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Effect of pre and post harvest treatments on shelf life and quality of guava fruits. (*Psidium guajava* L.) cv. GWALIOR –27

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ABSTRACT

The shelf life of guava fruits increased with the increase in concentration of calcium compounds and bavistin. The maximum self life, T.S.S, Ascorbic acid, pectin content and minimum titrable acidity of guava fruits was obtained under 2.0% Ca $(NO_3)_2$ pre-harvest spray and 2.0% Ca$(NO_3)_2$ post –harvest dip. Pre and post-harvest application of calcium compounds and bavistin significantly affected the shelf life of guava fruits and calcium nitrate was proved better than calcium chloride and bavistin. There was gradual increase in TSS up to 6 days and decline there after, however, higher ascorbic acid and pectin content was maintained up to 9 days of storage in all the treatments. Titrable acidity was declined gradually with the increasing period of storage.

Key words : Guavava, Post harvest treatment, Shelf life, T.S.S., Ascorbic acid.

Guava is one of the most important fruit trees grown in India. Comparative low cost of fruit production combined with high nutritive value makes it Ideal desert fruit of the common man. It is rich in vitamin C and a good source of calcium, phosphorus, pantothenic acid, riboflavin, thiamin and niacin. Guava ranks fifth in terms of acreage and fourth position in terms of production under different fruits in the country. There is enormous scope for increasing production with the availability of new selections and hybrids in guava. Being highly perishable, fruits have to be marketed immediately after harvest. The post harvest losses range from 10-15 per cent. The fruits of most of the cultivars can be stored only up to two days at room temperature (Chundawat *et al.*,1976). Considering its short shelf life, work was carried out for longer availability of fresh fruits.

MATERIALS AND METHODS

The experiment was carried out at Department of Horticulture and Food Science Laboratory, Jawaharlal Nehru Krishi Vishwa Vidhyalaya, College of Agriculture Gwalior (M.P) during the year 2002-2004. The experimental site is situated in the north of Madhya Pradesh and this tract enjoys sub-tropical climate with extreme of temperature both in summer (maximum temperature 47º C) as well as in winter (minimum 1º C). The frost is of rare occurrence but the cold waves are experienced from the middle of December up to end of January. The guava fruits were harvest at jelly making stage of maturity. Neither under ripe, nor over – ripe fruits were selected on the basis of uniformity in maturity, size and shape. The experimental field was layout in the randomized block design with twenty treatments. All the treatments were replicated thrice and 25 fruits served as one unit of treatment in each replication. All the treatments were randomized separately in each replication and the treatments were: T_1- post –harvest dip in distilled water, T_2- 2.0% $CaCl_2$ post –harvest dip, T_3- 2.0% Ca $(No_3)_2$ post – harvest dip, T_4- 500 ppm bavistin post – harvest dip, T_5- 1.0% $CaCl_2$ pre-harvest spray, T_6- 1.0% $CaCl_2$ pre-harvest spray and 2.0% $CaCl_2$ post – harvest dip, T_7- 1.0% $CaCl_2$ pre- harvest and 2.0% Ca $(No_3)_2$ post-harvest dip, T_8- 1.0% $CaCl_2$ pre-harvest spray and 500 ppm bavistin post – harvest dip, T_9- 2.0% $CaCl_2$ pre-harvest spray, T_{10}- 2.0% $CaCl_2$ pre- harvest spray and 2.0% $CaCl_2$ post harvest dip, T_{11}- 2.0% $CaCl_2$ pre – harvest spray and 2.0% Ca $(No_3)_2$ post harvest dip, T_{12}- 2.0% $CaCl_2$ pre-harvest spray and 500 ppm bavistin post harvest dip, T_{13}- 1.0% Ca$(No_3)_2$ pre harvest spray, T_{14}- 1.0% Ca$(No_3)_2$ pre- harvest spray and 2.0% $CaCl_2$ post-harvest dip, T_{15}- 1.0% Ca$(No_3)_2$ pre – harvest spray and 2.0% Ca $(No_3)_2$ post harvest dip, T_{16}- 1.0% Ca$(No_3)_2$ pre- harvest spray and 500 ppm bavistin post – harvest dip, T_{17}- 2.0 % Ca$(No_3)_2$ pre-harvest spray, T_{18}- 2.0% Ca$(No_3)_2$ pre-harvest spray and 2.0% CaCl2 post – harvest dip, T_{19}- 2.0% Ca$(No_3)_2$ pre- harvest spray and 2.0 % Ca$(No_3)_2$ post-harvest dip, T_{20}- 2.0% Ca$(No_3)_2$ pre harvest spray and 500 ppm bavistin post-harvest dip.

Single spray of calcium compounds was carried out one month before harvesting with the help of foot sprayer using 0.1% Teepol as surfactant, (Bhanja and Lenka, 1994). Harvesting of fruits were done one month after the pre-harvest spray of fruit and dipped for 2 minutes in the solution of definite concentration of different chemicals. The total soluble solids (T.S.S.) of the fruit Juice was determined by using a Zeis refractormeter.

(A.O.A.C., 1990), Ascorbic acid in fruit was estimated by 2,6–dichloride phenol Indophenol visual titration method (A.O.A.C.,1984). The pectin content was estimated with standard analytical procedure, and titrable acidity was estimated by simple acid-alkali titration method (A.O.A.C., 1984).

RESULTS AND DISCUSSION

The shelf life of guava fruits increased gradually with the increase in concentration of calcium compounds and bavistin (Table 1). The maximum shelf life of guava fruits was recorded in T_{19} (10.17 days) followed by T_{18} (9.50 days) T_{20} (9.16 days) and T_{17} (9.00 days) and the minimum (3.50 days) in T_1 (control). Pre and post-harvest application of calcium compounds and bavistin significantly affected the shelf life of guava fruits and calcium nitrate proved better than calcium chloride and bavistin.

Calcium being a divalent caution readily enters the apoplast and is bound in exchangeable form to cell wall and exterior surface of the plasma membrane. Nontoxic even at high concentration, it serves as a detoxifying agent tying up toxic compounds and maintaining the cation-anion balance in the vacuole. In the cell walls calcium serves as a binding agent in the form of calcium pectates. Calcium has received considerable attention in the recent past due to its ripening and senescence, increase firmness, vitamin "C" and phenolic contents, reduces respiration, incidence of physiological disorders and storage rots and extends storage life (Chung *et al.*, 1993) and Ramakrishna *et al.*, 2001 in papaya).

Table 1: Effect of calcium compounds with and without bavistin on shelf life and rotting of guava fruits after 9 days of storage (Two year mean)

Treatments	Self life (days)	Rotting (%)
T_1	3.50	81.16
T_2	4.33	69.00
T_3	4.83	64.17
T_4	3.83	77.16
T_5	5.33	51.00
T_6	5.67	49.00
T_7	6.17	54.16
T_8	5.50	50.33
T_9	6.83	35.67
T_{10}	7.17	32.50
T_{11}	7.50	29.67
T_{12}	7.50	35.17
T_{13}	7.50	26.50
T_{14}	8.16	22.83
T_{15}	8.50	21.18
T_{16}	8.33	24.00
T_{17}	9.00	18.33
T_{18}	9.50	17.00
T_{19}	10.17	13.93
T_{20}	9.16	17.33
C.D. (P=0.05)	0.90	5.58
S.E. (D)	0.45	2.80
S.E. (M)	0.32	1.98

The highest rotting percentage was recorded in T_1 (81.16%) followed by T_4, T_2 and T_3 and lowest with T_{19} (13.93%) followed by T_{18}, T_{20} and T_{17}. The calcium compounds and bavistin has significantly affected the rotting percentage of guava fruit at harvesting up to 9th days of storage period (Table 1).

The decrease in ripening rate with calcium nitrate might be due to reduction in endogenous substrate catabolism (respiratory rate) by limiting the diffusion of substrates from the vacuole to the cytoplasm as reported by scott and wills (1975) in apples. Higher concentration of calcium compounds significantly increased firmness in guava fruits. (Sharma *et al.*, 1991 and Hiwale and Singh, 2003 in guava fruits).

The highest TSS content was maintained by T_{19} (11.62%) followed by T_{18} (11.49%), T_{17} (11.30%) and T_{20} (11.27%) and the lowest in T_4 (9.88%) and T_1 (10.08%). There was gradual increase in TSS content of fruit with all the treatments up to 6th day of storage but T_1 (control) and T_4 decreased the TSS content of fruits and afterwards declining trend in this parameter was observed under all the treatments (Table 2). This might be due to quick metabolic transformation in soluble compounds and more conversion of organic acids into sugars by calcium (Singh *et al.*, 1998).

The maximum titrable acidity was recorded with T_4 and T_1 (control) (0.47%) followed, T_2 and T_3 and minimum with T_{19} (0.31%), followed T_{18}, T_{17} and T_{20} up to 9th day of storage. There was gradual declining trend in acidity with the increasing period of storage. (Table 2). Maximum decrease in acidity was caused by pre and post application of calcium nitrate 2.0%. The acids under the influence of chemicals might have either been firstly converted into sugars and their derivatives by the reactions involving reversal of glycoytic pathway or might have been used in respiration or both. Brahmachari *et al.* (1997) also reported similar findings in guava fruits.

Maximum ascorbic acid content was maintained in T_{19} (208.77) up to 9th day of storage while the minimum ascorbic acid content was maintained with T_4 (118.72). Post harvest dip in bavistin did not affect the ascorbic acid content of guava fruits significantly but it actually

Table 2: Effect of calcium compounds with and without bavistin on the T.S .S. and Titrable acidity content of fruits during storage (Two year mean)

Treatments	T.S.S (%)				Titratable acidity (%)			
	At harvesting Time	Average Mean (Days of Storage)			At harvesting Time	Days of storage		
	0	3	6	9	0	3	6	9
T_1	8.79	10.08	9.29	7.32	0.70	0.67	0.59	0.47
T_2	8.76	10.29	10.58	8.17	0.69	0.64	0.56	0.46
T_3	8.83	10.46	10.80	8.52	0.70	0.63	0.55	0.45
T_4	8.69	9.88	9.06	6.95	0.69	0.67	0.59	0.47
T_5	8.88	10.42	10.83	8.60	0.64	0.60	0.54	0.45
T_6	8.89	10.51	10.94	8.95	0.63	0.58	0.52	0.44
T_7	8.93	10.60	11.05	9.04	0.61	0.59	0.52	0.43
T_8	8.91	10.34	10.76	8.47	0.62	0.61	0.55	0.46
T_9	9.15	10.73	11.21	8.87	0.59	0.57	0.52	0.42
T_{10}	9.16	10.82	11.25	9.08	0.58	0.55	0.50	0.42
T_{11}	9.15	10.94	11.41	9.38	0.59	0.55	0.50	0.41
T_{12}	9.20	10.65	11.14	8.81	0.58	0.56	0.52	0.43
T_{13}	9.43	10.94	11.34	9.30	0.50	0.48	0.44	0.39
T_{14}	9.44	11.06	11.51	9.62	0.50	0.47	0.44	0.38
T_{15}	9.58	11.18	11.60	9.92	0.49	0.47	0.43	0.37
T_{16}	9.37	10.89	11.28	9.22	0.50	0.49	0.45	0.40
T_{17}	10.05	11.30	11.83	9.93	0.45	0.44	0.41	0.35
T_{18}	10.22	11.49	11.97	10.58	0.42	0.42	0.39	0.35
T_{19}	10.26	11.62	12.30	11.02	0.43	0.39	0.37	0.31
T_{20}	10.10	11.27	11.74	9.70	0.46	0.44	0.41	0.35
C.D. (P=0.05)	0.37	0.19	0.18	0.19	0.04	0.02	0.04	0.02
S.E. (D)	0.18	0.09	0.09	0.09	0.02	0.01	0.02	0.01
S.E. (M)	0.13	0.06	0.06	0.06	0.01	0.01	0.01	0.01

Table 3: Effect of calcium compounds with and without bavistin on the ascorbic acid and pectin content of fruits during storage (Two year mean)

Treatments	Ascorbic acid (mg/100g pulp)				Pectin content (%)			
	At harvesting Time	Days of storage			At harvesting Time	Days of storage		
	0	3	6	9	0	3	6	9
T_1	179.36	160.39	146.59	123.48	0.79	0.62	0.55	0.39
T_2	178.05	168.26	156.36	126.93	0.77	0.70	0.58	0.44
T_3	178.02	176.50	161.35	139.59	0.82	0.75	0.66	0.51
T_4	174.78	158.16	144.50	118.72	0.80	0.62	0.51	0.36
T_5	204.32	191.18	174.46	148.58	0.88	0.78	0.67	0.55
T_6	204.88	194.94	178.65	158.19	0.86	0.80	0.69	0.58
T_7	191.32	197.19	183.71	164.15	0.92	0.81	0.71	0.59
T_8	198.14	181.56	166.03	145.41	0.88	0.73	0.65	0.51
T_9	220.56	206.46	187.19	169.27	0.96	0.89	0.76	0.62
T_{10}	215.65	211.98	192.96	172.76	0.99	0.89	0.79	0.66
T_{11}	222.39	214.05	199.87	174.47	0.98	0.93	0.84	0.71
T_{12}	219.40	203.93	183.76	161.45	1.01	0.85	0.75	0.60
T_{13}	230.93	222.89	210.95	189.15	1.08	0.98	0.87	0.73
T_{14}	229.35	225.66	214.18	195.22	1.10	1.02	0.91	0.78
T_{15}	237.92	232.54	219.10	197.30	1.12	1.05	0.93	0.80
T_{16}	233.20	221.76	207.85	183.67	1.07	0.97	0.85	0.72
T_{17}	244.05	233.21	219.37	198.92	1.15	1.08	0.98	0.85
T_{18}	241.58	235.63	222.16	202.19	1.18	1.11	1.05	0.90
T_{19}	243.28	241.21	230.96	208.77	1.22	1.18	1.11	0.97
T_{20}	239.70	229.20	216.39	194.36	1.18	1.07	0.97	0.83
C.D. (P=0.05)	26.46	13.88	13.88	14.13	0.08	0.08	0.08	0.07
S.E. (D)	13.30	6.97	6.98	7.13	0.04	0.04	0.04	0.04
S.E. (M)	9.40	4.93	4.93	5.04	0.03	0.03	0.03	0.02

decreased the ascorbic acid content. (Table 3). Calcium nitrate probably retarded oxidation process and hence the rate of conversion of L- ascorbic acid in to de-hydro ascorbic acid was slowed down. Higher retention of ascorbic acid with these treatments was also reported in peach by Singh *et al.* (1982).

Higher pectin content was maintained by T_{19} (0.97%) followed by T_{18} (0.90%), T_{17} (0.85%) and T_{20} (0.83%) and minimum by T_4 (0.36%) up to 9^{th} day of storage. The calcium compounds at their various concentrations increased the pectin content of fruit significantly at harvesting time, while with increasing storage period the pectin content decreased. Bavistin, however, did not maintain the pectin content in guava fruits (Table 3)

Rossingal *et al.* (1977) estimated that at least 60 per cent of Ca++ in plants is associated with cell wall fraction. Calcium is essential for structural integrity of both the cell wall and plasma membrane. Firmness in guava fruit is an important characteristic that is used to determine storability and it is predominantly determined by cell wall composition and structure. The pectin content was enhanced to maximum with 2.0% calcium nitrate. This is in conformity with the findings of Rajput *et al.* (1977) and Brahmachari *et al.* (1977), in guava, Gautam *et al.* (2003) in mango and Yadav *et al.* (2003) in ber.

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