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CISH-Bael-1: New cultivar with thin shell

Bael (*Aegle marmelos* Correa.), which belongs to family Rutaceae occupies a special importance in Indian tradition and culture. Owing to its wider adoptability and unique medicinal *vis-a-vis* nutritional value and religious importance, it is greatly valued in Hindu religion where its fruits and leaves are used as important offering for lord Shiva. This article discusses CISH-Bael-1, a new thin shelled variety of Bael.

CISH-Bael-1 is a selection from open pollinated seedlings especially identified for its very thin shell. This is a mid-season maturing selection in which fruit attain maturity during April-May. Trees are tall with vigorous growth and dense canopy having erect growth habit. The tree is precocious and prolific bearer. Fruit shape is oval to oblong, measuring the fruit size as 15.00 cm in length and 39.2-41.0 cm in circumference with a average fruit weight 1.00 kg/fruit. Fruit colour turns to attractive lemon yellow on ripening. Fruits have very thin shell with a thickness of 0.12-0.15 cm which can be easily removed to obtain a dark yellow pulp of pleasant flavour with least mucilage and seed content. Seed number varies between 45 to 60 seeds per fruit with seed to pulp ratio 1:206 which demonstrate an excellent pulp recovery preferred for juice industry. CISH- Bael-1 has very good taste and flavour which is again a positive trait for processing industry. Fruits pulp recovery is quite high with about 65.57% pulp content having TSS of (38.0°B), total carotenoids (1.18 mg/100 g pulp), total sugar (20.54%), tannin content (3.5%), marmelosin (596.57 µg g), psoralen (102.02 µg g), aurapten (53.23 µg g) and polyphenols (3.66%), ascorbic acid (79.00 µg g), riboflavin (158 µg g), thiamine (233 µg g) and niacin (1340.00 µg g) of this variety depicts a very high nutritive and therapeutic value. The yield of fully grown up trees (10-12 years) of CISH- Bael-1 varies from 50-80 kg/tree.

The fruits are also suitable for processing into number of nutritive and medicinal products such as squash, nectar, leather, pulp, powder and jam.

Table 1. Comparative nutraceutical contents of CISH-B-1 with other commercial cultivars

Nutraceuticals	CISH B-1	NB-5	NB-9
Fruit weight (kg)	1.11	0.75	1.62
Marmelosin (µg g^{-1})	596.57	256.71	84.79
Psoralen (µg g^{-1})	102.02	34.20	62.83
Aurapten (µg g^{-1})	53.23	55.43	19.32
Polyphenols (%)	3.66	2.91	2.89
Ascorbic acid (µg g^{-1})	79	78	81
Riboflavin (µg g^{-1})	158	76	99
Thiamine (µg g^{-1})	233	26	59
Niacin (µg g^{-1})	1340	1041	471

Crop husbandry

Bael has wide adaptability for soil and climatic conditions in subtropical region. It can be grown up to an elevation of 1,200 m and tolerates low (7°C) as well as high (48°C) temperatures. All type of soils are recommended for its cultivation, however, sandy loam soil with proper drainage is considered ideal. Soil with *p*H 6.0-8.5, sodicity up to 30 ESP and salinity up to 9 dsm^{-1} EC is also suited for its cultivation. It is considered as one of the scavenger plant for problematic soils, due to it xerophytic characters.

Plants are commonly raised by seeds, which are sown in 15-20 cm raised beds of 1 × 5 m size at 1-2 cm depth just after their extraction in the month of June. Seeds germinate within three weeks. The seedling are then shifted and transplanted in the field after seven weeks of sowing. These seedlings are ready for budding/ grafting after one year. Generally, plants are prepared commercially by budding and grafting, but sometimes plants are also raised from root suckers. Among different methods of propagation, patch budding gives 80-90% success, when performed in the month of June-July.

In situ orchard establishment

In the wasteland and areas having water scarcity, *in situ* orchard establishment can be advocated. As per layout plan, two bael seeds are sown in a pit refilled as stated earlier or seedlings grown in polythene bag should be planted during June-July. Desired cultivar is budded on these seedlings during June-July in the following year.

Pit of one cubic meter size are dug at a distance of 8 × 8 m two months prior to planting (April-May). About, 30-40 kg of well-rotted FYM and one kg of neem cake or 0.5 kg bone meal are mixed in top 50% soil of each pit. The pit is filled first with unmixed soil and then with mixed soil. In sodic soil, 5-8 kg gypsum along with 20

Branch laden with fruits

Newly developed flower buds

Branch laden with fruits

Fruit attached on twig

Mature fruit

kg sand is also incorporated. Before filling, the rain water should be allowed to collect in the pit and then be flushed twice or thrice to remove harmful salts from the pit for better establishment of plants. Thereafter, filled pit should be irrigated immediately and planting should be done after 20-25 days of filling of the pit which helps to complete the soil reaction with pre-treated gypsum. After soil becomes workable the grafted/ budded plants are planted in the centre of the pit with the help of planting board during July-August.

Young plants need irrigation; frequency should be at 10-15 days interval in summer and one month interval during winter. In bearing orchards, generally irrigation is not required. During dry summer, bael plants shed all its leaves enabling the plant to escape ill-effects of hot dry winds. However, irrigation may be applied at an interval of 20-30 days during May-June just after the emergence of new leaves. Apart from irrigation, basin of trees should be cleaned by weeding and hoeing to provide suitable environment for tree growth.

Mulching with organic waste has been found very effective for establishment of bael orchards in sodic and ravenous wasteland. Among the different materials, of mulch, paddy straw or sugarcane thrash show better response.

Young plants are trained with the help of stakes, so that plants grow erect. In order to provide good framework, it is essential not to allow lateral branches upto 75 cm from the ground level on trunk. Afterwards, 4-6 branches emerging in different directions should only be allowed. The tree should be trained in modified leader system during initial 4-5 years. Generally, bael does not require pruning, however, dead and criss-cross branches, diseased, weak and broken twigs should be removed time to time.

For good yield and quality production, fertilizer dose of 5 Kg FYM, 50 g N, 25 g P and 50 g K per plant is applied to one year old plant. This dose is increased every year to the multiple of 10 years. Hence, a ten year or above aged plant should be given FYM 50 Kg, 1.0 Kg N, 250 g P and 500 g K. In sodic soil, plants generally show symptoms of zinc deficiency, which can be corrected by basal application of zinc sulphate (250 g) per tree along with fertilizer. In the orchards where fruit cracking is the problem, 250 g borax per tree should be applied along with fertilizers.

During the early years of young plantations, the inter-space can be utilized for growing suitable intercrops. Leguminous crops like, pea, cowpea, moong, urd, guar and vegetables like brinjal, tomato, spinach, coriander, chilli and garlic or oil seed crop like mustard can be cultivated. While taking inter-crop, care should be taken that crops requiring frequent irrigation and heavy dose of fertilizer should not be grown. In salt affected or marginal soils, green manure crops like *Dhaincha* should be grown in the bael orchards for few years to improve the physico-chemical properties of the soil.

Plant health management, yield and economics

Fruit of CISH- B-1 is ready for harvest in the month of April-May when shell changes its colour from deep green to yellowish green (colour break stage). The fruit should be picked individually along with a small portion of stalk (approx. 2 cm). It not only makes handling easy but also provides a signal for ripening of the fruits as the stalk gets easily separated when fruits ripen.

Bearing in budded/grafted plants start within 4-5 years of planting, whereas in seedling, it starts only after 7-8 years. The number of fruits per tree increases with the age of the tree. A 10-15 year old full grown up tree of CISH-B-1 can yield up to 80-100 fruits per tree.

CISH-B-1 is not much affected by disease and pest. However, canker and gummosis disease affect the crop to some extent. Gummosis is cured by pasting of copper fungicide or spraying of cupper fungicide. However, Canker is cured by spraying the tree with streptomycin (200 ppm).

Leaf weevil and leaf eating caterpillar are two important insect which affect the tree growth and these can be controlled effectively by spraying of Rogar (0.5%) twice or thrice at fortnightly intervals.

Generally bael fruits cracks during December-January. These can be managed by maintaining proper moisture in root zone. Mulching of tree basin by paddy straw/ dry leaves and also protecting orchard by plantation of wind break reduces the fruit cracking. Sometimes, due to borax deficiency fruits crack. This can be corrected by 50-100 g per tree borax along with fertilizer application in tree basin.

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