

# Challenges of Star Fruit *Averrhoa carambola*: A Comprehensive Overview

Shivani Dhyani<sup>1</sup>, Harsh Mehta<sup>2</sup>

<sup>1</sup>Department of Horticulture (Vegetable Science), Assistant Professor Doon Business School Group Agriculture and Allied Sciences)  
Mail Id: shivani1425[at]gmail.com,

<sup>2</sup>Department of Genetics and Plant Breeding, Professor Doon Business School Group Agriculture and Allied Sciences (Ex Principle Scientist, ICAR - IISWC Dehradun  
Email: harshmehta[at]doonbusinessschool.com

**Abstract:** *This article provides a comprehensive overview of the lesser - known star fruit *Averrhoa carambola*, also known as *Carambola*, including its origins, adaptability, plant characteristics, uses, nutritional composition, climate and soil requirements, propagation methods, pests and diseases, harvesting techniques, and post - harvest handling. With a focus on its cultivation, nutritional benefits, and challenges, the article sheds light on the potential of this fruit for consumption and commercial production.*

**Keywords:** Star fruit, *Averrhoa carambola*, cultivation, nutritional value, challenges

## 1. Introduction

Carambola (*Averrhoa carambola*), also known as star fruit (Five Corner) is the lesser known fruit in India. The edible fruit has distinctive ridges running down its sides, when cut in cross section, it resembles a star, giving it the name of star fruit. The entire fruit is edible, usually raw, and may be cooked or made into relishes, preserves, garnish and juices. It may be transformed into Jams and stored in sterilized jars for long periods. Star fruits are juicy, crunchy and with a mixture of slightly sweet and sour tastes. It is commonly consumed in southeast Asia, South Asia, and the South Pacific, Micronesia, parts of East Asia and United States, Parts of Latin America and the Caribbean. The tree is cultivated throughout tropical areas of the world. It is popular in number of common names as “Kamrakh” in Hindi and in Gujrati, “Star fruit” in English, “Kamranga” in Bangali, Karambal in Marathi and Konkani, Karambal - drakshi, Kaparakshi hannu (Kannada), “Carmbala” in Marathi and “Konkani”, “Kaparakhi hannu” in Kannada and “Chaturappuli and Vajrappuli” in Malayalam, Karmanga in Oriya, Thambaratham in tamil, Ambanamkaya (Telugu) and Kordoi, Rohdoi in Assam. This Star fruit plant belongs to the genus, *Avverrhoa*, which contain 5 species, namely *A. bilimbi*, *A. dolichocarpa*, *A. leucopetala*, *A. microphylla* and *A. carambola*. However, *A. carambola* is widely cultivated

on a commercial scale. It is widely consumed in Central South America and Asia pacific region including Indonesia. It belongs to the family Oxalidacea having Chromosome number  $2n=2x= 22$  and is native of tropical Southeast Asia.

### Origin:

The centre of Origin of Kamrakh is unknown but probably native to Malaysia, Indonesia and Southern China. In India it was domesticated throughout India and Southeast Asia in prehistoric times.

### Adaptation:

The Carambola is subtropical in nature because mature trees can tolerate temperatures below 27<sup>o</sup>F for short period of time with little damage and the young plants are most susceptible to frost.

### Plant Characteristics:

The Carambola tree has a short trunk with many branches, reaching up to 9m in height. Its deciduous leaves are 15 to 25 cm long, with 5 to 11 ovate leaflets medium green in colour, with purple streaks and the leaf is small and oval in shape. The upper surface of leaf is smooth and yellowish green in colour. The lower surface is dark green in colour. The leaf is 2 - 4 cm wide and 2 - 9cm long. about



5mm. Trees in bloom supply pollen and nectar leading to high quality honey. The showy fruits have a thin, waxy pericarp, orange yellow skin, and crisp, yellow flesh with juice when ripe. The fruit is about 5 to 15cm in length and is an oval shape. It usually has five or six prominent longitudinal ridges. The flesh is translucent and light yellow in colour. Each fruit can have 10 - to 12 flat light brown seeds about 5 - 15 mm in width and enclosed in gelatinous aril. Once removed from the fruit, they lose viability within a few days. The sour varieties have a higher oxalic acid content than the sweet type. Carambola is tropical and subtropical fruit which can be grown at elevations up to 1200 metres. It prefers full sun exposure, but requires enough humidity and annual rainfall of at least 1800 mm. The tree grows rapidly and typically produces fruit at four or five years of age. The large amount of rain during spring actually reduces the amount of fruit. The producers of carambola in the world market include Australia, India, Israel, Malaysia, and Philippines, Taiwan and United States. Malaysia is a global leader in star fruit production by volume and ships the product widely to Asia and Europe. The trees are also grown as ornamentals for their abundant brightly coloured and unusually shaped fruits, as well as for their attractive dark green leaves and their lavender to pink flowers.

#### Uses of Star Fruit:

Carambola is mainly consumed as fresh fruit but also can be used as juice. It may also be processed into preserved products like Jam, Jellies, Wine and Brandy. It is very beneficial for lowering blood pressure, relief headache, vomiting, coughing and restlessness.

#### Nutrient Availability:

Star fruit contains various nutrients such as vitamin (B1, B2 and C), minerals and bioactive compound. It is a good source of fibre and contains cellulose, hemicelluloses and pectin and the rich source of natural antioxidants such as l - ascorbic acid (Vitamin C) and Gallic acid, which are common antioxidants. Star fruit may help with various diseases related to the brain, heart and stomach. The

nutritional value of Star fruit per 100g are Water (92.6g), Energy (35.7kcal), Protein (0.38g), Carbohydrate (9.38 g) and Fibre (0.8 g), Calcium (6.37 - 6.40 mg), Iron (0.34 - 0.45 mg), Potassium (167 - 168 mg), Phosphorous (17.87 - 17.88), Sodium (3.8mg), Copper (0.19 - 0.45 mg), Zinc (0.29 - 0.51), Magnesium (11.85 - 12.05 mg), Carotene (0.003 - 0.55), vitamin C (25.8 mg), Vitamin B1 and B2 (0.12) and Oxalic acid (9.6 mg).

It has very high potassium content and water can be called as potassium rich fruit. Potassium is very important for our body function. It works as an electrolyte and maintains blood pressure, transmitting nerve signals between organs, controlling muscle contraction, balancing pH in the body, regulating proper digestion process, preventing heart and stroke disease and regulates heart muscle activity. As in a normal life especially in hill region people do not know about it and do not consume it because of lack of knowledge they say this is the poisonous fruit so do not eat it. So this is our responsibility to aware society about their nutrient availability. Another side of Carambola has one drawback that it contains oxalic acid and neurotoxin caramboxin. Both substances are harmful to individuals suffering from kidney failure, kidney stones or those under kidney dialysis treatment.

#### Climate Requirement for Star Fruit:

Star fruit trees grow in warm climate and moist condition. This fruit is cultivated in India from sea level to the hills up to 1200 m height. Well distributed rainfall throughout its growth would result in good quality fruit and better yield.

#### Soil Requirement:

Star fruit can be cultivated in a wide range of soils. However deep soils with good organic matter and good drainage are best for its cultivation and yield. This fruit can be grown both in alkaline and acidic soils, but it prefers moderately acidic soil with the pH range 5.5 - 6.5

**Propagation of Star fruit:**

Grafting, Budding, Layering are recommended, even though this tree is often propagated through seed. The reason being is to produce true type plants. Seed should be cleaned, dried and grown in plastic bag and allow hardening of the seeds. Seed should be planted in a well draining potting media such as peat moss and will germinate in approximately 7 days depending upon temperature. Once seeds have germinated, they should be transplanted into individual containers containing sandy loam soil. Seed should be transplanted in the main field. Seeds only remain viable for a few days and should be plump and fully developed for propagation. The seedling should be kept in these containers until they are transplanted. If the root stocks are to be used, make sure to have at least a year old to transplant in the field. Grafting and Budding should be carried out on one year old seplings. Veneer grafting onto suitable rootstock yields the best result for commercial production. There are two types of vegetative propagation for the production of planting material. They are patch budding and cleft grafting. The plant can be planted into the field four months after grafting.

**Spacing:**

The most common spacing system is square system with the distance of 6 x 6 m resulting of plant density 278 plants per hectare. Planting holes should be almost 0.6 x 0.6 x 0.6 m are dug after ploughing.

**Irrigation in Star Fruit:**

Irrigation immediately after transplanting the Star Fruit plant into the main field is required. Young plants may require frequent irrigations until they are established in the main field. In rainy season, it does not require any irrigation. In case of heavy rains or flooding, good water drainage is a necessity as these trees are sensitive to water logging and water should not be allowed to stagnate

**Varieties:**

There are two main varieties of star fruit, the smaller type fruits are tart in taste and the bigger and longer counterparts are sweet. Both of these fruits when unripe are dark green in colour and during the ripening process there colour may varies from a bright yellow to golden or orange. The taste of star fruit is very sweet when it is fully ripe on the tree. The ripening will take 60 - 75 days based on the climatic conditions, irrigation practices, and the variety of the fruit. There are four clones of the plant available for cultivation B2 (MAHA 66), B10, B11b (Chan Yong I) are medium in size and B17 (Belimbing Madu) are Large size.

**Pruning and Canopy Management:**

Pruning of the Carambola plant is important for getting a good shape, easy maintenance and subsequently give good yields. Removing unhealthy branches and water shoots improves ventilation, reduces occurrences of diseases and facilitates fruit bagging. The height of the tree is maintained at about 2 - 4 meters to enable foliar spraying. Pruning also induces flowering. Pruning usually stops when the tree starts to bear fruits. The following Pruning methods can be used such as: -

- 1) Open centre system
- 2) Modified central leader system

- 3) Trellis branching system

**Insets and Diseases:**

The diaprepeps weevil (*Diaprepes abbreviates*) cause damage to the roots, which may lead to root and shoot dieback. Major pests are Carambola fruit flies, fruit moths, ants and birds. Carambola trees are also attacked by a number of scale insects including plumose (*Morganella longispina*) and philephedra tuberculosa scales, which attack leaves and twigs, causing defoliation and stem die back. Fruit damaged caused by stink bugs (*Nezara sp.*) and squash bugs (*Acanthocephala sp.*) result in pinhole sized markings on the fruit surface and dry areas of the flesh under puncture wounds. This may lead to infection by fungi which cause soft rot of the fruit.

Fruit blotch miner causes a superficial damage to the waxy cuticle and can be identified by meandering brownish coloured trails on the fruit surface. Brown scales (*Coccus hesperidum*) and red banded thrips (*Selenothrips ubrocinctus*) have also been observed feeding on carambola fruit. The common disease of star fruit Algal disease, *Alternaria* black spot, Anthracnose, *Cercospora* leaf spot, *Phythium* root rot.

Harvesting of Star Fruit: Grafted trees will be ready for harvesting in 1 to 2 years whereas seedlings can take about 4 years. These trees bloom and bear fruits even on trunk. Usually these trees bear fruits all around the year but peak stage is during January to February and September to October months. Fruits are ready to harvest when they turn from green to yellow in colour. Hand picking is recommended.

Yield of Star Fruit: Yield will be varied according to variety and age. An average of 80 - 90 kg/ fully grown tree can be obtained.

**Post Harvest Handling and Storage**

The fruit should be harvested carefully and arranged in a basket with the wrappers still intact. It is then carried to the collection centre and arranged horizontally in a special plastic baskets or corrugated paper boxes which are insect proof as to avoid insect pest infestation. It is not necessary to get rid of the wrappers because this will prevent the fruits from damage due to bruises.



At the collecting center, the first phase inspection is conducted to look for damaged or fruit fly infected fruits are then removed or discarded. The fruits are then transported to the packing house using insect - proof cold trucks to keep

them fresh, for preserving the quality. The wrappers are removed and the fruit are graded according to size, colour and quality.

## **2. Conclusion**

The cultivation of star fruit, *Averrhoa carambola*, offers a promising avenue for diverse applications, from fresh consumption to processing into various products. The fruits unique appearance, nutritional richness, and adaptability to various climates make it a valuable addition to tropical and subtropical agriculture. However, challenges such as susceptibility to pests and diseases, especially in post-harvest stages, emphasize the need for effective management strategies. By harnessing its nutritional potential and addressing cultivation obstacles, the star fruit industry can contribute significantly to both local economies and global markets.