
Production Technology and Medicinal Properties of Bael

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ABSTRACT

Bael is native to Indian sub-continent and widely distributed in Nepal, Sri Lanka, Malaysia, Pakistan, Bangladesh, Myanmar, Thailand and other South East Asian countries. It is rich in minerals, fat, fibre, protein, carbohydrate, vitamins, protein substances and fats. It is being used in many traditional medicinal systems. Important varieties of Bael are NB 5, NB 7, NB 9, NB 16, NB 17, CISH B -1, CISH B -2, Goma Yashi, Pant Aparna, Pant Shivani, Pant Sujata, Pant Urvashi, Thar Divya and Thar Neelkanth. Patch budding and soft wood grafting are commercially feasible methods of Bael propagation. The spacing adopted for bael is 6 x 6 m. The leaf, fruit, bark and roots of bael is widely used in Indian Systems of medicine.

INTRODUCTION

Bael (*Aegle marmelos* Correa.) is native to Indian sub-continent and it comes under Rutaceae. The demand for Bael is being increasing due to its medicinal and nutraceutical properties. It is rich in minerals, fat, fibre, protein, carbohydrate, vitamins, protein substances and fats. It is being used in many traditional medicinal systems.

ORIGIN AND DISTRIBUTION

Bael is widely distributed in Nepal, Sri Lanka, Malaysia Pakistan, Bangladesh, Myanmar, Thailand and other South East Asian countries. In India, it is abundant in Uttar Pradesh, Bihar, Madhya Pradesh, Chhattisgarh, Jharkhand, and it can also be seen growing in West Bengal, Punjab and Odisha. Gujarat possess very good genetic diversity in Bael.

VARIETIES

Sl.No.	Variety	Institute	Special characteristic
1.	NB 5	Narendra Deva University of Agriculture and Technology, Kumarganj	Small and semi-spreading growth habit; medium size round fruits with thin rind and smooth surface; attractive yellow pulp, with low seed content; average fruit weight is One kg; average fruit yield - 54 kg /tree
2.	NB 7	Narendra Deva University of Agriculture and Technology, Kumarganj	Small and semi-spreading growth habit; medium size round fruits with thin rind and smooth surface; attractive yellow pulp, with low seed content; average fruit yield – 48kg /tree; suitable for processing
3.	NB 9	Narendra Deva University of Agriculture and Technology, Kumarganj	Medium height; compact canopy; fruits are bigger; round elliptical ;average yield 69.00 kg fruits/tree; good shelf life and suitable for processing
4.	NB 16	Narendra Deva University of Agriculture and Technology, Kumarganj	Small and semi-spreading; average fruit yield - 40 kg/ tree; fruits are round with thick rind and smooth surface; attractive yellow pulp, with less seed content.; fruit weight 750-800 g; used for both table purpose and processing both.
5.	NB 17	Narendra Deva University of Agriculture and Technology, Kumarganj	Erect; average fruit yield 45.39 kg/ tree. Fruits round, with very thin rind; attractive yellow pulp, with low seed content; used for both table purpose and processing.
6.	CISH B-1	Central Institute of Sub-tropical Horticulture, Lucknow	Early maturing variety; medium size fruits with oval-oblong shape; attractive yellow pulp, with high seed content; average fruit weight 800.8-1400 g; average fruit yield 67 kg/plant
7.	CISH B-2	Central Institute of Sub-tropical Horticulture, Lucknow	Average fruit yield - 56.78 kg/ plant; fruits are medium in size; round; attractive yellow pulp, with less seed content. Average fruit weight ranges 1.7 - 2.6 kg/fruit.
8.	Goma Yashi	Central Horticultural Experiment Station, Godhra	Average fruit yield is 65 kg/plant with average fruit weight of 1.00-1.62 kg
9.	Pant Aparna	G.B. Pant University of Agriculture and Technology, Pant Nagar	Trees are dwarf; late season cultivar, fruit size small ; less fibre and acidity; flesh yellow, sweet, tasty and having good flavour rind. Average yield is 61.06

			kg/plant.
10.	Pant Shivani	G.B. Pant University of Agriculture and Technology, Pant Nagar	Tall trees with vigorous, dense and upright growth, Mid-season early variety; precocious and heavy-bearer; Mean fruit weight ranged from 2 to 2.4 kg; lemon-yellow colour pulp with thin rind; pleasant aroma; mean fruit yield is 49 kg/plant
11.	Pant Sujata	G.B. Pant University of Agriculture and Technology, Pant Nagar	Susceptible to fruit splitting, mid-season early variety, medium-dwarf trees; globose shaped fruit, average fruit weight 1.12 to 1.40 kg; light yellow colour pulp with thin rind; less seeds and fibre; average yield is 65.57 kg/plant.
12.	Pant Urvashi	G.B. Pant University of Agriculture and Technology, Pant Nagar	Mid-season variety; trees are tall; fruit is ovoid-oblong; Mean fruit weight ranges from 1.5 to 2.5 kg.; mean fruit yield is 60.15 kg/ plant,
13.	Thar Divya	CIAH-CHES Vejalpur Godhra	Average fruit weight is 1.62 kg; Early maturing group (February) and highly suited to rainfed situations.
14.	Thar Neelkanth	CIAH-CHES Vejalpur Godhra	Medium height, dense canopy, early flowering, thorny, high yield with pleasant aroma and attractive pulp colour. Mean yield per plant is 75 kg; mean fruit weight is 1.5 kg; It grows well under dry land situations. It is used for making sherbet, powder and squash.

PROPAGATION

Bael is propagated by seeds. The seedling progenies are not true to type. Hence varieties are propagated through budding, grafting, layering and root suckers. Patch budding and soft wood grafting are commercially feasible methods of Bael propagation. *In vitro* cultural techniques for *Aegle marmelos* has been standardized. Explants taken from both *in vitro* and field grown seedlings performed better with respect to time required for bud break, multiple shoots per explant and micro-shoot length in MS media added with BAP 1.5 mg l⁻¹. The micro-shoots rooted better in ½ MS media with IBA 10.0 mg l⁻¹ and NAA 4.0 mg l⁻¹ indicated by highest response to rooting, time taken for rooting and number of roots per micro-shoot. The rooted plantlet dipped in IBA 100 ppm for 5 minutes and planted in pot mixture survived and established better than the plantlets without root dip (Indhumathi and Rajamani, 2020).

CULTURAL PRACTICES

The spacing adopted for bael is 6 x 6 m. Planting is done in a pit size of 1 x 1 x 1 m. FYM 25 kg/ pit is applied and planting is done. Regular irrigation is done for better establishment. Usually 4 - 6 well spaced branches are allowed at early stage of the crop to develop good framework of the

tree. Staking should be done at the early stage of the crop for erect growing. The secondary branches at lower heights should not be allowed for better frame work. Though there is no recommended nutrient management work in Bael, it will be beneficial to apply 25 kg of FYM per tree and 50: 25: 50 g of NP for young plants. There is no major pest and diseases causing severe yield loss. But fruit rot and fruit cracking are the problems reported in Bael.

MEDICINAL PROPERTIES

The leaf, fruit, bark and roots of bael is widely used in Indian Systems of medicine. The leaves of *Aegle marmelos* are useful as laxative, astringent, expectorant and are useful in inflammation, diabetes and asthmatic complaints. The fruits can treat diarrhoea, dysentery and stomachalgia. The fruits extracts are also reported to show antiviral activities. The fresh pulp can used as a laxative and to cure digestive problems. The root extracts are useful in curing diarrhoea, cardiopalmus, seminal weakness and vomiting. Though there is a large body of literature on the pharmacological studies of *Aegle marmelos*, most are done using the only with crude or partially purified extracts of the plant materials.

The phytochemicals in *Aegle marmelos* identified previously are presented in Table 1.

Table 1. Phytoconstituents of *Aegle marmelos*

Sl.No.	Phytochemical	Plant part
1.	Aegelin	Leaf
2.	Aegeline	Fruit
3.	Aegelinol	Root, bark
4.	Aeglin	Leaf
5.	Alloimperatorin	Fruit
6.	Anthraquinones	Wood
7.	Coumarins	Root
8.	Decursinol	Root
9.	2,4-Epibrassinolide	Leaf
10.	Fagarine	All parts
11.	Glucopyranosides	Bark
12.	Haplopine	Root
13.	Marmelosin	Fruit
14.	Marmesin	All parts
15.	Marmin	Root
16.	Marminol	Leaf
17.	Rutacin	Leaf
18.	Scopoletin	Fruit
19.	Skimmianine	Aerial parts
20.	Umbelliferone	All parts
21.	Xanthotoxol	Root

CONCLUSION

All parts of bael is used for medicinal purpose and this tree is highly suitable for poor and marginal dry lands. In India, State Agricultural Universities and ICAR Research institutes released severa varieties to enhance the production of bael fruits. Hence, bael can be promoted for commercial cultivation in dry lands to supply the raw material requirements of medicines prepared for various Indian systems of Medicine. Being an industry oriented crop, the farmers can get maximum profit from Bael cultivation.

REFERENCE

Indhumathi, K and K. Rajamani, 2020. Invitro germination of Bael (*Aegle marmelos* (L.) Corr.) seeds for clonal propagation, *Annals of Plant and Soil Research* 22(4): 449-453.