Indian J. Hort. 67(3), September 2010: 381-386

Effect of pre-harvest treatment of organic manures and inorganic fertilizers on post harvest shelf-life of sapota cv. Kalipatti

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ABSTRACT

Ten different pre-harvest treatments were applied on sapota cv. Kalipatti *viz.,* T1-25 kg FYM + 400 + 60 + 300 g NPK/tree, T2-25 kg FYM + 350 + 60 + 250 g NPK/tree, T3-25 kg FYM + 300 + 60 + 200 g NPK/tree, T4-25 kg FYM + 250 + 60 + 150 g NPK/tree, T5-25 kg FYM alone/tree, T6-5 kg vermicompost + 250 + 60 + 300 g NPK/tree, T7-5 kg vermicompost + 350 + 60 + 250 g NPK/tree, T8-5 kg vermicompost + 300 + 60 + 200 g NPK/tree, T9-5 kg vermicompost + 250 + 60 + 150 g NPK/tree and T10-5 kg vermicompost alone/tree. Among all pre-harvest treatments, 5 kg vermicompost + 400 + 60 + 300 g NPK/tree was found to be superior in respect of extending post-harvest shelf-life as well as other physico-chemical parameters, *viz.,* volume, peel weight, pulp weight, colour acceptance, TSS, reducing sugar, non reducing sugar, acidity and vitamin-C content, while maximum firmness of fruits was found under 25 kg FYM + 400 + 60 + 300 g NPK/tree. Organoleptic test in respect of colour and texture was more acceptable under 5 kg vermicompost + 400 + 60 + 300 kg NPK/tree while flavour and taste was superior under 25 kg FYM alone/tree.

Key words: Pre-harvest treatment, organic, inorganic, shelf-life, sapota.

INTRODUCTION

Sapota [*Manilkara acharas* (Mill), Forsberg] is popularly known as *chiku* in India. It is an evergreen fruit tree native of Tropical America especially South Mexico in Central America. It is a major fruit crop grown in south Gujarat region. Use of various organic manures and fertilizers is a good practice to obtain higher yield with good quality of fruits throughout the year. To meet the recommended requirements of manure and fertilizers for different fruit crops, it could either be through inorganic sources or organic source to meet 50-50 percent nitrogen through organic and inorganic fertilizers for better yield. An excessive and indiscriminate use of chemical fertilizers and pesticides has resulted in considerable deterioration of soil health. It also disturbs the soil micro-organisms, reduces pH and built up of P_2O_5 and K_2O that cause reduction in soil health. Addition of organic matter will not only provide needed nutrients including micronutrients but also improve physical condition of soil, improve aeration, provide better scope for root growth and production. It is a sound practice for sustainable horticulture base on low external chemical input. Organic farming is a production system which favours maximum use of organic material and discourages the use of synthetically produced agro-inputs for maintaining soil productivity and fertility. The combination of using organic manure with inorganic fertilizers not only increased fruit yield/production but also improves fruit quality and maintains soil health.

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MATERIALS AND METHODS

Fruits of cv. Kalipatti were procured from the established sapota orchards which have 10 m × 10 m spacing and 17-year-old fruit trees at Fruit Research Station, NAU, Gandevi. There were 10 treatments including combination of organic manure and inorganic fertilizers. The fruits were harvested treatment wise in the morning hours. The scarf on the surface of the fruits was removed by washing the fruits in gunny bags. The uniform sized proper shaped and healthy fruits were selected and brought to the Departmental Laboratory of Horticulture for storage studies. Fruits were kept in paper dish under open condition at room temperature (25° to 28° C) and relative humidity of 39 to 55 per cent. Each treatment had four replications and each replication had three fruits. The data were recorded for physical quality characters *viz.,* fresh and ripened weight of fruits, fruits volume, peel weight, pulp weight, colour development in unripe to ripen condition and firmness, biochemical quality characters *viz.,* TSS, reducing sugar, non-reducing sugar, vitamin - C content. Storage study characters including ripening after harvest, shelf-life after ripening, organoleptic test and deterioration stage were also estimated. Fresh and ripened weight of fruits, peel weight and pulp weight were weighed on electronic weighing balance, fruits volume was worked out through water displacement method, colour changes was recorded by visual observation, TSS was recorded by using a hand reflactometer, reducing sugar, vitamin-C

content and acidity were measured by the titri-metric method described by Ranganna (10), non reducing sugar was measured by subtracting reducing sugar from total sugars, ripening after harvest, shelf-life and deterioration stage were scrutinized by visible symptoms and organoleptic test for assessing the colour, texture, flavour and taste were done by a panel of five judges by using 25 score to each characters (Ranganna, 10). The data collected were analyzed statistically as per the procedure (Sukhatme and Panse, 8)

RESULTS AND DISCUSSION

The data recorded on fresh weight, ripened weight, volume of the fruit, peel weight and pulp weight, were non significant among the various treatments (Table 1). However, maximum fresh and ripened weight, fresh volume, peel weight and pulp weight were recorded under treatment T6 (5 kg vermicompost + 400 + 60 + 300 g NPK/tree) which was followed by T1 (25 kg FYM + 400 + 60 + 300 g NPK/tree). This may be due to the more friable and pours soils made by nutrients to the tree hence quality improvement reflected in fruit character. Similar results has been reported by Ushakumari *et al.* (13) and Ramanswamy (9) in banana, Azhakiamanavalan *et al.* (5) in mandarin, and Anonymous (2) in papaya.

The data presented in Table 2 indicates that just after harvesting of the fruits the skin colour of the fruits was found dark brown (DB), which was the sign of immature fruit, on 5th day of storage the fruit skin colour turns light brown (LB) which was sign the of half mature fruit. Finally on 7th day and onwards there was dull (DO) colour of the fruit skin which was the sign of fully mature fruit. However fruits obtained from plants treated with 5 kg vermi compost + 400 + 60 + 300 g NPK/tree took more time for colour change.

Fruit firmness was found significant at various storage periods (Table 2). On 3rd and 5th day, firmness of fruit was significantly higher in T5 (25 kg FYM alone/ tree), i.e. 4.63 and 4.81 kg/cm^2 respectively, which was statistically at par with T1, T10, T9 and T4 on 3rd day and T10 on 5th day. On 7th and 9th day, firmness of fruit was significantly higher in T1 (25 kg FYM + 400 + 60 + 300 g NPK/tree), *i.e.* 3.14 and 3.00 kg/cm^2 respectively which was on par with T10 and T5 on 7th day and followed by T10 on 9th day. This change in firmness during storage may be due to slower rate of ripening and softening of pulp composition along with slower biochemical changes in conversion of starch to sugar fraction. This result is in agreement with Huchche *et al.* (6) in Nagpur mandarin.

The TSS was highest on 5th day and thereafter it decreased on 7th day and again roses on 9th day (Table-3). The TSS content in fruits was found non significant on 3rd day. However, on 5th, 7th and 9th day, it was found significant. On 3rd day TSS was maximum in T6 (20.56°B) which was followed by T7 (20.43 °B) while on 5th, 7th and 9th TSS content were significantly higher in T6, *i.e.* 23.94, 22.36 and 22.85 °B respectively, while on 9th day the next best in order of merit was T7, *i.e.* 22.51 °B. The minimum accumulation of TSS may be due to reduced rate of hydrolysis of starch as well as biochemical reaction among the different constituents and delayed ripening. This finding is in line with Anon (1) in sapota, Anon (3) in custard apple; and Athani and Hulamni (4) in banana. The vitamin-C content and acidity of fruits had been found non significant

Table 1. Effect of pre-harvest application of organic manures and inorganic fertilizers on physico-chemical parameters of sapota.

Treatment	Fresh weight (g)	Ripened weight (g)	Volume (ml)	Peel weight (g)	Pulp weight (g)
T1	86.43	79.02	72.45	4.80	74.22
T2	83.48	76.20	69.43	4.64	71.56
T3	81.74	74.53	67.63	4.54	69.98
T4	82.82	75.56	68.73	4.60	70.96
T5	79.73	72.60	64.55	4.43	68.17
T6	87.77	80.31	73.85	4.88	75.43
T7	85.76	78.38	71.78	4.76	73.62
T8	82.96	75.69	68.85	4.61	71.08
T9	82.69	75.44	68.58	4.59	70.84
T10	81.74	74.53	66.88	4.54	69.98
CD at 5%	NS	NS	NS	NS	NS

Table 2. Effect of organic manures and inorganic fertilizers on colour changes and fruit firmness at various storage periods.

Treatment	Colour change				Fruit firmness (kg/cm^2)			
	Days of storage				Days of storage			
	3rd	5th	7th	9th	3rd	5th	7th	9th
T1	DB	LB	DO	DO	4.57	4.44	3.14	2.75
T2	DB	LB	DO	DO	4.28	4.10	2.95	2.74
T3	DB	LB	DO	DO	4.31	4.15	2.98	2.76
T4	DB	LB	DO	DO	4.34	4.21	2.98	2.77
T5	DB	LB	DO	DO	4.63	4.81	3.06	2.84
T6	DB	LB	LB	DO	4.09	3.72	2.85	2.68
T7	DB	LB	DO	DO	4.12	3.77	2.9	2.71
T8	DB	LB	DO	DO	4.29	4.11	2.97	2.76
T9	DB	LB	DO	DO	4.34	4.22	3.01	2.79
T10	DB	LB	DO	DO	4.48	4.51	3.09	2.99
CD at 5%	-	-	-	-	0.30	0.30	0.10	0.08

DB = Dark Brown; B = Light Brown; DO = Dull orange

with respect to all treatments (Table 3). The changes in reducing sugar on 3rd day was found non significant while on rest of storage period it was significant (Table 4) on 5th, 6th and 7th significantly the maximum reducing sugar was reported in T6, *i.e.* 6.93, 5.99 and 5.92% respectively which was at par with T7, T8 and T2 on 5th day, T7, T2, T8 and T3 on 7th day and T7, T2, T8, T3 and T4 on 9th day. Accumulation of reducing sugar is a function of starch metabolism, which was slower in treated plants. This was in line with the findings of Anon (3) in custard apple; and Venkatesh *et al*. (14) in grape.

Non-reducing sugar was found significant at all storage days (Table 4). The significantly higher non reducing sugar was noted in T6 at all storage days *i.e.* 20.42, 26.14, 21.42 and 19.99% respectively which was at par with T7, T8, T2 and T3 at all storage days. Non-reducing sugar increased up to 5th day and then decreased continuously. This may be due to the consequence of release of sugars by the hydrolysis of starch reserve during the post harvest stage. This result is in close proximity of the result of, Ushakumari *et al*. (13) in papaya, Athani and Hulamni (4); and Venkatesh *et al.* (14) in grape.

The data on days to ripening shelf-life and deterioration stage of sapota was found significant (Table 5). The days to ripening, shelf-life and deterioration were significantly maximum in T6, *i.e.* 8.00, 5.50 and 9.50 days respectively. The days to ripening were on same bar with T8 and T10, shelf-life with T7 and T2 and deterioration T7, T8 and T2. These delays in repening and extended shelf-life have been due to the consequence of slow ripening changes like reduced weight loss and other physiological processing. Extended deterioration may be due to retarded ripening and reduced weight loss through controlled transpiration and respiration. This finding was supported by earlier findings of Huchche *et al*. (6) in Nagpur mandarin, Singh *et al*. (11) in guava; and Athani and Hulamni (4) in banana.

The sensory score for colour and texture was found significantly higher in T6, *i.e.* 22.25 and 22.75 respectively (Table 6). The score of flavour and taste of sapota fruits was higher in treatment T6, *i.e.* 21.88 and 22.63, respectively. The higher score for colour and texture may be due to higher dose of K_2O application, which might have in improving better colour and texture of the sapota fruits. This finding is in line with result obtained by Huchche *et al*. (6), whereas higher score for flavour and taste may be due to application of FYM alone in T5, The similar results has been reported by Singh *et al*. (11) in sapota, and Pereira snd Mitra (7) in guava.

It is concluded that among all ten pre-harvest treatments application of 5 kg vermicompost + 400 + 60 + 300 g NPK/tree proved best in respect of extending post harvest shelf-life, days to ripening and other nutritional parameters, while maximum firmness of fruit and organoleptic score for flavour and taste were found better under treatment of 25 kg FYM + 400 + 60 + 300 g NPK/tree.

Table 3. Effect of organic manure and inorganic fertilizers on TSS, vitamin-C, acidity of sapota cv. Kalipatti fruits at various storage periods.

Treatment	TSS (°B)				Vitamin-C (mg/100 g pulp)				Acidity (%)			
	Days of storage				Days of storage				Days of storage			
	3rd	5th	7th	9th	3rd	5th	7th	9th	3rd	5th	7th	9th
T1	19.51	20.4	18.43	19.8	10.34	7.38	3.92	0.98	0.17	0.08	0.05	0.014
T2	20.33	22.76	21.31	21.31	10.21	7.3	3.89	1.03	0.16	0.08	0.04	0.012
T3	20.19	22.34	20.74	20.52	10.11	7.24	3.87	1.02	0.17	0.08	0.04	0.012
T4	20.18	22.21	20.65	20.27	10.15	7.26	3.88	1.02	0.17	0.08	0.04	0.013
T5	19.84	21.74	20.3	19.48	10.52	7.49	3.97	1.05	0.17	0.08	0.04	0.013
T6	20.56	23.93	23.38	22.85	10.17	7.27	3.88	1.02	0.17	0.07	0.04	0.013
T7	20.43	23.9	22.26	22.51	10.44	7.44	3.95	1.04	0.18	0.07	0.04	0.013
T8	20.21	22.68	20.85	20.89	10.42	7.43	3.94	1.04	0.17	0.08	0.04	0.013
T9	20.06	22	20.49	19.9	10.18	7.28	3.88	1.02	0.17	0.08	0.04	0.013
T10	19.69	21.18	19.02	15.7	10.31	7.36	3.92	1.03	0.17	0.08	0.04	0.013
CD at 5%	NS	1.25	1.39	1.08	NS	NS	NS	NS	NS	NS	NS	NS

Table 4. Effect of organic manure and inorganic fertilizer on reducing sugar and non-reducing sugar of sapota cv. Kalipatti fruits at various storage periods.

Treatment	Reducing sugar (%)				Non-reducing sugar (%)			
	Days of storage				Days of storage			
	3rd	5th	7th	9th	3rd	5th	7th	9th
T1	4.7	6.04	5.01	5.04	16.32	20.89	12.11	15.77
T2	4.9	6.59	5.89	5.83	20.27	25.94	21.26	19.84
T3	4.86	6.47	5.72	5.66	20.14	25.77	21.12	19.7
T4	4.86	6.43	5.7	5.64	19.48	24.93	20.43	19.02
T5	4.78	6.3	5.6	5.54	17.27	22.1	18.11	16.75
T6	4.95	6.93	5.98	5.92	20.42	26.13	21.41	19.99
T7	4.92	6.92	5.96	5.9	20.31	25.99	21.3	19.88
T8	4.87	6.57	5.76	5.7	20.23	25.89	21.22	19.8
T9	4.83	6.37	5.65	5.59	17.43	22.3	18.28	16.91
T10	4.74	6.14	5.24	5.15	17.05	21.83	17.89	16.53
CD at 5%	NS	0.34	0.32	0.23	0.63	0.81	0.66	0.65

Table 5. Effect of organic manure and inorganic fertilizers on days to ripening after harvest, shelf-life after ripening and deterioration stage of sapota cv. Kalipatti fruits.

Treatment	Days to ripening	Shelf-life (days)	Stage of deterioration
T1	4.25	4.00	7.00
T2	6.75	5.25	9.25
T3	5.25	5.00	8.50
T4	5.25	5.00	8.50
T5	6.50	5.00	8.00
T6	8.00	5.50	9.50
T7	6.50	5.25	9.25
T8	7.50	5.00	9.00
T9	6.00	5.00	8.25
T10	7.75	4.75	7.75
CD at 5%	0.72	0.46	0.599

Table 6. Effect of organic manure and inorganic fertilizer on organoleptic test of sapota cv. Kalipatti fruits after ripening and storage.

Treatment	Organoleptic test (score)				Over all acceptability (100)
	Colour (25)	Texture (25)	Flavour (25)	Taste (25)	
T_1	17.38	19.00	17.50	18.13	72.00
T_2	16.75	17.38	17.25	17.00	68.38
T_3	18.38	18.50	18.13	18.00	73.00
T_4	21.13	21.38	20.50	20.63	83.63
T_5	18.88	19.25	21.88	22.63	89.50
T_6	22.25	22.75	18.25	18.25	74.63
T_7	19.13	20.13	17.25	18.38	74.88
T_8	16.00	16.88	17.38	17.38	67.63
T_9	17.50	17.13	17.25	17.25	69.13
T_{10}	21.50	21.63	20.88	21.63	85.63
CD at 5%	0.86	0.59	1.14	0.86	2.90

REFERENCES

1. Anonymous. 2000a. *35th Meeting of Horticulture and Forestry Sub-Committee of Agricultural Research Council of GAU,* held at Navsari on April 26-27, pp. 479.
2. Anonymous. 2000b. *36th Meeting of Horticulture and Forestry Sub-Committee of Agricultural Research Council of GAU,* held at Navsari on 11-12th April, pp. 70-72.
3. Anonymous. 2001. *36th Meeting of Horticulture and Forestry Sub-Committee of Agricultural Research Council of GAU* held at Navsari on 11-12th April, pp. 67-68.
4. Athani, S.I. and Hulamani, N.C. 2000. Effect of vermicompost on fruit yield and quality of banana cv. Rajapuri (Musa AAB). *Karnataka J. Agric. Sci.* **13**: 942-46.
5. Azhakiamanavalan, R.S., Thangraj, T. and Muthumanickam, D. 1996. Studies on the super phosphate enriched FYM on yield and quality of mandarin in Shevroys. *South Indian Hort*. **44**: 124-27.
6. Huchche, A.D., Ladniya, M.S., Lallan Ram, Kohli, R.R. and Srivastava, A.K. 1998 Effect of nitrogenous fertilizers and farmyard manure on yield, quality and shelf-life of Nagpur mandarin. *Indian J. Hort*. **55**: 108-12.

7. Pereira, L.S. and Mitra, S.K. 1999. Studies on organic along with inorganic nutrition in guava, *Indian Agric*. **43**: 155-60.

8. Panse, V.G. and Sukhatme, P.V. 1987. *Statistical Methods for Agricultural Workers,* I.C.A.R., Pub., New Delhi. 369 p.

9. Ramaswamy, N. 1986. Studies on the effect of different levels of phosphoric acid on the yield and quality of Robusta Banana. *AUARA-Annamalai Univ. Agric. Res. Ann.,* **6**: 30-37.

10. Ranganna, S.S. 1979. *Manual of Analysis of Fruit and Vegetable Products*, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

11. Singh, S.S., Kalyansundram, P. and Muthukrishnan, C.R. 1962. Studies on the effect of nitrogen and potash on the physico-chemical characters of sapota. *AUARA* **4/5**: 22-33.

12. Singh, U.R., Khan, A. and Singh, G. 1972. Effect of NPK fertilization on growth, yield and quality of sapota cv. Kalipatti. *Punjab Hort. J*. 64-69.

13. Ushakumari, K., Prabhakumari, P. and Padmaja, P. 1997. Efficacy of vermicompost on yield and quality of banana (AB) cv. Njalipoova. *South Indian Hort*. **45**: 158-60.

14. Venkatesh Patil, P.B., Athani, S.I., Reddy, P.N. Patil, M.P. and Dharmatti, P.R. 1998. Quality characteristics of grape beries as influenced by *in situ* vermiculture and vermicompost. *Adv. Agril. Res. Indian,* **10**: 129-32.

Received: March, 2008; Revised: April, 2010;
Accepted : May, 2010