HortFlora Research Spectrum, 1(4): 344-347 (2012) ISSN : 2250-2823

EFFECT OF POST HARVEST CALCIUM TREATMENTS ON SHELF LIFE OF GUAVA CV. SARDAR

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ABSTRACT: The search for techniques that extend shelf life of guava (*Psidium guajava*) fruits, and reduce its postharvest losses is desirable. The objective of this work was to evaluate the effects of concentrations of competitive ethylene antagonist calcium salts on conservation of 'Sardar' guava fruits. Treatments consisted of 0.5%, 1% Calcium Nitrate, 1%, 2% Calcium Chloride and 0.5%, 1% Calcium Sulphate for 12 days followed by storage at room temperature. The application of 1% calcium chloride for 12 days was efficient in delaying loss of skin color and in keeping fruit firm at room temperature storage. The calcium nitrate at 1% concentration was efficient in delaying skin colour loss only when fruits were stored at 25°C. The effect of calcium nitrate was quite significant on the reduction of acceptability in both the year. The product was efficient in delaying the ripening of fruits and the calcium chloride 1% showed the best effect.

Keywords: *Psidium guajava, calcium salts, postharvest, shelf life.*

Guava is a highly perishable fruit that shows intense metabolic activity. Guava fruit becomes fully ripe between three and five days at room temperature. Due to such perishability, the control of fruit ripening is fundamental for increasing shelf life after harvest. The main factors depreciating postharvest quality in guava are fast loss of green color, excessive softening, high rot incidence and loss of turgidity. Storage under low temperatures has been considered the most efficient method to maintain quality of most fruits due to its effects on reducing respiration rate, transpiration, ethylene production, ripening, senescence and rot development. In climacteric fruits, like most guava varieties, the reduction of temperature delays the climacteric peak and, consequently, ripening. The recent finding that calcium salts interferes with ethylene link to its binding site represents a new and powerful tool for postharvest management of climacteric fruits. It has been demonstrated that the inhibition of the ethylene action delays ripening and senescence in several species of fruits, such as custard apple, guava, papaya, peach, apple, avocado, banana, strawberry and tomato. Previous finding revealed that post-harvest treat of various calcium compounds and packaging material have enhanced their shelf life, reducedment the spoilage and improved the fruit quality by delaying the onset of senescence during storage. Keeping in view the importance on crop, a study was carried out to study the effect of these compounds on storage life of guava cv. Sardar.

Received : 24.7.2012 *Accepted : 18.8.2012*

MATERIALS AND METHODS

Healthy, firm, mature and uniform sized fruits of guava cv. Sardar were procured from a Horticulture Research Centre, Pattharchata on December 2007 and December 2008. The analysis carried out at post harvest laboratory of the Department of Horticulture, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar. The selected fruits were cleaned, dried and treated dip method with $Ca(NO_3)_2$ (0.5% & 1%), $CaCl_2$ (1% & 2%) and $CaSO_4$ (0.5% & 1%) and subsequently packed in newspaper and stored at room temperature (28-33°C) and 85-90% relative humidity. There were seven treatments replicated thrice in a completely randomized design (CRD). Fruit samples, each comprising of 5 fruits, were drawn from each treatment at the time of storage and subsequently after 0, 3, 6, 9 and 12 days of storage for physico-chemicals analysis. The fruits were evaluated for palatability rating by a panel of 7 judges on a score card (10 points). Reducing sugar,

nonreducing sugar and pectin were analysed by following standard procedures suggested by Ranganna (8).

RESULTS AND DISCUSSION

Data depicted in Table 1 showed that packaging material, storage period, chemicals and their interaction had significant effect on reducing sugar of fruit during both the years. Maximum reducing sugar (3.18 % and 3.55 %) was found in wrapped fruits as compared to unwrapped fruits during both the years. With respect to storage period, maximum reducing sugar (3.42%) was obtained at 6th day of storage in first year, whereas, highest (3.83 per cent) reducing sugar was found in second year at 3rd day of storage. On the other hand, minimum reducing sugar (2.91% and 3.05%) was found at 12th days of storage during both the years, respectively. Different chemicals significantly affected the reducing sugar content of fruits. Highest reducing sugar (3.21% and 3.58%) was obtained with calcium chloride (1%) and lowest (3.08% and 3.44%) was found in control during both the years, respectively. The present studies indicated that after an initial rise, the percentage of reducing sugar decreased during storage in ambient temperature. The initial increase in reducing sugars might be due to the conversion of starch into reducing sugar and later on reduction could possibly might be due to utilization of sugar in the process of respiration. The percentage of reducing sugar increased slowly during storage period upto 6th day and declined thereafter. The highest content of reducing sugar was obtained in the wrapped fruits kept in paper box. The increase in reducing sugar might be due to increased rate of starch degradation by a amylase activity (Hiwale and Singh, 7). In general, after 6th day of storage, reducing sugar decreased in all the treatments including control.

Conversion of starch and polysaccharides into simple sugar with the advancement of storage was responsible for the increase of reducing sugar and onward decline was due to the utilization of sugar in evapo-transpiration and other biochemical activities. Data presented in Table 1 showed that packaging material, storage period and chemicals and their interaction had significant effect on non-reducing sugar content of fruits during both the years. Maximum non-reducing sugar was found in wrapped fruits during both the years. In case of storage period, maximum non-reducing sugar (4.08%) was recorded at 9th day of fruit storage in first year, whereas, in second year non-reducing sugar was highest (3.66%) at 6th day of storage. Minimum non-reducing sugar (3.61 and 3.53%) was found at 12th days of storage during both the years. With respect of chemicals, highest non-reducing sugar (4.06% and 3.67%) was obtained in calcium chloride 1% while minimum non-reducing sugar was found in control during both the years. Percentage of non-reducing sugar of guava fruit increased up to 9th day of storage at room temperature. This increase in sugar in the beginning of storage is mainly due to the hydrolysis of starch. These results are in line of the results reported by Biale (2) in mango fruit during storage. Fruit treated with calcium compound as post harvest treatments retained higher percentage of non-reducing sugar during storage. High percentage of non-reducing sugar was found in wrapped fruits kept in paper boxs. The increase in the non-reducing sugar might be due to the hydrolysis of starch and conversion in the pectin substances from water insoluble to water soluble fractions. These results are in accordance with the findings of Chahal and Bal (3), Chundawat *et al.* (5), Hiwale and Singh (7) and Singh *et al.* (11).

It is evident from the data presented in Table 2 that packaging material, storage period and chemicals had significant effect on pectin content of the fruits in both the years of the investigation. In first year, maximum pectin content was obtained in wrapped fruits and minimum pectin content was found in unwrapped fruits. Similar trend was observed in second year. Storage period also had pronounced effect on pectin content of the fruits. It was found maximum at the day of harvest (zero day) and minimum at 12th day of storage. Similar pattern was obtained during second year. Pectin

Table1: Effect of post harvest treatments on the reducing sugar (%) and non-reducing sugar (%) in guava fruits cv. Sardar.

Treatments	Reducing sugar (%)			Non reducing sugar (%)		
	2007	2008	Pooled	2007	2008	Pooled
Packing (W)						
Unwrapping	3.15	3.47	3.31	3.82	3.63	3.73
Wrapping	3.18	3.55	3.37	3.99	3.65	3.82
C.D. (P=0.05)	0.03	0.033	0.032	0.057	0.051	0.054
Storage days (D)						
0 days	3.11	3.67	3.39	3.92	3.55	3.74
3 days	3.28	3.83	3.56	3.83	3.66	3.75
6 days	3.42	3.62	3.52	4.07	3.80	3.94
9 days	3.13	3.38	3.26	4.08	3.66	3.87
12 days	2.91	3.05	2.98	3.61	3.53	3.57
C.D. (P=0.05)	0.047	0.052	0.050	0.090	0.081	0.086
Chemical (T)						
$Ca(NO_3)_2$ 0.5%	3.18	3.49	3.34	3.99	3.64	3.82
$Ca(NO_3)_2$ 1.0%	3.2	3.53	3.37	4.05	3.66	3.86
$CaCl_2$ 1.0%	3.21	3.58	3.40	4.05	3.67	3.86
$CaCl_2$ 2.0%	3.18	3.53	3.36	4.02	3.65	3.84
$CaSO_4$ 0.5%	3.17	3.5	3.34	4.00	3.64	3.82
$CaSO_4$ 1.0%	3.17	3.5	3.34	3.97	3.63	3.80
Control	3.08	3.44	3.26	3.25	3.59	3.42
C.D. (P=0.05)	0.055	0.062	0.059	0.106	0.096	0.101

Table 2: Effect of post harvest treatments on the pectin (%) and fruit texture in guava cv. Sardar.

Treatments	Pectin (%)			Texture		
	2007	2008	Pooled	2007	2008	Pooled
Packing (W)						
Unwrapping	1.20	1.22	1.21	7.44	7.46	7.45
Wrapping	1.22	1.23	1.22	7.80	7.94	7.87
C.D. (p=0.05)	0.013	0.012	0.013	0 .107	0.076	0.076
Storage days (D)						
0 days	1.31	1.32	1.31	8.41	8.44	8.43
3 days	1.27	1.29	1.28	8.09	8.21	8.15
6 days	1.23	1.24	1.24	7.67	7.65	7.66
9 days	1.15	1.18	1.17	7.14	7.59	7.37
12days	1.09	1.09	1.09	6.76	6.75	6.76
C.D. (P=0.05)	0.020	0.019	0.020	0.170	0.121	0.146
Chemical (T)						
$Ca(NO_3)_2$ 0.5%	1.23	1.24	1.23	7.71	7.58	7.64
$Ca(NO_3)_2$ 1.0%	1.23	1.25	1.24	7.87	8.18	8.02
$CaCl_2$ 1.0%	1.25	1.27	1.26	8.18	8.26	8.22
$CaCl_2$ 2.0%	1.21	1.23	1.22	7.80	7.65	7.72
$CaSO_4$ 0.5%	1.20	1.23	1.21	7.39	7.62	7.51
$CaSO_4$ 1.0%	1.19	1.19	1.19	7.28	7.46	7.37
Control	1.19	1.17	1.18	7.10	7.14	7.12
C.D. (P=0.05)	0.024	0.022	0.023	0.201	0.143	0.172

content was significantly affected by different chemicals during both the years. Maximum pectin content was found in calcium chloride 1% and minimum pectin content was found with control during both the years. A significant decrease in pectin content was observed with the advancement of storage period during both the years. Maximum pectin percentage was observed in calcium chloride (1%) followed by calcium nitrate (1%). Fruit firmness is closely related with the pectin content of the fruit. Pectin content of the guava fruit decreased progressively during storage. The reduction in pectin content during storage might be due to degradation of insoluble protopectin by the enzymes. These finding are in line with findings of Bhattacharya and Ghosh (1) in banana and Seipp (9) in apple fruits. Calcium chloride (1%) maintain the fruit firmness by retarding breakdown of pectin during storage, hence the level was higher under these treatments. Higher retention of pectin following calcium chloride (1%) treatment has been reported by Singh (10) in guava fruits. Lowest pectin content was found in wrapped fruits kept in paper boxes during both the years in storage. It might be due to the softness occurring in fresh fruits after maturity at the peak of ripening which is generally associated with fairly narrowing down of firmness. Pectin methyl esterase (PME) enzyme activity increased as ripening advanced in guava. These findings are in accordance with the results of Chaitanya (4) in guava. Data presented in Table 2 showed that packaging material, storage period, chemicals and their interaction had significant effect on the texture of fruits during both the years. Minimum texture change was obtained in wrapped fruits during both the years. With respect of storage periods, minimum texture change was observed at day of harvest and maximum texture change was obtained at 12^{th} day of storage. Different chemicals had significant effect on fruit texture. Lowest texture change was found in calcium chloride 1% during both the years. Minimum texture change during storage was found with wrapped fruits kept in paper box in both the years. The reduction in moisture in fruits causing shrinkage, dullness in skin and loss of turgidity observed in control fruits. On the other hand wrapped fruits kept in paper box maintained turgidity, glossiness and smooth skin of fruits. These results are in corroboration with the Dhoot *et al.* (6) in guava.

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