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Physiological changes induced by maturity indices, post-harvest treatments and storage temperature in mango cv. KESAR

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ABSTRACT : Fruit volume, Physiological weight in loss of Kesar' mango gradually increase till the end of shelf-life and exhibited inversely proportional relationship with specific gravity of fruit while the maximum physiological loss in weight in immature fruits with sp.gr. less than 1.00 as compared sp.gr. more than l.00. Whereas, maximum organoleptic evaluation reported in sp.gr. more than 1.02. Dip treatment of harvested fruits in bavistin 500 ppm for 5 min. had been found to be useful for enhancing the flavour and consumer acceptability. Beneficial effect on minimizing physiological weight loss, maximum fruit volume and firmness in wax coating (6%) followed by bavistin 500 ppm for 5 min. Delay in PLW, maximum fruit volume and firmness with lower organoleptic score were registered at 15^0C of storage temperature with 85 per cent RH.

KEY WORDS : Kesar, Maturity indices, PLW, Waxing, Fruit volume

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Mango (*Mangifera indica* L.) is a "National fruit of India" because of its delicious taste, excellent flavor aroma, attractive colour a amount of vitamin A and C. India contributes 12 per cent of total fruit production of the world. Out of these, India contributes 39.5 per cent share of mango in world production. Kesar variety of mango has been planted on large area and the production is expected to be increased by many folds in near future in the state of Gujarat and Maharashtra.

Mango being a highly perishable fruit suffers from huge postharvest losses to the extent of about 30- 40 per cent (Salunkhe and Desai, 1984).

For the optimum stage of maturity, mango fruits should be harvested at specific gravity show in Fig. 1. range between 1.00 and 1.04 as suggested in Kesar by Kapse (1993). Post harvest hot water dips with fungicides and wax coating stored with low temperature and relative humidity have been proven to be effective in physiological changes in mango fruit. Therefore, the present investigation was undertaken to physiological changes induced by maturity indices, post-harvest treatments and storage temperature in mango cv. KESAR.

RESEARCH METHODS

There were three factors, *viz.*, (1) maturity indices, (M_1 sp.gr. >1.02, M_2 sp.gr. 1.00-1.02 and M_3 sp.gr. <1.00), (2) post-harvest treatments (R_1 hot water treatment 52±1°C for 5 min., R_2 bavistin 500 ppm and R_3 wax coating 6%) and (3) storage treatments (T_1 15^0C with 85% RH and T_2 20^0C with 85% RH) were included in present investigation conducted at Department of Pomology in collaboration of Department of Post-harvest Technology, ASPEE College of Horticulture and Forestry,

N.A.U., Navsari during May-June, 2008. Total eighteen combinations and three repetitions were laid out in CRD with Factorial concept.

The physiological characters like fruit volume (ml), PLW (%), fruit firmness (kg/cm and organoleptic evaluation of fruits were studied at four days interval and analysed statistically. The PLW was measured by subtracting the initial weight from final weight. Fruit firmness was determined using a penetrometer. A measuring cylinder of two liters capacity was taken in which fruit was dipped in the water. The rise in the level of water to the mark was noted, which indicated fruit volume. The organoleptic evaluation was recorded by five trained panelists with respect to pulp colour, rind colour, texture, flavour and taste each attributes given 20 point score higher product scoring was treated as more acceptable from the quality point of view.

RESEARCH FINDINGS AND DISCUSSION

Fruit volume was significantly differ during each storage period up to 40th day of storage in mango cv. KESAR (Table 1). The fruit volume was significantly higher in treatment M_1 (sp.gr. >1.02) during storage. Whereas, the fruit were discarded due to early ripening and low shelf-life of fruits under M_1 and M_2 treatments after 28th and 32nd day of storage. It was higher in M^1 (sp.gr. >1.02) and was lower volume in M_3 (sp.gr. <1.00) treatment. Fruit volume decreased with increasing time the storage period. Decreasing trend was higher in lower specific gravity of fruit *i.e.*, before optimum maturity. This may be due to higher percentage of PLW and decrease trend of specific gravity. Higher PLW in immature fruit *i.e.*, sp.gr. of <1.00 was noted by Joshi and Roy (1985) and Kapse (1993) which was also related with fruit volume.

Experimental result evidently shows that fruit volume was found non-significant on the of storage and therefore decreasing trend was observed. The higher fruit volume was noted in the R_3 (Wax coating 6%) as compared to other post-harvest treatment sat the end of storage. Treatment of wax coating (6%) extended the shelf-life of fruit, so there was slow decrease in the rate of fruit volume. It may be due to coating of the fruit. The significantly maximum fruit volume was maintained till the end of storage period, when fruit were stored at 15^{0}C with 85 per cent (RH). The minimum fruit volume was recorded in the storage temperature of 20^{0}C with 85 per cent (RH) 0th to 32nd days of storage. Fruit volume slowly decreased under low temperature.

Physiological loss in weight (PLW) presented in

Table 1: Influence of maturity indices, post-harvest treatments and storage temperatures on fruit volume (ml) of mango cv. KESAR

	Fruit volume (ml) storage days										
Treatments	0	4	8	12	16	20	24	28	32	36	40
Maturity indices											
M_1	239.62	235.04	230.86	226.82	223.37	220.57	218.73	3.05 (218.21)	0.71 (00)	0.71 (00)	0.71 (00)
M_2	233.15	227.36	222.07	216.91	212.42	208.58	205.38	9.77 (203.93)	2.97 (203.49)	0.71 (00)	0.71 (00)
M_3	218.63	214.12	207.75	201.41	196.18	191.67	187.46	13.61 (184.69)	9.30 (184.47)	2.86 (185.54)	2.84 (182.57)
S.E. ±	0.17	0.25	0.30	0.39	0.45	0.55	0.62	0.02	0.01	0.003	0.002
C.D. (P=0.05)	0.48	0.71	0.85	1.12	1.28	1.58	1.79	0.06	0.03	0.01	0.01
Post-harvest treatments											
R_1	230.43	224.70	218.62	212.66	207.47	203.09	199.41	7.13 (183.10)	2.79 (174.35)	0.71 (00)	0.71 (00)
R_2	230.52	225.40	219.88	214.46	209.80	205.99	202.59	7.25 (190.15)	2.84 (181.48)	0.71 (00)	0.71 (00)
R_3	230.46	226.41	222.18	218.02	214.70	211.74	209.58	12.04 (204.46)	7.35 (195.17)	2.86 (185.54)	2.84 (182.57)
S.E. ±	0.17	0.25	0.30	0.39	0.45	0.55	0.62	0.02	0.01	0.003	0.002
C.D. (P=0.05)	NS	0.71	0.85	1.12	1.28	1.58	1.79	0.06	0.03	0.01	0.01
Storage temperature treatments											
T_1	230.65	225.91	220.88	216.12	212.14	208.78	205.92	11.11 (198.13)	6.51 (188.87)	2.14 (185.54)	2.13 (182.57)
T_2	230.29	225.11	219.57	213.98	209.18	205.10	201.79	6.50 (188.77)	2.15 (185.87)	0.71 (00)	0.71 (00)
S.E. ±	0.14	0.20	0.24	0.32	0.37	0.45	0.51	0.02	0.01	0.002	0.002
C.D. (P=0.05)	NS	0.58	0.69	0.91	1.05	1.29	1.46	0.05	0.03	0.01	0.004
CV %	0.31	0.47	0.57	0.77	0.90	1.13	1.30	1.04	1.06	0.86	0.55

Figure in parenthesis indicates original value NS=Non-significant

Table 2, shows significant difference between maturity indices at 0th to 40th day of storage in mango cv. KESAR. Significantly lower PLW (%) was noted in maturity indices M_1 (sp.gr. >1.02) at 0th to 28th day of storage, which was followed by M_2 (sp.gr. 1.00-1.02) at 32nd days. The highest PLW was noted under maturity indices M_3 (sp.gr. <1.00) up to 32nd day of storage. This could be due to more number of lenticels per unit area of fruits with lower maturity as reported by Joshi and Roy (1985) and Roy and Joshi (1988) in Alphonso, Tandon *el al.* (1988) in Dashehari and Kapse (1993) in Kesar.

Post-harvest treatments were also found significant with respect to PLW (Table 2). Significantly the minimum PLW was found in treatment R_3 (Wax coating 6%) followed by R_2 (Bavistin 500 ppm) at each storage period under study. The highest PLW was noted in R_1 Hot water 52±1 ^{0}C for 5 min) at 0th to 28th day of storage. The lower PLW was due to the effect of the coating on internal atmosphere of fruit (raising the internal carbon dioxide and lowering the internal oxygen concentration). The observation tally with the results of Patel (2006); Parmar and Chundawat (1988); Singh *et al.* (2003) and Antala *et al.* (2008). The higher PLW in hot water treatment was due to hydrolytic effect of heat on starch. The similar result was also recorded by Parmar and Chundawat (1988); Kapse (1993); El-Salhy *et al.* (2006) and Rathore *et al.* (2007).

Fig. 1 : Matirity indices on the basis of specific gravity

There was significant difference in PLW of fruit under different storage temperature. It was found to be highly significant in treatment T_1 (15^{0}C with 85% RH) with lower per cent of PLW than T_2 (20^{0}C with 85% RH). The lower temperature reduced the PLW and it was directly proportional to the storage temperature. Low temperature which slowed down the metabolic activities like respiration and transpiration in fruit. The observation tally with the result of Waskar and Masalkar (1997) in Kesar, Totapuri and Vanraj, Dhemre and Waskar (2004)

Table 2 : Influence of maturity indices, post-harvest treatments and storage temperatures on physiological loss in weight of mango cv. KESAR

	Physiological loss in weight (%) storage days									
Treatments	4	8	12	16	20	24	28	32	36	40
Maturity indices (M)										
M_1	2.06	4.05	6.03	7.71	9.11	10.12	1.15 (10.98)	0.71 (00)	0.71 (00)	0.71 (00)
M_2	2.62	5.14	7.65	9.84	11.75	13.38	2.80 (14.43)	1.24 (14.81)	0.71 (00)	0.71 (00)
M_3	3.44	6.57	9.73	12.48	14.89	17.14	4.40 (19.04)	3.22 (19.64)	1.34 (19.77)	1.37 (21.44)
S.E. ±	0.06	0.09	0.13	0.16	0.20	0.23	0.03	0.01	0.003	0.002
C.D. (P=0.05)	0.17	0.25	0.37	0.45	0.58	0.66	0.08	0.03	0.01	0.01
Post-harvest treatments (R)										
R_1	2.97	5.86	8.76	11.36	13.61	15.54	2.69 (21.32)	1.42 (24.31)	0.71 (00)	0.71 (00)
R_2	2.76	5.41	8.06	10.31	12.20	13.91	2.47 (17.46)	1.35 (20.50)	0.71 (00)	0.71 (00)
R_3	2.39	4.49	6.60	8.36	9.94	11.19	3.20 (13.31)	2.39 (16.18)	1.34 (19.77)	1.37 (21.44)
S.E. ±	0.06	0.09	0.13	0.16	0.20	0.23	0.03	0.01	0.003	0.002
C.D. (P=0.05)	0.17	0.25	0.37	0.47	0.58	0.66	0.08	0.03	0.01	0.01
Storage temperature treatments (T)										
T_1	2.60	5.02	7.39	9.44	11.20	12.74	3.27 (15.73)	2.32 (18.55)	1.13 (19.77)	1.15 (21.44)
T_2	2.82	5.49	8.21	10.59	12.63	14.35	2.30 (18.19)	1.12 (19.13)	0.71 (00)	0.71 (00)
S.E. ±	0.05	0.07	0.11	0.13	0.17	0.19	0.02	0.01	0.002	0.002
C.D. (P=0.05)	0.14	0.20	0.30	0.37	0.47	0.54	0.06	0.03	0.01	0.004
CV %	9.07	6.99	7.06	6.71	7.20	7.23	4.22	2.99	1.35	0.87

Figure in parenthesis indicates original value

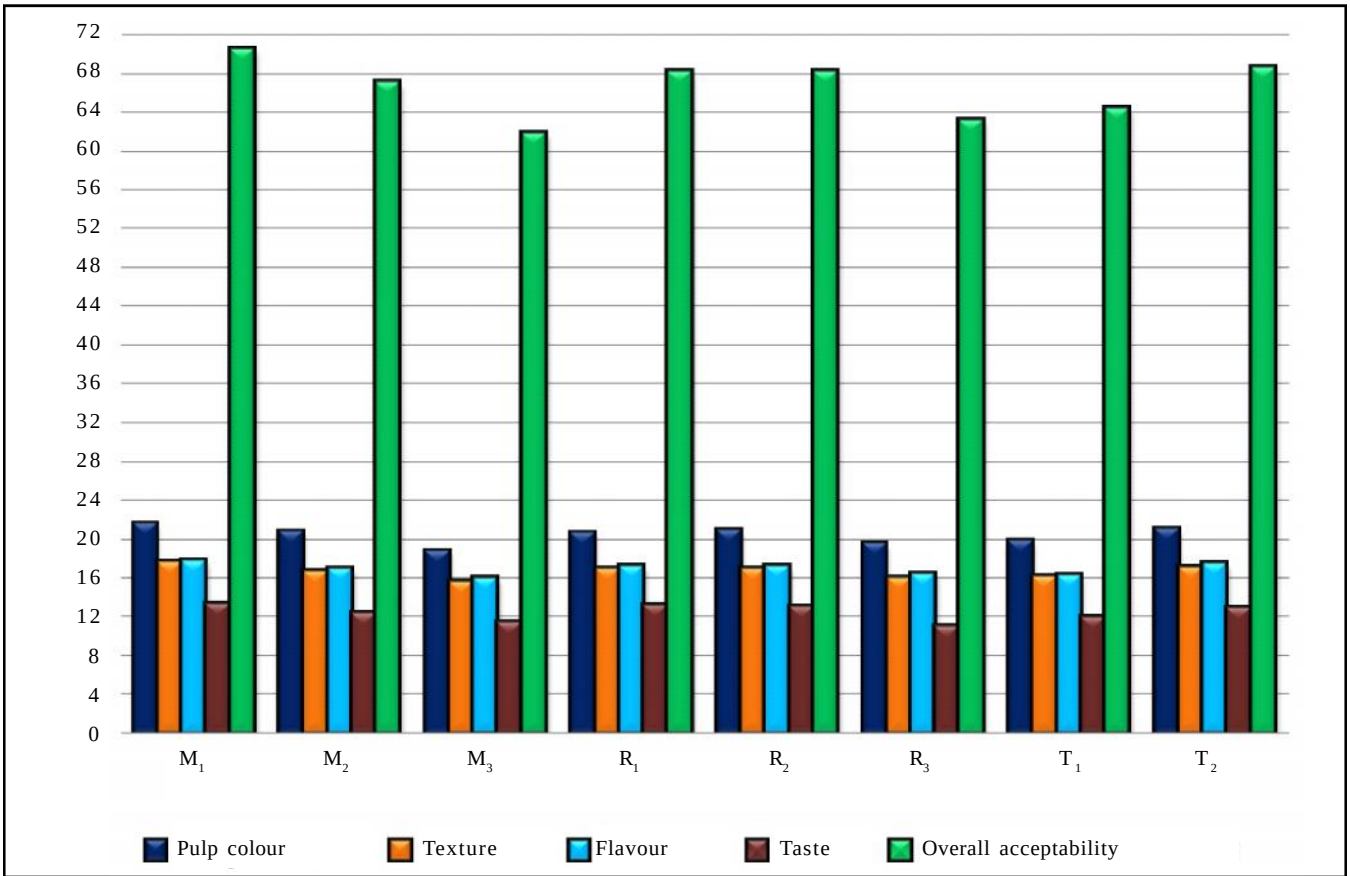

Fig. 2 : Influence of maturity indices, post-harvest treatments and storage temperatures on organoleptic score of mango cv. KESAR

Table 3: Influence of maturity indices, post-harvest treatments and storage temperatures on firmness (kg/cm^2) of mango cv. KESAR

Treatments	Fruit firmness(kg/cm^2) storage days				
	14	21	28	35	42
Maturity indices (M)					
M_1	2.72	1.66	0.75 (0.39)	0.71 (00)	0.71 (00)
M_2	2.97	1.80	0.89 (0.46)	0.73 (0.21)	0.71 (00)
M_3	3.13	1.82	1.06 (0.62)	0.75 (0.22)	0.72 (0.10)
S.E.±	0.003	0.001	0.001	0.0003	0.0002
C.D. (P=0.05)	0.10	0.004	0.002	0.001	0.001
Post harvest treatments (R)					
R_1	2.88	1.70	0.86 (0.51)	0.71 (00)	0.71 (00)
R_2	2.91	1.74	0.86 (0.53)	0.71 (00)	0.71 (00)
R_3	3.02	1.84	0.98 (0.56)	0.78 (0.21)	0.72 (0.10)
S.E.±	0.003	0.001	0.001	0.0003	0.0002
C.D. (P=0.05)	0.10	0.004	0.002	0.001	0.001
Storage temperature treatments (T)					
T_1	3.03	1.85	0.95 (0.55)	0.74 (0.22)	0.71 (0.10)
T_2	2.85	1.67	0.84 (0.53)	0.72 (0.21)	0.71 (00)
S.E.±	0.003	0.001	0.0004	0.0003	0.0002
C.D. (P=0.05)	0.008	0.003	0.001	0.001	0.001
C.V.%	0.48	0.33	0.25	0.19	0.12

Figure in parenthesis indicates original value

and Antala *et al.* (2008) in Kesar.

The fruit firmness (kg/cm^2) of mango fruit was recorded at 14th, 21st, 28th, 35th and 42nd day of storage and are shown in Table 3, maturity indices (Specific gravity) gave significantly effect on skin pressure of mango fruits at 14th, 21st, 28th, 35th and 42nd day of storage. Significantly higher fruit firmness was noted with treatment M_3 (sp.gr. <1.00) which was followed by M_2 (sp.gr. 1.00-1.02). Treatment M_1 (sp.gr. >1.02) had significantly lowest firmness (kg/cm^2) of fruit, which indicate earliness in ripening. The firmness decreased fastly in higher sp.gr. (>1.02) groups whereas steady decline was observed in lower sp.gr. (<1.00) fruits. It may be due to the slow metabolic activities and thereby slow ripening in the lower sp.gr. fruits as compared to higher sp.gr. fruits. This observation was tally with the result of Kapse (1993) in Kesar mango.

The firmness (kg/cm^2) of mango fruits decreased continuously throughout the storage period due to advancement of ripening. The firmness (kg/cm^2) was found higher under wax coating (6%) and lower in Bavistin 500 ppm (R_2) up to 28th day of storage. Significantly lower value of fruit firmness was recorded in R_1 (Hot water 52 ± l ^{0}C for 5 min.).This may be due to retardation of the bio-chemical changes, ripening process and enzymatic activities suppressing the cell wall degradation in the mesocarp cells of the fruits. This finding is in conformity with the observation recorded by Dhaka *et al.* (2001) and Jain *et al.* (2001).

The better firmness was maintained till the end of shelf-life in treatment 15^{0}C with 85 per cent (RH) followed by T_2 (20^{0}C with 85% RH) at 14th, 21st, 28th, 35th and 42nd day of storage period. This may be due to retardation of the biochemical changes and ripening process at low temperature. These findings are in conformity with the observation as recorded by Jain *et al.* (2001).

The best score for overall acceptability was recorded in the fruits having higher sp.gr (>1.02) which was related to the better score due to their optimum maturity, proper development of sugar acid blend in pulp, higher carotenoids synthesis in fruits and better degreening of the fruits (Fig. 2). The results are in conformity with the findings of Kapse (1993) in Kesar. The score of all organoleptic tests was higher in Bavistin (500 ppm) followed by Hot water dip treatment (52 ± 1^{0}C for 5 min). This may be due to the increased synthesis of carotenoid, degradation of chlorophyll and synthesis of cell wall degrading enzymes. These findings are in accordance with the observation recorded by Bhatnagar and Subramanyam (1973); Lakshminarayana *et al.* (1974) and Patel (2006)

The overall acceptability score was significantly higher in fruits stored at 20^{0}C with 85 per cent (RH). The higher score for organoleptic parameters on ripening might have obtained because of cool stored fruits lost their taste and flavour due to prolonged storage of mango at lower temperature and high humidity as compared to those store under higher temperature storage. The results are in conformity with the findings of Kapse (1993), Dhemre and Waskar (2004) and Antala *et al.* (2008) in Kesar.

REFERENCES

Antala, D.K., Sangani, V.P., Cholera, S.P., Vyas, D.M., Bhatt, V.M. and Varshney, A.K. (2008). Effect of wax coating and packaging at low temperature on the storage behaviour of Kesar mango. *Indian Fd. Pack.*, **62**(6):21-27.

Bhatnagar, H.C. and Subramanyam, H. (1973). Some aspects of preservations, processing and export of mango and its products. *Indian Fd. Pack.*, **27**(4):33-52.

Dhaka, R.S., Verma, M.K. and Agrawal, M.K. (2001). Effect of post harvest treatments on physico-chemical characters during storage of mango cv. TOTAPURI. *Haryana J. Hort. Sci.*, **30**(1-2): 36-38.

Dhemre, J.K. and Waskar D.P. (2004). Effects of post harvest treatments on shelf life quality of Kesar mango fruits during storage. *J. Maharashtra Agril. Univ.*, **29**(2): 159 – 163.

El-salhy, F.T.A., Khafagy, S.A.A. and Haggag, L.F. (2006). The changes that occur in mango fruits treated by irradiation and hot water during cold storage. *J. Applied Sci. Res.*, **2**(11):864-868.

Jain, S.K., Mukherjee, S. and Gupta, N.K. (2001). Effect of post harvest treatments and storage condition on the quality of mango during storage. *Haryana J. Hort. Sci.*, **30**(3&4): 183-187.

Joshi, G.D. and Roy, S.K (1985). Effect of integrated post-harvest handling on bio-chemical changes in Alphonso mango fruits. *Prog. Hort.*, **17**(1): 56-63.

Kapse, B.M. (1993). An integrated approach to post-harvest handling of mango (*Mangifera indica* L.) cv. Kesar. Ph.D. Thesis, Gujarat Agricultural University, S.K.Nagar, GUJARAT (INDIA).

Lakshminarayana, S., Krishnaprasad, C.A. and Shetty, M.S. (1974). Hot water treatment to regulate ripening and reduce spoilage of Alphonso mangoes. *J. Hort. Sci.*, **49**(4) : 365-371.

Parmar, P.B. and Chundawat, B.S. (1988). Effect of various post-harvest treatments on the physiology of Kesar mango. *Acta Hort.*, **231**: 679-684.

Patel, U.A. (2006). Effect of post harvest treatments on storage behaviour of hybrid mango (*Mangifera indica* L.) cvs. AMRAPALI AND NEELPHANSO. M.Sc. (Ag.) Thesis. Navsari Agricultural University, Navsari, GUJARAT (INDIA).

Rathore, H.A., Masud, T., Sammi, S. and Soomro A.H. (2007). Effect of storage on physico-chemical composition and sensory properties of mango (*Mangifera indica* L.) variety Dashehari. *Pakistan J. Nutrition*, **6**(2):143-148.

Roy, S.K. and Joshi, G.D. (1988). An approach to integrated post-harvest handling of mango. *Acta Hort.*, **231**:649-661.

Salunkhe, D.K. and Desai, B.B. (1984). *Mango in post harvest Biotechnology of fruits*. ICRC press, BOCA Raton, Florida USA, pp. 77-94.

Singh, R., Sharma, R.K., Kumar, J. and Goyal, R.K. (2003). Effect of oil emulsion and pre cooling on shelf-life of mango cv. AMRAPALI. *Haryana J. Hort. Sci.,* **32**(1&2): 54-55.

Tandon, D.K., Karla, S.K. and Singh, B.P. (1988). Ripening pattern of specific gravity graded Dashehari. *Indian J. Hort.*, **45** (4&5) : 219-24.

Waskar, D.P. and Masalkar, S.D. (1997). Effect of hydro-cooling and Bavistin dip on the shelf-life and quality of mango during storage under various environmental conditions. *Phytoparasitica.*, **25**:1.