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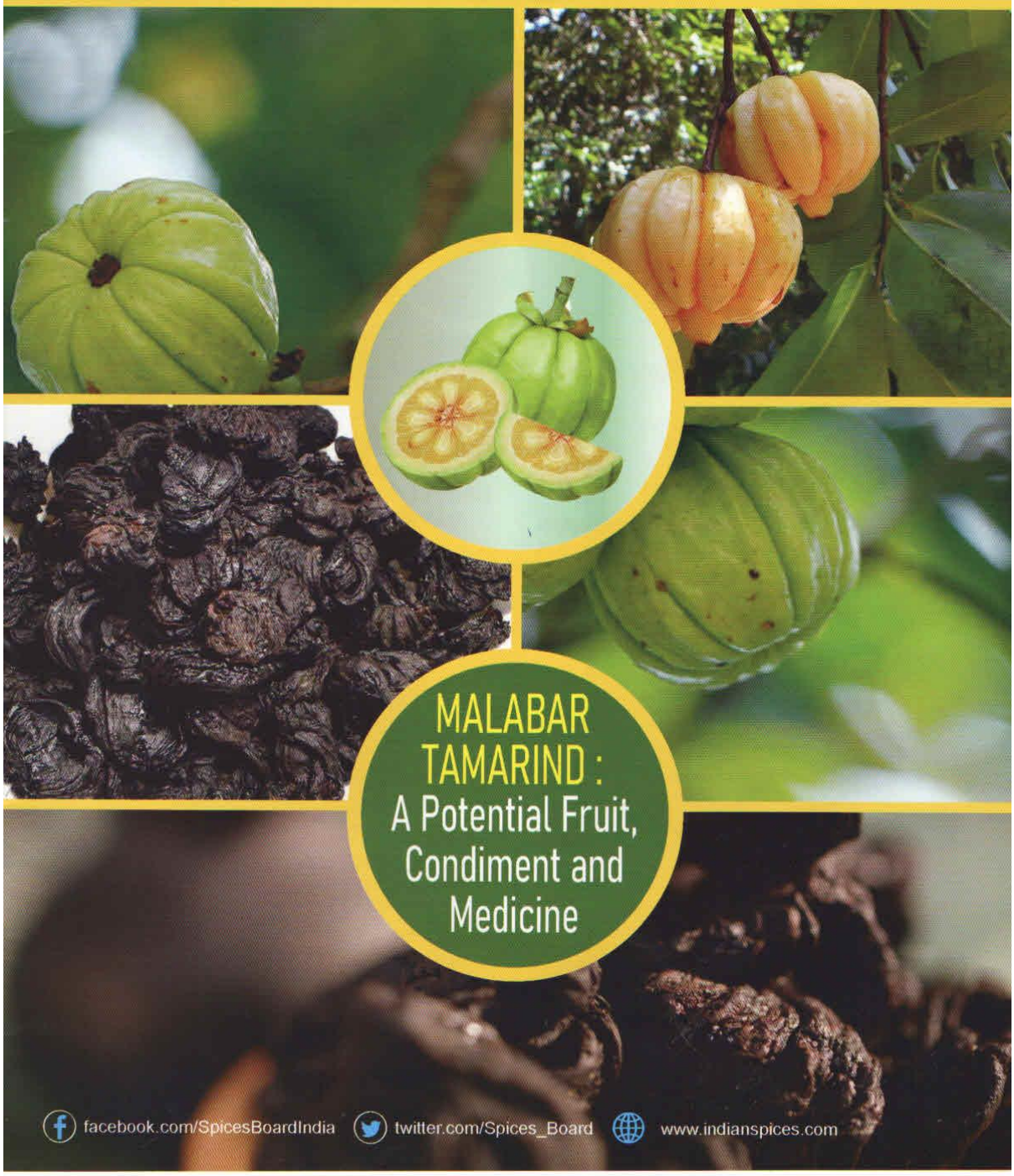

MALABAR TAMARIND : A Potential Fruit, Condiment and Medicine

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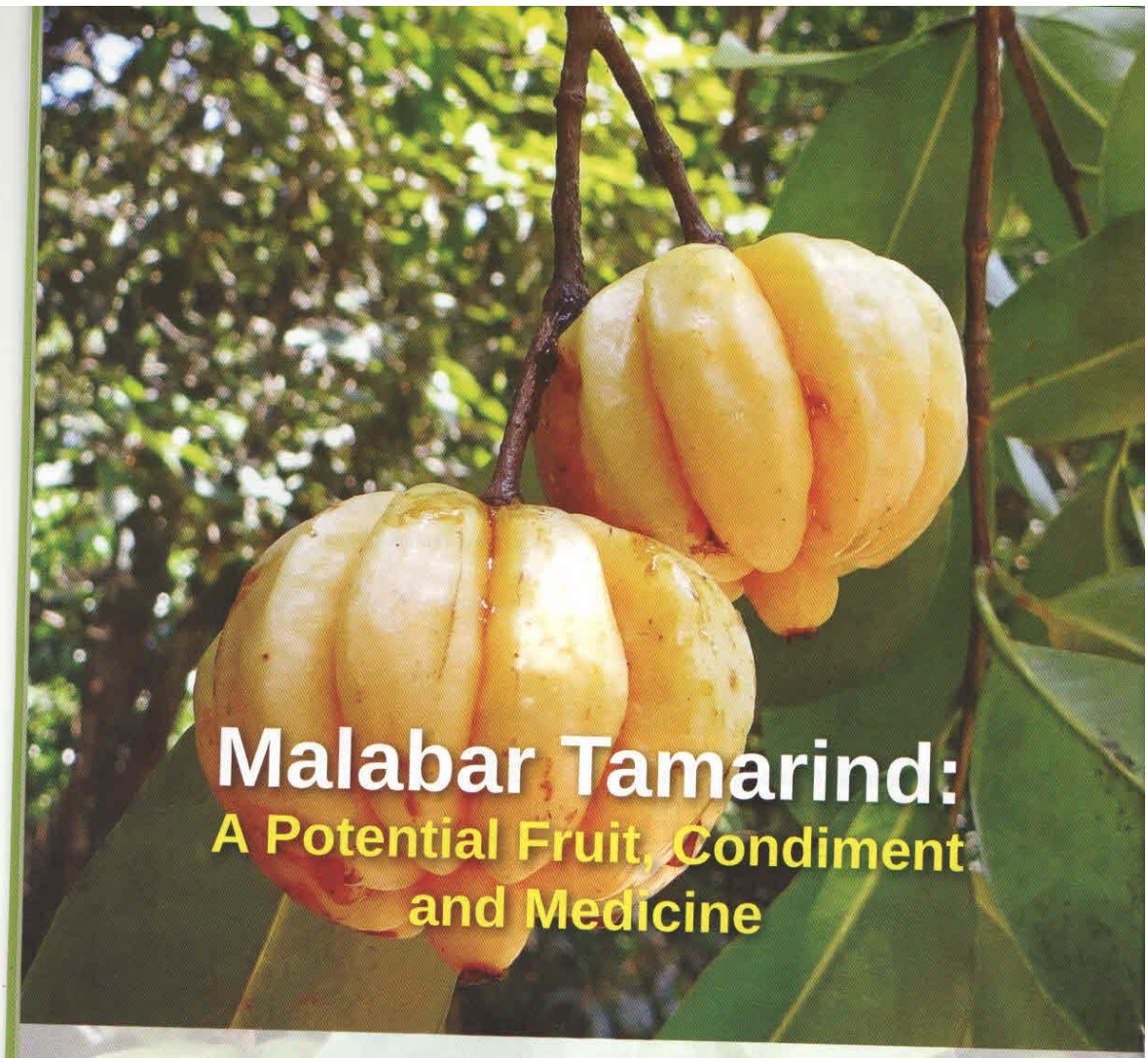

Malabar Tamarind: A Potential Fruit, Condiment and Medicine

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India is the centre of origin for many tropical fruit tree species. Some of them are still unexploited though they are significant sources of food and nutrition for many ethnic communities. Garcinia is one of the important genus of fruiting plants. The genus Garcinia, belonging to the family Clusiaceae, includes about 200 species found mostly in Asia and Africa. Around 35 species of Garcinia are found in India.

Malabar tamarind (*Garcinia gummi-gutta*), one of the important condiments widely seen in the homesteads of Kerala and some parts of Karnataka, is valued for its dried rind which is used in the preparation of fish curries for imparting a special flavour and taste. It is known as *Upagi mara* in Kannada, *Kudampuli* in Malayalam, Cambodge in English, *Pannampuli* in Tamil and *Goraka* in Sri Lanka. The tree is found commonly in the evergreen forests of Western

Ghats south of Konkan region and the shola forests of Nilgiri Hills up to an altitude of 2000 meters. This fruit resembles a small pumpkin and is green to pale yellow in colour. The dried rind of the fruit is used in the preparation of non-vegetarian dishes. This species is traditionally used for polishing silver and gold. The tree is moderate in size, evergreen and the flowers are unisexual, sessile and auxiliary. Its leaves are dark green, shining, elliptic to abovate and the fruit resembles a small yellow or reddish pumpkin. The fruit pulp is dull yellow, edible, sour with one to five seeds at the centre. The fruits are used for making dried flakes, vinegar, etc., and its fruit has many medicinal properties. The dried flakes and powder is used in several anti- obesity products.

Origin and Distribution

Malabar tamarind is a native of India and Myanmar (Burma). *G. gummi-gutta* is also known as *G. cambogia.* It grows extensively in Sri Lanka and Southeast Asia. Three varieties have been reported in *G. gummi-gutta,* out of which *G. gummi-gutta* var. *gummi-gutta* is distributed widely. The other two varieties are restrictedly endemic to the Western Ghats. *G. gummi-gutta* var. *gummi-gutta* is distributed wildly in the evergreen forests of the Western Ghats ranging from 400 m to 900 m. It is fairly common and abundant in the forests of western Sri Lanka from sea level to an elevation of 600 m and in Malaysia.

In Kerala, it is very popular in the Central Travancore areas, where maximum diversity is seen. *G. gummi-gutta var. gummi-gutta* is cultivated all over the low lands and mid lands of Kerala ranging from sea shore to the high lands up to 600 m. *G. gummi-gutta* var. *conicarpa* is a high altitude species (1350- 1950 m) distributed rarely in evergreen forests of south Western Ghats. *G. gummi-gutta* var. *papilla* is very rare in the evergreen forests of southern Western Ghats and found in an altitude of 800-1850 m. Samples of *G. gummi-gutta* var. papilla and gummi-gutta var. conicarpa were collected from Silent Valley, Palakkad District and Kadalar, Rajamala, Kottamala forest regions of Idukki District and Vellarimala, Chembra Hills of Wayanad District respectively.

Nutritional Value

The fruits of Malabar tamarind have a peculiar taste and are used for edible purposes. It contains a lot of nutrients too. The fruits are rich in carbohydrates, potassium, tanins, etc., and contain alpha-HCA Hydroxy Citric Acid, garcinol, and xanthones that possess a lot of nutritional as well as pharmaceutical values (Table 1).

Nutrients	Quantity	Nutrients	Quantity
Moisture	86.91 g	Non reducing sugars	5.62 g
Protein	0.61 g	Fibre	3.1 g
Fat	1.4 g	Potassium	169.7 mg
Total sugars	8.6 g	Sodium	2.1 mg
Reducing sugars	2.67 g	Tannins	1.7 g

Table 1. Chemical Composition of Malabar Tamarind Rind (100 g edible portion)

Use

Fruits are edible but too acidic to be eaten raw. They are valued after they are processed and dried. The fruits are used in traditional food preparations and have a distinct taste. The dried rind is used as a condiment in Kerala and Karnataka in place of tamarind or lime. The unripe fruit is cut into sections, sun dried and used in curing of fish. The dried fruits and fruit vinegar are extensively used by the natives of Coorg in food preparations. Malabar tamarind is used commercially in fish curing, especially in Sri Lanka and South India. It is a spice that dominates the Kerala red fish curry. The edible kernel fat is used as a component in ointments, soaps, confectionaries, cosmetics, and also for culinary purposes. The gum is used to make varnish.

Medicinal Values

The fruits have anti-scorbutic, astringent, demulcent, and antiseptic properties. They are anti-inflammatory and anti-microbial. Some health benefits of the fruits include lowering of blood pressure, promoting skin regeneration, strengthening of bones, alleviating allergies, reducing stress, fighting depression, lowering cholesterol, regulating blood sugar, increasing metabolism, and boosting energy levels. The fruits are used in the treatment of cancer, flu,

cough, and arthritis. Fruit rind is a rich source of alpha-HCA (Hydroxy Citric Acid) which prevents fat accumulation in body cells. The HCA content in the fruits is reported to be three times higher than that in Kokum. This natural HCA is a potent metabolic regulator of obesity and also lowers blood lipids such as cholesterol and triglycerides by triggering the fatty acid oxidation in the liver via thermogenesis. It mobilizes body's fat stores and dissolves fat in the liver and throughout the body paving way for weight management. It has antiulcerogenic effect. It decreases acidity, increases the mucosal defense in the gastric areas and prevents gastro mucosal injury.

Even though Malabar tamarind is increasingly becoming important industrially, commercially and medicinally, its worth has not been fully utilized. It is gaining importance for assisting weight loss through appetite suppression and by reducing the body's ability to form adipose (fatty) tissue during times of overeating. Garcinia has also been historically used to treat gastric ulcers due to garcinol. Garcinol is known to lower the acidity in the stomach and protect the gastric mucosa. The rind of fruit is also an astringent, and historically used in the treatment of diarrhoea and dysentery as well as having the added benefit in the treatment of gastric and duodenal ulcers. It is reported to have a protective ability against external toxins, such as alcohol. The extract of fruits is used as purgative in traditional medicine. Malabar tamarind is known for its medicinal values in ayurveda. It helps to promote digestion and decoction made out of it is used against arthritis and some uterine diseases. Fruit rind is hydragogue, antihelmintic and emetic, particularly in dropsies. It is employed in veterinary medicine as a rinse for diseases of mouth in cattle. The roots of the trees are used to relieve the swelling of body due to viper bite.

Botanical Description

It is a small or medium sized tree with round, hemispherical, conical or pyramidal crown, and horizontal or drooping branches that are orthotropic and plagiotropic. The bark is rough and dark brown but young shoots glabrous. Leaves are dark green and shining, simple, opposite, elliptic-obovate or lanceolate, slightly acuminate, glabrous, 5-13 cm long and 2.5-7.5 cm broad. The petiole is 2.5-16 cm long and stout. The tree is dioecious exhibiting male and bisexual types. Flowers are borne in the axils of leaves or on the tip of branches either solitary or in group. Male trees produce 10 to 40 male flowers as bunches that falls off quickly; elongated, with 40-80 fertile stamens. There are 0.3-05 cm long thick and fleshy sepals. Petals are four, more than twice as long as the sepals, abovate oblong, concave, with narrowly membranous margins, pink, cream or pale yellow, fleshy and thick. In the female/bisexual plants solitary or three to four flowers are seen in a bunch in terminal or auxiliary fascicles and are bigger than male flowers which are located at the short end and visibly stout. Pedicel is short or absent. There are 6-20 stamens, unequal, mostly sterile, arise around the ovary in a ring, free or connate at the base. Ovary is superior, globular, grooved with 6-10 carpels with a single ovule in each. Stigma is sessile, ramified, 5-12 rayed and tubercled. Fruit is a berry, ovoid or spherical in shape, 5.7-7.5 cm in diameter, yellow or red when ripe, with 7-13 grooves, not continued to the apex which is smooth, depressed, and often mamillate. Pericarp is fleshy, 1.0 cm thick. Fruit contains 7-10 seeds surrounded by a succulent white or red aril which is edible, sweet or acrid. Seed is 1.8 cm thick, ovoid, compressed, with pale brown testa, veined. The fruits vary in size from 50 to 200 g. Male trees flower from December to March while bisexual trees flower from February to March. After flowering it takes three weeks for fruit set and the fruit takes 120 to 135 days to ripen which coincides with the rainy season i.e., June-July.

Area and Production

The trees can be found in forested areas and are also protected in plantations otherwise given over to pepper, spice, and coffee production. The Malabar tamarind tree grows in almost every backyard in Kerala. There is almost no plantation of *Garcinia gummi-gutta* in India except a few orchards in some research institutes. The fruits are collected from forests or home gardens and sold in the market. It is estimated that almost 2500 tonnes of the dried rind of Malabar tamarind is collected from forest and other areas. Karnataka is the leading producer of Malabar tamarind where almost 1200 tonnes of rind

is collected every year earning more than 2.0 crores (Table 2).

Table 2: Collection and sale of *Garcinia gummi-gutta* rind in Karnataka*

Districts	Collection (Tones)	Value (Rs)
Uttara Kannada	48	8,64,000
Dakshina Kannada	113	20,034,00
Hassan	136	24,48,000
Kodagu	972	1,64,15,000
Total	**1206**	**21,762,000**

*Report of Forest Dept., Karnataka (2014), based on the market collectors', information.

Climate and Soil

Malabar tamarind grows well under humid tropical climatic condition. It flourishes very well in plains as well as in hills upto an elevation of about 2000 m from mean sea level. It requires bright sunlight for best growth and yield but can grow in 50 per cent shade. It thrives well in areas receiving over 250 cm of rainfall and grows in all soil types i.e., lateritic, alluvial soils, etc. It grows well in dry or occasionally water logged or flooded soils, but good drainage is required for optimum growth.

Varieties

Very little research has been done in *Garcinia gummi-gutta*. Lot of variability was observed in terms of vegetative, floral, fruiting and biochemical character of the fruits by National Bureau of Plant Genetic Resources Regional Station (NBPGRRS), Thrissur, Indian Institute of Spices Research (IISR), Kozhikode, Central Horticulture Experiment Station (CHES), Chettalli and Indian Institute of Horticulture Research (IIHR), Bengaluru. The institutes also possess some collections of the fruit variety. So far no variety has been released in India. However, a few promising lines (cultivars) have been identified at NBPGRRS, Thrissur; IISR, Kozhikode and CHES, Chettalli.

IC244110 is promising for fresh fruit weight (200.0 g), fresh rind weight (125.5 g), fresh rind thickness (13.6 mm), fresh seed weight (2.4 g), fresh and dry kernel weight (0.6 g). It is an accession with the highest length of protrusion (nipple) in fruit.

IC244100-2 (INGR No. 04061) is early bearing (6 years after transplanting), high yield in number of fruits (1496), high fresh fruit yield (104.2 kg), single fresh fruit weight (82.6 g), high number of seeds per fruit (6), high seed weight (1.6 g), high dry rind thickness (3.5 mm) and high yielding during the last nine years.

IC244111-1 (INGR No. 04062) is early bearing (7 years after transplanting), high yielding in number of fruits (1470), high fresh fruit yielding (99.3 kg), single fresh fruit weight (84.4 g), yields high number of seeds per fruit (6) and high seed weight (2.4 g), high dry rind thickness (2.5 mm) and high yielding during the last nine years.

CHES-GG-V/1

This is a promising seedling selection with higher fruit weight. The tree has upright growth, and is medium sized. The fruits ripe in the month of July. The fruit weight ranges between 75 to 85 g. Fruits are dull yellow in colour and having white flesh, 6-7 seeds/ fruit, yellow coloured rind, and is eight segmented, juicy, and acidic. The rind recovery is 62 per cent. The fruit contains 13.5° Brix total soluble solids and 62 mg Vitamin - C /100 g pulp. The average yield is 400-700 fruits per tree (Fig. 1).

Fig 1. Fruits of CHES-GG-V/1

IIHR-GG-2-09

This collection is a high yielding regular bearer. The tree has upright growth, and is medium sized. The fruit ripe in July-August under Bengaluru conditions and the fruit weight ranges between 75 to 80 gm. Fruits are dull yellow coloured, having 6-7 seeds/fruit, yellow coloured rind, white flesh, eight segments and

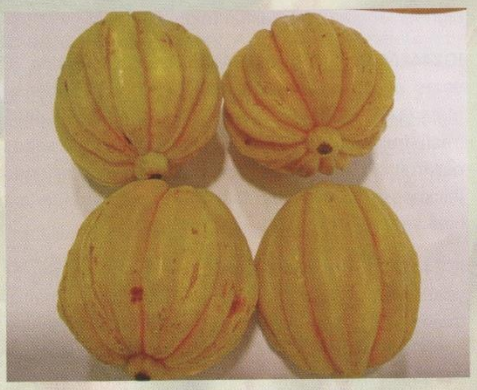


Fig 2. Fruits of IIHRGG-2-09

is juicy and acidic. The rind recovery is 56 per cent. The fruit contains 13^0 Brix total soluble solids. The average yield is 200-250 fruits per tree (Fig. 2).

Propagation

The plant may be propagated by seed, grafting and root suckers. Traditionally seed propagation is used to multiply plants. The seed germination and growth was found very slow due to seed dormancy. Higher seed germination and control over seed dormancy can be achieved within seven days by *in vitro* inoculation of ¾ mature seed on to ½ MS basal medium. The seedling produces 50-60 per cent male and 40-50 per cent of female trees, but still, seed propagation is used particularly for afforestation programmes. Vegetative multiplication through cleft grafting has been found successful with success rate of 70-75 per cent if done in rainy months. The pencil thickness size seedlings can be used for grafting and scion should taken for upward growing twigs of three to four months. The own seedlings are nest rootstocks as the performance is not studied on other rootstocks. The plants become ready for planting after 10-12 months of grafting.

Planting

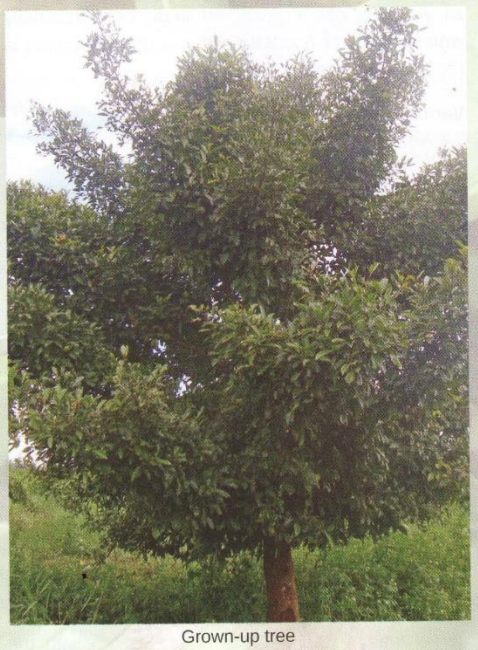
The land should be prepared by cleaning of bushes, ploughing and levelling. Pits of 2x2x2 m size are dug before rainy season in the month of May. These pits are filled with a mixture of topsoil and organic manure. Planting is done at the onset of monsoon. The planting is usually done at 6 x 6 m distance. The plants grow slowly, therefore they require proper care and maintenance in the initial years of planting. Growth of shoots and sucker should not be allowed below the grafting/budding joints. Do not over water or allow rain water to stagnate near young plants during rainy season.

Manure and Fertilizer

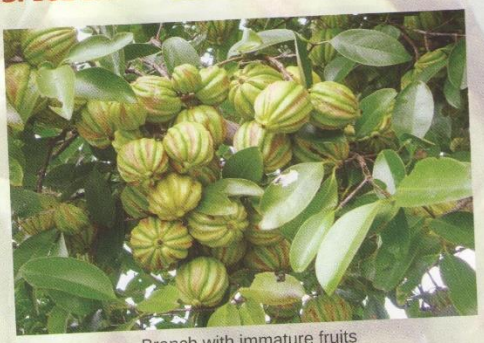
Most of the plants are found in forest and periphery of other plantations and inorganic fertilizers are generally not used. Use of organic manures such as farmyard manures or leaf compost may give higher yield. Apply 10 kg farmyard manure or compost per plant during the first year. Gradually increase the quantity so that a well-grown tree of 15 years and above receives 50 kg of organic manure per year. There is no recommendation for inorganic fertilizer so far.

Irrigation

Irrigation should be given immediately after planting to ensure better establishment of plants. Irrigation is essential for young plants in first three years during dry months. There is not much irrigation required as it is grown at high rainfall areas but regular supply



Grown-up tree



Branch with immature fruits

of water in fruiting season ensures higher yield and quality of fruits.

Training and Pruning

It is an evergreen plant. The seedling plant has tendency to grow upright, hence so apical branches may be trimmed during the initial years to make way for an open centre system. The drooping and interlocking branches must be removed every year for better yield and quality of fruits. The suckers should be removed regularly.

Flowering, Pollination and Fruiting

The seedlings start flowering at eight to ten years from planting whereas grafted plants starts flowering after five to six years. Flowering takes place in the month of March-April and fruits ripe by July– August. However, this may vary as per climatic conditions. Pollination is supposed to be done by wind but parthinocarpic fruit set is also found in few cases. The fruit set is high. There is some fruit drop if there is moisture stress. The fruit drop of mature fruits is very common if not harvested timely. Fruit requires 110 to 125 days to mature.

Disease and Pest

There are no major disease and pests reported so far.

Maturity, Harvesting and Yield

The fruit matures in the months of July–August. Fruit colour changes from green to bright yellow at maturity. Colour become dull yellow at ripe stages and fruit become soft. Generally fruit matures in 110-125 days after fruit set. All fruits do not mature at one time, thus the harvesting is done several times. Ripe fruits fall from the trees and are gathered from the forest by local people. However, most of the fruits get damaged and the quality is poor. For a tree planted in orchard/plantations, harvesting should be done manually to maintain good quality. These fruits may be kept for six to seven days for softening. Generally a 15 year old seedling plant produces 30-40 kg fruits per plant. The old trees may yield up to 200 kg /tree.

Post-harvest handling, Value addition, Storage and Marketing

Matured fruits are hard and can be stored for six to seven days at room temperature. They are very sour and are not used as fruits. The fruits are made into dried flakes, powder, vinegar, etc. Dried flakes are used as a substitute for tamarind in curries. The ripe fruits are cut into slices, dried in the sun and sold in market as a sour relish in curries as well as for dressing fish. It has a lot of demand in Malnad and Kerala and is sold at Rs 300-800 per kg. Seeds which contain high amount of oil are used to extract garcinia butter. The butter has a lot of demand in cosmetics.

Value added Products

1. Dry flakes

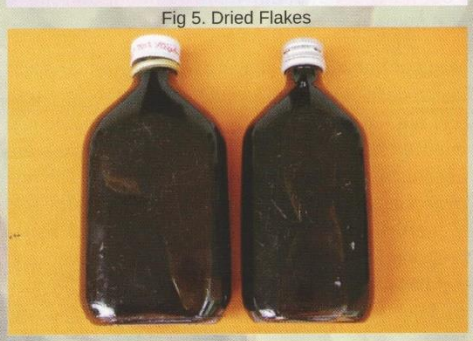
The dried flakes are prepared by sun drying. The fruits are washed in running water and air dried. Then fruits are manually cut into halves/ segments and the fleshy portion containing the seeds is removed. The outer skin is sun dried for three to five days.

2. Vinegar

Vinegar (*Kachampuli* in Kodagu) of Malabar tamarind is routinely used in Kodagu non - vegetarian preparations especially in pork for emulsification of fat, to add flavour and to improve taste. For generations in Kodagu, this is used at the rate of half teaspoon for one kg of meat. Reddish colour of pork after cooking with vinegar will turn to brownish black. It is also used in making fish, chicken and mutton curries.

For preparation of vinegar, fruits are allowed to ferment in bamboo basket for 10-15 days after harvesting. Yellowish green juice coming out of the fruits (*panakke* in Kodagu) is collected in mud pot. This mud pot is gently boiled for four to five hours, after repeated agitation, to get the water evaporated and to get a sticky and black residue like honey, which

Fig 5. Dried Flakes



Vinegar

Seed Butter

is the concentrated form of vinegar. Depending on the dryness of the vinegar, it can be stored in bottles for five to six years without spoilage.

3. Garcinia Butter

Generally seeds of Malabar Tamarind are a waste product of post-harvest operations. The seeds contain oil and the oil content ranges between 22.12 to 48.30 with a mean of 36.45 per cent which is comparable to the yield of oil in Kokum. The seed oil has been in use for edible purposes since nearly 100 years ago in South India. Later as the financial status of the farmers improved and as the availability of other edible oils became widespread, use of seed oil from Malabar tamarind decreased. However, for the preparations of special dishes such as *holige* and *pancha kajaye* (local names of the dishes), use of edible fat and oil of Malabar tamarind is still in practice. The seeds of Malabar tamarind contain oleic acid, a rich edible fat that resembles Kokum butter. Total of five fatty acid methyl esters were present in the oil sample. Among the five fatty acid esters present in the Malabar tamarind seed oil, Methyl 16-methyl heptadecanoate (54.57%) was found to be the predominant compound. Traditionally seed butter is obtained through a very laborious process. Seeds are dried in the sun, chopped, and boiled in water and churned for the separation of butter. The butter can be used in various cosmetic products just like Kokum butter.

Malabar tamarind is known for its anti-obesity and other health benefits. Powder and tablets are prepared by many pharmaceutical companies and sold in the market. There is a lot of demand for processed products of Malabar tamarind in Kerala and coastal parts of Karnataka. Dried flakes are sold at Rs 300 to 800 per kg and market price for *kachampuli* vinegar in Coorg ranges from Rs 1000 to 1500 per litre. Cultivation of Malabar tamarind is almost negligible and almost all quantity is collected from forests or home gardens. Deforestation and low regeneration has resulted in depletion of the yielding trees. Thus, production is decreasing while demand is increasing day by day. Hence, it is high time that the commercial cultivation of this tree is started as a part of mixed cropping system in the Western Ghats. The forest departments should also include this tree species in their afforestation programmes in the Western Ghats.