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EFFECT OF POST HARVEST TREATMENTS ON BIOCHEMICAL CHANGES OF MANGO CV. KESAR FRUIT DURING STORAGE

Sachin Patil[1], Chillawar R. G[2]. and R.R. Viradia[3]*

[1,2] *Department of Botany and Horticulture, Yeshwant Mahavidyalaya, Nanded, (Maharashtra), India - 431602*
[3]*Departmen of Horticulture, Junagadh Agricultural University, Junagadh (Gujarat), India – 362001*

E-mail: sachin7599@gmail.com

ABSTRACT

A study was carried out to evaluate the role of post-harvest treatments on ripening quality and shelf life of mango cv. Kesar fruit during storage. The quality of fruits also improved by different growth regulator treatments. The fruits treated with Ethrel increases TSS, reducing sugar, total sugar at initial stage of storage, while GA_3 increased TSS, reducing sugar and total sugar. It is concluded that for enhancing ripening and quality for early marketability, the treatment of Ethrel 500 ppm is most beneficial. However, GA_3 250 ppm is better for increasing shelf life, quality and marketability of fruits as post-harvest treatments before storage.

Key words: Mango, Post-harvest, Ethrel, GA_3, TSS, Total sugar, Reducing sugar.

INTRODUCTION

The mango (*Mangifera indica* L.) belongs to family anacardiaceae and is an important fruit crop of India as well as tropical and subtropical countries of the World. Being a useful and delicious fruit, it is the part of culture and religion since long time. Besides fine taste, its high palatability, sweet fragrance, attractive colour and nutritional value, it is called as "The king of tropical fruits."

The total production of mango in world is estimated to be 25.76 million metric tonnes with India being the largest producer (11.40 mt) accounting to above 50 per cent of the world production (FAO, 2003). Gujarat produces 4 per cent of India's mango production and contributes 21 per cent of India's export (Anon., 2001). Post-harvest handling can play a major role in reducing post-harvest losses by following definite methodology, viz., post-harvest treatments with certain chemicals, and plant growth regulators and inhibitors. These plays a vital role in retarding/enhancing the rate of ripening, thereby reducing the breakdown of physico-chemical and enzymatic activity in treated fruits, which ultimately leads to increase the shelf life of mango fruits. To catch early market for higher returns, people ripe fruits by artificial means. Ethrel (2-chloroethylphosphonic acid) is well known for induction of early ripening in a number of fruit crops. (Russo *et al*., 1968).

Generally, maturation and ripening are believed to be associated with change in fruit colour. This implies that exogenous application of growth regulators might retard the pace of colour development delaying thereby the ripening process. Among the growth regulators, gibberellic acid (GA_3) has been known to delay the process of ripening in various fruit crops. In mango, a rapid change of colour from green to

bright yellow occurs with the onset of climacteric accompanied by softening of mesocarp. This change is caused by chlorophyll degradation with concomitant increase in carotenoid content, depending on the level of endogenous phyto-hormones present in the fruits (Goldschmidt, 1980). The main objective of the study was to study the effect of different treatments on ripening, quality and shelf life of mango and to find out the effective treatment which can be conveniently be used to reduce post-harvest losses.

MATERIALS AND METHODS

Green mature fruits with uniform size and shape having specific gravity between 1.0 and 1.04 were selected. The trial was conducted during the year 2005-2006 with C.R.D. The trial comprised of twelve different treatments including control was used. The fruits were dipped for 10 minutes in GA3 250, 500, 750 ppm, ethrel 500, 750, 1000 ppm, neem leaf extract @ 5 and 10%, hot water 50 ±20C, carbendazim 500 ppm, hot water 50 ± 20C + carbendazim 500 ppm. After treatment, the fruits were air dried for 30 minutes. For hot water, fruits were dipped in hot water at 50 ±20C for 10 minutes.

For hydro-cooling, fruits were dipped in cool water at 13 ± 10C temperature and the constant temperature were maintained by continuous adding of ice water. Temperature was measured by using thermometer. Treated fruits were packed as such without wrapping in Corrugated Fibre Board (CFB) Boxes and stored in the laboratory at room temperature. Boxes were of 30 x 30 x 30 cm size having 8 vents of 3 cm diameter of each one. Paper cutting was used as a cushioning material during store. The fruits were selected from each lot at a time and used for analysis and organoleptic taste. Analysis was done at 3 days interval and all the observations were recorded till the fruits were over ripe.

RESULTS

Total soluble solids (%):

The changes in TSS content of mango fruits as affected by various treatments during storage are presented in Table No.1 and graphically depicted in Fig. No.1.The data indicated that the TSS of fruits was significantly influenced by various post-harvest treatments during storage. There was significant difference found in various treatments during 3rd, 6th, 9th ,12th & 15th day of storage.

Table 1: Effect of post-harvest treatments on total soluble solids (%) of mango (cv. Kesar) fruit during storage.

Treatments	Storage period (days)							
	0	3	6	9	12	15	18	21
T_1 - Control	8.49	9.34	10.71	12.78	15.91	17.65	17.55	16.61
T_2 - GA_3 250 ppm	8.21	9.12	10.45	11.52	14.95	16.97	18.72	17.78
T_3 - GA_3 500 ppm	8.20	9.11	10.43	11.50	14.90	16.96	18.96	18.01
T_4 - GA_3 750 ppm	8.19	9.04	10.33	11.08	14.56	16.94	18.98	18.04
T_5 - Ethrel 500 ppm	8.08	9.46	10.87	13.61	16.55	18.61	18.57	17.63
T_6 - Ethrel 750 ppm	8.11	9.49	10.89	13.64	16.58	18.67	18.65	17.72
T_7 - Ethrel 1000 ppm	8.12	9.51	10.90	13.66	16.60	18.70	18.67	17.73
T_8 - Neem leaf extract 5 %	8.21	9.20	10.56	11.95	15.28	17.33	17.28	16.34
T_9 - Neem leaf extract 10 %	8.17	9.14	10.47	11.54	14.98	17.01	18.71	17.77
T_{10} - Hot water 50 ± 2°C	8.19	9.48	10.88	13.62	16.57	18.65	18.61	17.67
T_{11} - Carbendazim 500 ppm	8.39	9.27	10.65	12.37	15.60	17.98	17.73	16.79
T_{12} - Hot water + Carbendazim 500 ppm	8.07	9.40	10.79	13.20	16.23	18.30	18.08	17.14
S.Em. ±	0.28	0.02	0.02	0.13	0.10	0.07	0.01	0.01
C.D. at 5 %	NS	0.05	0.07	0.37	0.28	0.20	0.03	0.03
C.V. %	5.81	0.31	0.37	1.73	1.05	0.67	0.10	0.11

Table 2: Effect of post-harvest treatments on reducing sugar (%) of mango (Cv. Kesar) fruit during storage.

Treatments	Storage period (days)							
	0	3	6	9	12	15	18	21
T_1 - Control	3.07	3.16	3.65	4.38	4.84	4.31	4.28	0.00
T_2 - GA_3 250 ppm	3.12	3.06	3.59	4.27	4.78	5.70	5.65	5.59
T_3 - GA_3 500 ppm	3.08	3.05	3.58	4.26	4.77	5.22	5.20	5.14
T_4 - GA_3 750 ppm	3.24	3.02	3.57	4.24	4.76	5.20	5.18	5.12
T_5 - Ethrel 500 ppm	2.71	3.30	3.72	4.50	4.91	4.90	4.89	4.83
T_6 - Ethrel 750 ppm	3.06	3.52	3.82	4.70	5.01	4.75	4.72	4.74
T_7 - Ethrel 1000 ppm	2.88	3.72	3.92	4.90	5.10	4.60	4.57	4.61
T_8 - Neem leaf extract 5 %	2.87	3.09	3.61	4.30	4.80	5.37	5.32	5.31
T_9- Neem leaf extract 10 %	2.81	3.08	3.60	4.29	4.79	5.66	5.54	5.48
T_{10} - Hot water 50 ± 2°C	3.07	3.32	3.73	4.52	4.92	4.46	4.43	0.00
T_{11} - Carbendazim 500 ppm	2.74	3.10	3.62	4.32	4.81	5.52	5.40	5.34
T_{12} - Hot water + Carbendazim 500 ppm	2.97	3.29	3.71	4.49	4.90	5.05	5.02	4.96
S.Em. ±	0.12	0.06	0.03	0.05	0.03	0.04	0.03	0.02
C.D. at 5 %	NS	0.18	0.08	0.15	0.08	0.13	0.10	0.05
C.V. %	7.18	3.32	1.32	2.04	1.03	1.53	1.16	0.69

Table 3: Effect of post-harvest treatments on total sugar (%) of mango (Cv. Kesar) fruit during storage.

Treatments	Storage period (days)							
	0	3	6	9	12	15	18	21
T_1 - Control	6.00	7.74	9.31	14.04	16.53	13.90	13.88	0.00
T_2 - GA_3 250 ppm	6.31	7.66	9.24	13.92	16.45	17.08	17.03	18.13
T_3 - GA_3 500 ppm	6.34	7.65	9.22	13.90	16.44	15.98	15.96	16.48
T_4 - GA_3 750 ppm	6.41	7.64	9.20	13.89	16.43	15.94	15.92	16.43
T_5 - Ethrel 500 ppm	6.33	7.81	9.41	14.15	16.63	15.26	15.24	15.19
T_6 - Ethrel 750 ppm	6.30	7.94	9.59	15.16	16.80	14.92	14.90	14.85
T_7 - Ethrel 1000 ppm	6.37	8.05	10.72	15.33	16.94	14.58	14.56	14.51
T_8 - Neem leaf extract 5 %	6.28	7.68	9.26	13.95	16.47	16.32	16.30	16.98
T_9- Neem leaf extract 10 %	6.29	7.67	9.25	13.94	16.46	17.00	16.97	18.05
T_{10} - Hot water 50 ± 2°C	6.32	7.83	9.43	14.17	16.65	14.24	14.22	0.00
T_{11} - Carbendazim 500 ppm	6.29	7.69	9.27	13.97	16.48	16.66	16.64	17.58
T_{12} - Hot water + Carbendazim 500 ppm	6.28	7.80	9.40	14.14	16.62	15.60	15.58	15.95
S.Em. ±	0.17	0.03	0.04	0.05	0.04	0.11	0.10	0.04
C.D. at 5 %	NS	0.10	0.12	0.16	0.13	0.32	0.30	0.10
C.V. %	4.55	0.75	0.75	0.66	0.46	1.22	1.14	0.45

Fig. 1: Effect of post-harvest treatments on total soluble solids of mango (cv. Kesar) fruit during storage.

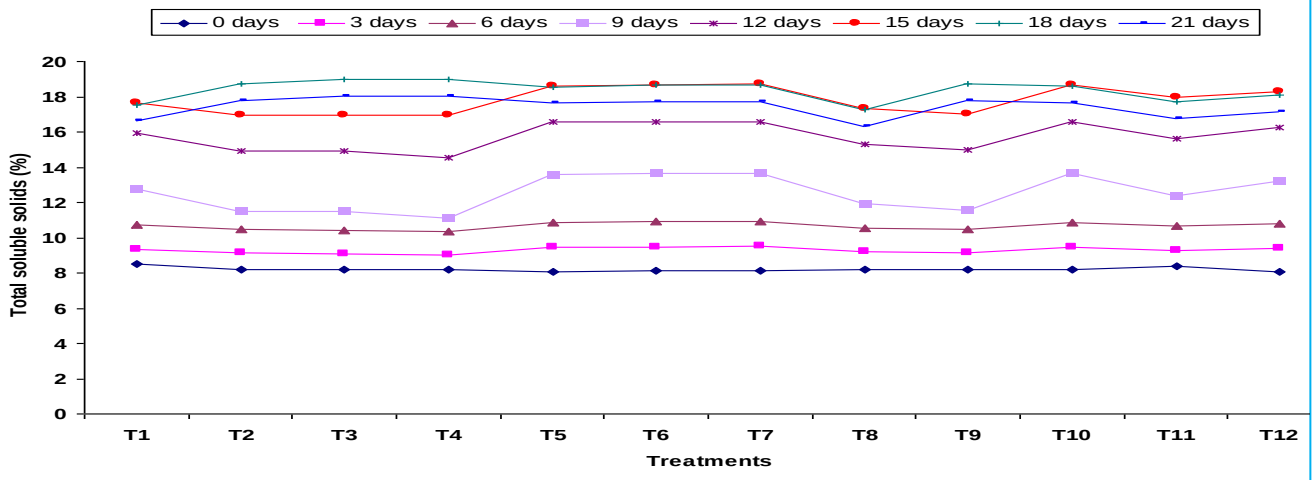
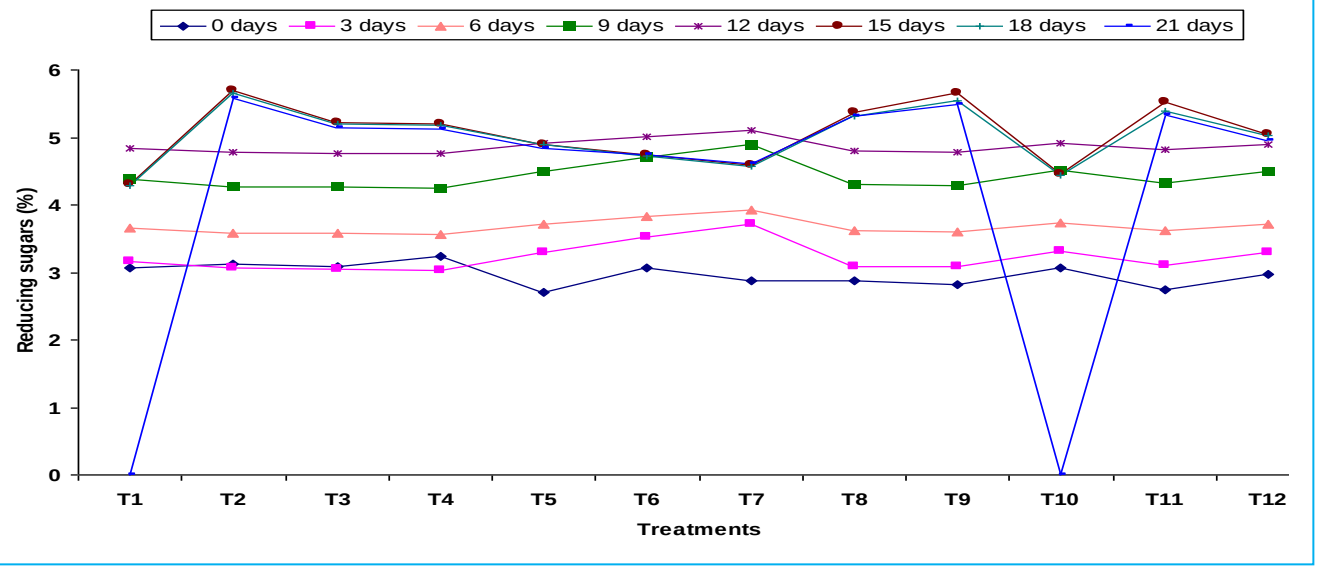


Fig. 2: Effect of post-harvest treatments on reducing sugar of mango (cv. Kesar) fruit during storage.



The highest TSS (9.51%, 10.90%, 13.66%, 16.60% and 18.70%) was observed in T7 (Ethrel 1000 ppm) respectively, which was at par with T6, T10 and T5. whereas the minimum TSS (9.04%, 10.33%, 11.08% and 14.56%) was recorded in T4 (GA3 750 ppm), respectively and on 15th day of storage the minimum TSS (16.94%) was recorded in T4 (GA3 750 ppm) that were at par with T3, T2 and T9.On 18th and 21st day of storage highest TSS (18.98% and 18.04%) was noted in treatment T4 (GA3 750 ppm), respectively, which was at par to T3 (GA3 500 ppm), whereas the minimum TSS (17.28% and 16.34%) was observed in T8 (Neem leaf extract 5 %), respectively.

Reducing sugar (%):

The changes in reducing sugar percentage in mango fruit as influenced by various treatments during storage are presented in Table No.2 and graphically depicted in Fig No.2.There was significant difference found in various treatments on 3rd, 6th, 9th and 12th day of storage.

The highest reducing sugar (3.72%, 3.92%, 4.90% and 5.10%) was recorded in T7 (Ethrel 1000 ppm), whereas the minimum reducing sugar (3.02%, 3.57%, 4.24% and 4.76%) was recorded in T4 (GA3 750 ppm), respectively, which was at par with treatments T3, T2, T9, T8, T11 and T1.The highest reducing sugar

(5.70%, 5.65% and 5.59%) was observed in treatment T2 (GA3 250 ppm) on 15th, 18th and 21st day of storage, respectively although simultaneously on 15th day of storage treatment T9 was at par with it, whereas the minimum reducing sugar (4.31% and 4.28%) were noted in T1 (Control), on 15th and 18th day of storage and on 21st day of storage 4.61 % reducing sugar was observed in T7 (Ethrel 1000 ppm), respectively.

Total sugar (%):

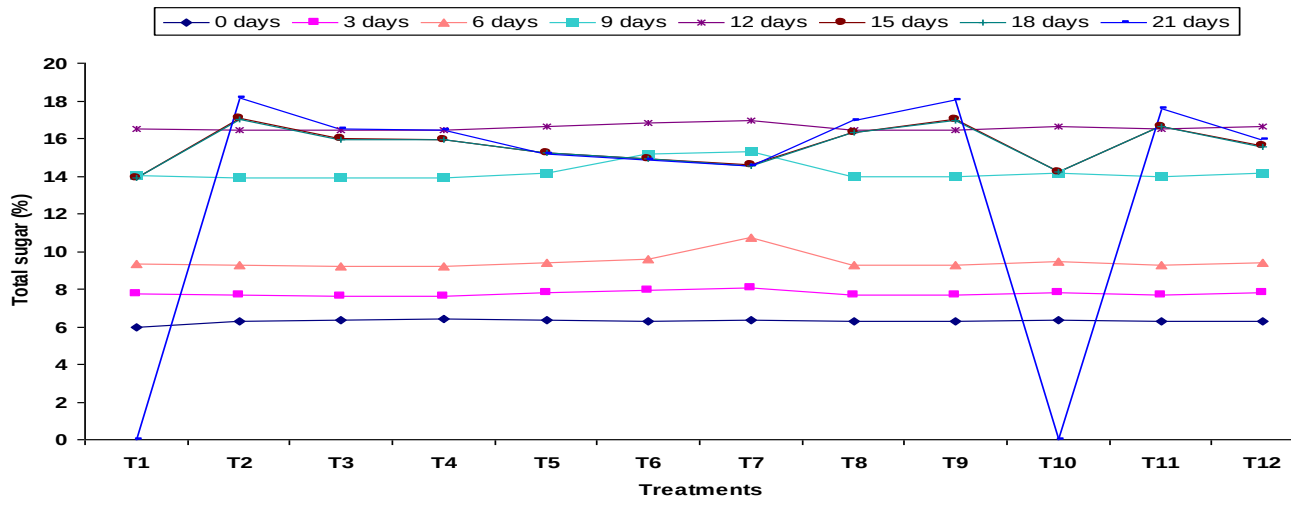
The changes in total sugar percentage in mango fruit as influenced by various treatments during storage are presented in Table No. 3 and graphically depicted in Fig. No.3.There was significant difference found in various treatments during 3rd, 6th, 9th and 12th day of storage. The highest total sugar (8.05%, 10.72%, 15.33% and 16.94%) was recorded in T7 (Ethrel 1000 ppm), respectively, whereas the minimum total sugar (7.64%, 9.20%, 13.89% and 16.43%) was recorded in T4 (GA3 750 ppm), respectively, which was at par with T3, T2, T9, T8, T11 and T1. The highest total sugar (17.08%, 17.03% and 18.13%) was observed in T2 (GA3 250 ppm) on 15th, 18th and 21st day of storage respectively, but T9 was at par with it on 15th day of storage, whereas the minimum total sugar (13.90% and 13.88%) were noted in T1 (Control) on 15th and 18th day of storage and minimum total sugar (14.51%) was observed in T7 (Ethrel 1000 ppm) on 21st day of storage.

DISCUSSIONS

There was increase in TSS in Ethrel 1000 ppm treated fruits due to accumulation of sugar as consequence of starch hydrolysis, while the later it decreased due to consumption of sugar for respiration during storage. Similar trend was recorded by (Medicott et al. 1986), (Selvaraj et al. 1989) and Kumar et al. (1994) in their findings in mango. During the later phase TSS was observed higher in GA3 750 ppm. GA3 reduced the rate of hydrolysis of starch and delay ripening in the starting phases the results of (Reddy and Haripriya 2002), (Kahlon 2005) and (Amorocho and Turriago 2000) are in confirmation with those obtained under the present study.

Maximum percentage of reducing and total sugar was recorded in Ethrel 1000 ppm at initial stages and GA3 750 ppm at later stages. It is corroborated to the fact that the treatments stimulated the rate of starch hydrolysis and increased rate of respiration and oxidation might be responsible for retention of sugars during storage. Similar trend was obtained by (Mann 1985) obtained similar results. It can also be observed that reducing sugars and total sugar content were reduced in the later period of storage. This may be due to their rapid utilization in respiration. These are in confirmation with those obtained by (Soule and Haltton 1955).

Fig. 3: Effect of post-harvest treatments on total sugar of mango (cv. Kesar) fruit during storage.



CONCLUSION

From the present study, it is concluded that per cent TSS of mango fruits were significantly increased with Ethrel 1000 ppm during early ripening and GA_3 750 ppm increased maximum TSS during later period. The reducing sugar and total sugar percentage were recorded highest with Ethrel 1000 ppm and GA_3 250 ppm at 12th days and 21st days of storage, respectively.

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