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## Orchard Health Management and Cultivation of Bael

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Bael is being native to India having high nutritional and medicinal value due to presence of different medicinal properties. It is a rich source of vitamin A and Vitamin B<sub>1</sub> content of fruit is higher than those of mango, guava, banana and apple; Vitamin C content of fruit is also higher than of apple. In India bael is cultivated in Uttar Pradesh, Bihar, Rajasthan, Madhya Pradesh, Uttarakhand, Chhattisgarh and Odisha. Being hardy in nature it can be cultivated in different type of soils and can stand high soil pH semi arid to arid regions. It can be cultivated commercially on waste land and unproductive land for the upliftment of farmers. Bael is 8-10 month crop from April to till the May month, produces on an average 150-200 fruits under good management practices.

### Introduction

Bael (*Aeglemarmelos* Correa.), a native fruit of religious importance is well known to the Indian people for its nutritional and medicinal values. The fruit has been known in India from prehistoric times. It is regarded as sacred tree and is mentioned in the Yajurveda and the Ramayana and the importance of bael fruit lies in its curative properties which make the tree one of the most useful medicinal plant of India. Leaves are used as sacred offering to 'Lord Shiva'. All parts of plant viz., leaves, roots, bark, fruits, seeds etc. are used in preparation of various Ayurvedic medicines. In spite of its Indian origin and high medicinal and nutritional values, well organized orcharding of bael is not commonly seen in the country. It is grown throughout India as well as in Sri Lanka, Pakistan, Bangladesh, Burma, Thailand and most of the South-East Asian countries. In India, it is found growing along foothills of Himalayas, Uttar Pradesh, Bihar, Chhattisgarh, Uttarakhand, Jharkhand, Madhya Pradesh, The Deccan Plateau and also along the East Coast. In Uttar Pradesh it is being cultivated in limited areas are Faizabad, Gonda, Basti, Deoria, Mirzapur and Etawah districts and several districts of Bihar and Madhya Pradesh. However, data on area and productivity per unit area and suitability under various kinds of wasteland situation, the cultivation of this fruit is a popular and fruit has also showed great potentiality for processing industries, which may have great demand in national and international market.

### Nutrition Value

Bael fruit is a rich source of vitamin A and Vitamin B<sub>1</sub> content of fruit is higher than those of mango, guava, banana and apple; Vitamin C content of fruit is also higher than of apple. Fruit contents about 20% rind and 4.6% sugar and 9% tannin in pulp. It is reported that 100 g edible

pulp contains 61.5g water, 1.8g protein, 0.39g fat, 1.9g minerals, 31.8g carbohydrates, 55mg carotene, 0.13mg thiamin, 1.19 mg riboflavin, 1.1 mg niacin and 8g ascorbic acid. The ripe fruit is sweet, aromatic and very palatable being highly esteemed and eaten by all classes of people. The fruit have excellent aroma which is not destroyed even during processing indicates untapped potential for its processing into various highly nutritive and therapeutically important products which can be very easily popularized in domestic as well as International markets. Green bael fruits are used for preparing preserve (murabba) and candy which are an important Ayurvedic medicinal product and generally prescribed in all types of digestive troubles. It has been described as Kasyap (Astringent) and Tikta (Bitter) in taste and Laghu (Light), Rooksha (Dry) and Ushna (Hot) in effect, it alleviates Vata and Kapbay. Other products like squash, R.T.S., dehydrated slices, toffee, slab, nectar and bael powder can also be prepared from this fruit. The processing of bael fruits into easy to serve products, is also important because generally, bael fruits are not used for table or dessert purpose due to hard shell, seed, mucilage content and difficulties due to making fresh cut on the ripe fruits. The processing solves these difficulties of the consumers and thereby increases the demands of bael fruits in the market. The high potential of bael fruits attracts the research scientists and organizations subsequently cultivars, agro-techniques and orchard management practices have been developed for the fruit. The post-harvest management is an important aspect that plays role in expansion of area of a fruit.

#### **Climate and Soil**

The bael tree has its origin from Eastern Ghats and Central India in various climatic conditions. It is a very hardy subtropical, deciduous tree that can thrive well in swampy, alkaline or stony soils having pH range from 5 to 8 and up to an altitude of 1200 meters and it has also grown well and fruited on limestone of southern Florida. The bael tree grows best on rich well drained soil. It can be cultivated commercially on waste land and unproductive land for the upliftment of farmers. In India, there is a large area of waste land which is unproductive. These areas can be exploited with bael cultivation. Although it is grown in almost all the states of India yet its cultivation has received great impetus in recent years in Northern part of India due to wide adoptability and ability to withstand drought, low cost of cultivation and high economic returns.

#### **Varieties of Bael**

Some improved varieties developed by the Agricultural Universities and ICAR Institutions are given below and these below mentioned institutes can be approached for further information on bael cultivation.

#### **Varieties developed by institution**

- **G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand:**
- Pant Aparna, Pant Shivani, Pant Sujata, Pant Urvashi
- **NarendraDevUniversity of Agriculture and Technology, Faizabad, Uttar Pradesh**
- Narendra Bael-5, Narendra Bael-7, Narendra Bael-9
- **Central Institute of Sub-tropical Horticulture, Lucknow, Uttar Pradesh**
- CISH B-1, CISH B-2
- **Central Horticultural Experiment Station**
- Godhra, Gujarat. GomaYashi

#### **Planting Material**

Plants raised from seeds are not considered suitable planting material because of late bearing and not being true to the types which shows much variation in Growth of plants, physical characters

(Fruit size, number seeds per fruit, fruit weight, shell thickness, pulp ratio etc.) and chemical characters (TSS, Sugars, Acidity, Vit-A, B, and C etc.). For commercial orcharding, farmers are advised to use planting material produced by vegetative propagation methods viz., patch budding and soft-wood grafting. Seedlings can be used as rootstock for producing true to the type planting material.

### **Planting**

Rainy season (July-August) is the best time for planting. However, planting can also be done in spring season (February-March) if irrigation facilities are available. Dig the planting pits of 1m x 1m x 1m size at least one month prior to onset of monsoon. Keep the planting pits open for 20-25 days thereafter; fill each pit with a mixture of topsoil and 10-15 kg of FYM. This may be followed by irrigation to settle down the soil in pits. If depression takes place due to irrigation, add pit filling mixture to the pit. Plant the bael sapling at the center of pit and provide support to the plant. Make a basin around it and irrigate gently. Do mulching with dry leaves to conserve moisture.

### **Training and Pruning**

Training and pruning is done during early years of plant to develop good and strong framework of scaffold branches. Cut the main stem at a height of 0.9-1.0 m. Heading back results in the formation of new shoots below the cut point. Retain 3-4 well spaced and well oriented new shoots (primary branches). Do keep the tree trunk clean i.e. without side shoots up to 60-75 cm. This is required for carrying out intercultural operations smoothly. The primary branches become mature in 6-7 months. After attaining the maturity prune these primary branches to their 50% length. This induces new shoot growth on primary branches. Retain only 2-3 secondary branches per primary branches. In bearing trees, pruning is generally not advisable as this fruit crop bears fruits on one year old shoots. Pruning is restricted to central opening and removal of weak, dead, diseased, dried, criss-cross and broken branches after fruit harvesting and before commencement of new flush. Remove suckers from the rootstock time to time.

### **Manure and Fertilizer**

Plant produces a number of fruits hence application of manures and fertilizers is beneficial. Apply 10kg farm yard manure, 50g N, 25g P and 50g K per plant to one year old plants. This dose should be increased every year in the same proportion up to the age of 10 years, after which the fixed dose should be applied each year. Half dose of N, full dose of P and half dose of K should be given after harvesting the fruits. Remaining half dose of N and K should be given in the last week of August. Fertilizer application must be followed by the irrigation immediately.

### **Irrigation**

Young plants need to be watered regularly in summer and one month interval in winter for their rapid vegetative growth and establishment. In bearing trees irrigation is not required in dry summer, as it sheds leaves and resists hot dry summers. Irrigation can be applied at the time of new leaf emergence.

### **Culture**

The tree has no exacting cultural requirements, doing well with a minimum of fertilizer and irrigation. The spacing in orchards is 25 to 30 ft (69m) between trees. Seedlings begin to bear in 6 to 7 years, vegetatively propagated trees in 5 years. Full production is reached in 15 years. In India flowering occurs in April and May soon after the new leaves appear and the fruit ripens in 10 to 11 months from bloom—March to June of the following year.

**Plant Protection**

Bael being a hardy crop, there is no serious insect pest and diseases as of now. But sooty mould has been noticed in commercial bael orchards which can be managed by spraying wettable sulphur+chlorpyrifos/methyl parathion+ gum acacia (0.2+0.1+0.3%). During new leaf emergence, leaf eating caterpillar is causing serious problem and it can be managed by application of Thiodan @ 0.1%. Fruit cracking and fruit drop are two important physiological disorders found in bael. These can be managed by providing good irrigation facility, making wind breaks around the orchard and by spraying borax @ 0.1% twice at full bloom and after fruit set.

**Harvesting and Yield**

Budded and grafted plants start fruiting after 4-5 years of planting whereas, seedlings after 8-10 years of planting. Bael fruit takes around 8-10 months to mature and 10-12 months for ripening after fruit set. Bael is climacteric fruit that can be ripened, off the tree, if harvested at proper maturity stage. Maturity can be judged by the change in skin colour from dark green to yellowish green. Mature fruit should be harvested individually with 5 cm fruit stalk. A full grown (10-12 years old) budded or grafted bael tree produces on an average 150-200 fruits under good management practices.

**Storage**

Normally harvested bael fruits can be held for 2 weeks at 86° F (30° C), 4 months at 48.2° F (9° C). Thereafter, mold is likely to develop at the stem and any crack in the rind.