INDIAN JOURNAL OF ARID HORTICULTURE
2006, Vol. 1 (1): 35-38

Effect of post harvest treatments on the quality and shelf life of custard apple (*Annona squamosa* L.) local cultivar during storage.

Prabhakar Singh*, A. K. Singh[1] and Ranjana Singh[2]
Department of Horticulture, Indira Gandhi Agricultural University, Raipur, Chattisgarh
[1]Department of Statistics, Directorate of Research, Indira Gandhi Agricultural University, Raipur

Abstract

Custard apple is a climacteric fruit and highly perishable in nature as well as mostly utilized for fresh market. It has very short shelf life that makes the marketability difficult. Therefore, in the period of glut it has to be sold at unremunerative prices. Increasing shelf life of fruit is the only remedy for getting the remunerative profit from them. An investigation with bavistin, calcium carbide, Dithane M-45, oil emulsion (mustard oil, groundnut oil) and paraffin wax treatments were carried out. The application of Paraffin wax was found to be significantly better in physiological loss in weight (PLW), acidity, total soluble solids, reducing sugar and ripening of custard apple during storage.

Key Words : *Custard apple, storage, shelf life*

Introduction

Horticultural crops are good revenue generators but are highly perishable too. In India post harvest handling of fruits and vegetables accounts for 20 to 40 per cent of the losses at the different stages of storage, grading, packing, transport and marketing of fresh produce or processed product. Such an enormous loss is a great handicap in exploiting the full potential of these crops in increasing production, which is one of the constraints in improving the rural income, employment opportunity and nutrition of the masses. Custard apple is mostly used as a desert fruit for its delicious taste and nutritive value. It is a hardy crop, which can be grown on marginal lands with minimum inputs. Due to its climateric nature, it ripens fast and gets spoiled easily. Therefore, increasing the shelf life of its fruits is the only remedy for getting the remunerative profit from it. Thus, the present study was carried out to compare the effects of different chemicals viz., fungicides and oil emulsion on physico chemical characteristics of custard apple during storage.

***Coressponding author :**
Associate Professor (Hort.)
IGAU, Raipur (Chattisgarh)

Material and Methods

The experiment was carried out in the Department of Horticulture, Indira Gandhi Agricultural University, Raipur during 2004-05. It was laid out in split plot under completely randomized design. The physiologically matured fruits of custard apple having uniform size and shape were procured from local market and cleaned with moist cloth. Fruits were treated with Bavistin (500ppm), calcium carbide (2.0%) mustard oil, Groundnut oil, paraffin wax, Dithane M-45 (1%), control and then dried in shade for 20-30 minutes. Later, they were kept for 0, 3, 6 and 9 days under ambient storage condition. The fruits were analyzed at regular intervals for physiological loss in weight (PLW), ripening percentage and other physico-chemical characteristics. The total soluble solids (TSS) were recorded with hand refractometer at 20°C. The ascorbic acid content was determined by using 2, 6 Dichlorophenol-indophenol dye (Ranganna, 1986). The per cent acidity was analyzed by titrating the fruit juice pulp with N/10 NaOH using phenolphathalein as an indicator. The reducing sugar was determined by standard methods (AOAC, 1970).

Results and discussion

The observations on physiological weight loss Table 1 revealed that there was a uniform increase in loss of

Table 1: Effect of post harvest treatments on physiological weight loss (percentage) in custard apple

Treatments	Days of Storage			Mean
	D2 (3 days)	D3 (6 days)	D4 (9 days)	
T1: Bavistin 500 ppm	*15.36 b (7.00)	22.62 b (14.80)	30.52 d (25.80)	22.83 bc (15.10)
T2: Calcium carbide @ 2%	25.32 d (18.30)	30.93 d (26.40)	34.38 e (31.90)	30 d.21 (25.30)
T3: Mustard oil	17.09 b (8.60)	23.25 b (15.60)	23.38 b (15.70)	21.2 b4 (13.10)
T4: Groundnut oil	17.78 bc (9.30)	23.98 bc (16.50)	24.63 bc (17.39)	22.13 bc (14.20)
T5: Paraffin wax	7.97 a (1.90)	12.20 a (4.48)	14.75 a (6.50)	11 a.64 (4.10)
T6: Dithane M-45 @ 1%	19.45 c (11.10)	26.66 c (20.10)	27.32 c (21.03)	24.4 c7 (17.10)
T7: Control	16.55 b (8.10)	24.49 bc (17.20)	24.89 bc (17.07)	21.98 bc (14.00)
Mean	17.07 a (8.60)	23.43 b (15.80)	25.70 c (18.80)	
	SEm±	CD at 5%		
Treatments (T)	1.05	3.21		
Days (D)	0.25	1.02		
T X D	0.94	2.74		

* Arc sine transformed values, corresponding to original per cent data
Figures in parenthesis indicate per cent value corresponding to arrange arc- sine transformed value

Table 2: Effect of post harvest treatments on ripening percentage in custard apple

Treatments	Days of Storage			Mean
	D2 (3 days)	D3 (6 days)	D4 (9 days)	
T1: Bavistin 500 ppm	26.90 (20.48)	30.00 (25.00)	35.17 (33.19)	30.69 b (26.03)
T2: Calcium carbide @ 2%	35.17 (33.29)	45.00 (50.00)	63.10 (79.50)	47.75 d (54.80)
T3: Mustard oil	23.00 (16.29)	30.00 (25.00)	35.17 (33.19)	29.65 b (24.48)
T4: Groundnut oil	23.80 (16.29)	27.97 (22.00)	40.17 (41.60)	30.64 b (25.08)
T5: Paraffin wax	0.00 (0.00)	13.80 (5.70)	26.90 (20.49)	13.56 a (5.50)
T6: Dithane M-45 @ 1%	20.00 (1.70)	35.17 (33.19)	42.58 (45.80)	32.58 bc (29.00)
T7: Control	32.58 (29.00)	37.76 (37.50)	49.89 (58.36)	40.05 c (41.40)
Mean	23.18 a (15.49)	31.38 b (27.11)	41.84 c (44.50)	
	SEm ±	CD at 5%		
Treatments (T)	2.46	7.49		
Days (D)	1.23	3.59		
T X D	-	NS		

* Arc sine transformed values, corresponding to original per cent data
Figures in parenthesis indicate per cent value corresponding to arrange arc- sine transformed value

weight with the increase in storage period under all treatments. The interaction effect of post harvest treatments with storage period was found to be significant in case of physiological weight loss (Table 1) and acidity percentage (Table 4). Therefore, the treatment effects on these characters have been compared for different storage periods under study, while in case of ripening percentage (Table 2), TSS percentage (Table 3) and reducing sugar percentage (Table 5), this interaction is not significant so in such cases only the average effects of treatments over storage period have been compared. On comparison of the effects of post harvest treatments on physiological weight loss it was found that paraffin wax caused significantly lowest (1.90, 4.48 and 6.50) weight loss for 3 days, 6 days, as well as 9 days of storage periods. Similarly, the highest (18.30, 26.40 and 31.90) weight loss was attributable to the calcium carbide treatment across all the storage period under study, which was also having significantly different effect compared to all other treatments. For 3 and 6 days of storage period the treatments bavistin, mustard oil and ground nut oil were having at par effect as that of control on the physiological weight loss i.e., these treatments showed same impact on physiological weight loss as in case of control. However, for the storage period of 9 days only mustard oil and ground nut oil were having at par effect with the control. These losses in weight were caused due to reduction in respiration, transpiration and ethylene production by the application of respective treatments.

The observation in ripening percentage is presented in Table 2. Due to non significance of interaction effects the average effects of storage period over treatments as well as the average effects of the treatments over storage periods have been discussed. The ripening percentage significantly increased from 3 to 9 days of storage period. At each level of storage period the ripening was significantly different from the others. On comparison of the average effects of the treatments, minimum (5.50) ripening was observed in paraffin wax while maximum (54.80) ripening was in case of calcium carbide, both of which were having significantly different impact on ripening

compared to other treatments. However, the treatments bavistin, mustard oil, ground nut oil and Dithane-M45 were having at par effect on ripening.

The observation on TSS are given in Table 3, the perusal of which indicates that there was no significant effect of either the treatments or their interaction with the storage period on the TSS contents of custard apple. The different levels of storage period however had significant impact on the TSS content especially between 0, 3 and 6 days. Beyond 6 days upto 9 days the TSS contents were almost at par. The general increase in TSS may be due to hydrolysis of starch and other polysaccharides to soluble form and concentration of juice as a result of dehydration. Similar results were reported by Deol (1985) in mango, Singh *et al.* (1978) in Kinnow. The effect of post harvest treatments on acidity are presented in Table 4. The perusal of the table reveals that there was a significant effects on acidity due to the interaction between the treatments and storage days. Therefore, it suffices to discuss the interaction effects only. There was general decrease in acidity on increase of storage period across all the levels of storage. The decrease in acidity due to storage, might be attributed to the increase in activity of enzymes invertase which is responsible for conversion of acid into sugar and secondary due to utilization of acid in metabolism. Similar results were reported by Singh *et al.* (1978) in Kinnow and Sahni and Khurdiya (1989) in mango. The maximum (0.25) acidity was obtained in case of paraffin wax treatments across all the storage periods which was significantly different from those of all other treatments except that at 6 days of storage ground nut oil and paraffin wax were having at par effect. Similarly, the minimum (0.20) acidity was obtained in case of calcium carbide which was having at par acidity with that of the control from 0 day to 6 days only this was however not the case of 9 days of storage.

So far as other treatments at different levels of storage are concerned, other treatments were having significantly different impacts compared to others except that in case of 0 day storage bavistin, ground nut oil and Dithane M-45 which were having at par effect on acidity; at 3 days of

Table 3: Effect of post harvest treatments on total soluble solids (percentage) in custard apple

Treatments	Days of Storage				Mean
	D1 (0)	D2 (3)	D3 (6)	D4 (9)	
T1: Bavistin 500 ppm	26.68 (20.16)	27.46 (21.28)	23.22 (22.32)	29.35 (24.02)	27.23 (21.92)
T2: Calcium carbide @ 2%	26.40 (19.79)	26.44 (19.83)	29.29 (23.90)	30.50 (25.73)	28.16 (22.20)
T3: Mustard oil	26.49 (19.90)	27.78 (21.70)	29.17 (23.78)	29.44 (24.13)	28.22 (22.36)
T4: Groundnut oil	26.26 (19.60)	26.54 (19.97)	28.13 (22.26)	29.69 (24.49)	27.65 (21.57)
T5: Paraffin wax	25.99 (19.20)	26.84 (20.40)	28.97 (23.45)	29.21 (23.81)	27.75 (21.70)
T6: Dithane M-45 @ 1%	26.29 (19.60)	28.52 (22.80)	28.83 (23.27)	29.84 (24.78)	28.37 (22.60)
T7: Control	26.56 (20.00)	28.92 (23.40)	29.91 (24.87)	29.95 (24.89)	28.83 (23.28)
Mean	26.38 a (19.60)	27.50 b (21.28)	28.93 c (23.40)	29.64 c (24.40)	

	SEm±	CD at 5%
Treatments (T)	-	NS
Days (D)	0.26	0.72
T X D	-	NS

* Arc sine transformed values, corresponding to original per cent data
Figures in parenthesis indicate per cent value corresponding to arrange arc- sine transformed value

Table 4: Effect of post harvest treatments on acidity (percentage) in custard apple

Treatments	Days of Storage				Mean
	D1 (0)	D2 (3)	D3 (6)	D4 (9)	
T1: Bavistin 500 ppm	2.82 c (0.24)	2.78 cd (0.23)	2.76 c (0.29)	2.70 d (0.22)	2.77 bc (0.23)
T2: Calcium carbide @ 2%	2.76 ab (0.23)	2.66 a (0.21)	2.58 a (0.20)	2.29 a (0.16)	2.57 a (0.20)
T3: Mustard oil	2.82 c (0.24)	2.81 d (0.24)	2.79 cd (0.23)	2.71 d (0.22)	2.78 bc (0.23)
T4: Groundnut oil	2.81 bc (0.24)	2.77 cd (0.23)	2.77 cd (0.23)	2.73 d (0.22)	2.77 bc (0.23)
T5: Paraffin wax	2.90 d (0.25)	2.90 e (0.25)	2.82 d (0.24)	2.80 e (0.24)	2.86 c (0.25)
T6: Dithane M-45 @ 1%	2.78 abc (0.23)	2.73 bc (1.22)	2.67 b (0.21)	2.60 c (0.20)	2.69 abc (0.22)
T7: Control	2.75 a (0.23)	2.69 ab (0.22)	2.61 a (0.20)	2.51 b (0.18)	2.64 ab (0.21)
Mean	2.81 d (0.24)	2.76 c (0.23)	2.71 b (0.22)	2.62 a (0.21)	

	SEm±	CD at 5%
Treatments (T)	0.05	0.17
Days (D)	0.007	0.02
T X D	0.19	0.05

* Arc sine transformed values, corresponding to original per cent data
Figures in parenthesis indicate per cent value corresponding to arrange arc- sine transformed value

storage bavistin, mustard oil, ground nut oil and Dithane M-45. At 6 days of storage bavistin, mustard oil and ground nut oil were having at par effect and similarly at 9 days of storage also bavistin, mustard oil, and ground nut oil were have at par effect on acidity. Thus in general bavistin, mustard oil and ground nut oil were found to be have uniformly at par effect on acidity across all the storage period under study.

Table 5: Effect of post harvest treatments on reducing sugar (percentage) in custard apple

Treatments	Days of Storage				Mean
	D1 (0)	D2 (3)	D3 (6)	D4 (9)	
T1: Bavistin 500 ppm	22.08 (14.10)	23.44 (15.80)	23.83 (16.31)	24.30 (16.95)	23.41 a (15.80)
T2: Calcium carbide @ 2%	22.21 (14.50)	25.22 (18.14)	25.46 (18.48)	26.58 (20.02)	24.87 b (17.70)
T3: Mustard oil	22.70 (14.91)	23.44 (15.81)	23.83 (16.30)	23.99 (16.50)	23.42 a (15.90)
T4: Groundnut oil	21.90 (13.90)	23.60 (16.01)	24.12 (16.70)	24.35 (17.00)	23.49 a (15.90)
T5: Paraffin wax	21.74 (13.70)	23.28 (15.62)	23.94 (16.43)	24.24 (16.85)	23.30 a (15.61)
T6: Dithane M-45 @ 1%	22.81 (15.01)	23.52 (15.91)	24.06 (16.62)	24.29 (16.94)	23.67 a (16.11)
T7: Control	21.70 (13.40)	23.33 (15.70)	25.01 (17.90)	25.88 (19.03)	23.98 a (16.44)
Mean	22.16 a (14.20)	23.69 b (16.12)	24.32 c (16.97)	24.86 d (17.60)	

	SEm±	CD at 5%
Treatments (T)	0.23	0.70
Days (D)	0.15	0.44
T X D	-	NS

* Arc sine transformed values, corresponding to original per cent data Figures in parenthesis indicate per cent value corresponding to arrange arc- sine transformed value

The effect of post harvest treatments on reducing sugar of custard apple is presented in Table 5. The effects due to interaction of treatment and storage period has been found to be non significant on the reducing sugar. Therefore, the average effects of treatment across storage period as well as the average effects of storage periods across treatments have been discussed. The perusal of Table 5 shows that the treatments except calcium carbide were having at par effect on the reducing sugar compared to control. Thus it is an evident that calcium carbide is not able to maintain the reducing sugar compared to rest of the other treatments. As far as the effect of storage period is concerned, significant increase in reducing sugar levels on increase of each level of storage period was observed.

References

A.O.A.C. 1970. Official method analysis. Association of Official Analytical Chemists. 10th Ed. Washington D.C.

Deol, I.S. 1985. A study on chemical changes during storage life of Samar Bahist Chausa mango (*Mangifera indica* L.). *Punjab Horticultural Journal*, 25 (14): 5-11.

Ranganna, G.S. 1986. Manuals of analysis of fruit and vegetables products. Tata McGraw Hill Publishing Co. Ltd., New Delhi.

Sahni, C.K. and Khurdiya, D.S. 1989. Physiochemical changes during ripening in Dashehari, Chausa and Amrapali mango. *Indian Food Packer*, 36-41.

Singh, B.P., Gupta, A.K. and Chundawat, B.S. 1978. Effect of various treatments on storage of Kinnow fruits. *Punjab Horticultural Journal*, 23 : 161-165.