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A study on physiological changes of sapota varieties in cold storage with application of GA_3

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ABSTRACT

Investigations was conducted to study the effect of different temperatures *i.e.*, 5°C, 12°C, 15°C and ambient condition on post harvest life of sapota *(Manilkara achras)* fruits of different varieties (Kalipattai, PKM-1, Co-2, Singapore and Kirthibarthi). Post harvest application of GA_3 (150 mg l^{-1}) was evaluated for its effect on post storage fruit quality. Sapota fruits stored at 5°C sustained chilling injury manifested as uneven ripening, pitting and hardened pulp. Fruit stored at 12°C had improved shelf life and delayed ripening compared to fruit stored at 15°C and control (ambient condition). "Kalipatti" variety was superior in terms of longer shelf life and required quality attributes. Although 'CO-2' variety exhibited good post harvest quality but Singapore and Kirthibarthi varieties had poor fruit quality and limited shelf life. Thus, 'Kalipatti' variety of sapota fruit can be stored at 12°C temperature for a period of 12 days with edible acceptable quality.

Key words : Sapota, cold storage, physiological changes

Sapota or sapodilla *(Manilkara achras* (Mill) Fosberg), synonym *(Achrcis zapota* L.) commonly known as *chiku* is an evergreen fruit tree native of tropical America and spreaded to other countries like Philippines, Malaysia, USA, Srilanka and India where it adopted very well (Chadha, 1992). Fruit industries are being faced many challenges among them the most important is the post harvest losses. These losses, in India, are inevitable due to lack of modern cold storage, lack of technical knowhow, lack of proper handling and packing systems, lack of quick transportation facilities and common use of post harvest treatments.

When fruits were treated with GA_3 and stored at low temperature immediately after the harvest, the metabolic activities, like rate of respiration, ethylene release, build up of the respiration heat, thermal decomposition and microbial spoilage could be reduced with the retention of quality and freshness for a longer period (Krishnamurthy and Rao, 1999). The study was undertaken by keeping the problems in view faced during storage and transportation.

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MATERIALS AND METHODS

The present investigation was carried out for extending the shelf life and to know the physiological changes in sapota fruits at Department of Post Harvest Technology, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari in collaboration with Cold Storage Unit, Post Harvest Technology Centre, N.A.U., Navsari during the year 2008. The experiment was laid out in a Completely Randomized Block Design with factorial concept (FCRD) with three repetitions comprised cold storage temperature viz. fruits stored at C_1- (5°C), C_2- (12°C), C_3- (15°C) and C_4 control (ambient temperature) and sapota varieties V_1- Kalipatti. V_2- PKM-1, V_3- CO-2, V_4- Singapore and V_5- Kirthibarthi with post harvest dipping of GA_3 (150 mg l^{-1}) for 10 minutes. The data were recorded at alternate day. Statistical analysis of data was done by following the Fisher's analysis of variance techniques as given by Panse and Sukhatme (1967).

RESULT AND DISCUSSION

Physiological weight loss (%)

The perusal of data presented in Table 1 indicated

that physiological weight loss (%) was significantly minimum in fruits stored at C_1 (5°C) as compared to other storage temperature treatments. While V_1 (Kalipatti) variety noted lowest weight loss (%) throughout storage period. This could be attributed to the low temperature which slowed down the metabolic activities like respiration and transpiration, delayed ripening and due to restriction of ethylene accumulation in the fruits during ripening. Similar results were also reported by Madhavi and Srihari (2002), Sahoo and Munsi (2004) in sapota fruits. The highest weight loss percentage was recorded under treatment C_4 (control condition) and in V_5 (Kirthibarthi) variety.

Ripening percentage

The data in Table 2 showed that significantly lowest percentage of ripened fruits was recorded in sapota fruits stored in cold storage temperature C_2 (12°C) due to retarded ripening percentage by antagonistic effect on biosynthesis of ethylene and thereby retardation of senescence and physiological changes and control the metabolic activities and reduced the respiration rate as compared to that of fruits stored at ambient temperature. This result is in line with findings of Waskar and Nikam (1998), Madhavi and Srihari (2002) in sapota and Trivedi (2003) in guava. The fruits stored in treatment C_1(5°C) not ripened throughout the storage period due to chilling injury when highest ripening percentage observed in treatment C_4 Control (ambient temperature). In V_1(Kalipatti) and V_2 (PKM-1) varieties recorded minimum and maximum ripening percentage respectively during entire period of storage.

Days taken to ripening

It is apparent from the data given in Table 3 that significantly highest days taken to ripening (10.110

Table 1 Effect of post harvest application of GA_3 on PLW (%) of sapota varieties in cold storage.

Treatments	Storage periods (days)						
	2nd	4th	6th	8th	10th	12th	14th
Cold storage temperature							
C_1 - 5°C	0.758	0.935	1.1 10	1.280	1.460	1.594	1.736
C_2-12°C	1.392	3.664	6.324	9.030	11.976	14.822	0.00
C_3-15°C	3.736	7.402	12.358	15.886	19.928	0.00	0.00
C_4-Control	4.954	8.706	14.872	21.310	0.00	0.00	0.00
S.Em +	0.059	0.083	0.115	0.142	0.093	0.058	0.013
C.D. at 5 %	0.168	0.238	0.328	0.406	0.266	0.165	0.036
Varieties							
V_1 -Kalipatti	2.543	5.068	8.535	11.743	8.248	4.050	0.423
V_2-PKM-1	2.645	5.198	8.653	1 1.875	8.343	4.100	0.423
V_3-CO-2	2.580	4.853	8.400	1 1.525	8.040	3.953	0.403
V_4 -Singapore	2.743	5.280	8.758	1 1.958	8.473	4.138	0.433
V_5 - Kirthibarthi	3.040	5.485	8.985	12.283	8.603	4.280	0.470
S.Em±	0.066	0.093	0.129	0.159	0.104	0.065	0.014
C.D. at 5 %	0.187	0.266	0.367	0.454	0.297	0.185	0.040
Interaction (CxV)							
S.Em ±	0.131	0.186	0.257	0.318	0.208	0.129	0.080
C.D. at 5 %	NS	NS	NS	NS	NS	NS	NS
CV %	8.36	6.21	5.12	4.63	4.31	5.44	11.13

days) were recorded with cold storage temperature treatment C_2 (12°C) which was at par with treatment C_3 (15°C). The cold storage temperature treatment C_2 (12°C) delayed the ripening of sapota fruits by 3.922 days over C_4 (Control). This delay has been consequence of slower ripening change in reduced weight loss and other physiological process controls the metabolic activities and thereby controlling respiratory breakdown. Corroborative results obtained by Gautam and Chundawat (1990), Ramkrishna and Rao (1989) in sapota. The V_1 (Kalipatti) variety took significantly highest days (6.395 days) while the fruits of V_4 (Singapore) variety took minimum days (5.948 days) to ripe.

Shelf life

The result presented in Table 3 revealed that the different cold storage temperature treatments had significant effect on shelf-life of sapota fruits. The significantly the highest shelf-life 12.620 days and 8.188 days was recorded in cold storage treatment C_2 (12°C) and variety V_1 (Kalipatti) respectively due to delayed ripening, restrict ethylene production and the preclimacteric respiration rate were reduced and their activities peaks were postponed. The pectinmethylesterase (PME) and catalase activities were reduced in treated fruits compared with control. The shelf life goes on increasing with the decrease in storage temperature. These findings are in close proximity with the Sahoo and Munsi (2004) and Bhanja and Lenka (1994) in sapota. The lowest shelf-life (8.322 days) was recorded in treatment C_4 (Control) and V_4 (Singapore) variety (7.623 days).

Table 2 Effect of post harvest application of GA_3 on ripening percentage (%) of sapota varieties in cold storage

Treatments	Storage periods (days)					
	2nd	4th	6th	8th	10th	12h
Cold storage temperature						
C_1 - 5°C	0.00	0.00	0.00	0.00	0.00	0.00
C_2-12°C	13.028	25.458	43.678	65.724	84.592	99.230
C_3-15°C	24.408	42.652	64.630	83.870	99.392	0.00
C_4-Control	34.558	56.952	76.372	99.112	0.00	0.00
S.Em ±	0.293	0.412	0.431	0.558	0.598	0.268
C.D. at 5 %	0.837	1.177	1.231	1.595	1.707	0.766
Varieties						
V_1 - Kalipatti	16.878	30.040	44.925	61.765	45.685	24.718
V_2-PKM-1	17.908	30.778	45.860	62.138	45.888	24.785
V_3-CO-2	18.008	31.065	46.210	62.063	46.053	24.813
V_4-Singapore	18.668	32.420	47.025	62.533	46.207	24.870
V_5-Kirthibarthi	18.533	32.025	46.830	62.385	46.165	24.853
S.Em±	0.328	0.461	0.482	0.624	0.668	0.300
C.D. at 5 %	0.936	1.316	1.376	NS	NS	NS
Interaction (CxV)						
S.Em ±	0.655	0.921	0.963	1.248	1.336	0.599
C.D. at 5 %	NS	NS	NS	NS	NS	NS
CV %	6.30	5.10	3.61	3.47	5.03	4.18

Table 3 Effect of post harvest application of GA_3 on days taken to ripening and shelf life (days) of sapota varieties in cold storage

Treatments	Storage periods (days)	
	Days taken to ripening	Shelf life
Cold storage temperature		
C_1 - 5°C	0.00	0.00
C_2 -12°C	10.110	12.620
C_3 -15°C	8.226	10.468
C_4 -Control	6.188	8.322
S.Em±	0.084	0.090
C.D. at 5 %	0.240	0.256
Varieties		
V_1 - Kalipatti	6.395	8.188
V_2 - PKM-1	6.090	7.733
V_3 - CO-2	6.185	7.940
V_4 - Singapore	5.948	7.623
V_5 - Kirthibarthi	6.038	7.780
S.Em±	0.094	0.100
C.D. at 5 %	0.268	0.286
Interaction (CxV)		
S.Em ±	0.188	0.200
C.D. at 5 %	NS	NS
CV %	5.30	4.41

SUMMARY

The combined treatments of GA_3 (150 mg l^{-1}) dipping and fruits stored at 12°C cold storage temperature found to be more effective for extending the shelf life of fruits and reducing post harvest losses without any adverse effect on quality of Sapota fruits. The Kalipatti variety was found to be superior and recorded maximum shelf life and good physiological parameters when stored at 12°C cold storage temperature.

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