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STORABILITY, RIPENING BEHAVIOUR AND PHYSIOLOGICAL DISORDER OF ALPHONSO MANGO FRUITS IN RELATION TO MATURITY STAGE

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ABSTRACT

Alphonso mango fruits were harvested at different stages of maturity and grouped according to their specific gravity to determine the relationship between specific gravity and fruit maturity stage. Fruit quality characteristics; a* value, the stage of ripening, ripening %, TSS and total acidity percentage; proved that the specific gravity was a simple and reliable indicator to assess the maturity stages of Alphonso mango fruits. Fruits should be harvested at a specific gravity 1.01-1.02 (optimum mature fruits) followed by 1.0-1.01 (just mature fruits) in order to solve the problem of uneven ripening and to keep fruit quality, with minimum physiological disorder (internal breakdown). At 10°C, Alphonso mango fruits should not be stored more than three weeks to avoid the appearance of sever symptoms of chilling injury or internal breakdown during marketing period.

INTRODUCTION

In Egypt, mangoes are considered as the King of the fruits, it is greatly favoured for its succulence, exotics flavour and delicious taste. There is a close relationship between the stage of maturity and keeping quality of mango fruits (storability, ripening behaviour and appearance of physiological disorder). However, maturity stage is closely related to specific gravity. Maturity of mango fruits at the time of harvesting is determined by specific gravity (Lee 1998 and Tsuda *et al.,* 1999). Lee (1998) also suggested that fruits should be harvested at a specific gravity index of 1.01 in order to maintain fruit quality, yield and to solve the problem of uneven ripening. In many countries, physiological disorder causes large economic loss to mango industry. Spongy tissue affects up to 30% of Indian mango fruits (Alphonso is particularly susceptible) and limits production and quality of mango fruits. However, there is a close relationship between the stage of maturity and several physiological disorder, especially flesh breakdown of mango fruits (Katrodia 1989, Lee *et al.,* 1998 and Sampaio *et al*., 1999).Depending upon the symptoms and growing regions, internal breakdown is referred to as “jelly seed”, “soft nose”, stem-end cavity” (SEC), “yeasty fruit rot”, “insidious fruit rot”, or “flesh breakdown” (Raymond *et al*, 1998). Accordingly, this investigation was carried out in order to examine the influence of maturity stages of Alphonso mango fruits on storability, ripening behaviour and appearance of physiological disorder.

MATERIALS AND METHODS

Preliminary Experiment:

Since mango fruit ripening mainly depends on reaching maturity stage, a preliminary experiment was carried out to determine the best maturity degree. Hence, Alphonso mango fruits were obtained from Al-Khatatba region in August 1998 and 1999, washed, weighed individually, volume was taken and specific gravity was calculated; then grouped according to specific gravity as follows:

(1) 0.8-0.9 (2) More than 0.9-1.0
(3) More than 1.0-1.01 (4) More than 1.01-1.02
(5) More than 1.02-1.03 (6) More than 1.03

Each group contained 15 fruits and replicated 3 times. Fruits were placed at 22°C and 90% relative humidity for 5 days including 2 days for ripening by acetylene gas (released from calcium carbide 2 g./ kg. fruit according to Kumar *et al*, 1996). Fruit characteristics were measured at harvest time and after 5 days from ripening treatment as follows:

Physical Properties:

Percentage of weight loss: Fruits were periodically weighed and the percentage of weight loss was calculated by the difference between the initial weight and that recorded at the date of sampling.

Peel Colour Measurement (L, a & b values): was determined by using a Hunter colorimeter type (DP-9000) for the estimation of L, a, b values. The instrument was calibrated with white and black standards.

Chemical Properties:

Titratable Acidity %: Titratable acidity was determined in terms of anhydrous citric acid percentage after titration against 0.1 N. Sodium hydroxide using phenolaphthaline as indicator (A.O.A.C.,1990).

Total Soluble Solids %: Abbé refractometer was used to determine the percentage of total soluble solids in fruit juice (A.O.A.C.,1990).

The sensory evaluation:

The sensory evaluation of fruits was assessed by a panel of nine judges as follows:

Stage of ripening (or firmness by hand) was subjectively rated on a scale of 1 to 5, where 5 = overripe [very soft, very slight resistance to moderately applied finger pressure (MAFP)], 4 = soft-ripe (eating stage, slight resistance to MAFP), 3 = partially ripe, fairly soft (moderate yield to MAFP), 2 = fairly inedible, fairly hard (slight yield to MAFP), and 1 = inedible, hard (no yield to MAFP) (according to Miller *et al*, 1991).

Percentage of ripe fruit: Calculated depending on ripe stage (according to colour index) as follows:

$$\frac{\text{Number of fruits at the same ripe stage}}{\text{Total number of fruits}} \times 100 = \text{Percentage of ripe fruit}$$

Internal flesh breakdown: Two longitudinal cuts were made on each of the flat sides of the stone to expose the interior of the fruit and detect the presence of either jelly seed or soft nose. Then, internal flesh breakdown of the fruits was assessed as 1 = no breakdown, 2 = 1 – 5%, 3 = 6 – 15%, 4 = 16 – 30% and 5 = 31 – 100% of the cut flesh area affected (according to Hofman *et al.*, 1997 and Raymond *et al.*, 1998).

Principal Experiment

In August 1999 and 2000 Alphonso mango fruits with the same specific gravity as the successful groups of the preliminary works (group A: 1.0-1.01, group B: more than 1.01-1.02, group C: more than 1.02-1.03) were stored at 10°C and 90% RH (each group contained 30 fruits and replicated 3 times), inspected weekly for three week to study the relation between maturity stage and both storability and physiological disorder of Alphonso mango fruits.

Physical Properties:
Weight loss %: as mentioned before.
Skin Colour Development (L, a & b values): as mentioned before
Chemical Properties:
Titratable Acidity %: as mentioned before.
Total Soluble Solids % : as mentioned before

Sensory evaluation:
Chilling Injury (symptoms manifested in peel discolouration or surface pitting or both) was rated on a scale of 1 to 5 where 1 = none, 2 = trace,
3 = slight, 4 = moderate, 5 = severe (according to Gregory *et al*, 1993).

Internal flesh breakdown: as mentioned before
Firmness by hand: as mentioned before
Marketing Period

To determine and inspect the development of chilling injury, internal breakdown symptoms, and the influence of low temperature cold storage on ripening, one third of the fruits (in each treatment) were removed from 10°C and placed at 22°C and 80% RH. Then, chilling injury, breakdown, days to ripe (when fruits reached score"3 " of ripening stages) and marketing period per day (including days to ripe) were evaluated

Statistical analysis:

The obtained data were statistically analyzed using excel micro software (one factor randomized complete block design) according to Senedecor and Cohran (1990) and the L.S.D. test at 5% was applied to compare between the degrees of maturity (treatments).

RESULTS AND DISCUSSION

Preliminary Experiment:
Physical Properties:
Weight Loss percentage:

Results presented in table 1 indicated that weight loss percentage increased with the progress of maturity stages, where the highest percentage was recorded by 1.03 (7.7-8.1 %), while the least percentage was recorded by 0.8-0.9 (2.2-2.6%). This might be due to the fact that advanced mature fruits ripen more quickly than less mature fruits. This result was in line with that of Kumar *et al*. (1995) and Salles *et al.*(1999), who stated that weight loss % of mango fruits increased with the progress of ripening process.

Peel Colour Development (L, a, b Values):

Data in table (1) showed that L & b values were unreliable indicators for assessment of the differences between maturity stages because of their values' fluctuation. At the same time, a gradual and obvious increase of a* value accompanied the progress of maturity stages (manifested through the decrease of negative values), as the highest negative values (-11.03 –13.77) were attained by immature fruits, while advanced maturity fruits attained a less negative value of –4.72 –6.1. After 5 days of ripening a great change occurred, which clarified the big difference resulting from behaviour variation among maturity degrees, as fruits of delayed ripening still had negative values while positive values change with the increase of ripening degree which resulted from the progress of maturity stage. Thus, a* value can be used as a reliable indicator for ripening progress of Al-phonso mango fruits

Chemical Properties:
Total Acidity Percentage:

Data in table (1) revealed that total acidity decrease accompanied the progress of maturity stages or as a result of ripening advance, where the least percentage was attained by 1.03 fruits (0.64-0.76% at harvest and 0.33-0.38% after 5 days from ripening treatment). On the contrary, the highest percentage was attained by 0.8-0.9 fruits (2.01% at harvest and 1.34% after 5 days from ripening treatment). Due to the great variation, this characteristic could be used as an indicator for maturity stage. These results go in line with those reviewed by Kumar *et al.* (1995), Tandon and Kalra (1997) who noted that titratable acidity in mango fruits declined gradually towards the end of ripening period.

Total soluble solids Percentage:

Its obvious from table (1) that the accumulation of TSS percentage increased and widely varied according to the stage of maturity, either at harvest time or after 5 days from ripening. Due to the great variation, this characteristic could be used as an indicator for the effect of maturity stage on fruit ripening behaviour (under this study). In this connection, obtained results agreed with those observed by Abdul-Gofur *et al.* (1997) and by Tandon and Kalra (1997)who stated that a rapid increase in total soluble solid occurred during the ripening process.

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Kapse *et al.* (1997) reported that total soluble solids (TSS) and sugars are positively correlated to the specific gravity of fruits Ripening behaviour of'Kesar' mangoes in relation to specific gravity

Sensory evaluation:

Ripening stage:

After 5 days from ripening treatment, fruits which had specific gravity less than 1 did not reach the acceptable degree of ripening stage [1(inedible) – 2(fairly edible)], while edible and over-ripe stages were attained by advanced maturity fruits (more than 1.02). Both of 1.01.01 fruits and 1.01-1.02 recorded score 3 (partially ripe) in the two seasons, which was considered a suitable degree of ripening to extend the marketing period.

Ripening Percentage:

Ripening percentage increased with the progress of maturity stage. Significant differences were detected for this ripening percentage among most degrees of maturity evaluated in both seasons. The worse result was attained by 0.8 – 0.9 fruits (36.61 – 40%) while the best results were attained by 1.03-fruits (100%). fruits recorded (70.0-73.3%), while 1.01-1.02 recorded 86.6% in both seasons.

Internal Breakdown:

In both seasons, no internal breakdown was recorded at harvest for all degrees of maturity till 5 days from ripening, except 1.03 fruits recorded negligible symptoms after 5 days from ripening treatment.

The results about fruit characteristic; a* value, the stage of ripening, ripening %, TSS and total acidity percentage; confirmed those obtained by Lee *et al.* (1998) and Tsuda *et al.* (1999), who proved that the specific gravity was closely related to fruit maturity. Thus, one can conclude that the best degree of maturity was 1.01-1.02 followed by 1.0-1.01, in order to solve the problem of unacceptable ripening stage and percentage and to keep fruit quality. We can suggest that fruits, which had specific gravity of 1.01-1.02 to be considered as just mature, 1.01-1.02 as optimum mature and 1.02-1.03 as advanced mature fruits.

Principal Experiment

Physical Properties:

Weight Loss %:

Table (2) showed gradual increase of weight loss associated with the longevity of storage period. In all storage period in the two seasons data show that no significant differences were detected, except after 3 weeks in the second season. The highest loss was recorded by the high degree of maturity – fruits, where the least were obtained by the least degree of mature fruit. These results go in line with those reviewed by Kumar *et al*.(1995), and Salles *et al.* (1999) who stated that Physiological weight loss of mango fruits increased with increasing storage duration

Table (2): Effect of Cold Storage (10C and 90% RH) on Storability and Fruit Characteristic of Alphonso Mango Fruits in Relation to Specific Gravity

	Specific Gravity*	Weight Loss		Skin Colour Development						Total Acidity		T.S.S	
				"L" Value		"a" Value		"b" Value					
		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Initial	A	0.00	0.00	40.30	41.78	9.73	-11.43	17.19	24.41	1.53	1.48	6.3	6.0
	B	0.00	0.00	43.07	49.60	8.56	- 8.45	19.87	37.01	1.34	1.34	7.2	6.0
	C	0.00	0.00	44.50	44.27	7.56	- 6.68	22.08	24.41	0.92	1.12	8.5	9.6
	L.S.D at 5%	-	-	N.S	1.611	N.S	N.S	N.S	1.425	0.172	0.304	1.57	1.54
1 Week	A	2.53	2.13	46.33	51.02	-9.34	-9.00	31.85	42.66	1.47	1.34	6.6	6.4
	B	2.93	2.60	52.19	55.33	-8.35	-8.43	45.28	48.30	1.34	1.24	7.5	7.8
	C	3.18	3.23	52.96	54.40	-2.02	2.43	37.28	46.70	0.83	0.92	9.8	10.0
	L.S.D at 5%	NS	NS	**N.S**	6.175	2.871	2.549	N.S	**N.S**	N.S	N.S	0.65	1.15
2 Weeks	A	3.18	2.66	44.50	51.37	-7.56	-8.22	22.08	31.22	1.34	1.12	6.0	7.9
	B	3.42	2.89	47.44	52.32	-1.88	-1.04	32.13	43.17	0.83	0.76	7.9	8.9
	C	3.90	3.38	64.19	54.50	3.04	3.35	36.83	44.77	0.54	0.64	12.48	11.3
	L.S.D at 5%	NS	NS	4.048	9.175	3.866	4.304	7.914	5.184	0.328	0.101	1.12	2.19
3 Weeks	A	4.15	4.22	48.29	51.66	-1.29	-1.40	30.50	42.92	0.83	0.92	9.2	10.3
	B	5.00	5.36	49.15	45.31	2.49	2.80	39.22	29.84	0.64	0.54	11.65	12.2
	C	5.32	7.27	57.17	58.02	7.40	6.08	43.80	44.79	0.38	0.44	16.8	17.5
	L.S.D at 5%	NS	0.497	5.290	9.440	**N.S**	4.161	3.468	N.S	0.101	0.258	1.41	2.03

*** Specific Gravity Group: A = Just mature fruits, B = Optimum mature fruits, C = dvanced mature fruits**

Peel Colour Development

In general, the highest L* value (Lightness) was obtained by advanced mature fruits during the storage period. A* value (green-red) increased gradually towards the end of marketing period. Just mature fruits recorded negative values till the end of 3 weeks cold storage period, (it increased from –9.34 to –1.29 in the first season and from –9 to – 1.40) while optimum mature fruits recorded negative values for 2 weeks and advanced maturity fruits showed negative values only during the first week of cold storage(ranged between –2.02 to –2.43) and it reached the maximum positive value after 3 weeks (ranged between 6.08 to 7.40). This means that there is correlation between the enhancement of fruit colour development and maturity advance. Hence, A* value can be used as a reliable indicator for colour development of Al-phonso mango fruits. B* value (blue-yellow) increased with the advance of maturity, but there was some fluctuation in its values during storage period. Thus, we can not depend on this character as an indicator for evaluating storage period behaviour of fruits. In this respect, Jacobi *et al.* (1995) noted that mature heat treated fruits had increased skin colour development compared with immature heat treated fruits. In addition Oosthuyse(1994) reported that skin and pulp colouration increased during storage

Chemical Properties:

Total Acidity%

It is clear from table (2) that titratable acidity of Alphonso mango fruits in all stages of maturity declined gradually towards the end of storage period.

Titratable acidity of just mature fruits decreased from 1.48 – 1.53% at harvest time to 0832 –0.92% after 3 weeks of storage. Total acidity of advanced mature fruits decreased from 0.92 – 1.12% to 0.38 –0.44%. Value variation between the stage of maturity may be due to the increase of exchanges of respiration in fruits of advanced degree of maturity, which are considered as partially ripened. In this connection Kumar *et al.* (1995) pointed out that total acidity of mango fruits decreased with the increase of storage duration. These results also go in line with those reviewed by Kumar *et al.* (1995), Tandon and Kalra (1997) who noted that titratable acidity in mango fruits declined gradually towards the end of ripening period.

Total Soluble Solids

Advanced mature Alphonso mango fruits recorded the highest values of T.S.S. as compared with other stages of maturity during all storage period (ranged between 16.8-17.5 % at the end of storage period). On the contrary, the least values were attained by just mature fruits (ranged between 9.2-10.3 % at the end of storage period). However, it was also observed that optimum mature fruits had a slight increase of T.S.S. than just mature fruits (ranged between 11.65-12.2%. It is well known that fruits with slight T.S.S. accumulation, have high storability than those with high T.S.S. Thus one can conclude that just and optimum mature fruits are recommended for long storage period. In this connection, obtained results agreed with those observed by Abdul-Gofur *et al.* (1997) and by Tandon and Kalra (1997)who

stated that total soluble solid increased towards the end of storage period..

Sensory evaluation:

Firmness

Under two weeks of cold storage no change occurred in firmness degree (score 1), but after 3 weeks just mature fruits scored 2, optimum mature fruits scored 2.3 and advanced maturity fruits scored 3.6. These results confirmed those of Ashwani *et al* (1995), who stated that fruit firmness and total acidity decreased with increasing storage duration.

Chilling Injury

Data in tables (3 & 4) indicated that chilling injury did not appear for 2 weeks in all degrees of maturity under cold storage, while negligible injury appeared on just and optimum mature fruits after 2 weeks when fruits were transferred from cold storage to 22°C. After 3 weeks of cold storage, negligible chilling injury appeared on just and optimum mature fruits, while no injury appeared on advanced mature fruits, but no significant differences were detected (neither throughout the storage period). Moving fruits from cold storage to 22°C resulted in more obvious and higher score of chilling injury symptoms. The highest score (3) was attained by just mature fruits followed by optimum mature fruits (2.6), while advanced mature fruits recorded negligible chilling injury symptoms (2) at the end of marketing period, in both seasons. One can conclude that, chilling injury can not be evaluated under cold storage only, but development of symptoms during marketing period should be considered as well. The results obtained were similar to those mentioned by Zambrano *et al.* (2000), who stated that symptoms of chilling injury increased as storage duration increased. In addition, Pesis *et al.* (1999) reported that storage of mango cultivars Tommy Atkins and Keitt at 12°C caused slight chilling injury (CI) symptoms. In general, results recorded about the increase of chilling injury symptoms after moving fruits from cold storage to 22°C confirmed those obtained by Gutierrez *et al.* (1997), who stated that the appearance of chilling injury was correlated with elevated respiration rates at 25°C after prior refrigeration treatments.

Table (3): Effect of Cold Storage (10°C and 90% RH) on Firmness, Chilling Injury and Internal Breakdown of Alphonso Mango Fruits in Relation to Specific Gravity

Period	Specific Gravity*	Firmness by Hand		Chilling Injury		Break Down	
		1st	2nd	1st	2nd	1st	2nd
Initial	A	1	1	1	1	1	1
	B	1	1	1	1	1	1
	C	1	1	1	1	1	1
	L.S.D at 5%	N.S	N.S	N.S	N.S	N.S	N.S
1 Week	A	1	1	1	1	1	1
	B	1	1	1	1	1	1
	C	1	1	1	1	1	1
	L.S.D at 5%	N.S	N.S	N.S	N.S	N.S	N.S
2 Week	A	1	1	1	1	1	1
	B	1	1	1	1	1	1

	C	1	1	1	1	1	1
	L.S.D at 5%	N.S	N.S	N.S	N.S	N.S	N.S
3 Week	A	2.0	2.0	2	2	1	1
	B	2.3	2.3	2	2	1	1
	C	2.6	2.6	1	1	1	1
	L.S.D at 5%	N.S	N.S	N.S	N.S	N.S	N.S

Specific Gravity* Group: A = Just mature fruits, B = Optimum mature fruits, C = Advanced mature fruitsChilling Injury and Internal Breakdown Scored 1 - 5

Table (4): Effect of Post Storage Period on the Appearance of Both Chilling Injury and Breakdown Symptoms, Days to Ripe and Marketing Period of Alphonso Mango Fruits

Period	Specific Gravity*	Chilling Injury		Break Down		Days to Ripe		Marketing Period	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd
1 week at 10°C + 5 Days at 22°C	A	1	1	1	1	3.3	3.3	5	5
	B	1	1	1	1	3.3	3.3	5	5
	C	1	1	1	1	2.6	2.6	4.3	3.6
	L.S.D at 5%	N.S	N.S	N.S	N.S	N.S	N.S	N.S	0.272
2 week at 10°C + 5 Days at 22°C	A	1.3	1.6	1	1	3	3	5	5
	B	1.3	1.3	1.3	1.3	3	3	5	4.6
	C	1	1	2	2	2.3	2.3	3.6	4
	L.S.D at 5%	N.S	N.S	N.S	N.S	N.S	N.S	0.272	N.S
3 weeks at 10°C + 5 Days at 22°C	A	3	3	1.6	1.6	2.6	2.6	4	4.3
	B	2.6	2.6	2	2	3	2.3	5	3.6
	C	2	2	2.6	3	2.3	2.3	4	3.3
	L.S.D at 5%	0.75	0.75	1.0	0.70	N.S	N.S	N.S	N.S

- **Specific Gravity Group: A = Just mature fruits, B = Optimum mature fruits, C = Advanced mature fruits Chilling Injury and Internal Breakdown Scored 1 - 5**

Internal Breakdown

For 3 weeks of cold storage, internal breakdown phenomenon was not observed in any of the maturity stages. It was also noticeable, during marketing period, that the more maturity advanced the more internal breakdown increased. However, after 3 weeks at 10°C + 5 days at 22° C the highest score of internal breakdown was recorded by advanced maturity fruits (2.6-3), followed by optimum maturity fruits (2), then just mature fruit (1.6). The appearance of internal breakdown after removing from cold storage might be due to the sudden exposure of fruits to high temperature. These results were in line with those obtained by Lee *et al.* (1998), who pointed out that there was a close relationship between the mesocarp breakdown disorder of mango fruits and the stage of maturity. In addition, Sampaio *et al.* (1999) noted that physiological disorder internal breakdown increased with the later harvest in mango fruits

Days to Ripe

It was noticeable that after cold storage, the period necessary for ripening decreased with the advance of maturity stages and longer storage period was the less the period needed for ripening. In general, days to ripe were not less than 2.3 days (advanced maturity fruits) and they did not exceed 3.3 days (just and optimum mature fruits stored for 1 week at 10°C +

5 days at 22° C).

Marketing Period

Data in table (4) showed that the longest marketing period (per day) was obtained by just mature fruits, followed by optimum mature fruits. The marketing period of all maturity stages decreased with the increase of storage duration.

From the fore-cited results, one can conclude that fruits should be harvested at a specific gravity 1.01-1.02 (optimum mature fruits) followed by 1.0-1.01 (just mature fruits) in order to solve the problem of uneven ripening and to keep fruit quality, with minimum physiological disorder, for as long as possible during cold storage period.

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العلاقة بين درجات اكتمال النمو والقدرة التخزينية وسلوك الثمار أثناء النضج والأضرار الفسيولوجية لثمار المانجو الفونس

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حصدت ثمار مانجو الفونس عند درجات اكتمال نمو مختلفة ، قسمت إلى مجموعات على حسب الكثافة النوعية للثمار ، وذلك لتحديد العلاقة بين الكثافة النوعية ودرجات اكتمال النمو. أثبتت صفات جودة الثمار مثل قيم (a) ، درجة ونسبة النضج ، نسبة المواد الصلبة الذائبة الكلية ، والحموضة الكلية أن الكثافة النوعية تعتبر مؤشر يمكن الاعتماد عليه لتحديد درجات اكتمال نمو ثمار المانجو الفونس. يجب أن تجمع الثمار عند كثافة نوعية ١,٠١ – ١,٠٢ (الدرجة المثلى لاكتمال النمو) ثم ١ – ١,٠١ (أول مراحل الوصول لاكتمال النمو) وذلك للتغلب على مشكلة عدم إنتظام نضج بعض الثمار والاحتفاظ بجودة الثمار وتقليل الأضرار الفسيولوجية. يجب أن لا تخزن ثمار المانجو الفونس أكثر من ثلاثة أسابيع على درجة حرارة ١٠ درجة مئوية وذلك لتجنب ظهور أعراض شديدة لأضرار البرودة والانهيار الداخلى أثناء فترة التسويق.

Table (1): Effect of Acetylene Gas on Ripening Behaviour of Alphonso Mango Fruits in Relation to Specific Gravity

Specific Gravity	Physical Properties								Chemical Properties				Sensory Evaluation					
	Weight Loss %		"L" Value		"a" Value		"b" Value		Total Acidity %		TSS %		Stage of Ripening		Ripening %		Break Down	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
At Harvest																		
0.8 – 0.9	-	-	43.74	37.53	-13.77	-11.03	24.03	17.71	2.01	2.01	4.9	5.6	1	1	-	-	1	1
0.9 – 1.0	-	-	40.12	43.01	-10.80	-10.78	24.06	19.09	1.75	1.702	5.5	5.8	1	1	-	-	1	1
1 – 1.01	-	-	40.30	41.78	- 9.73	-11.43	17.19	24.41	1.53	1.48	6.0	6.3	1	1	-	-	1	1
1.01 – 1.02	-	-	43.07	49.60	- 8.56	- 8.45	19.87	37.01	1.39	1.34	6.8	7.2	1	1	-	-	1	1
1.02 –1.03	-	-	44.50	44.27	- 7.56	- 6.68	22.08	24.41	0.92	1.12	7.9	8.5	2	2	-	-	1	1
1.03	-	-	45.17	52.15	- 4.72	- 6.10	29.01	35.77	0.76	0.64	8.5	9.7	3	2	-	-	1	1
L.S.D at 5%	-	-	3.672	5.655	1.909	2.885	6.435	2.885	0.223	0697	0.82	1.397	NS	NS	-	-	NS	NS
After 5 Days From Ripening Treatment																		
0.8-0.9	2..2	2.6	46.42	43.01	-11.81	-10.78	36.6	40	1.34	1.34	7.9	6.8	1	1	26.88	19.09	1	1
0.9 – 1.0	3.9	4.1	50.00	52.28	- 2.01	- 2.27	66.6	66.6	1.288	1.12	10.7	9.3	2	2	34.88	31.89	1	1
1 – 1.01	3.6	3.2	52.66	46.78	3.73	2.96	73.3	70	0.92	0.832	13.5	13.0	3	3	36.23	34.95	1	1
1.01 –1.02	4.0	3.3	51.17	37.91	4.07	3.53	86.6	86.6	0.54	0.54	14.00	13.3	3	3	39.38	34.60	1	1
1.02 –1.03	5.2	5.6	55.26	48.07	5.77	4.31	100	96.6	0.38	0.44	16.1	16.8	4	4	41.30	34.77	1	1
1.03	8.1	7.7	56.14	53.74	8.98	8.68	100	100	0.33	0.38	19.7	19.2	5	5	41.71	39.26	2	2
L.S.D at 5%	1.164	1.302	4.852	N.S	5.309	3.801	7.913	9.402	0498	0622	1.026	0.804	1.371	1.371	5.509	10.41	N. S	N. S