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Effect of Plant Growth Regulators and Chemicals on Physic-Chemical Properties During Storage of *Mangifera indica* cv. Mallika

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ABSTRACT

An investigation entitled the "Effect of plant growth regulators and chemicals on physic-chemical properties during storage of *Mangifera indica* cv. Mallika" was conducted during June 2012 at the Post Graduate Laboratory, Department of Horticulture, B.A. College of Agriculture, Anand Agricultural University that in mango fruits cv. Mallika quality parameters found maximum value *i.e.* total soluble solids, total sugars, days to ripening and moderate value in physiological loss in weight, decay loss, reducing sugar, non reducing sugar, acidity %, ascorbic acid content and firmness with treatment $CaCl_2$ @ 1.5% at 6th days after storage. Mango (*Mangifera indica* L.) belonging to Family Anacardiaceae is the most important commercially grown fruit crop of the country.

Key words *growth regulators, TSS, Total sugars, $CaCl_2$, and Firmness*

The mango is the national fruit of India, Pakistan and the Philippines. It is also the national tree of Bangladesh. India ranks first among world's mango producing countries accounting for about 50 % of the world's mango production. Various PGRs and chemicals have been used to delay ripening, reduce losses to improve and maintain color and quality by slowing down the metabolic activities of fruit which ultimately leads to an increased shelf life and maintain the quality marketability of the fruit for a longer period. Therefore the present investigation was carried out.

MATERIAL AND MATHODS

Chemical and PGR treatments were applied as post harvest dips. In these chemical treatments, the fruits were dipped for 5 minutes in $CaCl_2$ 1.5 % solution, for 5 minutes in $Ca(NO_3)_2$ 1.5 %, and for PGR treatments, the fruits were dipped for 5 minutes in GA_3 250 mg/L and for 5 minutes in 2,4-D 500 mg/L solution. (C_1 – Control, C_2- GA_3 250 mg/l, C_3 - 2,4-D 500 mg/l, C_4 - $Ca(NO_3)_2$ 1.5 % and C_5 - $CaCl_2$ 1. 5%) Fully mature mango fruits were harvested and kept 20 fruits/box for storage. The graded fruits were stored in various CFB boxes for twelve days at ambient temperature. Stored fruits were subjected to various physico-chemical observations at 3rd, 6th, 9th, and 12th, day after giving them different treatments. The percentage of total soluble solids of the pulp was recorded, using hand Refractometer. The Vitamin-C, sugars and titrable acidity were estimated as per the method advocated by Ranganna (1979) and firmness of fruit was measured by pressure tester. The experiment was conducted in a Completely Randomized Design (Factorial) with three replications and five treatments. The data were subjected to statically analysis by making use of analysis of variance technique for Factorial Complete Randomized Block Design as describe by Steel *et al.,* (1997).

RESULT AND DISCUSSION

Total soluble solids (^{0}Brix)

The effect of treatment C_5- $CaCl_2$ 1.5 % found significantly the highest total soluble solids *i.e.* 19.38 (^{0}Brix) at 3rd day after storage as compared to rest of the PGR and chemical treatments. Das and Acharya (1969) also obtained the similar results. Thus, these findings support the results of the present investigation. The increase in TSS during storage may be attributed to the conversion of

Table 1. Effect of plant growth regulators and chemicals with and without ethylene absorbent on TSS, acidity, reducing sugar and during storage of mango *(Mangifera indica* L.*)* Cv. Mallika

Treatments	TSS(^{0}Brix)				Acidity (%)				Reducing sugar (%)				Total sugar (%)			
	3rd day	6th day	9th day	12th day	3rd day	6th day	9th day	12th day	3rd day	6th day	9th day	12th day	3rd day	6th day	9th day	12th day
C_1- Control	17.93	21.40	20.83	18.87	0.397	0.333	0.247	0.212	2.85	4.80	7.10	5.20	11.7	13.3	12.5	11.0
C_2- GA_3 250 mg/l	19.03	22.32	21.77	19.80	0.352	0.288	0.207	0.167	3.30	5.25	7.55	5.65	12.5	14.1	13.3	11.7
C_3- 2,4-D 500 mg/l	18.28	21.75	21.18	19.22	0.367	0.303	0.222	0.192	2.95	4.90	7.20	5.30	12.0	13.6	12.8	11.3
C_4- $Ca(NO_3)_2$ 1.5 %	18.58	22.05	21.48	19.52	0.397	0.333	0.232	0.187	3.05	5.00	7.30	5.40	12.2	13.8	13.0	11.4
C_5- $CaCl_2$ 1.5 %	19.38	22.35	21.78	19.82	0.347	0.283	0.202	0.162	3.55	5.50	7.80	5.90	12.7	14.3	13.5	12.0
S. Em. +	0.064	0.100	0.149	0.105	0.002	0.002	0.001	0.001	0.008	0.033	0.040	0.038	0.049	0.091	0.059	0.074
C. D. at 5%	0.187	NS	NS	NS	0.007	0.005	0.004	0.003	0.024	0.096	0.118	0.113	0.144	0.266	0.172	0.218

starch and other polysaccharides in sugars (Mukherjee and Dutta, 1967).

Acidity (%)

It was observed the application of various treatments had varying effect on the acidity of fruits. Treatment C_5- $CaCl_2$ 1.5 % significantly recorded the lowest acidity *i.e.* 0.347, 0.283, 0.202 and 0.162 (%) at 3rd, 6th, 9th and 12th day after storage as compared to rest of the PGR and chemical treatments. These results suggested that post-harvest fruits treated with calcium compounds are much sweeter as compared to control fruits. The decreasing in acidity may be due to conversion of acids to sugars (Pool *et al*., 1972). Similar decrease in acidity due to calcium was also reported by Singh *et al*. (1998) in mango.

Ascorbic acid (mg/100 g pulp)

Treatment C_5- $CaCl_2$ 1.5 % recorded significantly the maximum Vitamin-C content *i.e.* 24.6 and 19.7 mg/100 g pulp at 3rd and 9th day after storage as compared to rest of the PGR and chemical treatments while 6th and 12th day data were found non significant. The variation in decreasing trend of ascorbic acid might be due to different levels of oxidation in different treatments. Maximum ascorbic acid content was recorded in the fruits treated with calcium chloride. It might be due to the fact that application of calcium compounds retarded the oxidation process and hence the rate of conversion of L-ascorbic acid into dehydro ascorbic is slowed down. These results are in conformity with the findings of Gupta *et al.* (1979) in guava.

Sugars (%)

Treatment C_5- $CaCl_2$ 1.5 % significantly effect on reducing sugar recorded with maximum value *i.e.* 3.55, 5.50, 7.80 and 5.90 % at 3rd, 6th, 9th and 12th day after storage, respectively as compared to rest of treatments. Significantly, the maximum total sugar recorded with value 12.7, 14.3, 13.5 and 12.0 % was obtained with $CaCl_2$ 1.5 % while minimum total sugar was observed with C_1 (Control) with value *i.e.* 11.7, 13.3, 12.5 and 11.0 % at 3rd, 6th, 9th

Table 2. Effect of plant growth regulators and chemicals with and without ethylene absorbent on ascorbic aid, firmness, PLW, total sugar during storage of mango *(Mangifera indica* L.*)* Cv. Mallika

Treatments	Ascorbic acid (mg/100 g pulp)				Firmness(kg/cm^2)				PLW (%)				non sugar (%)			
	3rd day	6th day	9th day	12th day	3rd day	6th day	9th day	12th day	3rd day	6th day	9th day	12th day	3rd day	6th day	9th day	12th day
C_1- Control	23.5	21.8	18.7	16.8	7.12	5.12	3.68	1.69	5.55	6.48	18.85	23.47	8.85	8.50	5.40	5.77
C_2- GA_3 250 mg/l	24.3	22.1	19.5	17.1	7.72	5.72	4.28	2.29	4.85	5.34	15.88	20.52	9.15	8.80	5.67	6.07
C_3- 2,4-D 500 mg/l	23.9	21.7	18.9	16.5	7.32	5.32	3.88	1.91	5.40	5.98	17.56	22.18	9.05	8.70	5.60	5.97
C_4- $Ca(NO_3)_2$ 1.5 %	24.2	22.0	19.2	16.7	7.62	5.62	4.18	2.21	5.15	5.69	16.80	21.42	9.10	8.75	5.65	6.02
C_5- $CaCl_2$ 1.5 %	24.6	22.4	19.7	17.3	7.87	5.87	4.43	2.47	4.65	5.04	15.11	19.74	9.15	8.80	5.68	6.07
S. Em. +	0.065	0.119	0.064	0.099	0.041	0.035	0.025	0.013	0.034	0.037	0.099	0.139	0.044	0.059	0.037	0.038
C. D. at 5%	0.191	NS	0.187	NS	0.120	0.102	0.073	0.039	0.100	0.110	0.292	0.409	NS	NS	NS	NS

and 12th day after storage, respectively. The increase in reducing sugar and total sugar due to calcium treatments was also reported in cherry fruits (Bhat *et al.* 1997). An increase in sugars during storage was probably due to conversion of starch and polysaccharides in to soluble sugars and dehydration of fruits (Dhemre and Wasker 2003).

Physiological loss in weight (%)

Treatment $CaCl_2$ 1.5 % recorded significantly the lowest physiological loss in weight *i.e.* 4.65, 5.04, 15.11 and 19.74 %, at 3rd, 6th, 9th and 12th day after storage, respectively as compared to rest of treatments. This may be due to the role of calcium on limiting respiration, which was attributed to an altered membrane permeability (Bangerth, 1979). Similar results supported by finding of Haribabu and Shantakrishnamurthy (1993).

Firmness (kg/cm^2)

The firmness are significantly influenced with C_5-$CaCl_2$ 1.5 % treatment with value of 7.87, 5.87, 4.43 and 2.47 kg/cm^2 while minimum firmness was observed with C_1 Control *i.e.* 7.12, 5.12, 3.68 and 1.69 kg/cm^2 at 3rd, 6th, 9th and 12th day after storage, respectively. Decrease in fruit firmness during storage is presumably due to change in cell wall polysaccharides. Similar result were obtained by Tandon and Karla (1984) in mango.

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