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Influence of Pre and Post Harvest Chemical Treatments on Physical Characteristics of Sapota (*Achras sapota* L.) Var. PKM 1

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Abstract: An experiment was conducted at Horticultural College and Research Institute, Coimbatore during 2002-2004 to find out the influence of pre and post harvest chemical treatments on physical characteristic of PKM 1 sapota fruits. Treatments with growth regulator GA_3, chemicals like $CaCl_2$, Ca $(NO_3)_2$ and KCl were used both as pre harvest spray and post harvest dip. The study revealed that pre harvest spray of 50ppm GA_3 with post harvest dipping of GA_3 50ppm along with 0.2% bavistin recorded the lowest physiological loss of weight, shrinkage percentage, increased shelf life and reduced spoilage. The pre harvest spray of 50ppm GA_3 with post harvest dipping of $CaCl_2$ 1% along with 0.2% bavistin recorded highest firmness.

Key words: Post harvest, Chemicals, Shelf life, Physiological loss

INTRODUCTION

In India, sapota ranks fifth both in production and consumption next to mango, banana, citrus and grapes. It is highly perishable and rated very poor for processability and it is mainly used for table purpose. The shelf life of sapota fruits is short at ambient temperature. It is also sensitive to cold storage. The post harvest losses are high in tropical countries particularly in India and it ranges between 25-30%. Various chemicals have been used to hasten or delay ripening, to reduce losses and to improve and maintain the colour and quality by slowing down the metabolic activities of the fruit. These chemicals arrest the growth and spread of micro organism by reducing the shriveling which ultimately leads to an increased shelf life and maintain the marketability of the fruit for a longer period. Considering the above facts in view, a study was conducted at Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore during 2002 - 2004 to study the effect of pre and post harvest treatment of chemicals on the changes in physical characteristics of sapota fruits at various phases of storage.

MATERIALS AND METHODS

An experiment was conducted at Horticultural College and Research Institute, Coimbatore during 2002-2004 to find out the influence of pre and post harvest chemical treatments on physical characteristics of PKM 1 sapota fruits. The pre and post harvest treatments were laid out in a factorial completely randomized design replicated thrice. There were five pre harvest treatments *viz*., calcium chloride 1% (T1), calcium nitrate 1% (T2), potassium chloride 1% (T3), GA_3 50 ppm (T4) and water (T5) given as spray to the trees 30 days prior to harvest.

Water spray was given on the labeled, pre treated fruits before harvesting. For post harvest and packaging treatments, well matured, labeled, pre treated fruits were harvested. Fruits of uniform maturity were harvested carefully with minimum mechanical injury. The harvested fruits were washed with water to remove the latex and shade dried until no water was visible on the fruit surface. There were seven post harvest treatments *viz*., Pre harvest spray of GA3 50 ppm+ post harvest dipping of 0.2% Bavistin (T1), Pre harvest spray of GA_3 50 ppm+ post harvest dipping of $CaCl_2$ 1%+ 0.2% Bavistin (T2), Pre harvest spray of GA_3 50 ppm+ post harvest dipping of GA_3 50 ppm + 0.2% Bavistin (T3), 0.2% Bavistin (T4), 1 % Calcium Chloride +0.2% Bavistin (T5), GA_3 50 ppm + 0. 2% Bavistin (T6) and Control (T7),

The physical parameters *viz*., Physiological loss of weight of fruits were found at three days interval on original weight basis and expressed in percentage. The length and girth of fruits were measured as an index for shrinkage and expressed in centimeter. Shelf life was measured from the day of harvest till the softening of fruits and the firmness of the fruits was determined by using penetrometer and expressed in kg cm^{-2}. The

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spoilage was observed with respect to microbial damage and carbon di-oxide injury on every three days after storage and expressed as percentage.

RESULTS AND DISCUSSIONS

Among the different pre harvest treatments, spraying of GA_3 50 ppm (T4) recorded the least PLW (Physiological loss of weight), shrinkage percentage, spoilage percentage, increased shelf life and the highest firmness. So this pre harvest treatment was taken to post harvest studies. In case of post harvest treatments, pre harvest spray of 50ppm GA_3 with post harvest dipping of GA_3 50ppm along with 0.2% bavistin recorded lowest physiological loss of weight (2.21, 3.74, 5.34, 13.53 and 17.20 per cent on 3, 6, 9, 12 and 15 days after storage respectively). The reason attributed is that GA3 might have slowed down the process of ripening by retarding the pre climacteric respiration rate and subsequently on ethylene production and bavistin preventing pathogenic infection by antifungal activity. Reduction in PLW by pre and post harvest GA3 treatment was also observed in mango[3,8] and in banana[6].

The treatment T3 (i.e. pre harvest spray of 50ppm GA3 with post harvest dipping of GA3 50ppm along with 0.2% bavistin) also showed a lower percentage of shrinkage. The shrinkage percentage was 2.2 per cent (i.e. from 9.30cm to 9.10cm) for fruit length and 1.3 per cent (i.e. from 15.58cm to 15.38cm) for fruit girth. It might be due to the ant senescent action of GA3 and anti fungal activity of bavistin which in combination had an inhibitory effect on ethylene biosynthesis and retarded the activity of enzymes responsible for ripening and through creation of resistance to pathogen entry, hence cell degradation was prevented which in turn facilitated the reduced moisture loss and lesser respiratory gas exchange, hence delay in ripening and lower the shrinkage percentage.

Table1: Effect of pre harvest sprays on physical characteristics of sapota variety PKM 1 during storage

Treatments	Physical Characteristics										
	Physiological Loss in Weight (%)					Fruit Length (cm)		Fruit Girth (cm)		Shelf life (days)	Firmness (kg cm2 -1)
	3 DAS	6 DAS	9 DAS	12 DAS	15 DAS	Initial	Final	Initial	Final		
T1	3.41	4.24	7.63	14.33	16.64	8.5	7.95	13.58	13.27	10	3.2
T2	3.8	4.54	7.81	14.58	17.53	8.6	7.95	13.23	12.87	9.5	3.13
T3	4.18	5.11	7.93	14.84	17.68	8.2	7.5	15.27	14.85	9	2.7
T4	2.11	2.73	6.1	13.42	16.25	8.5	8.1	16.18	15.83	11	3.45
T5	7.25	8.75	9.35	20.87	23.4	8.4	7.52	13.5	12.2	8.5	1.05
SE d	0.012	0.006	0.002	0.01	0.003	0.012	0.012	0.014	0.029	0.017	0.024
CD (0.05 %)	0.024	0.012	0.005	0.02	0.006	0.026	0.026	0.029	0.06	0.035	0.051

Table 2: Effect of post harvest sprays on physical characteristics of sapota variety PKM 1 during storage

Treatments	Physical Characteristics										
	Physiological Loss in Weight (%)					Fruit Length (cm)		Fruit Girth (cm)		Shelf life (days)	Firmness (kg/cm2 -1)
	3 DAS	6 DAS	9 DAS	12 DAS	15 DAS	Initial	Final	Initial	Final		
T1	2.48	3.97	5.77	14.45	17.84	8.8	8.5	14.61	14.33	10	3.5
T2	2.32	3.85	5.46	12.36	17.52	9.1	8.85	13.82	13.55	11	3.9
T3	2.21	3.74	5.34	13.53	17.2	9.3	9.1	15.58	15.38	12	3.72
T4	5.97	7.76	8.2	15.47	19.11	7.5	7.1	15.25	14.77	9	1.7
T5	5.89	7.67	8.12	14.84	18.57	7.6	7.2	14.88	14.42	9.5	2.2
T6	5.71	7.53	7.94	14.65	18.31	9.2	8.37	15.64	15.18	10	2.43
T7	7.25	8.75	9.35	20.87	23.4	8.4	7.52	13.5	12.2	8.5	1.05
SE d	0.009	0.009	0.003	0.013	0.001	0.015	0.015	0.013	0.014	0.016	0.012
CD (0.05%)	0.019	0.019	0.007	0.027	0.003	0.031	0.032	0.026	0.028	0.034	0.024

Among the different post harvest treatments, pre harvest spray with GA_3 50 ppm + post harvest dipping of GA_3 50 ppm+ 0.2% bavistin recorded higher shelf life and reduced spoilage (Table 2). The delay in ripening was due to increase in endogenous levels of auxins and cytokinins and reduction in inhibitor content influenced by exogenous application of gibberellins[1]. Post harvest dipping of fruits in GA^3 delayed the conversion of starch to sugars, reduced peroxidase activity and ethylene production[5]. Increased shelf life of fruits dipping in GA_3 was also reported[7]. GA_3 + bavistin treatments were found to reduce PLW and increased the shelf life. This might be due to the growth promoting effect of GA_3 and the activity of enzymes responsible for creation of resistance to pathogen entry which prevented cell degradation which in turn might have facilitated reduction in moisture loss and lesser respiratory gas exchange[4].

The pre harvest spray of 50ppm GA_3 with post harvest dipping of CaCl2 1% along with 0.2 % bavistin recorded the highest firmness (3.72 kg per cm2). Treatment with GA3 at pre harvest stage resulted in the highest firmness level followed by 1 % CaCl2 spray (Table -1). Pre harvest spray of GA_3 50 ppm reduced the activities of softening enzymes i.e. polygalactouronase and pectin methyl esterase (PME) by protecting stiff pectin macromolecules against demethylation (or) reduced depolymarization of olygalactouronase[9]. With reference to $CaCl_2$, since Ca is a constituent of pectate it might have made the middle lamella of fruit cell wall thicker by increased deposition of calcium pectate and thus, maintained the firmness of fruits.

Highest physiological loss of weight, shrinkage percentage, reduced shelf life, least firmness and highest spoilage was found in control i.e. fruits sprayed with water (Table 1 and Table 2).

Spoilage of fruits during post harvest might be either due to microbes or CO2. Fusarium sp causes the most serious post harvest disease of sapota. Disease infection in fruits was not observed up to six days after storage in fruits pre harvest sprayed with GA_3 50 ppm (as pre harvest spray) treated fruits. It might be due to reduced level of respiration and transpiration loss in GA_3 treated fruits[2]. Among the post harvest treatments, pre harvest spray of GA_3 50 ppm with post harvest dipping of GA_3 + 0.2% bavistin fruits, the spoilage was not observed even after 12 days of storage. This might be due to GA_3 treated fruits having thick skin which prevented the entry on microbes and maintained low rate of various metabolic processes which in turn increased the resistance to microbial entry. Earlier findings reported by Patil and Halmani[4] lend support to the similar findings of the present investigation.

Conclusion: The study revealed that pre harvest spray of 50 ppm GA_3 with post harvest dipping of GA_3 50 ppm along with 0.2% bavistin recorded the least physiological loss of weight, shrinkage percentage, increased shelf life and reduced spoilage. The pre harvest spray of 50ppm GA_3 with post harvest dipping of $CaCl_2$ 1% along with 0.2% bavistin recorded highest firmness.

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