AJH
eISSN- 0976-724X

THE ASIAN JOURNAL OF HORTICULTURE
Volume **11** | Issue 1 | June, 2016 | 202-207
Visit us -*www.researchjournal.co.in*

RESEARCH PAPER

DOI : 10.15740/HAS/TAJH/11.1/202-207

Article history :
Received : 07.10.2015
Revised : 16.05.2016
Accepted : 23.05.2016

Effect of maturity indices, post-harvest treatments and storage temperature on shelf-life of mango cv. KESAR

■ **SHAILENDRA R. MANE, Y.T. JADHAV[1] AND D.P. BARKADE[1]**

Members of the Research Forum

Associated Authors:
[1]Ratnai College of Agriculture, AKLUJ (M.S.) INDIA

Author for correspondence :
SHAILENDRA R. MANE
Ratnai College of Agriculture, AKLUJ (M.S.) INDIA
Email : shailenrmane@gmail.com

ABSTRACT : Shelf-life of fruit was significantly enhanced with minimum ripening percentage, higher number of healthy fruit percentage in Kesar mango having sp. gr. < 1.00 (M_3) fallowed by sp. gr. 1.00-1.02 (M_2). Wax coating 6 per cent (R^3) was effective to increasing the shelf-life of fruit, ripening days, healthy fruit per cent and minimum ripening per cent. Soft-rot diseases incidence was does not found in hot water (R_1) and bavistin (R_2) treatments. A comparative study on the effect of low temperature storage of fresh harvested mango stored at 15^0C (T_1) and 20^0C (T_2) was made with respect to physiological changes. Not only delay the ripening percentage with ripening day, but also increase the healthy fruit per cent in lower temperature at 15^0C of storage temperature with 85 per cent RH up to 42nd days of shelf-life.

KEY WORDS : Mango, Kesar, Maturity indices, Shelf-life, Waxing

HOW TO CITE THIS ARTICLE : Mane, Shailendra R., Jadhav, Y.T. and Barkade, D.P. (2016). Effect of maturity indices, post-harvest treatments and storage temperature on shelf-life of mango cv. KESAR. *Asian J. Hort.*, **11**(1) : 202-207, **DOI : 10.15740/HAS/TAJH/11.1/202-207.**

Mango is a national fruit of India. Besides, its excellent flavour, delicious taste, delicate fragrance and attractive colour, it is known as 'King of fruits'. It is considered to be a good source of β-Carotene and vitamin-A, vitamin-B complex, vitamin-C, nutritive minerals, digestible sugars and trace elements.

The losses vary from 17 to 36 per cent in mango. These losses occur at the farm level (harvesting), grading, transport, storage and marketing (Krishnamurthy and Rao, 2001). Reduction of these losses both qualitatively and quantitatively could be achieved by proper harvesting methods, harvesting of fruits at an optimum maturity, pre-cooling of the fruits prior to the storage, adoption of the pre and post-harvest treatments and by proper marketing procedures.

Mango cv. KESAR is famous for its excellent quality and pleasant flavour. It is one of the leading commercial mango cultivar of India. It is usually preferred for indigenous market but now a day's getting place in export market also. It is high yielder, regular bearer, having good consumer acceptance because of its attractive shape, size, colour of pulp and good keeping quality.

For the optimum stage of maturity, mango fruits should be harvested at specific gravity range between 1.00 and 1.04 as suggested in Kesar by Kapse (1993).

Many scientists have worked on post-harvest and storage temperature treatments of hot water, bavistin and wax coating (Krishnamurthy and Joshi, 1989; Singh and Singh, 1992; Kapse 1993; Antonio and Ochagavia, 1997; Diaz-Sobac *et al.*, 2000; Vala, 2002; Bringas *et al.*, 2005 and Patel, 2006). Therefore, the present investigation was undertaken to study the effect of maturity indices, post-harvest treatments and storage

temperature on shelf-life of Kesar mango fruits.

RESEARCH METHODS

The present investigation was 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. 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^{0}C for 5 min., R_2 bavistin 500 ppm and R_3 wax coating 6%) and (3) storage treatments (T_1 15^{0}C with 85% RH and T_2 20^{0}C with 85% RH) were included in present investigation. Total eighteen combinations and three repetitions were laid out in CRD with Factorial concept.

The physiological characters like days required for ripening, percent ripened fruit, healthy fruit and diseases incidence of fruits were studied at four days interval and analysed statistically. Days required for ripening was considered as attain eating ripeness by more than 90 per cent fruits present in a lot. Each fruit was thoroughly scrutinized for any visible symptoms of spoilage and the end of shelf-life was considered when the 20 per cent fruits were having over ripening or spoilage symptoms. The number of fruits having change in colour from greenish yellow to yellow colour, soft (texture) and eating ripeness were counted at periodical intervals and expressed as percentage over total number of fruits taken for study. Healthy fruits were counted and expressed as percentage over the total number of fruits periodically. The number of diseased and rotten fruits were counted and expressed as percentage over the total number of fruits periodically.

RESEARCH FINDINGS AND DISCUSSION

The maximum number of days (21.67) from the Fig. 1, was taken for ripening in fruits with sp.gr. less than 1.00 followed by those with sp.gr. 1.00-1.02 and more than 1.02. It may be due to slow metabolic activities in fruits with lower specific gravity (<1.00). The results are in accordance with the observations recorded by Tandon *et al.* (1988) in Dashehari and Kapse (1993) in Kesar mango.

Wax coating 6% (R_3) treatment noted maximum days required for ripening followed by bavistin 500 ppm (R_2) and Hot water dip treatment 52 ± 1^{0}C for 5 min. (R_1). This could probably be due to the effect of the coating on the internal atmosphere of the fruit raising the internal CO_2 and lowering the internal O_2

Table 1 : Influence of maturity indices, post-harvest treatments and storage temperatures on firmness (kg/cm^2) and ripening (%) of mango cv. KESAR

Treatments	Ripening per cent (%) storage days						
	0	4	8	12	16	20	26
Maturity indices (M)							
M_1	--	2.49 (5.93)	5.74 (32.78)	8.03 (64.63)	9.73 (87.59)	9.95 (98.52)	100
M_2	--	1.92 (6.11)	5.11 (26.48)	7.73 (60.00)	9.12 (83.15)	9.89 (97.41)	100
M_3	--	0.71 (00)	3.23 (14.52)	5.79 (35.37)	7.80 (61.48)	9.24 (85.19)	100
S.E.±	--	0.06	0.05	0.04	0.02	0.01	--
C.D. (P=0.05)	--	0.20	0.14	0.10	0.07	0.04	--
Post-harvest treatments (R)							
R_1	--	2.03 (6.95)	5.52 (30.74)	8.20 (67.41)	9.51 (90.37)	9.90 (97.59)	100
R_2	--	1.91 (6.11)	5.09 (26.30)	7.46 (55.93)	8.83 (77.96)	9.81 (95.93)	100
R_3	--	1.16 (3.89)	3.47 (16.89)	5.89 (36.67)	7.95 (63.86)	9.37 (87.59)	100
S.E.±	--	0.06	0.05	0.04	0.02	0.01	--
C.D. (P=0.05)	--	0.20	0.14	0.10	0.07	0.04	--
Storage temperature treatments (T)							
T_1	--	1.54 (4.44)	4.41 (24.30)	6.92 (49.51)	8.46 (72.22)	9.48 (89.75)	100
T_2	--	1.87 (7.56)	4.97 (25.80)	7.45 (57.16)	9.07 (82.59)	9.90 (97.65)	100
S.E.±	--	0.05	0.04	0.03	0.02	0.01	--
C.D. (P=0.05)	--	0.13	0.12	0.08	0.05	0.03	--
C.V.%	--	14.60	4.53	2.08	1.21	0.64	--

Figure in parenthesis indicates original value

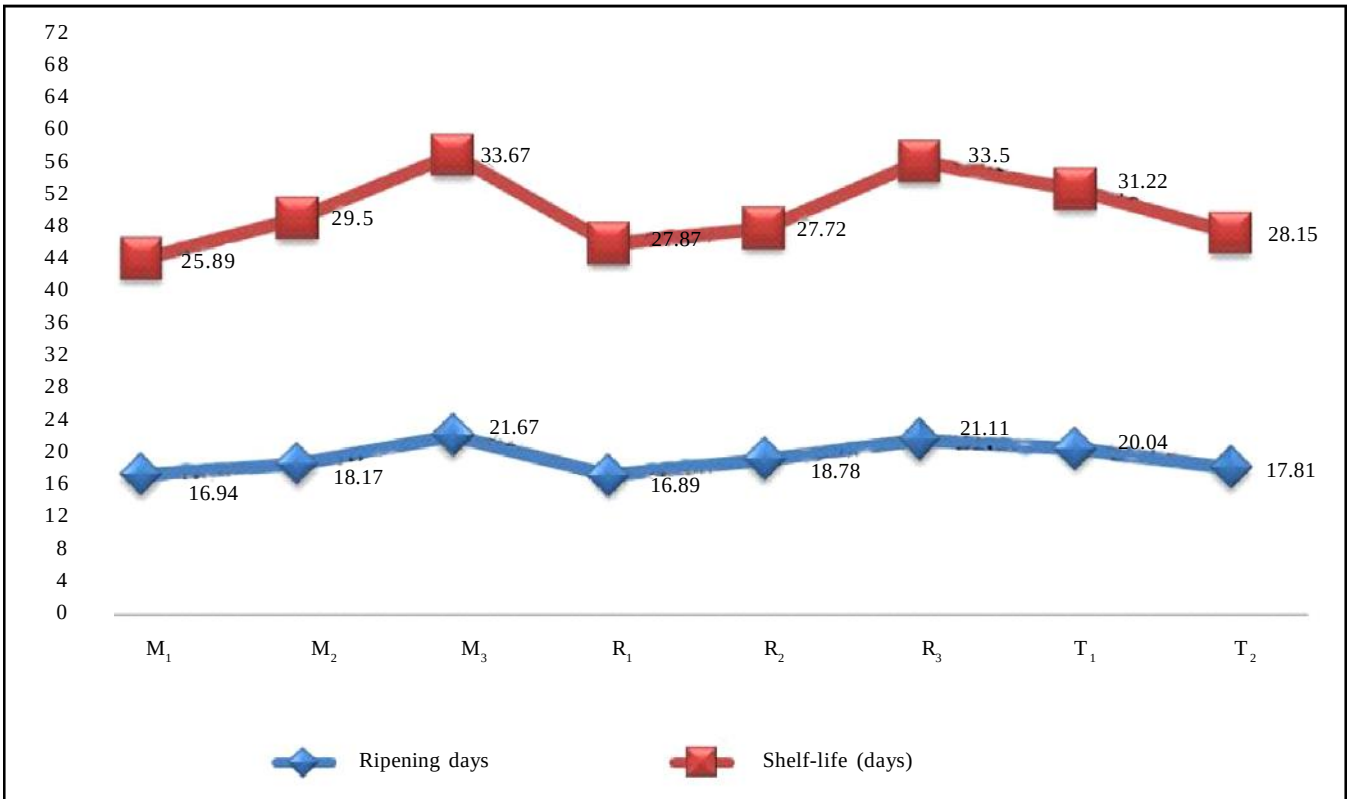

Fig. 1 : Influence of maturity indices, post-harvest treatments and storage temperatures on ripening days, shelf-life and overall acceptability of mango cv. KESAR

Table 2 : Influence of maturity indices, post-harvest treatments and storage temperatures on healthy fruit per cent and soft rot disease (%) of mango cv. KESAR

Treatments	Healthy fruit per cent storage days							
	4 to 12	16	20	24	28	32	36	40
Maturity indices (M)								
M_1	100	95.74	92.41	7.94 (88.15)	2.16 (87.78)	0.71 (00)	0.71 (00)	0.71 (00)
M_2	100	97.78	94.44	9.50 (89.81)	6.45 (86.39)	2.11 (82.22)	0.71 (00)	0.71 (00)
M_3	100	99.82	98.71	9.79 (95.37)	9.56 (90.93)	6.41 (85.56)	2.09 (81.11)	2.04 (75.56)
S.E.±	--	0.39	0.44	0.02	0.02	0.01	0.01	0.01
C.D. (P=0.05)	--	1.11	1.26	0.07	0.05	0.04	0.02	0.02
Post-harvest treatments (R)								
R_1	100	96.67	93.70	9.47 (89.26)	5.07 (88.52)	2.13 (84.44)	0.71 (00)	0.71 (00)
R_2	100	98.52	96.11	8.16 (92.78)	5.11 (90.00)	2.14 (85.56)	0.71 (00)	0.71 (00)
R_3	100	98.15	95.74	9.60 (91.67)	7.99 (88.67)	4.97 (84.81)	2.09 (81.11)	2.04 (75.56)
S.E.±	--	0.39	0.44	0.02	0.02	0.01	0.01	0.01
C.D. (P=0.05)	--	1.11	1.26	0.07	0.05	0.04	0.02	0.02
Storage temperature treatments (T)								
T_1	100	98.52	95.93	9.63 (92.22)	7.50 (89.04)	4.50 (85.00)	1.63 (81.11)	1.60 (75.56)
T_2	100	97.04	94.44	8.52 (90.25)	4.60 (88.89)	1.65 (84.44)	0.71 (00)	0.71 (00)
S.E.±	--	0.31	0.36	0.02	0.02	0.01	0.04	0.01
C.D. (P=0.05)	--	0.90	1.03	0.05	0.04	0.03	0.01	0.01
C.V.%	--	1.67	1.97	1.08	1.31	1.78	2.14	2.27

Figure in parenthesis indicates original value

concentrations. The results are in accordance with the observations recorded by Tandon *et al.* (1988). Minimum ripening days was noted in hot water dip treatment (52 ± 1^0C for 5 min) which might have initiated early metabolic changes as reported by Mattoo and Modi (1969). The significant delay in ripening was observed in fruits stored at 15^0C with 85 per cent (RH). The increase of days for ripening may be due to desirable inhibition of enzymatic activities leading reduction in the respiration and ethylene production, which was supported by Krishnamurthy and Joshi (1989) in Alphonso and Kapse (1993) in Kesar.

Shelf-life of the fruits was significantly affected by different specific gravity and maximum shelf life was noted in sp.gr. (<1.00) of the fruit. It may be due to delayed metabolic activities observed in lower sp.gr. (<1.00) as compared to higher sp.gr (>1.02) fruits. This finding is in conformity with the observation recorded by Tandon *et al.* (1988) in Dashehari and Kapse (1993) in Kesar (Fig. l). Regarding post harvest treatments, shelf life of fruit was maximum in waxol (6%) treatment. Waxol (6%) is a systemic which persists longer and extended shelf-life which could probably be due to the effect of the coating on the internal atmosphere of the fruit raising the internal CO_2 and lowering the internal O_2 concentrations retarding the ripening process. Similar results as regards to the shelf-life was obtained by Gautam *et al.* (2003) in Banganapalli mango.

Second best treatment was hot water treatment (52 ± 1^0C for 5 min) in shelf-life of fruit. These finding are in accordance with the observation recorded by Roy and Joshi (1988); Vala (2002); El-Salhy *et al.* (2006) and Patel (2006). The maximum shelf-life was observed when fruits were stored at lower temperature *i.e.*, 15^0C with 85 per cent (RH). The increase in shelf-life might be due to the desirable inhibition of enzymatic activities reducing the respiration and ethylene production at low temperature. This result was supported by Krishnamurthy and Joshi (1989) in Alphonso, Narayana *et al.* (1996) in Baneshan, and Antonio Lizana and Ochagavia (1997) in Tommy Atkins and Kent mangoes.

Percentage of ripening was significantly affected by specific gravity of fruit the data revealed in Table 1. Fruits were ripened earlier in higher sp.gr. *i.e.*, >1.02. Whereas steady increase was observed in lower sp.gr. (<1.00) fruits. It may be due to slow metabolic activities and resulting slow ripening in fruits with lower sp.gr. fruits as compared to higher sp.gr. fruits. The results are in accordance with the observations recorded by Tandon *et al.* (1988) in Dashehari and Kapse (1993) in Kesar mango. The fruits treated with wax (6%) showed in Fig.

Table 3 : Influence of maturity indices, post-harvest treatments and storage temperatures on healthy fruit per cent and soft rot disease (%) of mango cv. KESAR

Treatments	Soft rot disease (%) storage days			
	0 to 28	32	36	40
Maturity indices (M)				
M_1	00	0.52 (00)	0.52 (00)	0.52 (00)
M_2	00	0.52 (00)	0.52 (00)	0.52 (00)
M_3	00	6.27 (9.45)	4.59 (17.78)	4.99 (21.11)
S.E.±	--	0.15	0.08	0.07
C.D. (P=0.05)	--	0.42	0.23	0.21
Post-harvest treatments (R)				
R_1	00	0.52 (00)	0.52 (00)	0.52 (00)
R_2	00	0.52 (00)	0.52 (00)	0.52 (00)
R_3	00	6.27 (9.45)	4.59 (17.78)	4.99 (21.11)
S.E.±	--	0.15	0.08	0.07
C.D. (P=0.05)	--	0.42	0.23	0.21
Storage temperature treatments (T)				
T_1	00	2.62 (11.11)	3.23 (17.78)	3.50 (21.11)
T_2	00	2.26 (7.78)	0.52 (00)	0.52 (00)
S.E.±	--	0.12	0.06	0.06
C.D. (P=0.05)	--	0.34	0.19	0.17
C.V.%		25.50	17.88	15.67

Figure in parenthesis indicates original value

3. significantly slow ripening per cent. However, the early ripening of fruits were observed in Hot water dip treatment (52 ± 1^{0}C for 5 min) which might have initiated early metabolic changes as reported by Kalra *et al.* (1988) in Dashehari, Bringas *et al.* (2005) in Kent mango. The minimum ripening per cent was observed in the storage temperature of 15^{0}C with 85 per cent (RH) as compared to stored at 20^{0}C with 85 per cent (RH). The decrease of ripening per cent at low temperature might be due to slower enzymatic activities and decrease in respiration and ethylene production. The results tally with those obtained by Krishnamurthy and Joshi (1989) in Alphonso, Antonio and Ochagavia (1997) in Kent mango.

The healthy fruit per cent was significantly affected by each factor under study in Table 2, the healthy fruits per cent were decreased only after 12th days of storage in all factors. Decreasing trend was higher in higher sp.gr. >1.02. It might be due to early ripening of fruit with higher sp.gr. The results tally with those obtained by Roy and Joshi (1988) and Roy and Pal (1991). Regarding post-harvest treatments, the waxol (6%) treatment was found better for maximum healthy fruit per cent. The results are in conformity with the findings of Bringas *et al.* (2005). The maximum healthy fruit per cent was recorded in 15^{0}C with 85 per cent (RH). It was recorded minimum till the 32nd days of storage when stored at 20^{0}C with 85 per cent (RH). This may be ascribed in the light of the fact that low temperature coupled with high humidity in cool store had been more effective to maintaining health of fruit. The results tally with those obtained by Hidalgo *et al.* (1997) and Jain *et al.* (2001).

The disease (Soft-rot) incidence was observed only in the sp.gr. <1.00, it may be due to immaturity of fruit,

Fig. 2 : Diseases incidence at 32nd day of storage in treatment combination of $M_3R_3T_1$ (sp.gr.<1.00, wax coating 6% and storage temperature 15^{0}C with 85% RH)

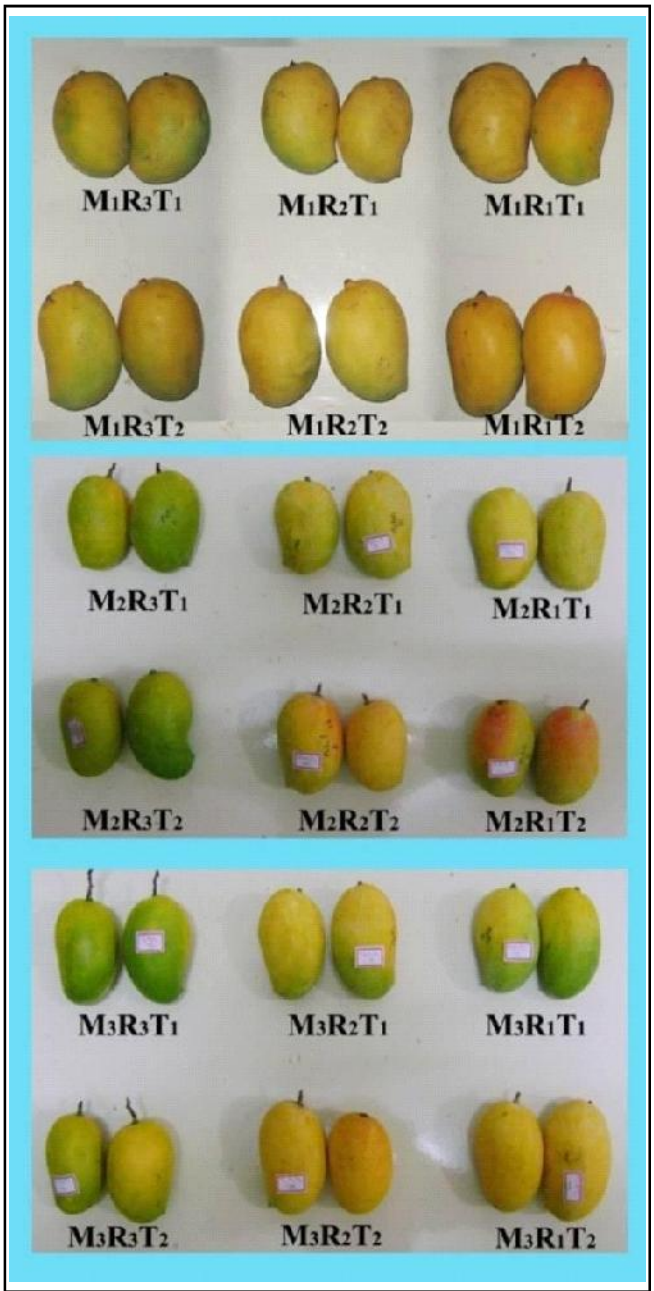

Fig. 3 : Effect of treatments combination on 22nd day of storage

which was more susceptible to disease. Whereas, disease incidence was not found in fruit with sp.gr. of 1.00-1.02 and >1.02 and are presented in Table 3 and Fig. 2. It was interesting to note that there was no disease incidence (Soft-rot) till 40th day of storage in post-harvest treatments of hot water dip treatment (52 ± 1^{0}C for 5 min) and bavistin (500 ppm). Disease incidence was observed in wax coating (6%) at 32nd day of storage and gradually increased at end of storage. This may be

due to the pathogen *Rhizopus stoloniger* and *Fusarium oxysporum schlecht* responsible for spoilage of mango fruits in cool storage under the reduced loss of water and low respiration in the fruits of mango due to waxing. The results are in conformity with the findings as reported by Diaz-Sobac *et al.* (2000). Soft-rot disease incidence was observed after 28th days of storage, at the temperature of 15^0C with 85 per cent (RH). It increased till the end of storage, which might have resulted in premature softening at distal end of fruit.

REFERENCES

Antonio, L.L. and Ochagavia, A. (1997). Controlled atmosphere storage of mango fruits (*Mangifera indica* L) cvs. TOMMY ATKINS AND KENT. *Acta Hort.* **455**:732-737.

Bringas T.E., Mercado Ruiz, J., Garcia Robles, J., Gonzalez Aguilar, G., Troncoso, R., Baez Sanudo, R. and Petit Jimenez, D. (2005). Effect of calcium and edible wax treatments on overall quality of ´Kent´ mangoes during cold storage. *Acta Hort.*, **682** : 1281-1286.

Diaz-Sobac, R., Perez Flores, L. and Vernon Carter, E. J. (2000). Emulsion coating control fruit fly and anthracnose in mango (*Mangifera indica* cv. MANILA). *J. Hort. Sci. & Biotech.,* **75**(1):126-128.

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.

Gautam, B., Sarkar, S.K. and Reddy, Y.N. (2003). Effect of post harvest treatments on shelf life and quality of Banganapalli mango. *Indian J. Hort.*, **60**(2): 135 – 139.

Hidalgo, M., Cruz, J., Parkin, K.L. and Garcia, H.S. (1997). Refrigerated storage and chilling injury development of manila mangoes (*Mangifera indica* L). *Acta Hort.*, **455** : 718-725.

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.

Kalra, S.K., Tandon, D.K. and Lohani, H.C. (1988). Ripening of wax coated Dashehari mango during storage. *Indian Fd. Pack.* Sept-Oct: 7-11.

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).

Krishnamurthy, S. and Joshi, S.S. (1989). Studies on low temperature storage of Alphonso mangoes. *J. Food Sci. & Tech.,* **26**(4): 177-180.

Krishnamurthy, S. and Rao, D.V.S.(2001). Status of post-harvest management of fruits. *Indian J. Hort*., **58** (1-2): 152

Mattoo, A.K. and Modi, V.V. (1969). Ethylene and ripening of mangoes. *Plant Physiol.*, **44** : 308-331.

Narayana, C.K., Pal, R.K. and Roy, S.K. (1996). Effect of pre-storage treatments and temperature regimes on shelf-life and respiratory behaviour of ripe Baneshan mango. *J. Food Sci. & Tech.,* **33**(1): 79-82.

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, N.A.U., Navsari, GUJARAT (INDIA).

Roy, S.K. and Pal (1991). Multilocational studies to reduce post-harvest losses during harvesting, handling, packing, transportation and marketing of mango in India. *Acta Hort.*, **291** : 499-507.

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

Singh, B.K. and Singh, T.P. (1992). Effect of certain post-harvest treatments on the storage life and quality of mango cv. ZARDALU. *Indian Fd. Pack.*, **46**(6): 57-64.

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.

Vala, K.V. (2002). Post-harvest investigations in mango (cv. KESAR). M.Sc. (Ag.) Thesis, Gujarat Agricultural University, S.K.Nagar, GUJARAT (INDIA).