ıd temperature on organoleptic score for flavour

iod (in days)			
Overall acceptability			
3	6	9	12
6.8	8.5	10.0	9.2
6.3	8.3	9.6	9.3
6.2	8.2	9.7	9.2
6.4	8.3	9.8	9.5
6.3	8.4	9.6	9.3
6.5	8.4	9.9	9.5
6.2	8.2	9.6	9.3
6.3	8.3	9.5	9.2
6.2	7.9	8.8	9.0

ns

and temperature on days taken for ripening and

Shelf life in days
13.5
12.5
12.0
11.5
12.0
11.5
12.0
11.0
15.0

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Studies on Extension of Shelf Life of Kesar Mango (*Mangifera indica* L.)

K. Sakhale[a]
Department of Chemical Technology
Dr. Babasaheb Ambedkar Marathwada
University Aurangabad-431 004
India

V.N. Pawar and B.M. Kapse
Marathwada Agricultural University
Parbhani-431402, Maharashtra State
India

Keywords: Kesar mango, shelf life extension, sensorial characteristics

Abstract

The Kesar, a commercial mango cultivar from western India was undertaken for assessing the shelf life during the year 2004-2005. The fruits were harvested at defined physiological maturity stage from well-managed commercial mango orchard near Aurangabad.The fruits were washed adequately and treated with gibberellic acid (50, 100 and 150 ppm) in combination with calcium chloride (8%) and fungicide. The fruits of various treatments were loosely packed in CFB boxes and stored at ambient temperature to assess post harvest storage life. The total soluble solids (TSS) and total sugars reported increasing trend where as titratable acidity, ascorbic acid and physiological loss in weight (PLW) were found linearly decreasing during the ripening. The fruits treated with 100 ppm GA_3 and 8% $CaCl_2$ were observed superior in respect of pre-ripening quality attributes. The treatement retarded the physico chemical changes feasible for manifestation of ripening quality features and certainly helped considerably in delaying the ripening. This has profoundly notified the extended storage life of Kesar mango. The observations on physico-chemical changes and sensorial quality parameters were used as ripening and shelf life monitoring indices.

INTRODUCTION

The Kesar, a commercially adopted Indian mango cultivar is planted on large scale in western India confined to mango cultivating zone involving particularly Maharashtra and Gujrat states. In the resent past numerous investigations have shown that Kesar mango is successfully competing with alphonso in domestic and export markets in respect of price, keeping quality, processability and overall marketability. The strengthening of export market potential and strategic domestic commercial exploitation as agrobase industrial raw material, kesar mango requires precise and consolidated studies on extension of storage life. The application of pre-cooling, as one of the selective post harvest management operations to monitor the shelf life during transportation and storage has been standardized and proved as a commercial viable asset to justify the export potential Kesar mango (Kapse and Katrodia, 1996). The calcium chloride treatment found beneficial to increase the shelf life and also to preserve eating quality parameters significantly in Haden cultivar of mango (Singh et al., 2000). The operationally feasible and more judicious post harvest treatment of gibberellic acid (GA_3) to extend shelf life of Amrapali mango was successfully investigated by Singh and Chundawat (1991). However, the studies on storage life determination of Kesar mango are still in infancy stage / scanty with respect to summary applicability and operational feasibility to all types of mango cultivars. In these investigations sincere efforts were made to design a set of commercially viable treatments involving use of grass chemicals to determine the post harvest storage life of Kesar mango by monitoring ripening as one of the constituent physiological development phages.

sksakhale@yahoo.co.in

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MATERIALS AND METHODS

The set of experiments was strategically designed and conducted at department of chemical technology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra during the year 2004-2005. The fruits of defined physiological maturity were harvested manually by keeping 3 cm stalk from well-managed commercial kesar mango orchard near Aurangabad. The fruits were sorted on the basis of physical parameters. More or less uniformly matured, hard, green fruits without blemishes were transported to laboratory with utmost care (Kapse and Katrodia, 1993). The fruits were washed thoroughly with plane water and treated with Bavistin (500 ppm) for 5 min. Then, fruits were subjected to the following notified treatments.

T_1- Absolute control (Plane water dip)
T_2 - 8 % calcium chloride
T_3- GA 50 ppm + 8 % calcium chloride
T_4- GA 50 ppm without calcium chloride
T_5- GA 100 ppm + 8 % calcium chloride
T_6- GA 100 ppm without calcium chloride
T_7- GA 150 ppm + 8 % calcium chloride
T_8- GA 150 ppm without calcium chloride

The treated fruits were packed in pre-designed perforated CFB boxes with sufficient air circulation for storage and ripening. During storage the observations were recorded at particular interval of time to assess shelf life. The TSS were measured with the help of Erma make hand refractometer. The physiological loss in weight (PLW) and biochemical characteristics like titrable acidity, total sugars, and ascorbic acid were determined as per the methods suggested by Ranganna (1989). The ß-carotene content was estimated using standard method reported by Roy (1973). The rate of respiration was determined by method as specified by Laxminarayana (1973). The sensorial quality features like colour, taste, flavor and overall acceptability were evaluated with the help of semi trained panel of 11 judges by using 9-point hedonic scale (Kapse et al., 1985). The room temperature and relative humidity were recorded simultaneously on every day during the whole course of storage studies.

RESULTS

The results obtained in the present investigation are presented and discussed with scientific and technological justification.

Physiological Loss in Weight (PLW)

Data on physiological loss in weight depicted in Table 1 indicate that PLW was increased slowly along with increased storage period in fruits treated with calcium chloride. It was found lowest in fruits treated with 150 ppm GA + 8% calcium chloride as compared to the fruits treated with 100 ppm GA and 8% calcium chloride. However, PLW was comparatively more in absolute controlled mango samples throughout the storage period.

Respiration Rate

The data on rate of respiration are presented in Table 2. It clearly shows that the rate of respiration was substantially increased along with the ripening of fruit and remains stable for a certain period followed by linear decrease till the shelf life comes to an end. However, the mangoes treated with of calcium chloride and GA reported low rate of respiration through out the storage period. The lowest rate of respiration was recorded in T-7 (150 ppm GA + $CaCl_2$) followed by T-5 (100 ppm GA+ 8% $CaCl_2$) and T-8 treatments respectively.

Total Soluble Solids (TSS)

The data presented in Table 3 indicate that the total soluble solid content of mango was slowly increased over a course of ripening phase of fruit. However, rapid and progressive increase in TSS of absolute control f of TSS associated with ripening as a phase trans of control mango fruits and fruits treated with 8 increase in TSS of fruits treated with 100 and calcium chloride found to be predominant over th

Titratable Acidity

The data on titratable acidity presented in progressive decrease in acidity in all the treatme the ripening and post ripening phases. The mini T-7 and T-8 followed by T-5 and T-6 treatments r

Fruit Sugars

The total sugar content of fruits reporte TSS in almost all treatments (Table 5). However, T-7 and T-5 treatments and comparatively faste life was predominant during the whole course of

ß-Carotene Content

The data presented in Table 6 indic continuously in all the treatments throughout sto carotene synthesis in absolute control fruits assc significantly retarded in almost all GA_3, and GA treated fruits. The higher values of β-carotene treatment at full ripening stage.

Ascorbic Acid

The data on retention of ascorbic acid i Table 7. It was revealed that the continuous summarily observed in almost all treatments. Ho in fruits treated with gibberellic acid in combir increased retention of ascorbic acid with incre efficacy of treatments.

Sensorial Quality Score of Different Test Para

1. Taste. The data presented in Table 8 regardin indicated that the score for taste increased s respectively along with storage period as compa comparatively highest in treatments T-3 and T surprising to note that highest score for taste ot end of shelf life notifies the cumulative effect of **2. Color.** It is clear from the Table 8 that the sc in T-7, T-8 followed by other treatments whereas in absolute control. However, the highest score f in T-5 followed by T-6 treatment respectively.
3. Flavor. The data on score for flavor expres flavor development was reported to be very slow compared to accelerated mode in absolute cc observed in T-5 and T-3 treatments at peak of rip
4. Overall Acceptability. The Table 9 compr overall acceptability clearly indicated that the re control as compared to all other treatments. H treatments at full ripening stage where as treatn attend desired score throughout the storage perio

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edkar Marathwada University, Aurangabad,
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rted by Roy (1973). The rate of respiration was
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of ripening phase of fruit. However, rapid and

progressive increase in TSS of absolute control fruits indicated normal course of change of TSS associated with ripening as a phase transfer phenomenon. The rate of respiration of control mango fruits and fruits treated with 8% calcium chloride reported at par. The increase in TSS of fruits treated with 100 and 150 ppm GA in combination with 8% calcium chloride found to be predominant over the other treatments.

Titratable Acidity

The data on titratable acidity presented in Table 4 clearly indicated substantial and progressive decrease in acidity in all the treatments throughout storage period involving the ripening and post ripening phases. The minimum rate of reduction was observed in T-7 and T-8 followed by T-5 and T-6 treatments respectively.

Fruit Sugars

The total sugar content of fruits reported increasing trend similar to that of the TSS in almost all treatments (Table 5). However, the slowest increase in TSS observed in T-7 and T-5 treatments and comparatively faster in absolute control till the end of shelf life was predominant during the whole course of storage period.

ß-Carotene Content

The data presented in Table 6 indicate that β-carotene content increased continuously in all the treatments throughout storage period. However, the accelerated β-carotene synthesis in absolute control fruits associated with normal ripening mechanism significantly retarded in almost all GA_3, and GA_3 in combination with calcium chloride treated fruits. The higher values of β-carotene were recorded in T-5 followed by T-3 treatment at full ripening stage.

Ascorbic Acid

The data on retention of ascorbic acid in various treated fruits are presented in Table 7. It was revealed that the continuous reduction in ascorbic acid content was summarily observed in almost all treatments. However, the better retention was recorded in fruits treated with gibberellic acid in combination with calcium chloride. The linear increased retention of ascorbic acid with increased concentration of GA specified the efficacy of treatments.

Sensorial Quality Score of Different Test Parameters

Taste. The data presented in Table 8 regarding the organoleptic score for taste clearly indicated that the score for taste increased slowly in T-7, T-5 and T-3 treatments respectively along with storage period as compared to absolute control. However, it was comparatively highest in treatments T-3 and T-5 at peak ripening phase. It was also surprising to note that highest score for taste observed in T-5 and T-3 treatments at the end of shelf life notifies the cumulative effect of combination treatment.

Color. It is clear from the Table 8 that the score for color development was very slow in T-7, T-8 followed by other treatments whereas fast development of color was observed in absolute control. However, the highest score for color was recorded at peak of ripening in T-5 followed by T-6 treatment respectively.

Flavor. The data on score for flavor expressed in Table 9 revealed that the overall flavor development was reported to be very slow in T-7, T-8 followed by other treatments compared to accelerated mode in absolute control. However the highest score was observed in T-5 and T-3 treatments at peak of ripening phase and till the end of shelf life.

Overall Acceptability. The Table 9 comprising of data on organoleptic score for overall acceptability clearly indicated that the relative score increased steadly in absolute control as compared to all other treatments. However, it was highest in T-5 and T-3 treatments at full ripening stage where as treatments T-7 and T-8 substantially failed to attend desired score throughout the storage period.

Ripening as Phase Transfer Phenomenon

The data on quantifying ripening tenure are presented in Table 10. It was observed that absolute control mango fruits ripened completely and uniformly within 8 days. The comparative delayed ripening period in almost all treated fruits notified the efficacy of defined treatments feasible for delaying ripening. However, the fruits treated with GA (150 ppm) in combination with calcium carbonate (8%) required 13 days followed by 12.5 days for T-8 and 11 days for T–5 treatments for manifestation of desired ripening quality parameters respectively.

Shelf Life

The data on shelf life determination depicted in Table 10 indicated that the maximum shelf life (20 days) was recorded in fruits treated with GA (150 ppm) in combination with calcium carbonate 8 % followed by T-8 and T-5 (19 days), T-6 (18 days) respectively with utmost preservation acceptability ripening features. The optimum shelf life (14 days) reported by Kesar mango at normal atmospheric conditions notifies the cultivar specificity for further investigations.

DISCUSSION

Effect of Gibberellic Acid

The Kesar mango fruits were treated with gibberellic acid with varying concentrations (50, 100 and 150 ppm) in combination with and without calcium chloride (8%). GA_3 treated fruits reported retarded development of biochemical parameters and physiological changes notifying delayed ripening as compared to control. The delayed ripening in the GA_3 treated fruits may be associated with the antisenescence property. GA_3 might have reduced down the tissue cell wall degradation in mesocarp of fruit with antisenescence action resulting in suppression of in vivo enzymatic activities. The down stream efficacy of enzymes for retardation of physico chemical changes was subsequently helped in delaying the ripening. However, the concentration more than 100 ppm had retarded the sequential ripening changes of fruit where as 50 ppm GA concentration reported inadequacy to stimulate desired ripening changes till the end of shelf life. The results are with conformity as reported by Hussain et al. (2001) and Singh and Chundawat (1991).

The overall sensorial quality evaluation revealed that the anticipated ripening was observed at 50-ppm GA concentration followed by rest of the treatments. The best score for color and flavor development was observed in the fruits treated with GA at 100 and 50-ppm concentrations respectively. The uniform and super imposition of yellow colored external surface appearance specifying the desired sensorial quality attribute of mango fruit is associated with substantial degradation of green pigment i.e. chlorophyll. However, natural ripening comparable color development could not be facilitated at 150 ppm GA3 concentration because higher concentration might have inhibited the degreening process. Generally, the desired flavor development is function of proper sugar acid blend coupled with suitable combination of biochemical and volatiles constituents, which might have developed properly with mild action of GA. The shelf life extension with sustainable quality attributes might be the result of antisenescence property of GA at mild concentration. The results are in agreements with others as reported (Kapse and Katrodiya, 1996; Vazquez and Laxminarayana, 1985; Kalra and Tandon, 1983; Amerine et al., 1965).

Effect of Calcium Chloride

The effect of calcium chloride as one of the commodity treatments found most effective for monitoring ripening with respect to development of quality attributes and prolonged shelf life of Kesar mangoes. The ripening quality attributes were developed slowly with comparatively low rate of respiration in almost all calcium chloride treated fruits. It is surprising to note that β-carotene development was significantly slowed down coupled with highest value at the end of she reported desired results because of addition irrespective of invivo calcium content of ti concentration might have provided additional followed by increased permeability of cell intermediary modified structural features of metabolic activities in the rind portion and rest whole fruit. Santosh et al., (2002), Hussain et al. et al. (1994) also reported the similar results.

The score for taste, color, flavor and slowly and found highest at the end of shelf li fruits. The flavor and taste is always associat which could have developed slowly but properly might have resulted in best score for overall acc as reported by Kapse et al. (1985, 1979) and Kap

CONCLUSIONS

The foregoing discussion revealed that th ppm concentration coupled with 8% calcium ch beneficial for desirable sensorial quality param least incidence of diseases followed by T-3 chloride). However, the increased concentratior inhibited the ripening process characterized by of shelf life of Kesar mango fruit stored at room

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coupled with highest value at the end of shelf life. The calcium chloride treatment reported desired results because of additional contributory strength of cell wall. Irrespective of invivo calcium content of tissue cell wall, substantially increased concentration might have provided additional strength facilitating delayed degradation followed by increased permeability of cell wall. The net result of such type of intermediary modified structural features of cell wall might have suppressed the metabolic activities in the rind portion and rest of the constituent morphological parts of whole fruit. Santosh et al., (2002), Hussain et al. (2001), Singh et al. (2000) and Badshah et al. (1994) also reported the similar results.

The score for taste, color, flavor and overall acceptability was also increased slowly and found highest at the end of shelf life in almost all calcium chloride treated fruits. The flavor and taste is always associated with expression of sugar acid blend, which could have developed slowly but properly with the calcium chloride treatment and might have resulted in best score for overall acceptability. The results are with conformity as reported by Kapse et al. (1985, 1979) and Kapur (1974).

CONCLUSIONS

The foregoing discussion revealed that the GA_3 treatment in Kesar mangoes at 100 ppm concentration coupled with 8% calcium chloride and 500 ppm bavistin proved to be beneficial for desirable sensorial quality parameters and better extended shelf life with least incidence of diseases followed by T-3 treatment (GA_3 50 ppm + 8% calcium chloride). However, the increased concentration more than 100 ppm of GA_3 might have inhibited the ripening process characterized by uneven and improper ripening till the end of shelf life of Kesar mango fruit stored at room temperature.

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Tables

Table 1. Effect of $CaCl_2$ and concentration of GA_3 on monitorial changes in PLW during storage*.

Treatments	Storage period (days)				
	4	8	12	16	20
T_1	3.8	8.2	13.3	16.0	Discarded
T_2	3.6	7.7	11.5	15.1	Discarded
T_3	3.4	7.5	10.3	14.6	16.5
T_4	3.4	7.6	10.4	14.7	16.6
T_5	3.3	6.0	9.5	12.2	13.1
T_6	3.4	6.6	10.1	13.0	14.8
T_7	2.7	4.5	7.8	9.0	10.2
T_8	3.0	5.1	9.0	11.0	12.1

* Each value is the average of three determinations

Table 2. Effect of $CaCl_2$ and concentration of GA_3 treatments on respiration rate (mg CO_2/kg/hr) during storage*.

Treatments	Storage period (days)					
	0	4	8	12	16	20
T_1	35.65	85.66	120.00	160.00	150.05	Discarded
T_2	35.65	80.34	115.69	155.38	158.36	140.68
T_3	35.65	75.49	111.92	145.00	158.00	152.36
T_4	35.65	78.40	117.97	159.38	161.00	150.21
T_5	35.65	71.11	105.50	149.70	150.69	147.00
T_6	35.65	80.40	120.15	160.00	158.17	142.36
T_7	35.65	70.00	102.02	131.03	135.00	130.00
T_8	35.65	75.79	110.13	140.10	140.39	128.36

* Each value is the average of three determinations

Table 3. Effect of $CaCl_2$ and concentration of GA_3 on changes in TSS during storage*.

Treatments	Storage period (days)					
	0	4	8	12	16	20
T_1	8.4	15.1	19.0	19.5	19.4	Discarded
T_2	8.4	14.5	17.0	19.6	19.6	19.2
T_3	8.4	13.6	16.5	19.7	19.8	19.5
T_4	8.4	14.0	16.9	19.5	19.5	19.4
T_5	8.4	13.4	16.4	19.5	19.7	19.8
T_6	8.4	13.9	17.0	19.4	19.5	19.3
T_7	8.4	13.2	16.2	17.9	18.8	18.9
T_8	8.4	13.3	16.4	18.2	18.5	18.9

*Each value is the average of three determinations

Table 4. Effect of $CaCl_2$ and concentration of during storage*.

Treatments	Storage pe		
	0	4	8
T_1	2.39	1.40	0.75
T_2	2.39	1.51	0.80
T_3	2.39	1.62	0.91
T_4	2.39	1.52	0.82
T_5	2.39	1.61	0.85
T_6	2.39	1.55	0.91
T_7	2.39	1.67	1.02
T_8	2.39	1.57	0.98

*Each value is the average of three determinations

Table 5. Effect of $CaCl_2$ and concentration of G

Treatments	Storage pe		
	0	4	8
T_1	6.10	8.60	12.26
T_2	6.10	8.02	11.56
T_3	6.10	7.93	11.10
T_4	6.10	8.11	11.25
T_5	6.10	8.02	11.75
T_6	6.10	8.23	11.13
T_7	6.10	7.83	10.90
T_8	6.10	8.01	11.21

Each value is the average of three determinations

Table 6. Effect of $CaCl_2$ and concentration of C during storage*.

Treatments	Storage pe		
	0	4	8
T_1	390	775	1160
T_2	390	749	1110
T_3	390	712	1100
T_4	390	738	1150
T_5	390	705	1068
T_6	390	720	1145
T_7	390	660	975
T_8	390	680	1011

* Each value is the average of three determinations

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of GA_3 on monitorial changes in PLW during

od (days)	
16	20
16.0	Discarded
15.1	Discarded
14.6	16.5
14.7	16.6
12.2	13.1
13.0	14.8
9.0	10.2
11.0	12.1

n of GA_3 treatments on respiration rate (mg

e period (days)			
12	16	20	
160.00	150.05	Discarded	0
155.38	158.36	140.68	9
145.00	158.00	152.36	2
159.38	161.00	150.21	7
149.70	150.69	147.00	0
160.00	158.17	142.36	5
131.03	135.00	130.00	2
140.10	140.39	128.36	3

of GA_3 on changes in TSS during storage*.

ge period (days)			
12	16	20	
19.5	19.4	Discarded	0
19.6	19.6	19.2	0
19.7	19.8	19.5	5
19.5	19.5	19.4	9
19.5	19.7	19.8	4
19.4	19.5	19.3	0
17.9	18.8	18.9	2
18.2	18.5	18.9	4

Table 4. Effect of $CaCl_2$ and concentration of GA_3 on changes in % titratable acidity during storage*.

Treatments	Storage period (days)					
	0	4	8	12	16	20
T_1	2.39	1.40	0.75	0.26	0.18	Discarded
T_2	2.39	1.51	0.80	0.32	0.28	0.26
T_3	2.39	1.62	0.91	0.40	0.34	0.31
T_4	2.39	1.52	0.82	0.33	0.29	0.27
T_5	2.39	1.61	0.85	0.43	0.35	0.30
T_6	2.39	1.55	0.91	0.37	0.31	0.29
T_7	2.39	1.67	1.02	0.61	0.41	0.39
T_8	2.39	1.57	0.98	0.42	0.41	0.37

*Each value is the average of three determinations

Table 5. Effect of $CaCl_2$ and concentration of GA_3 on percent total sugars during storage*.

Treatments	Storage period (days)					
	0	4	8	12	16	20
T_1	6.10	8.60	12.26	12.30	12.35	Discarded
T_2	6.10	8.02	11.56	12.10	12.30	12.21
T_3	6.10	7.93	11.10	12.00	12.18	12.30
T_4	6.10	8.11	11.25	12.23	12.30	12.24
T_5	6.10	8.02	11.75	12.35	12.33	12.32
T_6	6.10	8.23	11.13	12.23	12.28	12.25
T_7	6.10	7.83	10.90	10.15	11.21	11.20
T_8	6.10	8.01	11.21	12.18	12.20	12.18

*Each value is the average of three determinations

Table 6. Effect of $CaCl_2$ and concentration of GA_3 on ß-carotene content (µg/100 g pulp) during storage*.

Treatments	Storage period (days)					
	0	4	8	12	16	20
T_1	390	775	1160	1470	1520	Discarded
T_2	390	749	1110	1390	1530	1570
T_3	390	712	1100	1415	1545	1600
T_4	390	738	1150	1397	1555	1567
T_5	390	705	1068	1411	1627	1625
T_6	390	720	1145	1360	1570	1595
T_7	390	660	975	1140	1200	1225
T_8	390	680	1011	1190	1250	1320

*Each value is the average of three determinations

Table 7. Effect of $CaCl_2$ and concentration of GA_3 on ascorbic acid (mg/100 g) during storage*.

Treatments	Storage period (days)					
	0	4	8	12	16	20
T_1	86.0	55.1	46.0	28.0	22.0	Discarded
T_2	86.0	54.0	49.0	29.0	26.0	23.0
T_3	86.0	61.0	51.0	38.0	32.0	26.0
T_4	86.0	59.0	50	31.0	27.0	24.0
T_5	86.0	65.0	55.0	39.0	35.0	32.0
T_6	86.0	61.0	49.0	29.0	23.0	22.0
T_7	86.0	66.0	58.0	42.0	40.0	38.0
T_8	86.0	62.0	48.0	31.0	30.0	28.0

Each value is the average of three determinations

Table 8. Effect of $CaCl_2$ and concentration of GA_3 on changes in organoleptic score for colour and taste during storage.

Treat ments	Storage period (days)											
	Color						Taste					
	0	4	8	12	16	20	0	4	8	12	16	20
T_1	5.00	5.60	6.62	9.20	9.32	Dis.	5.20	6.72	7.93	9.16	8.87	Dis.
T_2	5.00	5.56	6.59	9.06	9.33	9.32	5.20	6.62	7.85	9.21	9.05	8.90
T_3	5.00	5.45	6.39	9.00	9.28	9.30	5.20	6.60	7.69	9.27	9.10	9.00
T_4	5.00	5.51	6.43	9.16	9.39	9.35	5.20	6.64	7.80	9.12	9.00	8.93
T_5	5.00	5.43	6.32	9.23	9.89	9.80	5.20	6.45	7.68	9.35	9.87	9.32
T_6	5.00	5.56	6.45	9.17	9.70	9.75	5.20	6.60	7.91	9.21	9.70	9.36
T_7	5.00	5.30	6.00	7.15	7.75	7.80	5.20	6.12	7.15	8.10	8.30	8.81
T_8	5.00	5.35	5.99	7.40	7.90	7.95	5.20	6.15	7.31	8.20	8.55	8.57

Table 9. Effect of $CaCl_2$ and concentration of GA_3 on organoleptic score for flavor and overall acceptability during storage life.

Treat ment	Storage period (days)											
	Flavour						Overall acceptability					
	0	4	8	12	16	20	0	4	8	12	16	20
T_1	5.0	5.30	6.45	9.50	9.35	Dis.	5.20	5.80	8.42	9.60	9.42	Dis.
T_2	5.0	5.25	6.32	9.12	9.36	9.28	5.20	5.67	8.35	9.61	9.43	8.30
T_3	5.0	5.21	6.27	9.23	9.55	9.50	5.20	5.43	8.12	9.65	9.60	9.00
T_4	5.0	5.23	6.29	9.27	9.76	9.70	5.20	5.57	8.23	9.62	9.63	9.36
T_5	5.0	5.17	6.16	9.34	9.87	9.80	5.20	5.50	8.15	9.80	9.89	9.81
T_6	5.0	5.22	6.31	9.35	9.72	9.73	5.20	5.58	8.31	9.72	9.82	9.62
T_7	5.0	5.12	5.67	7.23	7.55	7.56	5.20	5.16	6.70	7.50	8.12	8.10
T_8	5.0	5.16	5.90	7.47	7.85	8.00	5.20	5.27	7.10	7.73	8.32	8.00

Table 10. Effect of $CaCl_2$ and concentration of C

Treatments	Ripening period (days)	Shelf lif (days)
T_1	8.0	14.0
T_2	8.5	15.0
T_3	10.0	17.0
T_4	9.0	16.5
T_5	11.0	19.0
T_6	10.5	18.0
T_7	13.0	20.0
T_8	12.5	19.0

*Each value is the average of three determinations

of GA_3 on ascorbic acid (mg/100 g) during

rage period (days)			
3	12	16	20
5.0	28.0	22.0	Discarded
9.0	29.0	26.0	23.0
1.0	38.0	32.0	26.0
30	31.0	27.0	24.0
5.0	39.0	35.0	32.0
9.0	29.0	23.0	22.0
3.0	42.0	40.0	38.0
8.0	31.0	30.0	28.0

1 of GA_3 on changes in organoleptic score for

ge period (days)						
			Taste			
20	0	4	8	12	16	20
Dis.	5.20	6.72	7.93	9.16	8.87	Dis.
9.32	5.20	6.62	7.85	9.21	9.05	8.90
9.30	5.20	6.60	7.69	9.27	9.10	9.00
9.35	5.20	6.64	7.80	9.12	9.00	8.93
9.80	5.20	6.45	7.68	9.35	9.87	9.32
9.75	5.20	6.60	7.91	9.21	9.70	9.36
7.80	5.20	6.12	7.15	8.10	8.30	8.81
7.95	5.20	6.15	7.31	8.20	8.55	8.57

on of GA_3 on organoleptic score for flavor and

age period (days)						
			Overall acceptability			
20	0	4	8	12	16	20
Dis.	5.20	5.80	8.42	9.60	9.42	Dis.
9.28	5.20	5.67	8.35	9.61	9.43	8.30
9.50	5.20	5.43	8.12	9.65	9.60	9.00
9.70	5.20	5.57	8.23	9.62	9.63	9.36
9.80	5.20	5.50	8.15	9.80	9.89	9.81
9.73	5.20	5.58	8.31	9.72	9.82	9.62
7.56	5.20	5.16	6.70	7.50	8.12	8.10
8.00	5.20	5.27	7.10	7.73	8.32	8.00

Table 10. Effect of $CaCl_2$ and concentration of GA_3 on shelf life (days)*.

Treatments	Ripening period (days)	Shelf life (days)
T_1	8.0	14.0
T_2	8.5	15.0
T_3	10.0	17.0
T_4	9.0	16.5
T_5	11.0	19.0
T_6	10.5	18.0
T_7	13.0	20.0
T_8	12.5	19.0

*Each value is the average of three determinations