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Studies on the storage life of Bael (*Aegle marmelos* Correa)

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ABSTRACT

The present investigation was carried out on five genotypes of bael, namely, Kaghzi Gonda, Kanpur Local, Basti No. 1, Faizabad Local and Kaghzi Etawah. Physiological weight loss, total soluble solids and spoilage were increase while acidity was decrease of all five genotypes with the storage period. Kaghzi Gonda exhibited higher percentage of weight loss followed by Kaghzi Etawah, Kanpur Local, Faizabad Local and Basti No. 1. Kaghzi Gonda showed highest total soluble solids followed by Kaghzi Etawah, Kanpur Local, Faizabad Local and Basti No. 1. Kaghzi Etawah revealed maximum loss in acidity followed by Kaghzi Gonda. Kaghzi Gonda exhibited maximum spoilage followed by Kaghzi Etawah, Basti No. 1, Kanpur Local and Faizabad Local. Storage life of bael fruits was determined to utilized this fruit for beverage industry.

KEYWORDS

Physiological Weight Loss, Total Soluble Solids, Acidity, Spoilage, Bael

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Bael (*Aegle marmelos* Correa) is one of the very important fruit of Indian origin where it is known by different vernacular names in different parts of the country, *viz*., Indian quince, Bengal quince, Stone apple, Holly fruit, Shriphal (fruit of plenty) and Bilva. This is subtropical deciduous fruit grow wild throughout the country particularly in indogangetic plains up to an elevation of 1219 metre (Singh, 1998). The fruit has been known in India tree which belongs to the family Rutaceae and since, prehistoric era. According to Hindu customs, the trifoliate aromatic leaves of this tree are traditionally used as sacred offering to Lord Shiva. It is found to be known in wild state everywhere (Chundawat, 1990) and has wonderful adoptability to various agro-climatic conditions. It thrives well particularly in saline and alkaline soils. In India this fruit is found in plenty in Uttar Pradesh, Bihar, West Bengal, Madhya Pradesh, Orissa. In Uttar Pradesh it is being cultivated in Gonda, Basti, Deoria, Mirzapur, Etawah, Agra, Varanasi and Faizabad district at commercial level (Teaotia *et al.,* 1963). Besides India it is grown in Srilanka, Pakistan, Bangladesh, Mayanmar, Thailand and most of south-east Asian countries. It was introduced into Europe from India in 1759 (John and Stevenson, 1979). Bael fruits are very popular due to its medicinal and nutritional properties. All parts of the tree *viz*. Root, bark, leaves, fruits and seeds are used in curing various ailments of the body. The mature fruit is regarded as astringent, digestive and stomachic and prescribed for diarrhoea, dysentery, habitual constipation and irregularities of bowl. Bael Murabba is an ayurvedic medicinal product commonly prescribed in all types of digestive troubles. It is said that tree ripe fruit is an aromatic sweet tonic, restorative, appetizer, binding astringent, laxative and good for heart and brain. Sherbat from ripe fruit is pleasantly laxative and simple cure for dyspepsia and prevent the growth of piles. These medicinal properties are attributed to the active ingredient called "Marmelosin" a crystalline compound which is found in abundance *i.e.* 0.03 to 0.37mg/100 g pulp (Kaul *et al*., 1967). The fruit is very nutritive and contain fair amount of vitamins (A, B and C) and minerals and high content of carbohydrates. Vitamin 'B' (Riboflavin) content of fruit is higher than mango, guava, banana and apple. Vitamin 'C' is also higher than apple. The fruit has also fair amount of calcium, phosphorus potassium (Sharma and Singh, 1982). The fruit has good storage life because of its hard outer shell and can withstand transport and marketing hazards. The shelf life of the fruit is

normally two weeks at ambient temperature of 27^0 to 32^0 C which can be enhanced to 12 weeks by string the fruits at 9^0 C with 85 to 90 per cent relative humidity. Ripe bael fruit like some of the other tropical fruits is highly sensitive to low temperature injury. Whenever the fruit is stored at temperature below 9^0 C spoilage occurs because of chilling injury whereas, storage of fruit above 14^0 C cause spoilage due to fungal attack. Having excellent flavour, nutritive value and therapeutic properties however this fruit is not popular as fresh fruit due to its hardy shell and numerous mucilaginous seeds in the pulp. Thus, the commercial production of this fruit depends on its utilization for processing of quality products. The few important products like murabba, sherbet. syrup, powder and dehydrated slices are being prepared from fruits. The varietal suitability of bael fruit can be helpful for processing industries to adopt bael for commercial processing. Keeping this fact in view the present investigation, therefore, has been carried out to study the storage life of bael fruits of selected genotypes

MATERIALS AND METHODS

Fruits of five genotypes, namely, Kaghzi Gonda, Kanpur Local, Basti No. 1, Faizabad Local and Kaghzi Etawah with and without stalk were stored at ambient temperature for recording physiological weight loss (P.L.W.), T.S.S., acidity and spoilage percentage at 5 days intervals.

Moisture

The pre-weighed of fruits were put in an oven at 60°C and dried to constant weight then dry weight was recorded on physical balance. The percent of moisture was calculated in relation to fresh weight of the fruit (Ranganna, 1978).

Total Soluble Solids

Total soluble solids (T.S.S.) of pulp/RTS/nectar/squash and preserve was determined by hand refractometer and calibrated at 20° C with the help of reference table (Lal *et al.,* 1986). The mean value was expressed as per cent total soluble solids.

Acidity

10 g/ml sample of product was diluted to1 100 ml with distilled water and 10 ml aliquat was titrated against N/10 NaOH solution using phenolphthalein as indicator. The total titrable acidity was calculated as citric acid by following formula and the result was expressed in per cent. 1 ml N/10 NaOH = 0.0064 g of anhydrous citric acid

Spoilage Percent

The fresh fruits collected from the different places were surface sterilized by 1 per cent formaldehyde. Then fresh purified culture of the isolated fungi was used for the test. The injured fruits were dipped in spore suspension of all the identified pathogen for one minute and a set of healthy fruits were kept as control. The per cent rot was determined by the following formula given by Srivastava and Tondon (1968):

$$\text{Spoilage (\%)} = \frac{W - w}{W} \times 100$$

Where, W = represents the weight of the fruit before inoculation, w = represents the weight of the fruit after removal of the rotten tissue.

RESULTS AND DISCUSSION

The physiological loss in weight of bael fruit was increase with the storage period and the loss was relatively greater in fruits stored without stalk. Kaghzi Gonda recorded higher percentage of weight loss followed by Kaghzi Etawah, Kanpur Local, Faizabad Local and Basti No.-1 genotypes (Table 1). An increase in physiological loss in weight during storage particularly in without stalk as well as thin skinned fruits may possibly be due to greater loss of moisture from the fruits. Similar findings are also reported in mandarin (Dutta *et al*., 1960), Kinnow (Kumar and Chauhan, 1989, Lotha *et al*., 1994 and Pal, 1997), banana (Dalal *et al*., 1971) aonla (Ojha, 1987 and Pathak, 1988) and bael (Ram, 1996). Total soluble solids were increased during storage under all the genotypes (Table 2). In general, T.S.S. per cent was increased at fruits stored without stalk and fruits stored with stalk. The maximum increased in T.S.S. up to 20 days was observed in stalked fruits of Kanpur Local followed by stalked fruits of Kaghzi Gonda. In the T.S.S. per

Table 1. Change in physiological loss in weight (%) during storage of bael genotypes

Genotypes	Storage period (days)			
	5	10	15	20
Kaghzi Gonda with stalk	7.63	16.47	23.82	30.31
Kaghzi Gonda without stalk	8.25	20.52	29.41	37.28
Kanpur Local with stalk	4.40	8.46	14.30	23.69
Kanpur Local without stalk	5.28	10.51	15.52	26.29
Basti No.1 with stalk	4.20	7.58	12.13	15.33
Basti No.1 without stalk	5.65	8.68	13.49	16.54
Faizabad Local with stalk	4.18	7.67	12.51	18.14
Faizabad Local without stalk	4.80	9.42	14.18	21.89
Kaghzi Etawah with stalk	6.35	13.18	18.58	26.43
Kaghzi Etawah without stalk	7.65	16.52	24.74	31.27
C.D. at 5%	0.51	1.05	0.94	1.43

Table 2. Change in total soluble solids (%) during storage of bael genotypes

Genotypes	Storage period (days)				
	0	5	10	15	20
Kaghzi Gonda with stalk	33.08	34.43	35.38	36.48	38.20
Kaghzi Gonda without stalk	33.80	35.58	35.80	37.30	38.80
Kanpur Local with stalk	29.40	31.45	32.58	33.23	34.53
Kanpur Local without stalk	30.45	32.65	33.53	33.83	35.38
Basti No.1 with stalk	27.58	28.48	29.38	30.58	31.23
Basti No.1 without stalk	28.38	29.48	30.53	31.50	31.83
Faizabad Local with stalk	28.35	29.63	30.65	31.70	32.58
Faizabad Local without stalk	29.30	30.60	31.55	32.48	33.50
Kaghzi Etawah with stalk	31.48	33.30	33.75	34.63	35.70
Kaghzi Etawah without stalk	32.43	33.88	34.28	35.53	36.53
C.D. at 5%	1.51	1.41	1.46	1.36	1.25

Table 3. Change in acidity (%) during storage of bael genotypes

Genotypes	Storage period (days)				
	0	5	10	15	20
Kaghzi Gonda with stalk	0.46	0.43	0.41	0.40	0.38
Kaghzi Gonda without stalk	0.45	0.42	0.40	0.39	0.36
Kanpur Local with stalk	0.48	0.46	0.44	0.42	0.42
Kanpur Local without stalk	0.46	0.46	0.43	0.42	0.39
Basti No.1 with stalk	0.55	0.54	0.53	0.51	0.50
Basti No.1 without stalk	0.55	0.53	0.52	0.50	0.48
Faizabad Local with stalk	0.58	0.56	0.54	0.53	0.52
Faizabad Local without stalk	0.56	0.55	0.54	0.52	0.50
Kaghzi Etawah with stalk	0.48	0.44	0.43	0.41	0.40
Kaghzi Etawah without stalk	0.47	0.44	0.42	0.40	0.37
C.D. at 5%	0.02	0.03	0.02	0.03	0.04

Table 4. Change in spoilage (%) during the storage of bael genotypes

Genotypes	Storage period (days)			
	5	10	15	20
Kaghzi Gonda with stalk	-	12.65	22.45	36.58
Kaghzi Gonda without stalk	16.47	22.58	34.40	49.36
Kanpur Local with stalk	-	9.63	19.65	30.58
Kanpur Local without stalk	9.38	18.64	29.55	42.51
Basti No.1 with stalk	-	10.60	20.56	31.76
Basti No.1 without stalk	10.26	19.59	32.36	44.63
Faizabad Local with stalk	-	8.64	16.48	25.49
Faizabad Local without stalk	7.56	13.47	22.45	35.31
Kaghzi Etawah with stalk	-	11.46	21.46	35.55
Kaghzi Etawah without stalk	14.55	20.64	31.45	46.54
C.D. at 5%	2.07	2.73	3.32	2.96

cent there were no significant differences of fruits of all the genotypes stored with and without stalk, while, there were significant differences in the T.S.S. content of fruits in all five genotypes when compared among themselves. Total soluble solid was increased continuously during storage of bael fruit at room temperature. Kaghzi Gonda recorded higher total soluble solids as compare to Kaghzi Etawah, Kanpur Local, Faizabad Local and Basti No.-1. An increase in total soluble solids during storage may be ascribed to the loss of moisture from fruits and conversion of polysaccharides into fructose. Increase in total soluble solids with advancing storage has also been reported to peach (Gangwar and Tripathi, 1972), apple (Sethi *et al*. 1983), mango (Kaushik and Kumar, 1992) and aonla (Singh and Kumar, 1997). The per cent acidity is decreased during storage of all the five genotypes of bael (Table 3). Fruits stored without stalk showed more loss in acidity as compared with stalk. Fruits of Kaghzi Etawah (without stalk) showed maximum loss in acidity followed by Kaghzi Gonda (without stalk) up to 20 days of storage period. However, minimum loss in acidity was recorded in with stalk fruits of Basti No. 1 followed by with and without stalk fruits of Faizabad Local. There were no significant difference between with and without stalk fruits of all five genotypes of bael except Kanpur Local and Faizabad Local at the time of storage. In the present findings acidity content of bael genotypes decreased continuously during storage at room temperature. It was recorded slightly more in fruits stored with stalk as compare to without stalk. Acidity content was recorded to be higher in Faizabad Local as compare to other genotypes of bael. Reduction in acid content has also been reported in many fruits suchas mango (Dutta *et al*., 1960), apple (Ram *et al*., 1970 and Sethi *et al*., 1983), mango Kaushik and Kumar, 1992) and bael Ram, 1996). There was no spoilage up to 5 days of storage under with stalk fruits of all five genotypes of bael (Table 4). The maximum spoilage was occurred in Kaghzi Gonda followed by Kaghzi Etawah irrespective of the retention of stalk, whereas, minimum spoilage was recorded in Faizabad Local. There was significant difference in this respect between with and without stalk fruits among all genotypes. Spoilage of bael fruit was mainly caused by *Fusarium solani* (Mart.) Sacc. during storage. Small brownish spots were developed on fruit surface during initial storage of life, later on these spots increased covering large area. The flesh colour changed brownish after infection. Increase in spoilage with storage period has also been reported in peach (Dalal *et al.*1971), kinnow mandarin (Kumar and Chauhan, 1989, Lotha *et al.* 1994 and Pal *et al.* 1997), aonla (Pathak, 1988), ber (Gupta and Mehta, 1988) and bael (Ram, 1996). The findings of present investigation indicated the increase in physiological loss in weight, total soluble solids, per cent spoilage and decrease in acidity content during storage of all five genotypes of bael. Storage life of bael fruits was determined to utilized this fruit for beverage industry.

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