), while unsprayed fruits exhibited the highest physiological loss in weight (37.55%) (Table 1) in sapota fruits. This decrease in weight loss might be due to the retarding action of calcium on the rate of respiration, decay and prevents cellular disintegration by maintaining protein and nucleic acid synthesis thus, delays senescence (Faust and Sheer, 1971; Martin and Lewis, 1952; Mason *et al.*, 1975 in apple). The increased weight loss in untreated fruits might be due to increased storage break down associated with higher respiratory rate compared to calcium treated fruits sprayed with pre-harvest  $\text{CaCl}_2$  (Mootto, 1991 in Julie mangoes and Ramakrishna *et al.*, 2001 in papaya). The results of present study are in confirmation with the above findings.

**Table 1 : Effect of pre-harvest spray of different calcium sources on physiological loss in weight (PLW) (%), firmness (kg/cm<sup>2</sup>) and rotting (%) of sapota fruits cv. KALIPATTI**

Treatments	Days after harvesting											
	PLW (%)				Firmness (kg/cm <sup>2</sup> )				Rotting (%)			
	3 <sup>rd</sup>	6 <sup>th</sup>	9 <sup>th</sup>	12 <sup>th</sup>	3 <sup>rd</sup>	6 <sup>th</sup>	9 <sup>th</sup>	12 <sup>th</sup>	3 <sup>rd</sup>	6 <sup>th</sup>	9 <sup>th</sup>	12 <sup>th</sup>
Ca(NO <sub>3</sub> ) <sub>2</sub> 0.5 %	4.20	8.56	17.56	26.53	7.96	6.00	3.20	1.75	0.00	11.00	29.80	60.30
Ca(NO <sub>3</sub> ) <sub>2</sub> 1.0 %	4.00	8.42	16.37	25.11	8.70	6.50	3.50	2.00	0.00	11.70	31.20	62.25
Ca(NO <sub>3</sub> ) <sub>2</sub> 1.5 %	4.54	8.60	18.14	27.82	8.00	6.00	3.15	2.65	0.00	15.00	40.70	80.20
CaSO <sub>4</sub> 0.5 %	4.62	9.01	27.67	34.56	8.10	6.50	3.06	1.25	0.00	12.50	33.50	70.20
CaSO <sub>4</sub> 1.0 %	4.21	8.90	22.43	32.16	7.70	5.90	3.25	2.00	0.00	13.60	35.00	72.00
CaSO <sub>4</sub> 1.5 %	4.54	8.83	19.92	28.07	8.30	7.00	5.20	2.90	0.00	14.10	37.90	79.02
CaCl <sub>2</sub> 0.5 %	3.66	7.57	14.55	21.08	8.90	7.40	5.50	3.33	0.00	7.00	22.50	50.20
CaCl <sub>2</sub> 1.0 %	3.51	7.55	12.47	19.34	9.10	8.00	5.90	3.50	0.00	10.00	26.30	54.20
CaCl <sub>2</sub> 1.5 %	3.75	7.86	15.01	22.17	8.80	7.40	5.50	3.20	3.50	17.20	47.50	89.90
Control	5.95	10.06	34.22	00.00	7.60	5.20	2.90	0.00	5.00	30.20	76.70	100.00
S.E.±	0.17	0.35	0.88	1.11	0.33	0.29	0.25	0.10	0.04	0.61	1.85	2.63
C.D. (P=0.05)	0.50	1.04	2.61	3.30	0.98	0.86	0.74	0.30	0.11	1.83	5.49	7.80

**Firmness :**

Fruit firmness gradually decreased during storage period, due to advancement of ripening, senescence and break down in the later stage. The maximum fruit firmness (6.62 %) was recorded in pre-harvest spray of calcium chloride (CaCl<sub>2</sub>) 1.0 per cent as compared to the unsprayed (3.92 %). This was probably due to added calcium which helped to maintain the structure and function of cell wall. Similar findings have been reported by Poovaiah *et al.* (1988) in apple, Gupta *et al.* (1987) and Saran *et al.* (2004) in ber and supported the present investigation.

**Rotting :**

Rotting percentage of sapota fruits was found minimum (19.92%) when plants were sprayed with

calcium chloride (CaCl<sub>2</sub>) 0.5 per cent. Calcium chloride might have decreased in the rate of respiration resulting in to control of enzymatic activities, ethylene production and senescence. Similar reduction on fruit rot during storage with calcium compound has been reported by Lakshmana and Reddy (1999) and Aradhya *et al.* (2006), Saran *et al.* (2004) in ber.

**Shelf life :**

The maximum shelf life of sapota fruits was recorded by the pre-harvest spray of calcium chloride (CaCl<sub>2</sub>) 1.0 per cent (13.75 days) as compared to the other pre-harvest treatments. It might be due to role of calcium on maintaining the membranes integrity and influence on cellulose organization there by controlling respiratory breakdown. The binding action of calcium in the cell wall

**Table 2 : Effect of pre-harvest spray of different calcium sources on organoleptic test (score), overall acceptability and shelf life (days) of sapota fruits cv. Kalipatti**

Treatments	Organoleptic test (score)				Overall acceptability	Shelf life (days)
	Colour	Texture	Flavour	Taste		
Ca(NO <sub>3</sub> ) <sub>2</sub> 0.5 %	15.45	15.00	17.35	15.80	63.60	12.95
Ca(NO <sub>3</sub> ) <sub>2</sub> 1.0 %	15.55	14.94	17.50	15.67	63.66	13.20
Ca(NO <sub>3</sub> ) <sub>2</sub> 1.5 %	15.09	12.55	13.17	14.85	55.66	12.45
CaSO <sub>4</sub> 0.5 %	15.22	12.25	14.00	15.95	57.42	12.00
CaSO <sub>4</sub> 1.0 %	14.15	13.30	15.52	15.80	58.77	12.22
CaSO <sub>4</sub> 1.5 %	15.32	14.50	15.80	14.22	59.84	12.28
CaCl <sub>2</sub> 0.5 %	16.42	17.75	18.00	18.17	70.34	13.35
CaCl <sub>2</sub> 1.0 %	14.80	16.67	17.25	17.72	66.44	13.75
CaCl <sub>2</sub> 1.5 %	14.55	15.27	12.90	15.25	57.97	13.22
Control	13.22	13.42	13.00	15.32	54.96	10.22
S.E.±	0.54	0.32	0.37	0.41	2.25	0.46
C.D. (P=0.05)	1.59	0.96	1.10	1.22	6.68	1.37

may suppress ethylene production and retard ripening (Lakshmana and Reddy, 1999, Aradhya *et al.*, 2006, Bhanja and Lenka, 1994 in sapota).

#### **Organoleptic test :**

Organoleptic characters like fruit colour, texture, flavor, taste and overall acceptability showed (Table 2) the highest score in fruits treated with calcium chloride (CaCl<sub>2</sub>) 0.5 per cent among all the treatments when fruits were ripened during storage. The reason for maintaining the firmness for longer time and recording the higher score for organoleptic characters might be due to chemical treatment. The results for organoleptic characters are in agreement with those reported by Lakshmana and Reddy (1999) and Aradhya *et al.* (2006) in sapota.

### REFERENCES

- Aradhya, S.M., Policegoudra, R.S., Suma, Hanji, H. and Mahadeviah (2006).** Pre and post-harvest technology of sapota (*Archus sapota* L.)-A Review *Indian Food Packer*, : 63-70.
- Bhanja, P.K. and Lenka, P.C. (1994).** Effect of pre and post-harvest treatments on storage life of sapota fruits cv. OVAL. *The Orissa J. Hort.*, **22** (1 & 2): 54-57.
- Faust, M. and Sheer, C.B. (1971).** The effect of calcium on respiration of apples. *J. American Soc. Hort. Sci.*, **97** (4): 437-439.
- Gupta, O.P., Siddiqui, S. and Chauhan, K.S. (1987).** Evaluation of various calcium compounds for increasing the shelf life of ber. *Indian J. Agric. Res.*, **21**(2): 65-70.
- Lakshmana and Reddy, T.V. (1999).** Effect of pre-harvest foliar application of calcium on the post harvest behavior of sapota cv. Kalipatti fruits. *South Indian J. Hort.*, **47**(1-6): 147-148.
- Martin, D. and Lewis, T.L. (1952).** The physiology of growth in apple fruits. Cell characteristics and respiratory activity of light and heavy crop fruits. *Australian J. Sci. Res. B.*, **5**: 315-327.
- Mason, J.L., Drought, B.G. and Mc Dougald, J.M. (1975).** Calcium concentration of Spartan apple in relation to senescent breakdown in individual fruit. *J. American Soc. Hort. Sci.*, **100**: 339-542.
- Mootto, A. (1991).** Effect of post-harvest calcium chloride dip on ripening change in Julie mangoes. *Trop. Sci.*, **31**: 243-248.
- Poovaliah, B.W., Gleen, G.M. and Reddy, A.S.N. (1988).** Calcium and fruit softening: physiology and biochemistry. *Hort. Rev.*, **10**: 107-152.
- Ramakrishna, M., Haribabu, K., Reddy, Y.N. and Purushotham (2001).** Effect of pre-harvest application of calcium on physio-chemical changes during ripening and storage of papaya. *Indian J. Hort.*, **58**(1):228-231.
- Saran, P.L., Lal, G., Jat, R.J. and Singh, R.V. (2004).** Effect of pre-harvest foliar application of different chemicals on shelf life and quality of ber (*Zizyphus mauritiana* Lamk) cv. GOLA. *Haryana J. Hort. Sci.*, **33**(1-2): 71-73.

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