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BIOCHEMICAL CHANGES IN GUAVA FRUITS DURING STORAGE AS AFFECTED BY DIFFERENT METHODS OF HARVESTING FROM DIFFERENT POSITION OF TREE

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ABSTRACT: A study was carried out on the effect of position of the canopy and different methods of harvesting of guava to evaluate its chemical as well as mineral quality at the different period of storage. Matured healthy fruits of guava cv. 'Pant Prabhat' with uniform size were harvested with and without peduncle and with one leaf pair with the help of secateur to analyze the post harvest behaviour of fruit after three and seven days of storage. Time of maturity was influenced by position of fruits. Fruits from lower tree canopy mature earlier than rest of the canopy. There was also a variation in chemical as well as mineral quality between different canopy positions on tree. Calcium and potassium contents were higher in upper canopy positions than lower canopy fruits. Fruits should be harvested lower layer of fruit tree canopy for better quality as well as storage. Therefore, at the time of harvesting guava the pedicel should remain attached to its fruit for better storage quality.

Keywords : *Guava, canopy, biochemical changes, storage.*

Guava is an important fruit crop grown widely in tropical and subtropical regions of the world. Although, quite inexpensive in countries of its production, guava is a delicious fruit which is very nutritious and exceptionally rich in ascorbic acid and several minerals useful for human health (Tandon and Chandha, 11; Wilson, 13). To those fruit lovers who familiarized with its penetrating aroma, guava is considered as one of the most detectable and fascinating fruits (Menzel, 8). Besides its exceptionally high nutritive values, guava is also prolific and regular bearer that could produce fruit year round. Position on the tree has been found to influence fruits in many fruit crops, *e.g.,* guava, grapefruit, mango, peach, pear etc. The quality of guava fruits depends on maturity at which fruits were harvested and ultimately storage behaviour. The effect of canopy position on fruit quality revealed that fruits on top positions are more susceptible to diseases than lower and middle canopy fruits (Wallace, 12).

Considering the above facts, present investigation was under taken to assess effect of different methods of fruit harvesting from various positions of tree canopy on fruit quality of guava cv. 'Pant Prabhat' during storage.

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MATERIALS AND METHODS

A study was under taken at the Horticultural Research Centre, Patharchatta with guava cultivar Pant Prabhat, during the year 2009. The trees were divided into three layers-upper, middle and lower. Twenty fruits were harvested from each layer by different methods; with peduncle, without peduncle and with one leaf pair. The uniform size fruits were harvested from each position of trees from winter season crop. The harvested fruits of each category were divided into 3 lots. The design for experimentation was randomized design with nine treatments, three replications and 5 fruits per replication were taken. Just after harvesting one lot of fruits was analyzed and rest lots were stored at room temperature of 24 ± 2°C with relative humidity of 70-75 per cent. The remaining two lots were analyzed after 3 and 7 days of storage, respectively to assess the ripening behaviour and post harvest changes in chemical and mineral properties of the fruits. The total soluble solids concentration (T.S.S. %) was determined with the help of hand refractometer and results were expressed in terms of °Brix. The total pectin content was estimated for fruits as calcium pectate by the methods described by Ranganna (9). The ascorbic acid content was

estimated by 2,6-diochlorophenol indophenols dye expressed in terms of magnessium of ascorbic acid per 100g of fruit pulp (Ranganna, 9). Potassium content in fully ripened guava fruits was imated in percentage through procedure discussed by Ranganna (9). Magnesium and calcium content in guava fruits was precipitated as magnesium ammonium phosphate and calcium pectate. The data was analyzed statistically by analysis of variance (Fedrer, 3).

RESULTS AND DISCUSSION

Total soluble solids among the various treatments (Table 1) showed significant variations. Lower canopy fruits were found better in T.S.S content as compared to upper or middle canopy fruits. Maximum T.S.S. (9.83°Brix) was found in upper canopy fruits with peduncle at harvesting (T_2) and followed by 9.67° Brix in upper canopy fruits without peduncle at harvesting (T_1). While, minimum T.S.S. content of 7.93° Brix was found in treatment T_1 (upper canopy fruits without peduncle at 7 days of storage) and followed by 8.00° Brix in upper canopy fruits with peduncle at 3 days of storage (T_2).

The quantity and quality of fruits were significantly affected by the position of the fruits on the tree. The outside fruits had significantly higher T.S.S. and lower per cent of acid than the inside fruits. This resulted in higher T.S.S. acid ratios for the outside fruit than fruit from inside. Generally fruits from the top canopy positions have the lowest per cent of acid values. Total soluble solids were higher in fruits from the middle sector than from the remaining sectors and per cent juice showed no consistent pattern that can be associated with canopy position. The fruits from shaded portion that is middle and lower canopy of the tree contained both greater soluble solids and starch reserves while lower acidity in fruits. These results are in accordance with the findings of Barritt *et al*. (1) and Syvertsen and Albrigo (10).

The data (Table 1) on pectin content shows that pectin content (%) differed significantly among the treatments. Maximum pectin content (0.97%) was found in upper layer fruits with one leaf pair just after harvesting (T_3) and followed by 0.87% in upper layer fruits with one leaf pair at 3 days of storage (T_1). However, minimum pectin content (0.23%) was in middle layer fruits with peduncle at 7 days of storage (T_5) followed by 0.30% in lower layer fruits without peduncle at harvesting (T_7).

The data in Table 2 show that the variation in magnesium concentration differed significantly among the various treatment combinations. Maximum percentage (1.50%) of magnesium content was found in lower canopy fruits with one leaf pair at harvesting (T_9) followed by 1.47% in lower canopy fruits with one leaf pair after 3 days of storage (T_9). While, minimum percentage (0.10%) of magnesium content was found in middle canopy fruits with peduncle at harvesting (T_5) followed by 0.10% in middle canopy fruits with one leaf pair after 7 days of storage (T_6).

Fruiting position within the tree canopy has direct effect on fruit mineral content and quality. Fruits in the lower canopy have been mainly shown to have higher calcium concentrations but lower magnesium and potassium concentrations than in fruits from upper canopy. The fruit position on the outside of the canopy also accounted for substantial variation in mineral composition. It was observed that the fruits on terminals had higher average calcium and magnessium content. These results are in accordance with the findings of Ferre and Palmer (4) and Jones *et al.* (7).

The data presented in Table 2 show that potassium concentration (%) differed significantly among the various treatment combinations during storage. Maximum percentage (1.27%) of potassium concentration was recorded in lower region fruits with peduncle at harvesting (T_8) followed by 1.23% in lower region fruits with one leaf pair at harvesting (T_9). However, minimum percentage of potassium concentration 0.12% was observed in middle region fruits with peduncle after 3 days of storage (T_4) followed by 0.17% in middle region fruits with peduncle at harvesting (T_4).

Table 1: Effect of fruit positions and methods of harvesting on T.S.S. and pectin content of guava cv. Pant Prabhat during storage.

Treatment	Total soluble sugar (°B)			Pectin content (%)		
	At harvest	After 3 days	After 7 days	At harvest	After 3 days	After 7 days
T_1	9.67	8.40	7.93	0.37	0.87	0.17
T_2	9.83	8.00	8.07	0.47	0.57	0.33
T_3	9.57	8.00	8.40	0.97	0.30	0.27
T_4	8.70	7.93	8.70	0.30	0.63	0.23
T_5	8.40	8.07	8.40	0.57	0.37	0.23
T_6	8.07	8.40	8.07	0.43	0.57	0.37
T_7	8.83	8.23	8.67	0.30	0.60	0.47
T_8	7.93	8.00	8.90	0.63	0.60	0.53
T_9	8.83	8.40	8.83	0.33	0.57	0.60
CD (P = 0.05)	0.53	0.23	0.59	0.34	0.17	0.21

Table 2: Effect of fruit positions and methods of harvesting on magnesium content of guava cv. Pant Prabhat during storage.

Treatment	Magnesium (%) in fruits			Potassium (%) in fruits			Calcium (%) in fruits		
	At harvest	After 3 days	After 7 days	At harvest	After 3 days	After 7 days	At harvest	After 3 days	After 7 days
T_1	0.90	0.71	0.60	0.80	0.60	0.70	1.00	0.64	0.72
T_2	0.20	0.62	0.69	0.80	0.70	0.60	0.77	0.72	0.60
T_3	0.57	0.40	0.50	0.53	0.61	0.62	0.60	0.71	0.64
T_4	0.34	0.54	0.59	0.17	0.12	0.27	0.24	0.64	0.53
T_5	0.10	0.16	0.19	0.27	0.25	0.42	0.77	0.27	0.58
T_6	0.10	0.26	0.10	0.43	0.18	0.50	0.50	0.70	0.72
T_7	1.37	1.38	1.02	0.60	0.70	0.53	1.13	0.62	1.36
T_8	1.37	1.04	1.00	1.27	1.22	1.20	1.53	1.24	1.27
T_9	1.50	1.47	1.28	1.23	1.01	1.02	1.57	1.40	1.40
CD (P = 0.05)	0.18	0.16	0.15	0.19	0.12	0.10	0.20	0.18	0.19

The fruits developed under high light conditions were larger and had lower concentration of potassium and magnesium while the fruits developed under low light conditions were smaller but had higher amount of potassium and magnessium. It was also observed that the potassium concentration in shaded fruits was slightly higher than unshaded fruits, although, they were smaller in size. Thus, it was concluded that fruits from the upper parts of the canopy had a lower potassium content and susceptible to diseases than the fruits from the middle or lower parts of the tree canopy. These results are in accordance with the findings of Jackson *et al.* (5).

The data (Table 2) show that calcium concentration (%) differed significantly among the various treatment combinations during storage of 7 days. Maximum percentage (1.57%) of calcium content recorded was in lower canopy fruits with one leaf pair at harvesting (T_9) followed by 1.40% in lower canopy fruits with one leaf pair at 3 days of storage (T_9). Whereas, minimum percentage of calcium content (0.243%) was observed in middle canopy fruits without peduncle at harvesting (T_4) followed by 0.27% in middle canopy fruits with peduncle after 3 days of storage (T_5).

All elemental concentration were higher in bottom canopy fruits than the upper position. Reductions from bottom of the canopy to the top

were greatest for N (-32%), Zn (-27%), Ca (-20%), and Fe (-19%). These results are in conformity with the findings of Barritt *et al*. (1).

Differences in positions have pronounced effects on almost all aspects of fruit quality. There was also an adverse effect of shading on fruit size, mineral composition, yield and quality. The effect of light on fruit colour may be due to its influence on fruit nitrogen and carbohydrate concentrations and directly on anthocynin formation in the skin. The fruits developed under high light conditions were larger and had lower concentration of calcium while the fruits developed under low light conditions were smaller but had higher amount of calcium. Thus, it was concluded that the fruits from the upper parts of tree canopy had a lower calcium content and susceptible to diseases than the fruits of similar size from the middle or lower parts of the tree canopy. These results are in accordance with the findings of Farhoomand *et al.* (2) and Jackson *et al.* (5).

In conclusion, substantial variation was observed in chemical and mineral contents of fruits located on different positions of tree canopy. This study suggests that the fruits from bottom and middle canopy are better in quality aspects either chemical or mineral. Although there are some positional differences on fruit quality from different canopies of tree, but the fruits from upper canopy were good in colour texture only and some mineral content. Thus the fruits from middle and lower canopy should be preferred better in storage quality as well as mineral and chemical quality.

REFERENCES

1. Barritt Bruce, H., Rom, Curt, R., Guelich, Kurt, R. and Drake, S.R. (1987). Canopy position and light effects on spur, leaf and fruit characteristics of Delicious Apple. *Hort. Sci.,* **22:** 402-405.
2. Farhoomand, M.B., Patterson, M.E. and Chu, C.L. (1977). The repening pattern of Delicious' apples in relation to position on the tree. *J. Amer. Soc. Hort. Sci.,* **102:** 771-779.
3. Federer, W.T. (1977). Randomized complete block design. In *Experimental Designs*. Oxford and IBH Publishing Co. New Delhi. 86 pp.
4. Ferre, D.C. and Palmer, J. W. (1982). Effect of spur defoliation and ringing during bloom in fruiting, fruit mineral level and net photosynthesis of 'Golden Delicious' apple. *J. Amer. Soc. Hort. Sci.,* **107:** 1182-1186.
5. Jackson, J. E., Perring, M. A., Sharples, R. O. and Palmer, J.W. (1977). Effects of shade on growth and cropping of apple trees. Effects on fruit growth, chemical composition and quality at harvest and after storage. *J. Hort. Sci.,* **52:** 267-282.
6. Jackson, J. E., Sharples, R. O. and Palmer, J. W. (1971). The influence of shade and within tree position on apple fruit size, colour and storage quality. *J. Hort. Sci.,* **46** : 277-287.
7. Jones, H.G., Palmer, J.W., Rom, C.R. and Mackenzie, K.A.D. (1991). Water relations of 'Wijcik Mcintosh' apple trees. *J. Hort. Sci.,* **66 :** 322-317.
8. Menzel, C. M. (1985). Guava is an exotic fruit with potential in Queensland. *Queensland Agri. J.,* **111**(2) : 93-98
9. Ranganna, S. (1986). *Handbook of analysis and quality control of fruits and vegetables products*. 2nd Ed. New Delhi. Tata Mc Grow Hill Publishing Company Ltd. 19 pp.
10. Syvertsen, J.P. and Albrigo L.G. 1980. Effects of grapefruit tree canopy position on microclimate, yield and juice quality. *J. Amer. Soc. Hort. Sci.,* **105** (3) : 454-459.
11. Tandon, D.K. and Chadha, K.L. (1994). Physico-chemical characteristics of some guava varieties. *Prog. Hort.,* **15 :** 42-44.
12. Wallace, T. (1953). Some positions factors affecting the core in McIntosh apples. *J. Amer. Soc. Hort. Sci.,* **47 :** 67-74.
13. Wilson, C.W. (1980). *Guava.* S. Nagy and P. E. Shaw(eds), Tropical and sub tropical fruits: Composition and properties and values.AVI, Westport, CT. p. 279-299.