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EFFECT OF WAX EMULSION AND PACKAGING MATERIAL IN COMBINATION WITH CALCIUM SALTS ON THE SHELF LIFE OF GUAVA (*PSIDIUM GUAJAVA*) CV. ALLAHABAD SAFEDA, AT ROOM TEMPERATURE

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ABSTRACT

A laboratory experiment was conducted on prolonging the storage life of guava cv Allahabad Safeda in the Department of Horticulture, J.N.K.V.V. Jabalpur during 2011-12. In this experiment, wax emulsion and packaging material in combination with calcium salts were tried for extending the shelf life of guava under room temperature. Minimum weight loss and minimum decrease in specific gravity were recorded under HDPE+ $Ca(NO_3)_2$ while minimum reduction in TSS recorded under waxol + $Ca(NO_3)_2$. Minimum decrease in the ascorbic acid content recorded in waxol + $CaCO_3$. Least changes in titrable acidity observed in $KMnO_4$ soaked newspaper + $CaCO_3$. Maximum score in organoleptic quality was taken in HDPE+ $Ca(NO_3)_2$. The shelf life of guava can be increased at room temperature by using HDPE as wrapping material in combination with $Ca(NO_3)_2$ without affecting their organoleptic quality.

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INTRODUCTION

The fruit of guava are highly perishable in nature and cannot be stored for longer period of time under ambient condition. Inadequate handling during harvesting and postharvest processes accelerates fruit senescence, significantly affecting its quality. Moreover, its delicate skin offers very little protection against injury, aggravating the incidence of bruising, which may lead to the development of diseases and other disorders during storage. Thus the extent of the postharvest losses of guava depends not only on handling care but also on the storage conditions (Cunha *et al.,* 2012). However, during the storage of guava the marketability of fruits is lost rapidly owing to the quick desiccation, softening, discolouration and rotting of fruits. Post-harvest deterioration to fruits may be due to a variety of factors i.e. physiological change, physical and mechanical damage, chemical and chilling injury, varietal character and microbial infection. All these problems encourage or necessitate the development of suitable storage practices to extend the postharvest shelf life and quality. The effects of different wrappers and chemicals either alone or in combination of both on loss in weight of fruits due to physiological causes during storage have been at varying degrees in different fruits by various workers. Bramlage, 1977 reported that calcium treatment has been found to be very effective as it delays ripening and senescence, improves fruit quality, reduces some physiological disease and respiration. Calcium compounds extend the shelf-life of fruits by maintaining firmness, minimizing rate of respiration, protein breakdown, disintegration of tissues and disease incidence (Bangerth *et al.,* 1972). Solutions of calcium salts such as lactate, chloride, and nitrate (0.5%–3.5%) have been used for this purpose in guava by Gonzaga-Neto *et al*., 1999; Botelho *et al*., 2002 and in custard apple by Gohlani and Bisen (2012). The packaging material helps in reducing the post harvest injury and enhances shelf life as well as maintains the dietary values. Various packaging material like polyethylene cover, wax emulsion coating, $KMNO_4$ soaked newspaper reduces the losses in weight of the fruit, extends the shelf life and retain their marketable quality. Subhashchandra and Rao, 1985 and Prakash, 2005 reported that wax emulsion coating is very effective in increasing the storage life fruits as well as in keeping them fresh for longer periods without hampering the physico-chemical characters. The polyethylene packaging further had a concomitant effect in delaying senescence and physiological processes by creating modified atmospheric condition around the produce by controlling the gaseous (CO_2 and O_2) concentration in the package (Neeraj *et al*., 2003).

MATERIALS AND METHODS

The laboratory experiment was worked out on prolonging the storage life of guava cv Allahabad Safeda in the Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur during 2011-12. "Allahabad Safeda" is possibly the world's most cultivated cultivar and is highly popular in India. It is a medium to large size cultivar, characterized by its thin, smooth skin; dense, white flesh; and only a few seeds, which makes it suitable for canning (Cunha *et al.,* 2012). The fruits were picked from the orchard, whose specific gravity >1 were selected and washed in running tap water, the excess moisture was removed from the fruits and dried lightly at room temperature. These were then treated with fused $CaCO_3$ @15g/kg (fine powder form) or $Ca(NO_3)_2$ @1 per cent by dipping the fruits for 30 min. $CaCl_2$ was sprayed @ 4% in form of fine spray and then dried and stored under room conditions. Besides this, as packaging material $KMnO_4$ soaked newspaper ($KMnO_4$ @3g/l) and high density polyethylene were used. Except for the lot of pre-packaging material waxol, all the fruits were kept under the room temperature. Each treatment was replicated thrice and consists of sixty fruits. The experiment was laid out in factorial experiment in randomized block design.

Observations were recorded at 3 days interval on physiological loss in weight (g), Specific gravity, total soluble solids (°Brix), Vitamin C content (mg/100g), titratable acidity (%), Total sugars (%) and organoleptic evaluation. The physiological loss in weight was assessed by individual weighing of the fruits during the storage period. Total soluble solids (TSS) were estimated by a hand refractometer. The total and reducing sugars levels were determined by Nelson Somogyi's method (Nelson, 1994). Titratable acidity was determined as percentage citric acid according to method described in A.O.A.C. (1990).

RESULTS AND DISCUSSION

It is evident from the Table 1 that the different treatment has showed significant effect on 3rd and 12th day. The maximum weight loss were found with control (30g) while the minimum were found in HDPE + Ca $(NO_3)_2$. This might be due to Ca $(NO_3)_2$ which retards the rate of respiration and deterioration of cell organelles. Moreover, HDPE used in this combination as packaging material have been effective due to creation of controlled atmosphere condition around the fruits and hence increases the shelf life. The maximum reduction (0.27) in specific gravity from 3rd to 12th day were found with control while the minimum decrease (0.06) recorded under HDPE + $Ca(NO_3)_2$. The gradual decrease in specific gravity in treated fruits could possibly be due to slow reduction in weight and volume of the fruit because of the retarding effect of calcium on ripening process. Similar results were reports by Bisen *et al.* (2014) and Kher *et al.* (2005) in Guava fruits. Statistical data from Table 1 reveals that the treatment effect showed significant on TSS content of guava. The maximum reduction in TSS from 3rd to 12th day were found with control while the minimum reduction (2.37) were record under waxol + $Ca(NO_3)_{2+}$. The decrease in TSS might be due to its faster utilization in oxidation process. Bhalerao *et al.*, (1994) reported that the TSS increases upto 2 days in guava and then it gradually decreases and the observation recorded from 3rd day of storage also confirms the work in a positive way.

The ascorbic acid content of the fruit differed significantly among the fruits during its storage at room temperature. Vitamin C content in all the treatments were decreased from 3rd to 12th day. The decrease in acidity may be due utilization of organic acids in respiration. Similar results were reported by Jha *et al.*, 1998 in mango. The minimum decrease in the ascorbic acid content was recorded under waxol + $CaCO_3$ while maximum reduction in this content was recorded under waxol + $CaCl_2$. The decrease in ascorbic acid may be due to oxidation. The maximum change in the titrable acidity was found in waxol + $CaCO_3$ while minimum change was associated with $KMnO_4$ soaked newspaper + $CaCO_3$. High level of acid retention seems to be apparently associated with lower rate of respiration, since it forms the necessary respiration substrate.

The total sugar content were found maximum on 3rd day with $KMnO_4$ soaked newspaper + $CaCl_2$ while on 12th day it was associated with HDPE + $Ca(NO_3)_2$, the maximum change that occurred with total sugar were found with $KMnO_4$ soaked newspaper + $CaCl_2$, it might be due to inhibition of the rate of metabolic process after harvest by HDPE, moreover it is in conformity with the work of Tarkase and Desai (1939). It is obvious from the Table 1 that all the treatments improved the organoleptic quality of the fruit in comparison to untreated stored fruits. The maximum score was found under HDPE + $Ca(NO_3)_2$, they are liked very much by all the members of the team followed by $KMnO_4$ soaked news paper + $Ca(NO_3)_2$.

The HDPE polyethylene fruits had more acceptances because of the sour sweet nature of the fruit. Moreover, they were more firm and appealing for palatability. Barwal and Kumar (2014) confirmed the result in Nectarine that the calcium spray improves the quality and shelf life.

Therefore, from the present study it could be concluded that the increase in shelf life of guava at room temperature, HDPE

Table 1: Effect of wax emulsion and packaging material in combination with calcium salts on the shelf life of guava

Treatment	Loss in wt. (g)		Specific gravity		TSS (°Brix)		Vitamin C (mg/100g)		Acidity (%)		Total sugars (%)		Organoleptic score
	3rd day	12th day	3rd day	12th day	3rd day	12th day	3rd day	12th day	3rd day	12th day	3rd day	12th day	
T_0	240.00	210.00	1.12	0.85	12.10	6.13	198.33	101.00	0.24	0.18	7.50	5.70	2.0
T_1	260.00	231.30	1.10	1.00	11.33	7.53	200.00	125.66	0.22	0.24	7.66	5.95	6.8
T_2	216.67	191.50	1.01	0.81	12.50	7.90	198.33	110.46	0.24	0.25	7.15	6.02	6.5
T_3	213.33	191.95	0.96	0.85	11.80	8.13	195.00	109.83	0.27	0.32	7.43	6.37	8.0
T_4	290.33	263.17	1.04	0.93	12.16	8.16	228.00	117.66	0.28	0.42	7.72	6.41	6.7
T_5	230.00	210.17	1.09	1.01	12.33	8.96	200.33	140.23	0.26	0.47	7.30	6.28	5.8
T_6	216.67	201.84	1.00	0.92	11.90	9.53	197.00	126.33	0.30	0.38	7.50	6.09	6.5
T_7	200.00	186.91	1.00	0.92	12.16	9.50	226.33	127.53	0.27	0.34	7.24	6.25	7.5
T_8	206.67	192.57	1.04	0.96	11.76	8.00	204.00	110.83	0.30	0.35	7.27	6.17	7.5
T_9	181.66	170.00	0.89	0.83	12.16	9.50	224.67	144.63	0.33	0.30	7.02	6.81	8.5
CD at 5%	NS	18.13	0.14	0.14	1.30	0.81	23.75	9.95	0.04	0.05	0.55	0.63	-

T_0 – Control; T_1 – $KMnO_4$ soaked newspaper + $CaCl_2$; T_2 – $KMnO_4$ soaked newspaper + $CaCO_3$; T_3 – $KMnO_4$ soaked newspaper + Ca $(NO_3)_2$; T_4 – waxol + $CaCl_2$; T_5 – waxol; + $CaCO_3$; T_6 – waxol + $Ca(NO_3)_2$; T_7 - HDPE + $CaCl_2$; T_8 - HDPE + $CaCO_3$; T_9 -HDPE + $Ca(NO_3)_2$

as wrapping or packaging material in combination with $Ca(NO_3)_2$ proved to be the best without affecting their organoleptic quality.

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