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Studies on utilization of small size kinnow fruits for preparation of squash

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Abstract

Kinnow mandarin is an important fruit crop of sub-tropical and hot arid region. It is being grown in about 6500 ha in western parts of Rajasthan where irrigation facilities are available. It is sour- sweet in taste and fruits are available during November to January months. The fruit is generally used for fresh consumption and juice preparation. The post harvest losses in kinnow fruits has been faced by growers because of improper marketing and processing. The under size fruits are not suitable as such for fresh consumption because of small size and low percentage of juice recovery. The selling price of such fruits is also low in the markets. Therefore, the under sized kinnow fruits can be properly utilized for value addition purpose. The small sized unmarketable kinnow fruits can be used for making juice and ready-to- serve drinks. The physico-chemical characters of under size and normal fruits and its post harvest utilization studies were carried out at CIAH, Bikaner during 2010-11.

The fruits were cut down in halve and juice was extracted by juicer. The recovery of juice was 35-40 per cent. To the filtered juice, sugar @ 700 g per litre of juice was added to prepare the delicious drink. The squash was stored in bottle at ambient temperature for a period of 45 days with and without mixing of KMS as preservative. Organoleptic testing was done at 15 days interval with a panel of ten people on score basis. The squash was mixed with water in ratio of 30:70 for sensory evaluation of product. The sensory evaluation revealed that squash mixed with 30: 70 ratio water was acceptable by the panel of judges. In this paper, post harvest utilization of undersized kinnow mandarin fruits for value addition has been discussed.

Key words: *Kinnow mandarin, Juice, Value addition, Squash, Undersized fruits, storage, physico chemical properties*

Introduction

Kinnow, a mandarin hybrid of King orange (*Citrus nobilis* Lour) and Willow leaf mandarin (*Citrus deliciosa* Tenore), belongs to the family Rutaceae. Among the citrus species kinnow is an economically important sub-tropical fruit, which is grown almost all over the arid and semi-arid regions of India, where assured irrigation facilities are available. In view of its prolific bearing quality coupled with relative tolerance to diseases and pests. Kinnow has gained popularity amongst the growers and now, it is commercially cultivated in Punjab, Haryana, Rajasthan and to some extent in the states of H.P., Karnataka and Tamil Nadu.

It is one of the most important fruit because of its pleasant flavor, juicy and sour-sweet taste. It is a sub acidic fruit, freshly eaten and also used for preparing commercial pectin, refreshing drink and in making cosmetics (Bose and Mitra, 1996). The composition of citrus fruit juice is beneficial with respect to its mineral and ascorbic acid contents. In Rajasthan, total area under fruit crops is 30,601 ha with a production of 5,00,171 MT. In kinnow cultivation, Sri Ganganager district is on prime position with 6500 ha area and 143000 MT production followed by Hanumagrah and Bikaner district of north- west Rajasthan (Anonymous, 2010).

Kinnow fruits are not only delicious and refreshing but also have great nutritive value and used as a dessert fruit. It contains 20-30 mg/100g vitamin C, 11.5 to 13.5% T.S.S., 0.50-.56% acidity, 87.8% moisture, 50.0 mg calcium, 20.2 mg phosphorus and 100 mg iron. Presently 95% of the production goes for fresh fruit market and due to poor post harvest infrastructure wastage of kinnow is around 25-30% and only 5% of the total production is processed presently (Ahmed *et al.*,2008). There is a great potential to use this fruit in value added products such as diet drinks. Thus, in order to fully utilize the high production of kinnow, the only alternative is to make it feasible to process it into juice and other juice based products. The proper attention has not been given on post harvest utilization and marketing of kinnow fruits which is being faced by the kinnow growers for successful and profitable production. However, very limited information is available on the post harvest utilization of kinnow fruits and particularly no work has been conducted for utilization of under size and unmarketable fruits which is about 15-20% of the produce. Therefore, it seems essential to find out the way of utilization of small size kinnow fruits which is unmarketable and considered waste in arid parts of western Rajasthan.

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Material and Methods

The experiment on post harvest utilization of small size kinnow fruits was carried out at CIAH, Bikaner during 2010-11. The undersized fruits were sorted out from freshly harvested fruits which were not sold from produce. The morphological and physiochemical characters of fruits were recorded. Fruits were washed in tap water and cut into halves to extract juice by small juice extractor. Juice was filtered and used for preparation of squash. TSS and acidity was estimated as per standard procedure described by Rangana (1991). The squash was prepared during last week of December and stored in clean glass bottles in refrigerator at 7^0 C for organoleptic testing. The sensory evaluation of squash was carried out at 15 days interval. TSS was observed of the drink at every time of testing. Hedonic scale method was used for the organoleptic evaluation of drink for colour, flavour, taste and appearance by a panel of 10 person at 0, 15, 30, 45 and 60 days storage period. The mean data of 10 people was assessed for sensory evaluation of drink prepared.

Results and Discussion

The data on morphological characters of normal and under size fruits has been presented in Table-1 which revealed that the undersized fruit are comparable with normal size fruit w.r.t. TSS, acidity, ascorbic acid, reducing and non reducing sugars contents. However, they differ with respect to size, fruit weight, peel weight and seed content. It is clear from data that quality of fruit is good except morphological characters of fruits. Since the preference in market for fresh consumption is large size fruits, these small sized fruits are treated as waste and unmarketable.

The data on organoleptic testing of squash is presented in Table 2. The colour of product is an important character of any value added product. The initial colour of product was dark orange and attractive to lure consumers. The maximum scores (7.56) for colour was observed when it was fresh. Storage had an effect on colour perception of drink. As the storage period increased, a slight decline in colour score was observed. The gradual loss in colour over the entire period was due to action of different kinds of enzymes present in the drink. The minimum score for colour was obtained at 60 days of storage *i.e* .6.10, which showed the decrease in quality of product. Hence based on colour, the squash was rated high upto 45 days of storage. The change in colour during storage of beverage has been reported by Jain *et al* (2003).

In addition to colour, flavour also has a key role in sensory evaluation. The highest score (7.83) was accorded to the squash on 15th day of storage. Its flavour scored high upto 45 days after storage and then its score declined to 6.80. The finding is similar with the earlier results on sensory evaluation of ready to serve drink prepared from kinnow juice (Kaushik and Rajorhia, 1998)

The appearance of product was attractive in packed glass bottle at fresh stage and then it declined gradually during storage period. The appearance of fresh squash was dark orange and scored highest (7.54) by the panel of evaluator. Thereafter, a decreasing trend in score was recorded with increase in the storage period. The minimum score was recorded at 60 days of storage and discarded. Sweetness character of drink was also recorded similar trend as for appearance. The appearance and taste of ginger blended squash was good. Similar trend was also observed by Nath and Yadav (2002).

TSS of squash was monitored periodically but there was a marginal decrease in TSS of squash during storage period. The colour and acceptability of drink gradually declined with increasing period of storage. This may possibly be due the chemical reactions in carbohydrates and different type of acids. During storage, physico-chemical changes are common in any value added product. The findings is similar with the results reported by Jain *et al.* (2003) and Singh *et al.* (2007).

Thus, based on the above parameters, it can be argued that acceptability of kinnow squash was highest when it was fresh. However, the acceptability remained high upto storage period of 45 days, but by 60 days it had poor acceptability.

The sensory evaluation was indicative of high acceptance of product. By this way, small undersized fruits can be utilized for making delicious drink. Further, it can be stored up to 45 days under refrigerated condition without major change in quality of product.

Table 1: Morphological and physiochemical characters of kinnow fruits

Fruit Characters	Fruit weight (g)	Fruit length (cm)	Fruit width (cm)	No. of sac	No of seed/ fruit	Peel weight g.	Juice %	TSS ^{0}Brix	Acidity %	Ascorbic acid (mg/ 100g)	Total sugar %	Reducing sugar	Non reducing sugar
Normal fruits	136.20	5.45	5.85	9.6	6.8	40.10	44.0	11.0	0.68	23.50	6.88	3.48	3.40
Under size fruits	44.63	3.96	4.31	9.4	11.2	13.50	37.5	11.4	0.70	20.26	6.50	3.24	3.26

Table 2: Sensory evaluation of squash prepared from small size kinnow fruits on score basis (out of 10 marks).

Storage	Colour	Taste	Appearance	Sweetness	Flavour	Acceptability
0 day	7.56	7.78	7.54	8.05	7.95	8.25
15days	7.45	7.83	7.45	7.99	7.72	8.05
30days	7.49	7.82	7.20	7.73	7.97	7.89
45days	7.00	7.00	6.60	7.60	7.92	7.80
60days	6.10	6.80	6.00	7.20	7.00	6.80

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