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*Short Communication*

# ASSESSEMENT OF SUITABILITY OF BAEL FRUITS (*Aegle marmelos Corr.*) FOR PROCESSING QUALITY

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**ABSTRACT**
The present investigation was carried out to assess the suitability of bael fruits for processing quality at Post-Harvest Technology Laboratory, Department of Horticulture, University of Horticultural Sciences, GKVK, Bengaluru – 560 065. The fruits collected from Karnataka, Tamil Nadu and Andhra Pradesh differed significantly with respect to morphological characters of fruits such as colour, shape, weight, volume, Rind thickness, pulp weight and number of seeds. The chemical composition of different bael fruit genotypes showed that the total soluble solids varied from 26.70 to 34.10º B. whereas, moisture content was 59 to 65 per cent. The pulp colour ranges from yellow to orange. Total alkaloid content varied from 0.38% in Tamil Nadu and Andhra Pradesh. The variability studied indicated the possibility of selecting a cultivar suitable for processing the bael fruit.

**KEY WORDS:** Bael, morphological characters, chemical composition, total soluble solids, total alkaloid.

## INTRODUCTION

Bael has been extolled for its medicinal virtues than as an edible fruit, bael is a interesting member of the Rutaceae. The bael, *Aegle marmelos Corr*, is a handsome multipurpose social tree, sometimes, it is called elephant apple, which cause confusion with a related fruit of that Feronia limonia Swingle. Bael importance seems largely due to its panacea of medicinal qualities. All parts of this tree, vix., root, leaf, trunk, fruit and seed are used for curing one or anotherhuman ailment. The fruit has considerable medicinal value when it just begins to ripen. The ripen fruit is aromatic, sweet, astringent, which helps to regeneration of skin, coolant, laxative, febrifuge and good for the heart, brain and in dyspepsia. The unripe of half ripe fruit is acrid, sour, astringent, digestive, stomachic, which improves appetite, antiscorbutic, control of diarrhoea and dyssentry. Decoction of root, root bark and sometimes the stem bark is useful in intermittent fever, hypochontriasis, melancholia and palpitation of heart. An infusion of bael leaves in effective remedy for peptic ulcer, because of the leaves rich in tannins, which reduces inflammation and healing ulcers. Oil extracted from bael leaves gives relief from recurrent colds, cough and respiratory infections. Poultice of Ieaves used in opthamalia and infiammations (Nadkami; 1976). Indelible medicinal properties of bael have been described in the ancient medicinal treatise in Sanskrit, *Charka Samhitha.* Importance has been realized in vedic period and it is one of the ingredients in the *Dasamul* of *Ayurveda.* With all this benefit it is not consumed freely because of eating difficulties, but it may become popular if suitably processed. Bael fruits may be cut into halves or the soft types brake open to extract the pulp and dressed with palm sugar, eaten as a breakfast which is a common practice in Indonesia. The pulp is often processed as nectar or squash. A popular drink called sherbet in India is made by beating the seeded pulp together with milk and sugar. A beverage is also made by combining bael fruit pulp with that of tamarind. These drinks are consumed perhaps less as food or refreshment than for their medicinal effects. Therefore, the research findings will have commercial application in production of value added products with high medicinal properties from bael fruits, presently there are no standard bael fruit varieties and technology available to process in to various neutraceutical products. Hence, it is imperative 10 assess physico-chemical character of bael fruit.

## MATERIALS & METHODS

The fruits were collected from the vicinity of Lord Shiva temple and forst of Karnataka, TamilNadu and Andhra Pradesh during fruiting seasons and accordingly amed after their places. Five fruits were randomly selected from the lot of harvested fruit for recording the data. The fruit shape was recorded visually; whereas, fruit size was recorded by measuring length and diameter of fruits. The fruits were weighed and volume of the fruits was determined by water displacement method. The rind of the thickness was determined with the help of Vernier Calliper. Peel, pulp, fiber, mucilage and seeds were separated, weighed and calculated on fresh weight basis and number of seed per fruit and hundred seed weight were recorded. Colour of the fruits and pulp were recorded using British colour chart. The fresh pulp was analyzed to find out its proximate composition. The, total soluble solid content was recorded using 'Erma-hand refractometer' and expressed as degree Brix ($^{O}$B) pH using Toshniwal digital pH meter (Model Dl 707). Dry matter, moisture, acidity, ascorbic acid, sugars were determined as per the procedure outlined by Ranganna, (1970) and crude protein, and crude fibre was determined by method given by A.O.A.C. (1970) and for minerals such as P, K, Ca arid Mg. Jackson, (l973) procedure was fallowed and Lindsay and Norwell, 1978 for micronutrients like Fe, Mn, Zn and Cu. Total alkaloids contents was estimated by using High

Performance Liquid Chromatographic (HPLC) analysis. Orgnoleptic evaluation for pulp was conducted by a panel of 10 judges by fall owing numerical scoring method Amerine *et al. (1965).*

## RESULTS & DISCUSSION

The physical characters of different cultivars of bael fruits procured from different places of Karnataka, Tamil Nadu and Andhra Pradesh showed physical differences for shapes and size. From the limited study of three genotypes, variability met with in fruit characters are clearly described in the Table 1. The range of variability was larger in fruit size, while in shape varied types like that of near round (Kamataka) to near cylindrical (Andra Pradesh) and pear shaped (Tamil Nadu) have been observed.

**TABLE 1.** Physical characters of bael fruits collected from different locations

| Sl. No | Parameters | Karnataka | Tamil Nadu | Andra Pradesh |
|---|---|---|---|---|
| 1 | External colour | Greenish to yellowish | Greenist to yellowish | Greenish to yellowish |
| 2 | Internal colour | Shades of yellow | Shades of yellow | Shades of yellow |
| 3 | Shape | Round, spherical | Pyriform, oblong | Flat, oblong and cylindrical |
| 4 | Transverse diameter (cm) | 6.92 – 7.40 | 65.50- 7.00 | 5.36- 6.22 |
| 5 | Polar diameter (cm) | 6.11- 7.92 | 7.22-8.14 | 8.50-10.10 |
| 6 | Fruit weight (g) | 115- 167 | 143-173 | 109-1.39 |
| 7 | Volume (ml) | 125- 190 | 120-170 | 125-180 |
| 8 | Raind thickness (cm) | 0.28- 0.59 | 0.29-0.37 | 0.27-0.39 |
| 9 | No. of seed sack per fruit | 9-12 | 10-12 | 9-13 |
| 10 | No. of seed per trait | 56-74 | 72-81 | 70-82 |
| 11 | Pulp weight (g) | 70-82 | 72-81 | 70-74 |
| 12 | 100 seed weight (g) | 2.20- 22.10 | 19.50- 22.30 | 21.70-22.80 |
| 13 | No. of seed per seed sack | 4-7 | 5-7 | 4-7 |

**TABLE 2.** Chemical composition of bael fruits collected from different locations

| Sl. No. | Parameters | Karnataka | Tamil Nadu | Andhra Pradesh |
|---|---|---|---|---|
| I. | Total soluble solids ($^0$B) | 27.4 - 32.6 | 28.60 -34.10 | 26.70 - 32.80 |
| 2. | Acidity (%) | 0.29 - 0.32 | 0.30 - 0.32 | 0.29 - 0.33 |
| 3. | PH | 4.9 - 5.3 | 4.9 - 5.2 | 5.0 - 5.3 |
| 4. | Moisture (%) | 61 - 65 | 59 - 64 | 59·68 |
| 5. | Reducing sugar (%) | 2.15 - 3.94 | 2.46 - 3.62 | 2.34 - 3.82 |
| 6. | Non-reducing sugar (%) | 8.22 - 8.62 | 9.00 - 9.50 | 8.48 - 9.92 |
| 7. | Total sugar (%) | 10.37 - 12.56 | 11.46 - 13.12 | 10.82 - 13.74 |
| 8. | Ascorbic acid (100mg/l00 g) | 7.1 - 13.4 | 9.3 - J4.7 | 8.4 - 15.6 |
| 9. | Crude protein (%) | 1 .58 - 2.76 | 1.82 - 2.28 | 1.46 - 2.68 |
| 10. | Tannins (% Gallic acid) | 5.20 - 5.46 | 5.10- 5.74 | 5.42 - 5.78 |
| 11. | Fibre (%) | 3.12 - 3.86 | 3.20-4.00 | 3.46 - 4.12 |
| 12. | Nitrogen (%) | 1.48 | 1.13 | 1.07 |
| 13. | Phosphorus ('Ye) | 0.11 | 0.07 | 0.12 |
| 14. | Potassium (%) | 1.36 | 1.37 | 1.41 |
| 15. | Calcium (%) | 0.68 | 0.75 | 0.86 |
| 16. | Magnesium (%) | 0.21 | 0.23 | 0.31 |
| 17. | Sulphur (%) | 0.15 | 0.30 | 0.22 |
| 18. | Zinc (pprn) | 26 | 22 | 20 |
| 19. | Manganese (pap) | 7.4 | 5.0 | 4 |
| 20. | Iron (ppm) | 188 | 266 | 122 |
| 21. | Copper (ppm) | 7.0 | 5.0 | 7.0 |
| 22. | Total alkaloid (%) | 0.38 | 0.36 | 0.36 |
| 23. | organoleptic score out of 5.0 | 3.12 - 3.86 | 3.20 -4.0 | 3.46 - 4.12 |

The percent edible portion of the bael fruit has no relation to the size of the fruit. In general, larger fruit has lesser shell percentage than smaller fruits. Among the cultivars studied fruits from Karnataka recorded the highest per cent of edible portion (58.99 - 64.22%) by weight, with thin and low rind (0.28 cm and 33.63 %) and low seed content (56-74 no.). Incidentally all the above mentioned cultivars were bigger in size (Table 1.) In general, genotypes of Tamil Nadu which were smaller in size recorded high seed content. Such variations among the cultivar have been reported by Roy and Singh (1978), Jauhari *et al.* (1969) and Singh *et al.* (2000). The chemical composition of different bael fruit genotypes showed that the total soluble solids varied from 26.70 - :l4.100B whereas, moisture content was 59 to 65 per cent. The bael fruit appears to be one of the few fruits which contain a considerable amount of dry matter amounting to 35 to 41 per cent. This could possibly be due to the presence of higher per cent of mucilage and fibre and variations in pulp recovery, moisture and TSS of pulp as this contributed towards the

dry matter. Most other fruits are reported to have such high per cent of dry matter, Variation in sugar content was also observed I the ranged between 10.37 and 13.74 per cent for total sugar (Table 2). The non-reducing sugars were more I compared to the reducing sugars in all the cultivars, these results are in agreement with findings of Roy and SiIlgh (1978) and Jauhari *et al*. (1969). Unlike citrus, bael fruit contained a very low percent of acid 0.29 to 0.33 per cent which did not vary much from genotype to genotype unlike other chemical constituents. Variation in pH among the genotypes tested was very meagre, and round to be around 5.0. This indicates that bael fruit pulp cannot be heat processed in boiling water without lowering the pH and it needs higher temperature for processing. The ascorbic acid content (7.1 to 15.6 mg /100g) of bael fruit was not encouraging compared to its relative citrus fruits. The crude protein content in bael fruit appeared to be of quite high (1.58 to 2.68%) compared to other fruits and variation among the genotypes was not much. The bael fruit contained a substantial amount of tannins (5.0 to 5.78%), which contributed to astringent taste, and medicinal virtues of the frujt. (Table 2). The pulp colour in the fruits was yellow to orange. The yellow colour was not due to carotene as the pigments were not soluble in petroleum ether, but colour may be due to some flavonoid pigment. Minerals content of bael fruit genotypes varied substantially for all primary, secondary and trace elements (Table 2). These differences were due to prevailing agro-climatic conditions of tree grown and genetic constitution of bael clones. Total alkaloids content of bael fruit was varied from 0.38% in Karnataka genotype to 0.36% in Tamil Nadu and Andhra Pradesh (Table 2). Maximum organoleptic scores out of total 5.0 point was observed in Andhra Pradesh (3.46 - 4.12) followed by Tamil Nadu (3.20 - 4.00) and Karnataka (3.12 - 3.86). The variability studied indicated the possibility of selecting a cultivar suitable for processing the bael fruit. These results are in conformity with findings of Kaushik and Yamadagni (1999), Kar and Choudhary (1994) and Roy and Singh (1978).

## CONCLUSION

The assessment of bael fruits collected from different places showed varied morphological characters and having different chemical composition. It indicates the possibility selecting a cultivar suitable for processing of bael fruits.

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