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RIPENING AND POST-HARVEST QUALITY OF DASHEHARI MANGO AS INFLUENCED BY DIFFERENT PHYSICO-CHEMICAL TREATMENTS DURING STORAGE

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ABSTRACT: An attempt was made during 2011 to study the effect of different physico-chemical treatments on ripening behaviour and post-harvest quality of Dashehari mango with a view to improve storage quality and shelf-life of mango fruits. The experiment was designed under completely randomized design (CRD). Out of ten treatments applied the fruits treated with ethrel 750 ppm had significantly better fruit quality over other treatments in respect of physical parameters i.e., fruit skin colour, flavour/aroma, organoleptic taste, marketability, fruit firmness, specific gravity (0.87), moisture loss (12.54%), decay (3.11 %), total soluble solids (20.40° Brix), sugar content (14.69%), acidity content (0.16%) and sugar/acid ratio (91.81) followed by Ethrel 500 ppm {specific gravity (0.86), moisture loss (13.25%), decay (4.20 %), total soluble solids (TSS, 18.10° Brix), sugar content (14.61%), acidity content (0.18%) and sugar/acid ratio (81.16)}. The post-harvest treatment *i.e.,* pedicellate fruits with ethrel + bavistin (750+1000 ppm) was found to be next best over other treatments in respect of specific gravity (0.86 and 0.83), moisture loss (14.08% and 14.02%), decay (4.80 % and 4.99%), total soluble solids (19.20° Brix and 19.00° Brix), sugar content (13.59% and 13.89%), acidity content (0.19% and 0.18%) and sugar/acid ratio (71.84 and 81.70). Based on results obtained from the present study, it can be concluded that ethrel 750 ppm was found to be best post-harvest treatment on account of physical and chemical parameters of Dashehari mango.

Keywords : *Physico-chemical treatments, ripening, post-harvest quality, Dashehari mango.*

Mango (*Mangifera indica* L.) is one of the choicest fruit crops of tropical and subtropical regions of the world, especially in Asia. Its popularity and importance can easily be realized by facts that it is often referred as “King of fruits” in tropical world (Singh, 26). It has become popular due to juiciness, sweetness, delicious taste, excellent flavour, attractive fragrance, colour, and abundant source of essential nutrients and vitamins (Radha and Mathew, 21). This primer fruit has been cultivated in Indian sub–continent for well over 4000 years. Mango is next only to banana in terms of total fruit production in India. Now-a-days, it is recognized as one of most valuable fruit in the world market.

The genus *Mangifera* belongs to family Anacardiaceae. Mango is a native of South–East-Asia. Mango is grown in 57.30 million ha area in the world. In context of country like India, it has the second position in area and production of fruit next to China (Anon., 5). The total area under mango cultivation was 2500.56 thousand hectare in India during the year 2012-13. It produces 18002.4 thousand MT yearly with productivity of 7.2 MT ha^{-1} at national level. The total area under mango cultivation in Uttar Pradesh was 274.03 thousand hectare with 4386.99 thousand MT an annual production. The productivity of mango was approximately 16.00 MT ha^{-1}. Uttar Pradesh contributes 24.4 % share in area and production under mango cultivation in the country after Maharashtra 24.5% and Karnataka 10.0 % (Anon., 3). About 55585 thousand metric tonnes mango were exported and fetched foreign exchange in Indian Rs.26472 Lakh (Anon., 4 and 5).

Post-harvest losses have been estimated in developed countries ranging from 5-25% while it is much higher (20-50%) in developing countries depending upon the commodity basis, It was estimated that about one third of all fruits and vegetables produced are never consumed by human being in worldwide scenario (Kader, 11). The post harvest losses in mangoes have been estimated to be between of 20-40 per cent from harvesting until they reach to consumers hands. The main objective of post-harvest management practices is that to upkeep fruits in fresh state with excellent quality after harvesting and they are consumed by ultimate consumer according to need basis. Prior to consumption, it is extremely important to reduce the various losses due to physiological process and retain high quality fruit with freshness of harvested ones before they are marketed in local, distant market and international market for export purposes.

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Furthermore, the export of fruit to distant market needs a specialized post-harvest technology to ensure that the consumer receives a high quality fresh fruits and value for their money. For supply of fresh fruit to ultimate consumers, it is essential to standardize the post-harvest techniques and they can reduce post-harvest losses of the fruits after harvesting.

Keeping the above facts in mind, the present investigation entitled "Study on ripening and post-harvest quality of Dashehari mango (*Mangifera indica* L.) as influenced by different physico-chemical treatments during storage " was carried out to find out the ripening behaviour and post- harvest quality of mango cv. Dashehari.

MATERIALS AND METHODS

The present laboratory experiment was conducted at Post-Harvest Technology Laboratory, Department of Horticulture, SVPUA&T, Meerut (UP) during the year 2011-12.

The present trial was formulated in CRD (Complete Randomized Design) with ten treatments i.e, two physical, seven chemical treatments and one control (untreated fruits) and replicated three times. The details of treatments viz., ethrel 500, ethrel 750 ppm , ethrel 1000 ppm, bavistin 500 ppm, bavistin 1000ppm, bavistin 1500 ppm, pedicellate fruits with 15 mm pedicel, non-pedicellate and control. The chemicals like ethrel (SRL India) and bavistin (Bayer India) were taken for treating the fresh mangoes. For the post-harvest studies in laboratory, five fruits were taken for each treatment and wrapped in butter paper. Thus, total 150 of fruits were taken for experiment. These wrapped fruits were placed in ventilated light weight card board boxes at ambient room temperature. Thereafter, data were recorded on the basis of various physical and chemical parameters at 4^{th}, 8^{th} and 12^{th} day of storage.

Physical qualitative characters *i.e.* fruit skin colour, flavor/aroma, organoleptic taste, marketability, fruit firmness (done manually), moisture loss (%), decay (%), were recorded with opinion of panel of 5 judges and they scored according to Hedonic scale suggested by Amerin *et al*. (2). During sensory evaluation, fruits were rated in terms of Excellent (6 points), Very good (5 points), Good (4 points), Fair (3 points) and Non-acceptable (1 point). The Specific gravity of fruits was determined by using following formula

Specific gravity = Weight of fruit (g)/Volume of water displaced by fruit (ml)

The TSS (°B) in mango pulp was determined by using Digital Pocket Hand Refractometer (Make, ATAGO, Japan).The sugar content (%), acidity content(%) and sugar/acid ratio were determined by using standard analytical methods. Collected data were used to calculate the mean value of each treatment as per various physical and chemical parameters. Statistical analysis was carried out as suggested by Gomez and Gomez (9).

RESULTS AND DISCUSSION

Effect on fruit skin colour : The effect of various physical and chemical treatments on fruit skin colour at room temperature was recorded on $4^{th,}$ 8^{th} and 12^{th} day of storage, respectively (Table 1). The treatments like ethrel 500ppm, ethrel 750ppm, pedicellate fruit and ethrel + bavistin (750 + 1000ppm) were found significantly better in terms of fruit skin colour. The highest rating 6 (excellent) was obtained with fruits treated with ethrel 750ppm, when stored up to 8^{th} day followed by bavistin 750ppm and pedicellate fruit (5 very good) over controlled and other treatments. After that, rating was markedly decreased due to increase in dullness in colour with further storage periods. The colour development was better due to rapid degradation of chlorophyll and higher synthesis of carotenoid pigmentation and alteration in pigment due to the different applied treatments. These findings are more or less similar to the earlier findings of, Lizada (18), Bal *et al.* (6) and Singh and Janes (23). All the concentration of bavistin had favoured higher rating in terms of colour of fruit skin. It might be due to minimal fungal infection on skin of fruits for very impressive colour appearance (Dhemre and Waskar, 7). Similarly, the pedicellate fruits gave better results in terms of rating in the tune of skin colour at all the day of storage as compared to non- pedicellate fruits at ambient storage of fruits. The skin colour appearance was found to be better in pedicellate fruits due to minimum loss of water from the fruit pedicel and turgidity in fruits, whereas, poor results were reported with non-pedicellate fruits due to heavy loss of water from pedicel and lowering down the turgidity level of stored fruits of mango.

Effect on flavour/aroma : A persual of Table 1 revealed that the effects of different physical and chemical treatments were significantly affected the flavour/ aroma of fruits with increasing orders in storage period from 0 to 8^{th} day of storage. Furthermore, the flavour/aroma of fruit was markedly decreased with advanced storage period at room temperature up to 12^{th} day of storage. The fruits

treated with ethrel 750 ppm gave maximum ratings *i.e.,* 4 (good), 6 (excellent) and 5 (very good) in respect of flavour/aroma in the all storage days followed by pedicellate fruits and bavistin 750 ppm with comparison of control and other tried treatments. The minimum rating *i.e.,* 1(non-acceptable), 4 (good) and 3 (fair) were recorded in control and other treatments at 4^{th}, 8^{th} and 12^{th} day of storage, respectively. Flavour/ aroma in mango fruit is due to sugar and volatiles in ripe mango which increases in more mature fruits. More than 280 different aroma volatiles compounds have been reported. Fruit harvested at proper maturity has high concentration of total aroma volatiles as compared to hard green stage of harvesting. During the first seven days of ripening, α-turpinolene plays a vital role in flavour and then flavour/aroma produces the odd type flavour due to increasing level of ethyl octanoate in fruits in later stage of ripening. Similar findings were also reported earlier by Singh *et al.* (25).

Effect on organoleptic taste: Data illustrated in Table 1 showed that the organoleptic taste was significantly affected by various physical and chemical treatments applied during ambient storage condition at various stages of storage. The excellent taste of fruit was found in Ethrel 750 ppm dose as compared to control and other treatments. The highest rating in terms of organoleptic taste *i.e.,* 5 (very good), 6 (excell- ent) and 4(good) at 4^{th}, 8^{th} and 12^{th} day of storage were found with Ethrel 750 ppm followed by ethrel 500 ppm, pedicellate fruits, ethrel + bavistin (750+1000 ppm) and ethrel 1000 ppm. While, minimum ratings on organoleptic taste *i.e.,* 1(Not acceptable), 4 (Good), 3(Fair) were observed with control at the day of storage. Similar findings were reported in terms of excellent organoleptic taste during optimum storage periods in pedicellate fruits with bavistin + 750 ppm treated mango fruits gave higher organoleptic score at room temperature *i.e.,* 5 (Very good) at 8^{th} day of storage and lower ratings were observed with 4^{th} and 12^{th} day. Similarly, pedicellate fruits were also gave maximum rating 3(fair), 6(excellent) and 5(very good) in respect of organoleptic taste on the 4^{th}, 8^{th} and 12^{th} day of storage and minimum rating 1(non-acceptable), 4(good) and 3(fair) were observed in non-pedicellate at all the day of storage. Mango fruits harvested with stalk (15 mm) and stored at room temperature had higher organoleptic score viz, 3 (Fair), 6 (Excellent) and 5 (Very good) at 4^{th}, 8^{th} and 12^{th} day of storage, respectively. The above treatments gave the positive effect on organoleptic taste of fruit due to a good blend of volatile compounds for good flavour/aroma with perfect ratio of sugar/acid ratio in fruits resulting enhanced organoleptic taste. The ethrel and bavistin were also resulted the balanced external microbial infections and internal enzymatic activities in fruits. Similarly, minimal loss of water through pedicel of fruits also maintains internal metabolic activities in fruits which favoured excellent taste in fruits. These results of present findings are in close conformity with the reports of Waskar and Masalkar (27).

Effect on marketability : Marketability of fruits is a prime need for fruit growers which may be maintained by harvesting at proper stage and post-harvest handling. Disposal at improper stage and improper handling gives poor results during marketing in terms of decayed, shriveled and infected fruits *etc.* Data from Table 1 showed that various physical and chemical treatments were significantly affects the marketability of fruits during experimentation. The marketability of stored mango at room temperature significantly differed in all the treatments with advancement in storage intervals. The highest rating in terms of marketing were observed *i.e.,* 4 (good), 6 (excellent) and 4(good) with the application of ethrel 750 ppm at 4^{th}, 8^{th} and 12^{th} day of storage as compared to control and other applied treatments. However, bavistin 500 ppm and bavistin 750 ppm gave significant results in terms of marketability of fruits at all the day of storage period as compared to Ethrel + bavistin (750+1000 ppm) and 1000 ppm bavistin. Ethrel plays vital role in ripening of fruits and found to be better by indicating uniform ripening without change in flavour/aroma in fruit. Similarly, minimal fungal infections during marketing were found with bavistin treated fruits. These results are in close conformity with (Singh and Mandal, (24) and Singh *et al.* (25). Similarly, pedicellate and non- pedicellate fruits were also significantly affected the fruit marketability with all the storage days during experimentation. The maximum sensory ratings were found with pedicellate 6 (excellent) and 5(very good) at 8^{th} and 12^{th} day of storage, respectively. Although lower rating was found at 4^{th} day of storage in pedicellate fruits. Similarly, non-pedicellate fruits gave lower sensory ranking in terms of marketability in all the storage period *i.e.,* 4^{th}, 8^{th} and 12^{th} day of storage. It might be due to minimum loss of water in pedicellate fruits and maximum loss of water in non-pedicellate fruits during marketability. The optimum water content in fruits is responsible for internal metabolic activities; resulting good marketability maintained during storage. These findings are in accordance with earlier findings of Prakash *et al.* (20).

Table1: Physiological characters of mango cv. Dashehari as affected by physico-chemical treatments.

Treatments	Days of storage (At ambient room temperature)														
	Fruit skin colour			Flaour/ Aroma			Organolepthic taste			Marketability			Fruit Firmness		
	4th	8th	12th	4th	8th	12th	4th	8th	12th	4th	8th	12th	4th	8th	12th
Ethrel 500 ppm	3	5	3	3	6	5	3	5	3	3	5	3	4	5	4
Ethrel 750 ppm	4	6	5	4	6	6	5	6	4	4	6	4	5	6	5
Ethrel 1000 ppm	2	4	3	2	5	4	3	4	2	2	4	2	3	5	4
Bavistin 500 ppm	2	5	4	1	5	4	2	4	4	2	5	3	4	5	3
Bavistin 750ppm	2	6	3	2	4	5	3	5	3	3	6	4	5	5	3
Bavistin 1000 ppm	3	5	2	1	4	2	2	4	2	1	4	2	3	4	3
Pedicellate Fruits	3	6	5	2	6	5	3	6	5	2	6	5	5	6	5
Non-pedicellate Fruits	1	4	4	1	4	2	1	4	3	1	4	2	3	4	3
Ethrel+Bavistin (750+1000)	3	6	5	3	5	5	3	5	4	3	4	2	5	6	4
Control	1	4	3	1	4	2	1	4	3	1	4	3	4	5	3
CD (P = 0.05)	1.40	1.54	1.72	1.21	1.54	1.59	1.44	1.66	1.54	1.72	1.85	1.44	1.72	1.63	1.88

Effect on fruit firmness : Data (Table 1) elucidated that fruit firmness during storage period was recorded significantly differed between all the applied treatments at all the storage days during experimentation. The various physical and chemical treatments gave the significant property on fruit firmness. The ethrel 500 ppm, ethrel 750 ppm, ethrel 1000 ppm and ethrel + bavisin (750+1000 ppm) gave the significant effects on fruit firmness with the comparison of control and other treatments. The highest sensory ratings *i.e.,* 5 (very good), 6 (excellent) with ethrel 750 ppm. were observed at 4th, 8th day of ambient storage condition, while it was somewhat decreases (5-very good) with advancement of storage condition up to 12th day of storage as compared to Ethrel 500 ppm and 1000 ppm. It might be due to ethrel treated fruits decreased the texture of fruits by breakdown of insoluble protopectin into soluble pectin or by cellular disintegration in fruits with increasing ethrel doses and storage days (Singh *et al.,* 22). The treatments with bavistin (500 ppm, 1000 ppm and 1500 ppm) were also favoured fruit firmness ratings. The maximum fruit firmness score of 5 (very good), 5 (very good) and 3(fair) was observed with bavistin 750 ppm at 4th, 8th and 12th day of storage, while minimum sensory score 3 (fair), 4 (good) and 3(fair) with the treatment like 1000 ppm bavistin at 4th, 8th and 12th day of storage, respectively. Bavistin 500 ppm was resulted poor ratings in terms of fruit firmness at all the storage conditions. These results might be obtained due to the minimal pathogenic infection of fruit skin and minimum internal hydrolytic condition in fruit. Similarly, a combination of ethrel + bavistin (750+100 ppm) was considerably improved fruit firmness in all the storage days. It might be due to the optimum dose of ethrel whichl helps to significant improvement in fruit firmness and bavistin also plays a vital role to upkeep good fruit skin by controlling external fungal infection. These findings are collaborative with the finding of Kumar *et al.* (14), Kulkarni *et al.* (15) and Singh *et al.* (25).

The pedicellate fruits performed excellent sensory scoring as compared to non-pedicellate fruit and control during ambient storage condition at 4th, 8th and 12th day of storage. The maximum fruit firmness (5-very good, 6-excellent and 5-very good) were obtained with pedicellate fruit at 4th, 8th and 12th day of storage, respectively. Whereas, the minimum fruit firmness (3-fair, 4-good and 3- fair) were obtained with non-pedicellate fruits at all the day of storage. It might be due to the maximum hydrolytic condition (moisture loss) in non-pedicellate fruit as compared to pedicellate fruit. Therefore, pedicellate fruit performed better results with the comparison of non-pedicellate fruit. The findings are in close conformity with the reports of Prakash *et al.* (20) and Singh *et al.* (25).

Table 2 : Post-harvest quality characters of mango cv. Dashehari as affected by physico-chemical treatments.

Treatments	Days of storage (At ambient room temperature)																				
	Specific gravity			Moisture loss(%)			Decay (%)			TSS(^{0}B)			Sugar content(%)			Acidity content (%)			Sugar/Acid ratio		
	4 th	8 th	12 th	4 th	8 th	12 th	4 th	8 th	12 th	4 th	8 th	12 th	4 th	8 th	12 th	4 th	8 th	12 th	4 th	8 th	12 th
Ethrel 500 ppm	0.92	0.89	0.86	5.21	8.90	13.25	0	0	4.20	17.70	20.27	18.10	11.29	15.97	14.61	0.73	0.27	0.18	15.46	59.48	81.16
Ethrel 750 ppm	0.93	0.90	0.87	5.10	8.71	12.54	0	0	3.11	18.10	21.58	20.40	11.64	16.20	14.69	0.62	0.21	0.16	18.78	74.14	91.8
Ethrel 1000 ppm	0.91	0.88	0.86	5.35	9.25	14.24	0	0.30	6.90	17.50	19.50	18.20	10.57	14.29	13.79	0.77	0.28	0.20	13.73	58.70	72.57
Bavistin 500 ppm	0.90	0.88	0.83	5.58	9.18	14.28	0	0.79	7.12	16.46	20.40	17.90	9.83	13.88	12.27	0.71	0.23	0.19	13.84	60.35	68.16
Bavistin 750ppm	0.91	0.87	0.85	6.15	10.25	15.67	0	0.82	8.89	17.00	20.80	18.00	10.63	13.53	12.25	0.70	0.23	0.18	15.18	60.59	72.05
Bavistin 1000ppm	0.91	0.88	0.84	6.07	10.28	16.05	0	0.65	9.57	16.90	19.70	17.50	10.98	13.92	12.21	0.68	0.22	0.17	16.14	59.65	64.26
Pedicellate Fruits	0.93	0.90	0.86	5.19	8.93	14.08	0	0	4.80	18.10	21.00	19.20	9.59	14.79	13.59	0.63	0.22	0.19	15.23	67.22	71.84
Non-pedicellate Fruits	0.94	0.89	0.85	5.34	9.10	15.20	0	.99	12.50	14.50	16.90	14.80	7.65	11.45	10.10	0.90	0.29	0.25	8.50	39.48	44.70
Ethrel+Bavistin (750+1000)	0.92	0.89	0.83	5.61	9.18	14.02	0	0	4.99	17.60	20.70	19.00	10.41	14.14	13.89	0.72	0.25	0.18	16.69	52.81	81.70
Control	0.89	0.86	0.81	6.35	11.73	16.02	0	1.47	11.70	16.80	19.00	18.10	9.84	13.73	12.12	0.67	0.26	0.18	15.61	58.82	67.34
CD (P = 0.05)	NS	NS	NS	0.04	0.04	0.066		0.04	0.24	0.06	0.08	0.12	0.09	0.08	0.16	0.09	0.07	0.05	2.03	3.69	6.34

Effect on specific gravity : The data presented in Table 2 stated that specific gravity under different physico-chemical treatments revealed that the all the treatments were found statistically non-significant during all the observation intervals. The specific gravity of fruits was markedly decreased with every increasing day of storage up to 12 days. The maximum specific gravity (0.94) was recorded on the 14th day, when the fruit were non-pedicellate fruit, while minimum (0.81) was recorded in control at 12th day of storage.

Effect on moisture loss per cent : The data presented in Table 2 clearly indicated that the various physico- chemical treatments had significant effects during the storage period. All the chemical treatments (ethrel 500 ppm, ethrel 1000 ppm, ethrel + bavistin 750+1000 ppm, bavistin 500 ppm, bavistin 1000 ppm and bavistin 1500 ppm) except ethrel 750 ppm were found significantly superior over control at all the observational intervals in relation to moisture losses during storage. Overall, it was found that moisture loss per cent gradually increased with advancement 4 to 12th days of storage. It might be due to the transpiration and respiration process (Kaushik and Kumar, 12; Kok and Celk, 13). The minimum losses of moisture (5.10%, 8.71% and 12.54%) was recorded with ethrel 750 ppm whereas maximum moisture loss *i.e.,* 6.35%,11.73% and 16.02% were found with control at 4th, 8th and 12th day of storage, respectively. On the other hand, ethrel 500 ppm and ethrel 1000 ppm were lost slightly more moisture with the comparison of ethrel 750 ppm with the every storage intervals. Production of ethylene in a balanced form responsible for minimum loss of moisture as compared to control. Similar results were also reported by Kulkarni *et al.* (15) and Mahajan *et al.* (19). The application of bavistin doses was also caused maximum loss of moisture content as compared to ethrel application during all the storage periods. The maximum moisture loss (6.15%, 10.28 % and 16.05%) was recorded with bavistin 1000 ppm and minimum moisture loss (5.58%, 9.18% and 14.28%) with 500 ppm bavistin at 4th, 8th and 12th day of storage, respectively. The combined application of ethrel + bavistin reduced moisture loss as compared to control and bavistin alone and non-pedicellate fruit during all the day of storage. These findings are closely related to earlier findings of Singh *et al.* (25). Likewise, the fruits with pedicel were found statistically better than non pedicellate in terms of moisture loss per cent during ambient storage conditions at 4th and 12th day of storage. The minimum moisture loss (5.19%, 8.93% and 14.08 %) was determined with pedicellate fruit,

while maximum moisture loss (5.34%, 9.10% and 15.20%) was recorded under non-pedicellate fruit at 4th, 8th and 12th day of storage, respectively. It may be due to that the pedicellate fruits exhausted minimum moisture whereas non-pedicellate is responsible for advanced loss of moisture during storage. Similar results were also reported by Prakash *et al.* (20) and Singh *et al.* (25).

Effect on decay per cent : Data from the Table 2 exhibited that all the chemical and physical treatments were appreciably affected the fruit decay per cent with the advancement of storage period upto 12th day of storage. At the 4th day of storage, no decay was noticed in all the chemical and physical treatments. Thereafter, decaying of fruits was increased with further increment in storage period. Over all, no decay was found in the treatments like ethrel 500 ppm, ethrel 750 ppm, pedicellate fruit, ethrel + bavistin (750+1000 ppm), whereas treatments *viz.,* ethrel 1000, bavistin 500 ppm, bavistin 750 ppm, bavistin 1000 ppm, non-pedicellate fruit and control were showed minimal decay per cent of fruits at 8th day of storage. Likewise, the minimum decay per cent (3.11) was observed in ethrel 750 ppm followed by ethrel 500 ppm, pedicellate fruit, ethrel + bavistin (750+1000 ppm) while maximum decay per cent (12.50) was observed in non-pedicellate fruits followed by control (11.70%), bavistin 1000 ppm, bavistin 750 ppm, bavistin 500 ppm and ethrel 1000 ppm at 12th day of storage.It might be due to the ethrel treatment which are responsible for uniform ripening at optimum dose of ethrel like 750 ppm and caused minimum decay per cent. The findings agreed with the results of Kumar and Singh (16) and Singh *et al.* (25). The bavistin application on fruit surface of lower concentration reduced the microbe infection resulting lower rate of decay. Similar findings were also reported by Ahmad and Singh (1), Gangwar *et al.* (8), Singh and Mandal (24), Lakshmi *et al.* (17) and Singh *et al.* (25). The pedicellate fruits proved to be the effective for per cent decay in fruit due to minimum loss of water and high turgidity of fruits (Prakash *et al.,* 20); Singh *et al.,* 22).

Effect on total soluble solids (TSS) : The data presented in Table 2 stated that total soluble solids (TSS) in mango fruits were significantly influenced by the application of various physical and chemical treatments during the post harvest storage condition. The TSS was observed in the increasing trends from 0 - 8th day of storage; furthermore, it was slightly decreased with advancement of storage upto 12th day during experimentation. The maximum TSS (20.40°Brix) was determined with the application of ethrel 750 ppm followed as compared to non-pedicellate and other treatments including control, while minimum TSS (14.80°Brix) was recorded under non- pedicellate fruits at final day of storage. The values of TSS in other treatments *i.e.,* ethrel 500 ppm (18.10°Brix), ethrel 1000 ppm (18.20°Brix), , bavistin 500 ppm (17.90°Brix), bavistin 750 ppm (18.00°Brix), bavistin 1000 ppm(17.50°Brix) , ethrel + bavistin (750+1000 ppm) (19.00°Brix), pedicellate fruits (19.20°Brix) and control (18.10°Brix) were recorded at 12th day of storage. The above finding are in close accordance with reason that the TSS in fruit pulp during ripening increased with ethrel doses lower to higher concentration during storage. These findings are in accordance with the results of Prakash *et al.* (20) and Singh *et al.* (25).

Effect on sugar per cent : The data illustrated in Table 2 stated that sugar content (%) in mango pulp was significantly affected by various physical and chemical treatments during the storage days. The sugar content in fruits gradually increased with the advancement of storage days up to 8th day. Moreover, it was distinctly decreased with progression of storage up to 12th day during ambient storage condition. The maximum sugar content per cent (11.64, 16.20 and 14.69) were found in the treatment like found ethrel 750 ppm at 4th, 8th and 12th day of storage, followed by ethrel 500 ppm, ethrel + bavistin (750+1000 ppm), ethrel 1000 ppm and pedicellate fruits, whereas minimum sugar content (7.65%, 11.45% and 10.10%) was recorded in non-pedicellate fruits as compared to control in all respective storage days. The results of present investigation might be matched due to the conversion of starch in to sugar was rapid in ethrel treated fruits than untreated ones and other applied treatments. It could be also due to rapid induction of pre-climacteric and climacteric phase and onset of climacteric peak in respiratory metabolic pathway in starch hydrolysis. These findings are in accordance with results of Dhemre and Waskar (7) and Singh *et al.* (22).

Effect on acidity (%) : The results depicted in Table 2 showed that the effect of various physical and chemical treatments on acidity content in mango pulp significantly differed among in all the applied treatments during storage period at room temperature. All applied treatments resulted in gradual decrease in acidity content per cent in fruits with each increment in storage intervals *i.e.,* 0-12 day of storage periods. The non-pedicellate fruit gave the poor performance in relation to maximum values (0.90%, 0.29% and 0.25%)

of acidity content as compared to control and other treatments, while minimum acidity content (0.62%, 0.21% and 0.16%) was found with ethrel 750 ppm at 4th, 8th and 12th day of storage. Similarly, bavistin 1000 ppm performed well as next best treatment in tune of acidity content as compared to control and other treatments like ethrel 500 ppm, bavistin 750 ppm, ethrel + bavistin (750+1000 ppm), bavistin 500 ppm, bavistin 1000 ppm, ethrel 1000 ppm and pedicellate fruit. It was also concluded that the more acidity per cent was recorded with 4th day of storage compared to 8th to 12th day of storage, respectively. These treatments also showed that the level of acidity declined in each period of storage. It was due to faster rate of respiration and formation of sugar content. The acidity was reduced with the advancement of storage periods due to attainment of ripening starts from maturity stages. These findings are in agreement with Prakash *et al.* (20), Singh and Janes (23), Singh *et al.* (25) and Islam *et al.* (10).

Effect on sugar/acidity ratio : The data presented in Table 2 revealed that sugar/acidity ratio increased during each period of storage in all the treatments except in non-pedicellate fruits. The ethrel 750 ppm was found significantly superior over rest of the treatments with maximum value of sugar/acidity ratio i.e., (18.78, 74.14 and 91.81) at all the day of storage. Moreover, minimum sugar/acidity ratio (8.50, 39.48 and 44.70) was obtained under the non-pedicellate fruits. Similar trend was observed in the treatments with ethrel 500 ppm, ethrel 1000 ppm, bavistin 500 ppm, bavistin 750 ppm, bavistin 1000 ppm and ethrel + bavistin (750+1000 ppm), pedicellate fruits and control. The pedicellate fruits were found to be significantly superior as compared to non-pedicellate fruits. This could be due to increase in the total sugars and decrease in acidity, degradation of starch and advancement period of storage as influenced by physico-chemical treatments. The findings of the present investigation are in support with reports of Singh *et al.* (25) and Islam *et al.* (10).

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