



# Physical Attributes of Bael (*Aegle marmelos* L.) Fruit and Suitability for Commercialization and Processing

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## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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## ABSTRACT

The present experiment entitled "Studies on physical attributes of bael (*Aegle marmelos* L.) fruit suitable for commercialization and processing" was conducted at Horticulture laboratory of the Department of Applied Plant Science during 2011-12. Matured fruits procured from well established

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bael orchard and investigation was carried out Completely Randomized Block Design with three replications. The observations were recorded on fruit shape, skull colour, pulp colour, fruit weight, skull thickness, fruit length, fruit width, pulp content and seed content. Flattened round fruit shape, greenish skull colour and pale yellow in pulp colour was found in NB-7. Minimum skull thickness 3.10 mm, seed content 2.42 per cent, whereas maximum fruit weight 2.00 kg, fruit length 16.20 cm, fruit width 17.20 cm and pulp content 79.20 per cent was found in cv. Narendra Bael-7. Result indicated that on the basis of physical attributes NB-7 varieties was found best for commercialization and processing.

**Keywords:** Bael; physical attributes; Narendra Bael-7; fruit weight; pulp content.

## 1. INTRODUCTION

Bael is a plant of Indian origin and belongs to family Rutaceae. It is known with different names in different languages; Bel, Bilya, Shivadruma, Shivaphala, Vilva (Sanskrit), Bael, Bangal quince, Golden apple (English), Bel, Belkham (Urdu), Bel, (Assamese and Marathi), Bilvaphal (Gujrati), Marredy (Malyalam). It grows throughout the Indian peninsula as well as in Sri Lanka, Pakistan, Bangladesh, Burma, Thailand and most of the south-eastern Asian countries. It is a very hardy subtropical, deciduous tree that can thrive well in various soil-climatic conditions and can tolerate alkaline soil and is not injured by temperature as low as 7°C and pH up to 9.0. Every part of plant such as fruit, seed, bark, leaf, flower and root are important ingredients of several traditional formulations. Bael fruit colour greenish yellow, roundish oval in fruit shape, average fruit weight 210 gram, fruit length 9.3 cm, rind thickness 4.3 mm and seed per cent 3.31% Sawale et al. [1]. Anadani et al. [2] reported Rajasthani Local variety of ripe bael fruits have average fruit length 15.3±1.96 cm, average diameter 14.5±1.69 cm, rind thickness 3.11±0.32 mm and pulp seed ratio 13.21±0.83. The twigs and leaves are used as fodders. Sweet scented water is distilled from the flower; leaf juice is applied to body before taking a bath to remove the bad smell. The most valuable part of the tree is fruit. Due to its curative properties, it is one of the most useful medicinal plants of India from pre-historic time and has been mentioned in the ancient system of medicine, "Ayurveda". It has been described as Kshaya (astringent) and tikta (Biliter) in taste and laghu (light), rooksha (dry) and ushna (hot) in effect, it alleviates Vata and Kaphay. Different type of products can prepared from bael fruit in India such as powder, jam, wine, slab, syrup and preserve [3]. The bael fruit is highly nutritious. Fresh half ripe fruit is mildly astringent having antipyretic, digestive and restorative action on the body and used in dysentery & diarrhea treatment whereas, ripe

bael fruit is sweet, aromatic, nutritious and highly palatable. But, due to its hard shell, mucilaginous texture and numerous seeds and fibbers content the fresh fruit cannot be eaten out of hand and is generally used in the form of processed products like powder, preserve and beverages.

## 2. MATERIALS AND METHODS

The experiment for present investigation entitled "Studies on physical attributes of bael (*Aegle marmelos* L.) fruit and suitability for commercialization and processing" was conducted at Horticulture laboratory of the Department of Applied Plant Science during 2011-12 at Baba Saheb bhimrao Ambedkar (A Central) University Vidya Vihar, Rai Bareilly Road Lucknow (U.P.) India. Observations recorded on shape, skull colour, pulp colour, fruit weight (kg), skull thickness (mm), fruit length (cm), fruit width (cm), pulp content (%) and seed content (%). The data on fruit shape was recorded on the visual observation and match with the shape parameters as described in descriptor of bael [4]. Fruit weight is taken by weighing of the randomly selected five fruits and average weight is recorded. Fruit diameter was observed by cut the fruit horizontally and diameter is recorded by using the scale. Fruit length was observed by cut the fruit vertically and length was recorded by scale. Thickness of fruit skull was observed by Vernier calipers and average skull thickness was calculated. Pulp colour is also the parameter which is observed by using the sense organ eye and recorded. Pulp percentage was calculated by the separation of pulp from the selected fruits weight. Seed percent was calculated by the separation of seed from pulp manually and average weight of seed is calculated in the percentage.

### 2.1 Statistical Analysis

During physical attributes were recorded on different parameters of bael fruit were subjected

to statistical analysis using completely randomized design analysis of variance [5]. Results were interpreted at significance level of 5 per cent.

### 3. RESULTS AND DISCUSSION

#### 3.1 Fruit Shape, Skull Colour and Pulp Colour

As per observation of the present study, the fruit shape, skull colour and pulp colour of different bael fruit cultivar was presented in Table 1. Fruit shape was recorded in Kagzi Etawah (oblong round), Narendra Bael-4 (round), Narendra Bael-5 (round), Narendra Bael-7 (flattened round) and Narendra Bael-17 (oblong) was recorded. Skull colour in different varieties Kagzi Etawah (greenish yellow), Narendra Bael-4 (yellowish green), Narendra Bael-5 (greenish yellow), Narendra Bael-7 (greenish yellow) and Narendra Bael-17 (yellowish green) was recorded. Pulp colour in different varieties Kagzi Etawah (light yellow), Narendra Bael-4 (white yellow), Narendra Bael-5 (yellow), Narendra Bael-7 (pale yellow) and Narendra Bael-17 (deep yellow) was recorded during observation. The observations of the fruit shape, skull colour and pulp colour of bael fruit is in agreement with the findings of Singh et al. [4] Singh [6] and Sawale et al. [1].

#### 3.2 Fruit Weight, Length and Width

Data as embodied in Table 2, clearly reflected that the average fruit weight in different varieties Kagzi Etawah (0.47 kg), Narendra Bael-4 (0.95 kg), Narendra Bael-5 (1.147 kg), Narendra Bael-7 (2.00 kg) and Narendra Bael-17 (1.5 kg) was recorded. Fruit length in different cultivar Kagzi

Etawah (12 cm), Narendra Bael-4 (14.2 cm), Narendra Bael-5 (15.3 cm), Narendra Bael-7 (16.2 cm) and Narendra Bael-17 (15.2 cm) was recorded. Fruit width was observed Kagzi Etawah (10.6 cm), Narendra Bael-4 (13.5 cm), Narendra Bael-5 (14.1 cm), Narendra Bael-7 (17.2 cm) and Narendra Bael-17 (12.20 cm) was recorded. Several scientists have also reported average fruit weight of bael ranged from 1283 to 2818g Jauhari et al. [7], 1.55 to 2.81kg Jauhari and Singh [8], 401 to 1850g Roy and Singh [9] and 1.012 to 2.088 kg Ram and Singh [10], 2.21 to 2.40 kg Haridwar [11], 1630 to 2445g Singh et al. [12], 0.75 kg to 3.65 kg Mishra et al. [13], and 0.75 to 3.55 kg Singh et al. [5]. Fruit length and fruit width recorded 14.32 cm and 14.48 cm respectively supported by Singh et al. [5].

#### 3.3 Pulp Content, Seed and Pulp Content

The data portrayed in Table 2, apparently indicated that the pulp content in different varieties Kagzi Etawah (53.49 %), Narendra Bael-4 (72.4 %), Narendra Bael-5 (73.20 %), Narendra Bael-7 (72.9 %) and Narendra Bael-17 (68.12 %) was recorded. Seed content in different varieties of bael fruit Kagzi Etawah (10.21 %), Narendra Bael-4 (3.22 %), Narendra Bael-5 (2.51 %), Narendra Bael-7 (2.42 %) and Narendra Bael-17 (3.12 %) was recorded. Pulp content in different varieties of bael fruit Kagzi Etawah (53.49 %), Narendra Bael-4 (72.04 %), Narendra Bael-5 (73.20 %), Narendra Bael-7 (72.90 %) and Narendra Bael-17 (68.12 %) was recorded during investigation. The results of present study are in close conformity with the findings of Jauhari et al. [7], Singh [6] and Anadani et al. [2].



**Bael orchard (A)**



Bael orchard (B)

Table 1. Physical parameters (visual) of bael fruit

Cultivar	Fruit Shape	Skull colour	Pulp colour
Kagzi Etawah	Oblong round	Greenish yellow	Light yellow
Narendra Bael-4	Round	Yellowish green	White yellow
Narendra Bael-5	Round	Greenish yellow	Yellow
Narendra Bael-7	Flattened round	Greenish yellow	Pale yellow
Narendra Bael-17	Oblong	Yellowish green	Deep yellow

Table 2. Physical Characteristics of bael fruit

Cultivars	Fruit weight (kg)	Skull thickness (mm)	Fruit length (cm)	Fruit width (cm)	Pulp content (%)	Seed content (%)
Kagzi Etawah	0.470	3.00	12.0	10.6	53.49	1.021
Narendra Bael-4	0.95	3.20	14.2	13.5	72.01	3.22
Narendra Bael-5	1.147	3.40	15.3	14.1	73.20	2.51
Narendra Bael-7	2.00	3.10	16.2	17.2	72.90	2.42
Narendra Bael-17	1.50	3.12	15.2	12.2	68.12	3.12
SEm ±	0.07	0.08	0.39	0.36	1.8	0.15
CD at 5% Level	0.23	0.24	NS	NS	5.70	NS

#### 4. CONCLUSION

It can be concluded that on the basis of physical attributes Narendra Bael-7 have flattened round fruit shape, greenish skull colour, pale yellow in pulp colour, minimum skull thickness 3.10 mm, seed content 2.42 per cent, whereas maximum fruit weight 2.00 kg, fruit length 16.20 cm, fruit width 17.20 cm and pulp content 79.20 per cent was found best for commercialization and processing.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

#### REFERENCES

1. Sawale KR, Deshpande HW, Kulkarni DB. Study of physico-chemical characteristics of bael (*Aegle marmelos*) fruits. Journal of Pharmacognosy and Phytochemistry. 2018;7(5):173-175.
2. Anadani SV, Akbari SH, Ravani A, Neema A. Physico-chemical characteristics of bael (*Aegle marmelos*) fruit and pulp. The Pharma Innovation Journal. 2021;10(8): 1282-1284.
3. Sharma N, Radha, Kumar M, Zhang B, Kumari N, Singh D, Chandran D, Sarkar T, Dhumal S, Sheri V, Dey A, Rajalingam SK, Viswanathan S, Kumar PM, Vishvanathan

- M, Sathyaseelan SK, Lorenjo JM. *Aegle marmelos* (L.) Correa: An Underutilized fruit with high Nutraceutical Values: A Review. International Journal of Molecular Sciences. 2022;23:10889.
4. Singh HK, Srivastava AK, Prasad J, Dwivedi R. Descriptor of bael (*Aegle marmelos* Correa.). All India Coordinated Research Project and arid zone fruits & Department of Horticulture, NDU&T, Kumarganj, Faizabad; 2009.
  5. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. Indian Council of Agriculture Research, New Delhi; 1978.
  6. Singh J. Studies on preparation and storage of bael (*Aegle marmelos* Correa.) candy, M.Sc. (Ag.) Horticulture, thesis NDU&T, Faizabad (UP); 2011.
  7. Jauhari OS, Singh PO, Awasthi RK. Survey of some important varieties of bael (*Aegle marmelos* Correa.). Punjab Horticulture Journal. 1969;9:48-53.
  8. Jauhari OS, Singh RD. Bael-valuable fruit. Indian Horticulture. 1969;16(1):9-10.
  9. Roy SK, Singh RN. Studies on utilization of bael fruit (*Aegle marmelos* Correa.) for processing III physico-chemical characteristics of different cultivars. Indian Food Packer. 1978;32(6):3-8.
  10. Ram D, Singh IS. Physico-chemical studies on bael (*Aegle marmelos* Correa) fruits. Progressive Horticulture. 2003;35(2): 199-201.
  11. Haridwar. Studies on processing of bael (*Aegle marmelos* Correa.) fruit, M.Sc. (Ag.) thesis, NDU&T, Faizabad (UP); 1999.
  12. Singh HK, Srivastava AK, Prasad J. The catalogue on bael (*Aegle marmelos* Correa.) published from NDU&T, Faizabad (UP); 2003.
  13. Mishra DK. Studies on bael (*Aegle marmelos* Correa.) candy. M.Sc. (Ag.) thesis, NDU&T, Faizabad Uttar Pradesh India; 2005.

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