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RESEARCH ARTICLE

STAR FRUIT: ENHANCING INDIAN FOOD PRODUCTION AND SUPPORT TO NUTRITIONAL SECURITY NEEDS MORE LIMELIGHT

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ABSTRACT

India has done well to expand food production and build up adequate safety stocks of food grains. For over 70 percent of rural Indian households, agriculture, including livestock, still remains the principal source of livelihood. With a six-fold increase in food grain production from 50 million tonnes in 1950-51 to nearly 300 million tonnes in 2019-20, India has become a net food exporter, being the ninth largest exporter of agricultural products in the world. The share of agriculture and allied sectors in the total Gross Value Added of the Economy have improved to 20.2 per cent in the year 2020-21 and 18.8 per cent in 2021-22. The Indian economy is an agro-economy and depends highly on the agricultural sector. Despite just supporting the Indian Economy, the agricultural sector also supports the industrial sector and international trade in imports and exports. Although the contribution of the Agricultural Sector to the Indian Economy is reducing, it is the sector with the most number of people working in it around the country. Adequate nutrition is a basic human need. Only if people can satisfy their nutritional requirements on a regular basis, and use and utilize adequate and safe food with the respective energy, protein, vitamin and mineral content, is one of the most important pre-condition for an active, healthy and decent life. For nutritional security we need recent days, farm diversification and crop diversification. There are many not so recognized food plants those are nutritionally rich, among those Carambola is one. Carambola, also known as star fruit. 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. Carambola fruits contain oxalic acid and the neurotoxin caramboxin. Consuming large quantities of the fruit, especially for individuals with some types of kidney disease, can result in serious adverse health effects. The center of diversity and the original range of Averrhoa carambola is tropical Southeast Asia. It was introduced to the Indian Subcontinent and Sri Lanka by Austronesian traders. They are grown as ornamentals. Carambola is considered to be at risk of becoming an invasive species in many world regions. The showy fruits have a thin, waxy pericarp, orange-yellow skin, and crisp, yellow flesh with juice when ripe. Each fruit can have 10 to 12 flat light brown seeds about 5–15 mm (1/4–1/2 in) in width and enclosed in gelatinous aril. Once removed from the fruit, they lose viability within a few days. Carambola is known by many names across its regions of cultivation, including kamranga (Kamaranga) in Bengali (India and Bangladesh). The entire fruit is edible, including the slightly waxy skin. The flesh is crunchy, firm, and extremely juicy. It does not contain fibers and has a texture similar in consistency to that of grapes. Carambolas are best consumed shortly after they ripen when they are yellow with a light shade of green, or just after all traces of green have disappeared. Ripe carambolas may also be used in cooking. The juice from carambolas is also used in iced drinks, particularly the juice of the sour varieties. Carambolas contain caramboxin and oxalic acid. Both substances are harmful to individuals suffering from kidney failure, kidney stones, or those under kidney dialysis treatment. Consumption by those with kidney failure can produce hiccups, vomiting, nausea, mental confusion, and sometimes death. Caramboxin is a neurotoxin. Major pests are carambola fruit flies, fruit moths, ants, and birds. Crops are also susceptible to frost. Top producers of carambola in the world market include Australia, Guyana, India, Israel, Malaysia, the Philippines, Taiwan, and the United States. The trees are also grown as ornamentals for their abundant brightly colored and unusually shaped fruits, as well as for their attractive dark green leaves and their lavender to pink flowers. Knowing the importance of this star fruit crop, the extension agencies who are working at grass-root level, they must include this crop in their knowledge and extension activities to educate and aware the farmers which will ultimately reflect the total agricultural food production and that will support food security and nutritional security to countrymen.

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INTRODUCTION

Carambola, also known as star fruit, is the fruit of *Averrhoa carambola*, a species of tree native to tropical Southeast Asia. The edible fruit has distinctive ridges running down its sides (usually 5–6). 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 is commonly consumed in Southeast Asia, South Asia, the South Pacific, Micronesia, parts of East Asia, the United States, parts of Latin America, and the Caribbean. The tree is cultivated throughout tropical areas of the world. Carambola fruits contain oxalic acid and the neurotoxin caramboxin. Consuming large quantities of the fruit, especially for individuals with some types of kidney disease, can result in serious adverse health effects.



Star Fruit Tree & Star Fruit Ripe Fruit

What Is a Star Fruit?: Star fruit, also known as carambola, is a tropical fruit that looks like a star when you slice it. Unripe star fruit is dark green, but its thin layer of skin turns glossy yellow as it ripens. Carambolas are oval-shaped and are usually 3 to 5 inches long. It mainly grows in India, Malaysia, Indonesia, and the Philippines, but you can get it all over the world. Star fruit has many health benefits, but it can be dangerous if you have kidney disease. Star fruit is a nutritious tropical fruit packed with vitamin C, fiber, and antioxidants. Star fruit grows on the *Averrhoa carambola* tree. The trees grow well in sunny and humid climates like those of Southeast Asia, South America, Australia, and certain parts of the U.S. Ripe star fruit is fleshy, crunchy, and juicy, and has a sweet and slightly tart taste. Smaller star fruits are more tart than the larger fruits. Over-ripe carambolas may have a fermented flavor, or taste sour.

Origins and distribution: The center of diversity and the original range of *Averrhoa carambola* is tropical Southeast Asia, where it has been cultivated over centuries. It was introduced to the Indian Subcontinent and Sri Lanka by Austronesian traders.

Scientific classification

Kingdom: Plantae

Clade: Tracheophytes

Clade: Angiosperms

Clade: Eudicots

Clade: Rosids

Star Fruit Tree & Star Fruit Ripe Fruit

Oxalidales

Family: Oxalidaceae

Genus: *Averrhoa*

Species: *carambola* Binomial name *Averrhoa carambola*

DESCRIPTION

TREE

The carambola tree is small to medium in height (22 to 33 ft) and spreading (20 to 25 ft in diameter; 6 to 7.6 m), and single or multi-trunked. Carambola trees are evergreen, although when grown in cooler locations, they lose some or all their leaves during the late winter and early spring. Trees grow rapidly in locations protected from strong winds.

The mid-canopy area (3 to 7 ft high; 0.9 to 2.1 m) is the major fruit-producing area of mature trees.

LEAVES

Carambolas have compound leaves 6 to 12 inches long that are arranged alternately on branches. Each leaf has 5 to 12 green leaflets 0.5 to 3.5 inches long (1.5 to 9 cm) and 0.4 to 1.8 inches wide (1 to 4.5 cm).

INFLORESCENCE (FLOWERS)

Carambola flowers are borne on panicles on twigs, or small-diameter branches, and occasionally on larger wood. The flowers are perfect, small (3/8 inch or 1 cm in diameter) and pink to lavender in color. They have 5 petals and sepals. Depending upon the cultivar, carambola flowers have either long or short styles.

FRUIT

The fruit is a fleshy, 4- to 5-celled berry with a waxy surface. Fruit are 2 to 6 inches in length, with 5 (rarely 4–8) prominent longitudinal ribs. They are star-shaped in cross section. The fruit skin is thin, light to dark yellow, and smooth, with a waxy cuticle. The pulp is light to dark yellow in color, translucent, crisp, very juicy, and without fiber. Desirable varieties have an agreeable, subacid to sweet flavor. Fruit are sweetest when allowed to ripen on the tree. It takes about 60 to 75 days from fruit set to maturity depending upon variety, cultural practices, and weather.

SEEDS

There are usually no more than 10–12 seeds per fruit and sometimes none. Seeds are edible, 1/4 to 1/2 inch long, thin, light brown, and enclosed by a gelatinous aril. Seeds lose viability in a few days after removal from fruit.

POLLINATION

All the flowers on a given carambola variety have either long or short styles; this condition is called heterostyly. Some carambola cultivars may require cross pollination (short-styled by long-styled cultivar or vice versa) for good fruit set and yields. However, varieties such as 'Fwang Tung', 'Golden Star' and 'Arkin' produce abundant crops when planted in solid blocks, indicating that the need for cross pollination by opposing stylar types is not always necessary.

Other varieties such as 'B-10' and 'B-17' produce more fruit when cross pollinated with another variety.

VARIETIES

There are many cultivars; however, some may be unavailable for purchase from nurseries due to a limited amount of plant-propagation material or undesirable fruit characteristics. There are two main types of carambolas, sweet and tart. Sweet types are recommended for fresh fruit while both sweet and tart types are useful for processing and home recipes. Some tart cultivars, such as 'Golden Star' attain a sweet flavor if they are allowed to ripen on the tree (i.e., become golden yellow). List of cultivars provided by University of California Cooperative Extension.

The Kamarkha tree is unique in that it does not have any specific species or variety. Its varieties are identified on the basis of its sour and sweet taste. In this way, there are only two varieties of kamarkha – sour and sweet.

- 'Arkin' - Dark yellow skin, very sweet, medium-small size partially fertile, good keeper
- 'Golden Star' - Golden yellow, sub-acidic, large size self-fertile
- 'Hoku' - Bright yellow, sweet, medium size, few seeds
- 'Kajang' - Bright yellow, sweet, medium-small size, few seeds
- 'Kwang Tung' - Light yellow skin, very sweet, very large size
- 'Maha' - White-yellow, sweet, round (less star-shaped).
- 'Newcombe' – Tart
- 'Sri Kembangan' - Yellow-orange, sweet, large size, few seeds.
- 'Thayer' – Tart
- 'Wheeler' - Orange, sub-acid, medium large size, good bearer.

PROPAGATION: Carambola trees can be grown from seed, but fruit quality is inconsistent. You should grow carambola from grafted trees. Carambola trees need a regular supply of water and fertiliser. They respond well to heavy pruning. Basic requirements Carambola is a tropical to subtropical tree which grows best in warm to hot temperatures between 20 and 35°C (68–95°F). Trees will generally cease to grow at temperatures below 18.3°C (65°F) although established trees can withstand short periods at -2.8°C (27°F). Carambola is commonly grown from seed although veneer grafting onto suitable rootstock yields the best results for commercial production. Seeds only remain viable for a few days and should be plump and fully developed for propagation. Seeds should be planted in a well-draining potting media such as peat moss and will germinate in approximately 7 days depending on temperature. Once seeds have germinated, they should be transplanted into individual containers containing sandy loam soil. The seedlings should be kept in these containers until they are transplanted. Carambola trees should be planted in full sun and spaced 9 m (30 ft) apart.

METHODS

Seed: Seed propagation is not recommended for orchard production of star fruit because of how variable the seeds are, but many private growers have been successful with seed

propagation. It must be done quickly though because the seed is only viable for a few days.

Air Layering: Layering is a possible method but rarely used because the star fruit has very slow root production.

Grafting: Grafting is the most successful propagation method especially for large-scale production. It is recommended to use a cleft or veneer graft for best results.

Fruit Development: Fruits usually appear about 6 to 9 months after pollination, so around late fall to early winter. Cross-pollination is said to increase fruit set. The plant is not allowed to bear fruit until its second or third year to promote the plants hardiness. Carambola is produced all year

Package of practice

Nursery: Proper planting is one of the most important steps in successfully establishing and growing a strong, productive tree. The first step is to choose a healthy nursery tree. Commonly, nursery carambola trees are grown in 3-gallon containers and trees stand 2 to 4 ft from the soil media. Large trees in smaller containers should be avoided because the root system may be "root bound." This means all the available space in the container has been filled with roots to the point that the tap root is growing along the edge of the container in a circular fashion. Root bound root systems may not grow properly once planted in the ground. Inspect the tree for insect pests and diseases, and inspect the trunk of the tree for wounds and constrictions. Select a healthy tree and water it regularly in preparation for planting in the ground.

SITE SELECTION

In general, carambola trees should be planted in full sun for best growth and fruit production. Select a part of the landscape away from other trees, buildings and structures, and power lines. Remember, carambola trees may become moderately large if not pruned to contain their size. Select the warmest area of the landscape that is protected from constant winds and does not flood (or remain wet) after typical summer rains.

Field preparation and transplanting: Before planting Kamarkha, the field should be well plowed two to three times. The soil should be leveled by applying a pata after making the field free from weeds. For transplanting plants in the field a month before rainy season, pits should be dug in such a way that the distance between them is 8×8 meters. At the time of transplanting, the pits should be filled by making a mixture of 5 kg of manure and soil and should also make a tree bag. Regular cleaning and weeding of these bags should be done. This improves growth of the plant.

Climate: It is a subtropical plant it will not tolerate anywhere that it frosts regularly.

Soil: General care and maintenance Carambola trees require moist soil for optimum production. Carambola can be grown successfully in many soil types, from heavy clay to sandy soils but will perform optimally in a rich, well-draining loam with a pH between 4.5 to 7.0 Trees will not tolerate water logging but do require a moist soil for optimum production. A star fruit tree likes slightly acidic soils, but do not thrive on

salty soils. It is not particular of soil type but prefers a sandy loam. It has a low tolerance of flooding because it is susceptible to root rot. Carambola trees are well-adapted to many types of well-drained soils. Trees grow best where the soil reaction is moderately acid to neutral in pH (4.5 to 7). In calcareous and high-pH soils (above 7), special care is required to prevent minor element deficiencies, particularly iron, manganese, and zinc (see Fertilizer section). Warm climate is best suited for the cultivation of Kamarkha. For this the pH value of the soil should be between 5.5 to 6.5. Nutrient rich alluvial soil is suitable for good yield of Kamarkha. There should be proper arrangement of drainage in its garden. Kamarkha tree can be easily grown in areas up to an altitude of 1200 meters above sea level. But its yield is affected in frost prone areas. How to make Kamarkha plant? Before transplanting Kamarkha plants, they have to be prepared in the nursery. They can be prepared by almost all the popular methods. Such as gift pen, pressing, shield glasses, forkert glasses and armpits etc. January is the best time for pressure and glasses methods.

Spacing: The trees should be placed in a well-lit area with 15 to 20 foot centers. Provide a windbreak for the trees also. Carambola trees in the home landscape should be planted 20 to 30 feet or more (7.6 to 9.1 m) away from buildings and other trees. Trees planted too close to other trees or structures may not grow normally or produce much fruit due to shading.

Water: Young trees should be irrigated regularly after planting to promote establishment in the soil. Older trees should be watered regularly from flowering to fruit set. A star fruit tree loves to have moist soil, so water it regularly during every season. Keep an eye on it during extreme heat and drought periods. Lower watering during pollination for best pollination results. Young trees should be irrigated regularly to facilitate tree establishment and growth. Once trees begin to bear (1 to 2 years after planting), trees should be irrigated regularly from flowering through harvest. After transplanting, light irrigation of Kamarkha should be done. Irrigation is not required during the rainy season. But it is important to protect the trees from water logging. After this, irrigation should be done on 15 days in summer and at month interval in winter or as required.

Pruning: Young trees should be pruned in the first 1–2 years after planting by cutting the tips off of branches which are greater than 60–90 cm (2–3 ft) in length to encourage branching. Older trees should be pruned to maintain a manageable height. Many trees are pruned to maintain a healthy size and shape for healthy fruit growth. During the first 1 to 2 years after planting, young trees should be pruned by tipping shoots in excess of 2 to 3 ft to increase branching. If desired, trees may be trained to a modified central leader or open center configuration. Mature trees may be selectively pruned to maintain trees at 6 to 12 ft (1.8 to 3.6 m) in height. Selectively removing a few upper limbs back to their origins (crotches) each year will help prevent the loss of the lower tree canopy due to shading by the upper canopy. In addition, maintaining a smaller tree facilitates tree care and fruit harvest, makes it easier to spray the tree, and greatly reduces possible storm damage. Do not remove lower tree branches.

Fertilization: Young carambola will benefit from applications of fertilizer containing nitrogen, phosphorous, potassium and magnesium every 30 to 60 days. Established,

mature trees should be fertilized 4 to 6 times per year. Star fruit need a regular application of Nitrogen every 60-90 days. Occasionally it is prone to minor mineral deficiencies and they can be treated like other citrus fruits. Young trees should receive ¼ to ½ pound (113 to 226 g) of a mixed fertilizer containing nitrogen (N), phosphorus (P), potassium (K), and magnesium (Mg) every 30 to 60 days. As trees mature, the fertilizer rate should increase (0.45 to 2.3 kg) with an application frequency of 4 to 6 times per year. Fertilizer mixtures containing 6-8% nitrogen, 2–4% available phosphoric acid, 6–8% potash and 3–4% magnesium are satisfactory. In acid to neutral-pH soils, micronutrients such as managanese, zinc, and iron may be applied in dry applications to the soil or in a liquid form and sprayed on the leaves. Three to 6 applications should be made per year. Trees growing in high-pH or calcareous soils should receive 4 to 6 foliar applications per year of a micronutrient mix which includes zinc and manganese. Iron deficiency may be corrected by 1 to 2 yearly soil applications of iron sulfate for trees growing in neutral or low-pH soils and 4 to 6 soil drench applications of chelated iron (specifically formulated for calcareous soils) to high-pH soils (pH above 7). Since the Kamarkha tree is a multi-year plant and produces fruits throughout the year, it also needs nutrients throughout the year. That is why it is necessary to give 100 kg of decomposed cow dung in a year for better yield of each tree of Kamarkha. If only this is done, then the Kamarkha tree does not need any chemical fertilizer. However, chemical fertilizers can be used according to the soil test report.

Pests and Disease: California claims to have little problem with pests and disease but other parts of the world have difficulties with flies. 2-3 weeks after fruit development the fruits must be wrapped to prevent the fruit flies from laying their eggs in the fruit. 1-2 fruits per cluster are wrapped with either newspaper or plastic bags and kept that way until they reach their destination. You can tell if a plant has been infected by fruit flies by the appearance of black spots or scorched patches on the skin of the fruit. The best way to minimize pests is to remove all old or infected fruit immediately from the orchard site. There are several pests that can affect this crop, including sulphur-crested cockatoos, fruit fly, fruit-sucking moth, fruit-eating caterpillars, green vegetable bugs, flatids and red-banded thrips. You should use bird netting to protect carambola from pests. Carambola trees are attacked by a number of scale insects including plumose (*Morganella longispina*) and philephedra (*Philephedra tuberculosa*) scales, which attack leaves and twigs, causing defoliation and stem dieback. The diaprepes weevil (*Diaprepes abbreviatus*) causes damage to the roots, which may lead to root and shoot dieback. Fruit damage caused by stink bugs (*Nezara* sp.) and squash bugs (*Acanthocephala* sp.) results in pinhole-sized markings on the fruit surface and dry areas of the flesh under the puncture wounds. This may lead to infection by fungi which cause soft rot of the fruit. Fruit blotch miner (*Lepidoptera: Gracillaridae*) causes a superficial damage to the waxy cuticle and can be identified by meandering brownish colored trails on the fruit surface. Brown scales (*Coccus hesperidum*), red-banded thrips (*Selenothrips rubrocinctus*) and a weevil (*Myctides imberbis*) have also been observed feeding on carambola fruit. Birds, opossums, and raccoons may attack fruit especially early in

the season. Their damage can be identified by the V-shaped marks left on the ribs of the fruit. Reddish colored leaf spot diseases are caused by various fungi (*Cercospora averrhoa*, *Corynespora cassiicola*, *Phomopsis* sp., *Gloeosporium* sp. and *Phyllosticta* sp.). Observations indicate that these leaf spot fungi are more common on environmentally stressed or nutritionally deficient trees and occur on older leaves that normally abscise (drop) during the winter and early spring. No control is necessary for these leaf spotting fungi. Twigs and limbs may be attacked by red alga (*Cephaleuros virescens*). Symptoms include rough, circular, greenish-grey or rusty-red areas and shoot dieback. Ripe fruit that is injured may be attacked by the fruit-rotting fungus (*Colletotrichum gloeosporioides*), which causes anthracnose. A superficial blackish discoloration on fruit (sometimes called "sooty mold" or "sooty blotch") caused by *Gloeodes pomigena* may be found on fruit surfaces. Generally, no control is warranted for these fruit diseases. The fungus *Pythium splendens* has been identified as the cause of root rot and a general tree decline syndrome. Decline symptoms include loss of tree vigor, leaf drop, twig, shoot, and root dieback, and reduced fruit size and production.

MULCH

A layer of mulch around the trees will help to conserve moisture in the soil but should not be mounded up against the trunks. Mulching carambola trees in the home landscape helps retain soil moisture, reduces weed problems next to the tree trunk, helps to prolong warm soil conditions (beneficial to carambola trees) and improves the soil near the surface. Mulch with a 2- to 6-inch layer of bark, wood chips, or similar mulch material. Keep mulch 8 to 12 inches from the trunk.

HARVESTING & MARKETING

Harvest - The star fruit are usually harvested by hand from the tree or shaken down by a machine. They are harvested when the fruit becomes a yellowish-green color. It is preferred to harvest in the morning when the temperatures are cool. With preferred weather conditions trees can produce 100 up to 300 pounds of fruit in a year. Carambola is picked by hand when ripe. Fruits are ready to harvest when they have turned from green to yellow in color, with the tips of the ribs remaining green. Fully ripe fruit naturally fall from the tree but can be picked earlier if desired.

Storage – The fruit must be put into storage within 24 hours to minimize bruising. They should be kept at around 50 degrees F. Carambola can be stored for up to five weeks at 10 degrees Celsius and for 10 weeks at 5 degrees Celsius.

Grading – Before the fruits are shipped they are graded into 3 sizes:

Small – weighing 130-160 grams

Medium – weighing 160-190 grams

Large – weighing over 190 grams

Shipping – Because of good agricultural practices the US ships fruit regularly to Europe, but we receive little from Asia because the fruit loses its crispness when it is sterilized.

Availability – The fruit is available usually from August to March.

Selection – Choose a fruit that is firm, with no bruising or spotting. If it is still slightly green you may ripen it at room temperature out of the sun.

The Market – Asia has a large market for star fruit, while in other parts of the world the fruit is rarely seen. The market in America would increase tremendously if a frost-tolerant variety could be produced. Carambola fruit do not increase in sugar content after picking and so for optimum sweetness and flavor should be picked when fruit turn from green to a yellow color in the furrow between the ribs while the tips of the ribs (fins) remain green.

Fruit may be stored in plastic bags for up to about 21 days in the refrigerator. The colour of the fruit of Kamarkha changes from green to yellow on ripening. Its ripe fruits should be plucked carefully, so as not to harm it. After plucking, Kamarkha should be washed thoroughly with water, cleaned and sent to the market. It gives good prices.

NUTRITIONAL STATUS

Star fruit is low in calories has a lot of vitamins and other nutrients, including the following:

- Fiber
- Protein
- Vitamin C
- Vitamin B5
- Folate
- Copper
- Potassium
- Magnesium

NUTRITIONAL VALUE PER 100G RAW CARAMBOLA

Constituents	Quantity
Energy	128 kJ (31 kcal)
Carbohydrates	6.73 g
Sugars	3.98 g
Dietary fiber	2.8 g
Fat	0.33 g
Protein	1.04 g
Vitamins	Quantity %DV†
Vitamin A equiv. lutein zeaxanthin	66 µg
Thiamine (B1)	1% (0.014 mg)
Riboflavin (B2)	1% (0.016 mg)
Niacin (B3)	2% (0.367 mg)
Pantothenic acid (B5)	8% (0.391 mg)
Vitamin B6	1% (0.017 mg)
Folate (B9)	3% (12 µg)
Choline	1% (7.6 mg)
Vitamin C	38% (34.4 mg)
Vitamin E	1% (0.15 mg)
Minerals	Quantity (%DV†)
Calcium	0% (3mg)
Iron	0% (0.08mg)
Magnesium	2% (10mg)
Manganese	2% (0.037mg)
Phosphorus	1% (12mg)
Potassium	4% (133mg)
Sodium	0% (2mg)
Zinc	1% (0.12mg)
Other constituent	Quantity
Water	91.4g

Source: USDA Database entry

USES OF STAR FRUIT

- **Eat star fruit raw, on its own, or with other fruit.** Try pairing the fruit with avocados, kiwis, mangoes, and bananas in a fruit salad.
- **Cook it as part of a main dish.** Star fruit is used in many recipes, including Vietnamese sour soup (often with seafood) and Indian curries.
- **Make a puree, jam, or pickle.** You can preserve star fruit so it can be kept in the fridge or freezer to enjoy later. In India, star fruit is used for certain chutneys.
- **Create an edible garnish.** You can sauté star fruit slices for a second or two, and sprinkle with sugar to glaze. Pair this with fish and poultry dishes, or use it as a substitute for lemon or lime slices to garnish chilled beverages.
- **Drink it.** Use a juicer to extract star fruit juice, or add chopped star fruit to your blender with other fruit for a smoothie.
- The fruits are not only aesthetically appealing but are also the sources of antioxidants including vitamin C.
- Their high potassium and low sodium content makes them suitable for consumption by people suffering from hypertension.
- The juicy fruits are suitable for fresh consumption as well as for processing in the form of juice, squash, salad, pickle etc.
- Cultivation of carambola and its processing could promote small scale enterprises such as fruit salads, beverages etc. in tourist places of our islands.
- The wood is made into furniture.
- The juice removes rust stains.
- The juice can be used to polish brass because of its acidity.
- The fruit is used as a garnish, in salads and to make jellies and fruit tarts.
- The Chinese use it to cure coughs and colds and believe that it lowers blood pressure.
- Carambola fruit can be eaten fresh or cooked and the juice can be used in iced beverages. The fruit is also used in relishes or as a seasoning.
- Carambolas are primarily consumed as a fresh fruit.
- They may be used in fruit salads, as a garnish for meat, salad, and casserole dishes or they may be processed into pickles, sauces, wines, and jellies.
- Carambola trees are an excellent tree for the home landscape. The foliage is green and attractive, and flowers and fruit are beautiful. The fruit is valued for its appearance and unusual shape.
- The flowers are added to salads in Java and made into preserves in India.
- The leaves are eaten as a substitute for sorrel.
- The juice of acid types of Carambola is used to clean and polish metal and bleach rust stains from white cloth.
- Carambola wood is white, reddening with age, close-grained, and hard enough to use for construction.
- Lowering cholesterol levels.
- Rich in fibre to improve digestion.
- Treating cough.
- Anti-microbial ingredients.
- Sources of vitamin
- It is an excellent source of healthy plant compounds, including quercetin, gallic acid, and epicatechin. These compounds have powerful antioxidant properties and various health benefits.
- The plant compounds in star fruit have been shown to reduce fatty liver risk and cholesterol in mice.
- They're also being studied for their ability to prevent liver cancer in mice.
- What's more, some evidence from animal studies suggests that the sugars in star fruit may reduce inflammation.
- **Anti-inflammatory ability.** The high levels of antioxidants in this fruit make it a good anti-inflammatory that can help ease symptoms of psoriasis and dermatitis.
- **Weight loss promotion.** The fiber in star fruit can boost your metabolism and help you feel full longer, so you may eat less. It's also a low-cal snack.
- **Immunity-boosting ability.** Star fruit gives you a healthy dose of vitamin C, which helps your body make germ-fighting white blood cells for a strong immune system.
- **Improved heart health.** The potassium in star fruit helps lower your blood pressure, which lowers your risk of a heart attack or stroke. Research shows it also may lower cholesterol levels.
- **Improved digestion.** The fiber in star fruit helps move waste through your digestive tract, relieving constipation, bloating, cramping, and diarrhea.
- According to experts in Food Science and Post-harvest Technology of ICAR- IARI (Indian Institute of Agricultural Research), New Delhi, the minerals and vitamins found in kamarkha are very important and useful for health. They give us long life, energy and beauty. It is beneficial in diseases like bladder and kidney problems, relief from fever, problems related to bile and digestion, flatulence and diarrhoea.
- Consumption of kamarkha provides ample amount of vitamin 'B' complex. It makes women's hair strong and shiny.
- Antimicrobial elements found in kamarkha are beneficial in the treatment of eczema.
- It increases milk in women after delivery and delays the resumption of menstruation.
- Consumption of kamarkha is also very beneficial in the prevention of diabetes.
- Copper is also found in kamarkha, which improves heart health by reducing cholesterol levels. This reduces the risk of heart attack or coronary heart disease and keeps blood pressure balanced.
- Taking a glass of Kamarkha juice mixed with sugar in the morning ends the problem of loss of appetite.
- Kamarkha is also very beneficial in the prevention of phlegm, bile and blood disorders in smokers.
- For its treatment, grind kamarkha and cook it on low flame till it becomes one-fourth. Then after cooling, add rock salt and roasted coriander and cumin etc. to it according to taste. Consuming 7 to 10 grams of this in the morning and evening also eliminates fatigue and gives a feeling of being energetic.

HEALTH BENEFITS OF STAR FRUITS

- The fruit is used in traditional Asian medicine to treat chickenpox, intestinal parasites, headaches, and other illnesses. Star fruit contains oxalate, too much of which can be dangerous.
- Sources of vitamins A and C.

- Consumption of kamarkha increases bone density and helps in preventing osteoporosis.

SIDE EFFECT OF STAR FRUIT

Carambolas contain caramboxin and oxalic acid. Both substances are harmful to individuals suffering from kidney failure, kidney stones, or those under kidney dialysis treatment. Consumption by those with kidney failure can produce hiccups, vomiting, nausea, mental confusion, and sometimes death. Caramboxin is a neurotoxin which is structurally similar to phenylalanine, and is a glutamatergic agonist. Star fruit may cause adverse effects in some people, mainly due to its high oxalate content. Therefore, people with kidney problems should avoid star fruit and its juice — or consult with a doctor before trying it. For people with kidney problems, eating star fruit regularly may lead to kidney damage as well as star fruit toxicity, which may cause neurological problems — such as confusion, seizures, and even death. People taking prescription drugs should also proceed with caution. Similarly to grapefruit, star fruit can alter the way a drug is broken down and used by your body. Carambolas have many helpful nutrients, but they also contain a substance called caramboxin that is a neurotoxin. That means it can affect your brain and cause problems in your nervous system. Another substance in star fruit, oxalate, can cause damage at high concentrations, leading to reduced kidney function. If your kidneys are healthy, they can process and pass toxins out of your body. But if you have kidney disease, the toxins stay in your body and can cause serious illness.

CONCLUSION

The fruit is native to tropical regions of South East Asia, agro-climatic conditions of Andaman and Nicobar Islands are suitable for its cultivation. A few farmers in various parts of Andaman Islands have planted the trees of sweet carambola in their backyards. Studies at ICAR-CIARI have suggested that it can be planted at closer spacing with appropriate canopy management and produces flowers and fruits throughout the year with three major picking seasons.

The tree bears fragile branches and hence, the field should be protected against high wind velocity. However, the tree revives back on its own, thereby making it a suitable plant for fragile island ecosystem. A grafted or budded plant starts bearing fruits within 2-3 years of planting and from 7-8 years onwards, commercial harvest is obtained. Ideal stage of harvesting of fruits for direct consumption or for sale in local market is when about 50% of the fruit surface has turned yellow. Fruits should not be stored in refrigerator as they are sensitive to chilling injury. Present day needs of Indian agriculture—(1) Increase production of all food crops to cope up with increasing population. It will give food security to countrymen. (2) Increase quality production of all food crops for nutritional security. (3) For commercial gain or earning foreign exchange, we need to give more emphasis on food processing. (4) Emphasis on world market information and market intelligence. (5) Time has come to give more research emphasis on marketing of agricultural products compare to more production of agricultural products. (6) Changing food habit an unit of nutritional security. (7) More research on non-traditional crops for identifying their nutritional potentiality and encourage farmers to cultivate those. (8) To make Indian agriculture stable, population control is need of the hour. (9) To make Indian agriculture stable, compulsory education is needed. (10) In agriculture, educated youths are needed. (11) More emphasis on crop diversification and farming diversification. (12) Agricultural reformation is needed now-a-days. (13) Research on irrigation water availability, in this respect, vapour irrigation may open a new dimension. (14) Agricultural labourers availability must be ensured. (15) Availability of good quality seeds in everywhere in our country, (16) Excess Food Production Management (EFPM) is the need of the hour and essential. (17) Organic farming (18) Glorify agriculture and agriculture profession (19) Emphasis on cultivation of non-traditional crops etc. Carambola is also a non-traditional crop. Carambola cultivation has many advantages especially its nutritional compositions and medicinal values. Food processing of fruit of carambola itself, a value addition especially fruit juice is very good for consumption and promotion of this crop in future. Therefore, extension agencies working at base levels must consider this crop as an important crop for future extension.

REFERENCES

www.starfruit.com
