

Physiochemical Variation in Fruits of Different Kinnow Mandarin Trees

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Abstract

Kinnow fruits have special importance due to its flavours and nutritional value. It is rich source ascorbic acid with fair amount of vitamins and minerals. Maximum average length (5.61 cm) of fruits and fruit diameter (6.90 cm) was noted in tree No. 6. Minimum average length of fruit (5.00 cm) and fruit size (5.83 cm) was observed in tree No. 2. Maximum numbers of fruit/plant were recorded at tree No. 2 (123 fruit/plant), whereas tree No. 6 showed minimum number of fruits/plant and maximum average fruit weight i.e. 134.00 g. Maximum fruit juice percentage i.e. 53% observed at tree No. 6. While, the lowest juice percentage i.e. 36.7% was found at tree No. 2. The TSS of kinnow fruit ranged from 9.20—11.50 and acidity ranged from 0.865—0.980% among the 12 trees. Maximum acidity of fruit i.e. 0.980% were analysed in Tree No. 6, while minimum acidity content i.e. 0.86% were noted in tree No. 2. Maximum TSS/acidity ratio (13.29). Total sugar content (7.93%) and reducing sugar content i.e. 3.17% were noted at tree No. 2. However, minimum TSS/acidity ratio, total sugar content and reducing sugar content were estimated in tree No. 6.

Key words : Citrus, TSS/acidity ratio, Total sugar, Reducing sugar.

Citrus is an important genus of the family rutaceae in the plant kingdom. Its importance is demonstrated by its wide distribution and large scale production. Citrus fruits have special importance due to its distinct flavours and therapeutic value. Kinnow is an important citrus fruit used as fresh and now being processed too. It is rich in ascorbic acid with fair amount of vitamin A and B. Beside this, citrus fruits are rich source of minerals (Ca, Mg, and Fe). The juice is refreshing, delicious and soothing (1, 2). Along with their consumption as fresh fruit a large number of products and by-products are prepared and marketed with high priced (3). The cultivation of kinnow has been taken up at commercial scale in North-India, and subtropic region of Jammu and Kashmir state has quite progressively participated. It occupies about 10% area of Jammu sub-tropics. Progressive farmer prefer to grow kinnow due to its high yielding character, good processing quality fresh consumption, aromatic flavor and better adaptation of agro-environmental conditions (1) that possesses the potential to give the lucrative return in the form of profit (3). In orchard field soil does not have similar nutrient

concentration in entire field. For this reason, same cultivar plant/tree does not perform similarly on the basis of yielding and fruit size due to nutrient availability. There is no available information on fruit quality in different trees of one cultivars in the same orchard.

Methods

The studies were carried out at the rainfed research sub-station for subtropical fruits of S. K. University of Agricultural Sciences and Technology-Jammu at Raya, during 2000. Twelve kinnow mandarin tree were selected for fruit yield, fruit size and quality of fruits. Length and fruit size were recorded with the help of Vernier's calliper. Juice was estimated on fresh fruit weight basis to extracted filtered juice expressed in percent. Ten proximal fruits were pooled from all the three replications and analyzed for various biochemical parameters at time of harvesting. Acidity (percent anhydrous citric acid per 100 ml) of the extracted juice was determined by titrating 5 ml of juice against N/10 NaOH using phenolphthalein as an indicator. Total soluble solids (°Brix) were calculated using a

Table 1. Yield and yield attributing character of kinnow mandarian fruits.

Tree no.	Length of fruit (cm)	Diameter (cm)	No. of fruits	Fruit weight (g)
1	5.16	6.16	108	112
2	5.00	5.83	123	98
3	5.41	6.76	92	129
4	5.06	5.90	114	104
5	5.21	6.29	103	116
6	5.56	6.90	89	134
7	5.13	5.94	111	110
8	5.02	5.89	118	101
9	5.23	6.35	102	118
10	5.20	6.17	107	115
11	5.24	6.59	98	125
12	5.12	5.93	113	108
Range	5.00-5.56	5.83-6.90	89-123	98-134
Mean	5.28	6.36	106	116

hand refractometer (Erma, Japan). The total sugar and reducing sugar content in fruits was estimated spectrophotometrically using DNS reagent as per the method of Sadasivam and Manikam (4).

Results and Discussion

Average Length of Fruits. Length and diameter of fruits is a horticultural trait of immense importance. The results showed significant difference among the various trees. Maximum average length of fruits i.e. 5.61 cm. recorded at tree No. 6 followed by tree No. 3 and tree No. 11 having 5.41 cm and 5.24 cm, respectively. However, the lowest average length of fruit (5.00 cm) were noted at tree No. 2 (5.00 cm) and at par with tree No. 8 (Table 1).

Fruit Diameter. Fruit diameter is of commercial importance for citrus fruits marketing and trade/business. It is generally considered that in citrus with excessive increase in size the quality impaired, while on the other side small size fruit are of low quality on the basis of two year pooled data, maximum fruit diameter (6.90) was found in tree No. 6 followed by tree No. 8 tree No. 11 and tree No. 9 with a fruit diameter of 6.76, 6.59 and 6.35 respectively. The minimum fruit size of 5.83 was observed in tree No. 2 (Table 1). The fruit size of citrus which is agreement with the findings of Newaz et al. (3) who had reported the range of citrus fruit 66.52—71.20 mm.

Table 2. Juice, TSS, acidity content and TSS/acidity ratio in 12 kinnow mandarian fruits.

Tree no.	Juice (%)	TSS (%)	Acidity (%)	TSS/ acidity ratio
1	43.2	10.67	0.933	11.43
2	36.7	11.50	0.865	13.29
3	49.8	9.59	0.972	9.86
4	38.6	11.06	0.906	12.20
5	46.5	10.47	0.943	11.10
6	53.0	9.20	0.980	9.38
7	42.6	10.76	0.927	11.60
8	37.7	11.34	0.881	12.87
9	46.7	10.37	0.948	10.93
10	45.9	10.56	0.938	11.25
11	48.8	10.02	0.958	10.45
12	40.9	10.86	0.924	11.71
Range	36.7-53.0	9.20-11.50	0.865-0.980	9.38-13.29
Mean	44.85	10.35	0.922	11.33

Number of Fruits Plant. Yield is a horticultural trait of immense importance. The data (Table 1) for yield was taken by counting of total number of fruit harvested per plant. The number of fruit harvested per plant. The number of fruit ranged from 89—123. Maximum numbers of fruit/plant were recorded at tree No. 2 (123 fruit/plant) followed by tree No. 8 (118 fruit/plant). However, minimum number of fruit/plant i.e. noted at tree No. 6. Similar findings were reported by Newaz et al. (3).

Average Fruit Weight. The data on fruit weight showed significant variation (Table 1). Graphically showed maximum average fruit weight i.e. 134.00 g in tree No. 6 at par with tree No. 3 followed by tree No. 11 and tree No. 9 with 125.00 and 118.00 g respectively. However, minimum average fruit weight i.e. 98.00 g was observed at tree No. 2. The results were found to be in agreement with that of Saraswathi et al. (5).

Juice Percentage. Juice is an extremely important parameter for its industrial processing, being also related to size, which in turn, although determined by the genetic characteristics of each cultivar, but is affected by cultural practices. The results showed significant differences for fruit juice percentage among the various trees. Table 2 shows that highest fruit percentage i.e. 53% was observed at tree No. 6 followed by tree No. 3 and tree No. 11, with a juice percentage of 49.8 and 48.8%, respectively. Tree No. 9 and tree No. 5 were at par statistically with each other. While, the lowest juice percentage i.e. 36.7% was

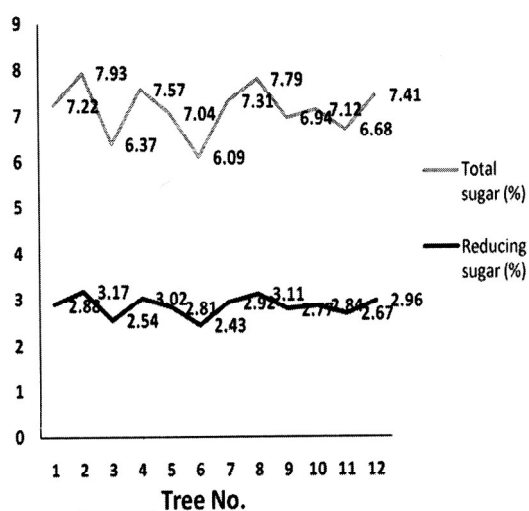


Figure 1. Total sugar and reducing sugar (%).

found at tree No. 2. Results regarding juice percentage were found to be in consonance with that of Mathew et al. (2).

Total Soluble Solids (TSS %). Total soluble solids measurement is considered to be an important parameter of fruit quality of citrus fruits. Observations were pooled of both years and processed for statistical analysis. The TSS of kinnow fruit ranged from 9.20—11.50 among the twelve trees. Maximum TSS content i.e. 11.50 recorded at tree No. 2 followed by tree No. 8, tree No. 4 and tree No. 7 with a TSS of 11.34, 11.06 and 10.76% (Table 2), while the minimum TSS (9.20%) was observed at tree No. 6. It is clear from the data that TSS content among the trees showed significant variation.

Acidity. The information procured for the determination of acidity in fruits showed significant results of fruit analysis. The acidity ranged from 0.865—0.980%. The maximum acidity of fruit i.e. 0.980% was analyzed in Tree No. 6 followed by tree No. 3 (0.972%), tree No. 11 (0.958) and tree No. 9 (0.948%), while minimum acidity content i.e. 0.86% were noted in tree No. 2 (Table 2). The result related to acidity percentage of fruit were found to be in closed agreement with the Newaz et al. (3).

TSS/Acidity Ratio. TSS/acidity ratio is an impor-

tant processing quality parameter. Maximum TSS/acidity ratio i.e. 13.29 was noted at tree No. 2, followed by tree No. 8 (12.87) and tree No. 4 (12.20). However, minimum TSS/acidity ratio i.e. 9.38 was observed at tree No. 6 (Table 2).

Total Sugar (%). Total sugar was determined and the data were statistically analyzed. The maximum total sugar content i.e. 7.93% was noted in at tree No. 2, followed by tree No. 8, tree No. 4 and tree No. 12 with TSS/acidity ratio i.e. 7.97, 7.57 and 7.41%, respectively. However, minimum i.e. 6.09% were noted at tree No. 6 (Fig. 1). The results regarding sugar contents were found similar with the findings of Newaz et al. (3).

Reducing Sugar (%). The reducing sugars showed significant results among 12 trees of kinnow mandarin (Fig. 1). Sugars are an important parameters of quality measurement in citrus fruits as they are main and ready source of energy when used by human. So keeping this aspect the sugars of fruits were analyzed among 12 trees. Maximum reducing sugar content i.e. 3.17% were noted at tree No. 2, followed by tree No. 8 and tree No. 4, with reducing sugar 3.11 and 3.02%, respectively. However, minimum reducing sugar content i.e. 2.43% were analysed at tree No. 6. Tree No. 1 (2.88%), tree No. 7 (2.92%), tree No. 10 (2.84%) were recorded to be statically at par. These results were found to be in agreement with that of Newaz et al. (3).

References

1. Ahmed W. M. A., M. Pervez, M. Amjad, C. M. Khalid, Ayyub and M. A. Newaz. 2006. Effect of stionic combinations on the growth and yield of kinnow mandarian (*Citrus reticulata* Blanco). *Pak. J. Bot.* 38 : 603—612.
2. Mathew W. F. and F. S. Davis. 2002. Gibberallic acid application timing affects fruit quality of processing oranges. *Hort. Sci.* 37 : 353—357.
3. Newaz M. A., A. Waqar, S. Ahmad and M. Khan. 2008. Role of growth regulators on pre harvest fruit drop, yield and quality in Kinnow mandarian. *Pak. J. Bot.* 40 : 1971—1981.
4. Sadasivam S. and A. Manikam. 1996. Bio-chemical methods, New Age Int. (P) Ltd. Publ.
5. Saraswathi T., P. Rangasamy and R. S. Azhakimavalan. 2003. Effect of pre-harvest spray of growth regulators on fruit retention and quality of mandarins (*Citrus reticulata* Blanco). *South Ind. Hort.* 51 : 110—112.