

ANNUAL SUBSCRIPTION 120



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SPICE INDIA

April 2019, Vol. 32, No.4



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PAGE LAYOUT, DESIGN & PRINTING

Print Express

44/1469 A, Asoka Road

Kaloor, Ernakulam 682 017

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SPICE INDIA

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Volume 32

Issue 04

April 2019



Spice India published simultaneously in
ENGLISH, MALAYALAM, TAMIL, KANNADA, TELUGU, HINDI & NEPALI

SUBSCRIPTION RATES

One year - ` 120, Five years - ` 500

Subscription may be sent either by
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The Secretary, Spices Board, Kochi

Contents Page

Technological Interventions for Tamarind Processing and its Value Addition **5**
DR. Siddharth Priyadarshi, DR. Chetana R, DR. Madheni Madhava Naidu

11 Tamarind: Cultural Practices
Manju Thomas



Malabar Tamarind: A Profitable Introduction for the Bay Islands **15**
Pooja Bohra and Ajit Arun Waman

19 Curry Leaves to Cure Animal Ailments
Dr. Ganesh M. Hegde



Plantation Crops Symposium (PLACROSYM XXIII) Concludes **21**

22 Fish Mint Plant to Add Fishy Taste to Dishes
K. V. Saji, V. A. Muhammed Nissar, G. D. Harish
M. S. Shivakumar, J. Rema, B. Sasikumar



24 Calendar of Operations May - 2019



Spice Statistics for the Month of March **28**
Trade Information Services

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Technological Interventions For Tamarind Processing and Its Value Addition

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Tamarind, *Tamarindus indica* L. is an arboreal fruit of *Leguminosae* family which is abundant in the Indian states of Andhra Pradesh, Bihar, Karnataka, Madhya Pradesh and Tamil Nadu. The word 'tamarind' is derived from the Arabic term, 'Tamar-ul-Hind', which means 'date of India'. Its life span is between 80-120 years. It is a large tree with wide spreading and grows up to 30 meter height.

India is world's leading producer and consumer of tamarind. Production of tamarind in India for the year 2016-2017 was about 2.02 lakh tons. Around 10,000 tons of tamarind has been exported from India to Arab countries, Europe and the United States. Karnataka is the largest producer of tamarind in India which produced 70,500 tons of tamarind in the year 2016-17 from crop growing area of about 15,000 hectares.

Generally, the tree begins to bear fruits at the age of 8-12 years, but the trees from grafts need only 5-6 years for bearing fruits. The flowering of the trees usually takes place during April and the pods ripen during the month of January or February. Tamarind fruits are straight or curved, brown and 5-18 cm long and 1.25-2.5 cm wide. Tamarind fruits are grouped into five *viz.* (1) long and bold fruit types (2) medium fruit types (3) small fruit types (4) curved and irregularly shaped fruits and (5) sweet types. The pulp colour varies from reddish brown to different shades of black. The pod length ranges from 7.6 to 20.6 cm while the pod girth varies from 4.5 to 10 cm. The mean pod weight varies significantly from seven grammes to 46.8 grammes. Among the groups, sweet types recorded medium values for various physical characters.

Tamarind is an essential ingredient of several culinary preparations and is extensively used in food, chemical, pharmaceutical, textile industries and herbal medicines. Tamarind leaves are a rich source of minerals such as calcium, chlorine, copper, iron, magnesium, phosphorus, sulphur as well as vitamins such as niacin, riboflavin, thiamine and vitamin C, while flowers are excellent sources for honey. Tamarind fruit contains 55% of juicy acid pulp, 34% of seeds and 11% of outer shell as well as fiber. The seeds and pulp are rich in calcium, iron, phosphorous, potassium, sodium and zinc. Tamarind fruit (ripe and dry) is rich in cellulose, fibre, pectin, reducing

sugars, tannin and tartaric acid, while the seed contains fat, protein, carbohydrates and sugars. The nutritional and functional properties of tamarind kernel suggests that it contains higher amounts of lysine, aspartic acid, glutamic acid, glycine and leucine and lower levels of sulphur-containing amino acids. Thus, tamarind kernel can be combined along with foods containing a lower level of lysine and higher level of sulphur-containing amino acids to obtain balanced amino acid profiles.

A study on suspensions from Tamarind Kernel Powder (TKP) revealed that it has thixotropic characteristics and that it behaved like non-newtonian fluid with yield stress. It was observed that the increase in TKP concentration decreased the flow behaviour and increased apparent viscosity, consistency index and yield stress.

Tamarind fruit has been used as a raw material for the preparation of several products like tamarind juice concentrate, tamarind paste spice mix, tamarind pulp powder, flavoured ready to serve tamarind beverage, tamarind kernel powder, tartaric acid, pectin, tartrates and alcohol.

Medicinal Use

Tamarind leaves are used to treat boils, conjunctivitis, coughs, external swellings, fever, intestinal worms, liver ailments, rheumatism, throat infections, ulcers, urinary troubles, for lowering blood sugar and reducing cardiac diseases. Tamarind seeds have anti-oxidant, anti-diabetic, anti-obesity and hypolipidemic effects and are used in the treatment of bladder stones, dysentery and ulcers. Tamarind pulp

A study on suspensions from Tamarind Kernel Powder (TKP) revealed that it has thixotropic characteristics and that it behaved like non-newtonian fluid with yield stress



provides health benefits such as anti-bacterial, anti-fungal, anti-inflammatory and molluscicidal properties. It is also used to treat sore throat, skin infections and intestinal ailments. Tamarind pulp is known to alleviate sunstroke, cure malaria, acts as a digestive agent, lowers blood sugar and cardiac diseases. Tamarind is used against anorexia, biliary disorders, coryza, cough and diabetic in traditional Indian medicine.

It is used as an antihelminthic, antimicrobial, antiseptic, antiviral, sunscreen and astringent

agent. It is also used in the healing of urinary stones, swelling of joints, sprains, sores, sore throat, skin disinfection / sterilization, saliva production, pregnancy-related vomiting, nausea, liver disorders, leprosy, keratitis, jaundice, indigestion, haemorrhoids, gingivitis, gastrointestinal disorders, gallbladder disorders, fever, eye inflammation, dysentery, dry eyes, diarrhoea, diabetes, constipation, conjunctivitis, colic, colds, cholesterol metabolism disorders, chest pain, boils, bacterial skin infections and asthma.

Technological Intervention for Tamarind Processing

Attempts to overcome the difficulties faced during tamarind processing have resulted in the development of various processes for the production of convenient value-added tamarind products at CSIR - Central Food



Technological Research Institute (CFTRI), Mysuru. Establishment of an integrated tamarind processing centre for value addition of tamarind is under progress at Chittoor district of Andhra Pradesh. The Ministry of Micro, Small and Medium Enterprises (MSME) is funding

this project costing about Rs. 353.40 lakhs (excluding land and development), and technical support is provided by CSIR-CFTRI, Mysuru. CSIR-CFTRI has unveiled various novel methods for processing of tamarind to produce tamarind paste/

concentrate, powder, candy and green paste.

1. Tamarind Concentrate/ Paste

Tamarind pulp is loosened and cleaned manually to remove any remaining seeds as well as fiber present. After loosening, the pulp is soaked in

water and boiled to facilitate easy dissolution of the water-soluble components. The boiled pulp is filtered so as to separate the extract and wet residue. The resultant extract is collected in holding tanks for further extraction from the material. The wet residue is again soaked in water, boiled and centrifuged. The filtered extract is passed through a sparkler filter press for final filtration before concentration. The filtered juice is then concentrated to a final concentration of 65-70° Brix (Figure 1). The concentrate is then filled into suitable containers such as wide-mouthed glass jars, or plastic containers (HDPE), cooled and then sealed. Tamarind paste obtained by this method is easy to dispense since the jam-like material is easily dispersible in water.



Figure 1 Tamarind paste

2. Tamarind Powder

For better compactness, convenience in use and handling, a method has now been standardized at CSIR - CFTRI, Mysuru for the production of dehydrated tamarind powder with a free-flowing nature. Tamarind powder is used as a souring agent in various culinary preparations, in dry masala mixes like chat masala, sambar masala, sambar mix, soup mix and also in seasoning blends for snack foods.

The pulp obtained after removing the rind and fibrous skeleton of tamarind is dried

and compressed into cakes. Starch (10-12% moisture) is roasted to obtain dried starch (6% moisture). Tamarind pulp is transferred into a mixer bowl along with dried starch, mixed thoroughly, dried using a dryer and finally cooled at ambient temperature. The dried and cooled mixture is pulverized and sieved (under size) product is taken for granulation. The granulates are cooled to ambient temperature and sieved to obtain even-sized granules. The granulated dry powder is collected and packed (Figure 2).



Figure 2 Tamarind powder

3. Tamarind Candy

Tamarind candy prepared using CFRTI process consists of sugar as well as fresh tamarind pulp as main ingredients along with added salts, spices and other condiments. It is prepared by heating the ingredients at a lower temperature compared to normal confectionery candies. Also, in this product part of sugar present is in crystalline form and granular sugar is coated on top (sanding). The product is sweet and sour with



Figure 3 Tamarind candy

slight pungency in the mouth. Tamarind candy can be prepared using tamarind concentrate/paste as the base material. The pulp is mixed with sugar, salt and wheat flour thoroughly and the mixture is heated on gentle flame with constant stirring. The hot mass is cooled and mixed with cumin and ginger powder and then made into rope and cut into small balls when the mass was still slightly warm. The formed balls are just like jujubes (Figure 3). Tamarind candy thus obtained is packed individually.

4. Green Tamarind Paste Spice Mix

Green tamarind '*tokku*' paste is a traditional food adjunct prepared in Indian households, especially in south Indian states. It is ready-to-use preparation that can find application in homes, restaurants, institutional catering and industrially processed foods.

The traditionally prepared '*tokku*' paste is associated with many drawbacks which include low shelf life, microbial spoilage of the base stock material, high salt content in the product and variation in quality. Recently, a process has been developed at the CSIR - CFTRI, Mysuru for the preparation of "Indian traditional '*tokku*' like product from green tamarind", which alleviates the drawbacks of traditionally prepared '*tokku*'

paste. In the improved CSIR-CFTRI process, green tamarind pods are harvested at the optimum maturity and cleaned thoroughly with water after trimming of the stalk portion of the pods. The cleaned green tamarind is highly perishable and is preserved by immersing in a steeping solution for a specific duration of time. The green tamarind is taken out of the steeping solution and disintegrated into coarse or medium size bits. The wet mass is thoroughly mixed with adjuvants and placed in airtight containers to facilitate natural curing. Water is added to cured mass, ground and blended with a seasoning. Permitted acidulants also can be added. This results in a dried product, processed with a good aroma, colour and represents a convenient-to-use paste form of the traditional green tamarind '*tokku*' paste (Figure 4).



Figure 4 Green tamarind paste spice mix

5. Flavoured Ready-to-Serve Tamarind Beverage

CFTRI also had a standardized process for the preparation of beverage concentrate and flavoured Ready To Serve (RTS) beverage from tamarind pulp. In this process, an enzymatic treatment under controlled conditions was given to pre-cleaned tamarind pulp to extract the maximum amount of soluble. This extract

was used for the preparation of flavoured RTS beverage. The tamarind RTS beverage was found to retain desirable flavour as well as taste and was microbiologically safe for two months at room temperature.

In conclusion, value addition of tamarind will help in increasing its intrinsic value and thereby enhancing the farmer's income. There is a good demand for these value-added products in the international and domestic markets. The

integrated tamarind processing centre envisages the production of value-added tamarind products using novel processing technology of CSIR-CFTRI. Apart from providing good value to farmers' produce, integrated tamarind processing centre also helps in employment generation. This processing unit equipped with a quality control laboratory can also be used as a training centre for farmers, operators, quality control analysts, etc.



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TAMARIND

CULTURAL PRACTICES

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Tamarind tree, botanically known as *Tamarindus indica*, is a native of Tropical Africa. It belongs to the sub family Caesalpiniaceae of the family Leguminosae. India is the largest producer of tamarind in the world. In India, tamarind is widely grown in the states of Tamilnadu, Karnataka, Andhra Pradesh, Madhya Pradesh and Odisha. It was introduced to Persian and Arab countries from India. Hence, in those countries tamarind is known as Indian Dates.

Tamarind is a multipurpose tree suitable for avenue planting. In agro forestry systems it can be planted as fire breaks along the forest margins. The wood of the tree is used for furniture making. Tamarind is rich in tartaric acid,

well on a wide variety of soils ranging from poor degraded, eroded, saline and alkaline soils. The yield is found to be considerably high, when it is grown in well drained red loamy soils. It can be very well grown in humid to dry hot regions but the crop is highly sensitive to frost.

The ideal time for planting tamarind is from June to December. Planting materials can be raised either from seeds or through vegetative propagation techniques such as patch budding, approach grafting and air layering. Seedlings will not be true to the type of mother plant and will not be uniform in growth and yield characteristics. Seedlings will have a prolonged juvenile phase. It will take at least 7 years for the seedling to come into bearing. Due to these reasons,

vegetatively propagated planting materials are recommended for tamarind cultivation. Such plants will start yielding from the third or fourth year of planting.

Field planting of tamarind is done in pits of 1m X 1m X 1m size at a spacing of 8 to 10m. Fertile top soil mixed with farm yard manure and super phosphate is filled in the pit and planting is done. 40 to 50 plants can be grown

in one acre land. When tamarind cultivation is done on commercial scale, leguminous crops such as cow pea or horse gram may be grown as a cover crop during rainy season. This would help to control weed growth, prevent soil erosion and improve soil health.

Tamarind is basically a dry land crop grown under rain fed conditions. Though the trees are hardy by nature and require minimal care, irrigation may be provided at 6 to 8 days interval

Tamarind trees have a long life of over a century, but its economic life is 50 to 60 years after which the yield will start declining

Vitamin B and sugars. Tamarind pulp as well as seeds have high content of minerals such as Calcium, Phosphorus and Potassium. It is used as an additive in medical and food industries. Processed tamarind is used in the preparation of juice concentrate, jam, candies etc. Tamarind seeds are used as a cheap substitute for cereal starch in textile industry.

Tamarind is a slow growing tree, which thrives

in hot summer months during the initial 3 to 4 years of planting. Tamarind trees have an extensive rooting system and once fully established in the soil, it will not require any irrigation during the subsequent years.

There has not been many elaborate studies on the scientific nutrient management of tamarind trees. However, Tamil Nadu Agriculture University has come out with a recommendation that the trees may be provided with 200g Nitrogen, 150g Phosphorus and 250 gram Potash annually along with 25 Kg farm yard manure and 2 Kg Neem cake.

Another important aspect to be considered during the early years of growth is pruning and training of plants. This is essential for the trees to develop a good frame work and canopy. Weak and diseased branches along with shoots developing from the root stock need to be pruned and removed. The plants may be trained into Modified Leader System with uniform scaffold branches in all directions.

Provided with proper growing conditions, a vegetatively propagated tree will come into bearing by the third or fourth year. However, environmental and genetic factors have been found to cause considerable variations in the yield. In most cases, good yield is obtained only during the alternate years. Harvesting of tamarind is done during March- April. During the initial years of bearing, a yield of 30 to 40



kg ripe tamarind can be expected from a tree. It will take about 15 years for the yield to stabilize, thereafter 200 to 250 Kg ripe tamarind can be harvested from a tree.

Tamarind trees have a long life of over a century, but its economic life is 50 to 60 years after which the yield will start declining.



Tamarind fruits will take 252 to 282 days to reach the ripening stage.

At this stage, the outer shell of the fruits will turn dark brown in colour and the moisture content of the fruits will decrease. The content of Tartaric acid and sugars in the fruit will be maximum at the harvesting stage. After harvest, the shell and seeds are separated from the pulp and the pulp is sun dried for 3 to 4 days. Thereafter, the pulp is mixed with 10% common salt ie. 100g salt per kilogram of tamarind pulp and stored in earthen pots. Instead of salt, sugar is also used for preserving tamarind pulp.



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Malabar Tamarind:

A Profitable Introduction For The Bay Islands

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The tropical Andaman and Nicobar islands in the Bay of Bengal are home to about 18 *Garcinia* species. Warm and humid climate of these islands has supported evolution of this genus under natural conditions and about seven endemic species have been reported from these islands. Plant parts of these species are used by settler communities as well as native tribal population for variety of purposes including food, medicine and timber. However, none of the species has been domesticated so far and all the species are

found in the wild or semi-wild condition.

Malabar tamarind is scientifically known as *G. gummi-gutta* and is a semi-domesticated species grown in home gardens of southern parts of India including Kerala, parts of Karnataka and Tamil Nadu. This species is known as *Kodampuli* in Malayalam and dried rind of its fruits is used as an acidulant in variety of vegetarian and non-vegetarian curries. Dried rind is not only marketed in these states, but is also exported to other countries and regions wherein the product is popular. In the distantly located markets of



Fig. 1 A fruit bearing tree in the experimental block of the Institute

Andaman islands also, dried rind of Malabar tamarind is available. Most of this supply is from brands of mainland India.

Considering favourable agro-climatic conditions of these islands for growth and development of *Garcinia*, efforts were made to promote cultivation of Malabar tamarind as a backyard crop. Though the species was introduced in the Andaman islands by settler communities from Kerala, systematic information about its performance under island condition was largely unknown. Hence, the species was introduced from

mainland India in the form of seedlings and planted in experimental blocks of the authors' Institute. Plants showed luxuriant growth and fruiting (Fig. 1) were noticed in most of the plants (non-male types). Being seedling progenies, variations in the age of first fruiting was expected. Under island conditions, flowering is generally noticed during February- March, whereas fruits attain harvestable stage during June-August (Fig. 2).



Fig. 2 Freshly harvested fruits grown in the islands

In order to promote any crop, superior genotypes/ varieties are the most important factors. As there are no released varieties in this crop, identification of superior germplasm

is important. Evaluation of seedling progenies available in the island has helped in identification of superior type that performs very well under agro-climatic condition of these islands. Bigger sized fruits (109 g), higher rind recovery (76%) and better biochemical parameters were observed in GG-02 collection (Fig. 3) that is maintained at *Garcinia* conservation block of the institute. Being dioecious in nature, propagation of these types using vegetative means is required to ensure supply of only female/ monoecious types to the farmers. Hence, grafting methods were tried, which suggested suitability



Fig. 3 Superior type (GG-02) identified from the islands

of approach grafting for this species under island condition. Grafts of identified superior type are being multiplied for distribution to the island farmers.

With efforts of Andaman and Nicobar Department of Agriculture, planting material was distributed to the

farmers in these islands. Though a few farmers planted this species in their backyards, two basic problems were noticed. Firstly, most of farmers from other than Kerala origin were unaware about the drying process and utility of the fruits. In such gardens, ripen fruits fell down on ground and rot without being used (Fig. 4). Secondly, the harvesting season coincides with rainy season in Andaman islands. This caused problems in drying of the produce. In order to address these issues, awareness programmes were conducted wherein scientific cultivation and postharvest handling were taught to the participants in



Fig. 4 Unharvested fruits rotting below the tree

different parts of islands. To facilitate quick drying without causing any spoilage, hot air drying of the produce was demonstrated as an effective technique. Participants from both settler as well as tribal communities were made aware and motivated to take up the crop (Fig. 5 and 6).

Considering the performance of this crop under island condition, it could be promoted for cultivation in the Andaman islands as commercial/ backyard crop. Lesser known but potential species such as *G. gummi-gutta* could help the island farmers in getting good profits.

In order to promote any crop, superior genotypes/ varieties are the most important factors. As there are no released varieties in this crop, identification of superior germplasm is important



Fig. 5 Awareness programme at Middle Andaman island



Fig. 6 Awareness programme conducted for farmers of Karen community



Curry Leaves to Cure Animal Ailments

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Curry leaf tree is a small tree growing in moist deciduous forests of India. The role of these spice leaves in enlivening Indian cuisine is widely known. But its usage in managing animal ailments is not as well known.

Scientifically proven medicinal properties of curry leaves are

- It increases general disease resistance.
- It reduces food induced toxicity.
- It is useful in diarrhea and painful urination.
- It reduces blood glucose level, hence is useful in diabetes.
- Roasted leaves are useful in vomiting.

f) It increases conception rate in animals.

g) Its roots induce diarrhea.

Curry leaves can be used in some of these animal ailments.



Ephemeral Fever

This viral disease is spread by a kind of biting flies. Though it is not life threatening, affected animal suffers from high fever which is characterised by severe pain in legs and inability to stand up.

As a folklore remedy, one can try drenching a mixture made by grinding two handfuls of curry



Some cows or buffaloes do not conceive even after repeated inseminations or by natural service by the bulls

leaves and neem leaves (*Azadirachta indica*), one aloe leaf (*Aloe vera*), two betel nuts (*Areca catechu*) and a lemon-sized jaggery along with a quarter litre of water. This can be repeated once a day for two to three days.

Difficulty to Conceive

Some cows or buffaloes do not conceive even after repeated inseminations or by natural service by the bulls. Some exhibit heat symptoms for an extended period of time making it difficult to decide the time of insemination. In such cases, two handfuls of fresh curry leaves are fed once a day for ten days starting from the day of insemination or natural service.

Alternatively, sufficient quantity of curry leaves are dried under shade and powdered. Ten teaspoons of this powder could be also be used in the above mentioned way.

Fast Healing of Foot Wound in Foot and Mouth Disease

A quarter kilograms of curry leaf or its tree bark, neem (*Azadirachta indica*) tree bark, Mahaneem (*Ailanthus excelsa*) tree bark and Jamun (*Syzygium cumini*) tree bark are all mixed and beaten. It is boiled in about ten liters of water to make a decoction. The foot wounds are washed with this decoction everyday till the wounds heal.



PLANTATION CROPS SYMPOSIUM (PLACROSYM XXIII) CONCLUDES

The Central Coffee Research Institute (CCRI) and Coffee Board of India hosted the 23rd Plantation Crops Symposium (PLACROSYM XXIII) from 6th to 8th March 2019 at Hotel Aadrika, Chikkamagaluru. Around 230 delegates from the plantation sector including scientists, specially invited experts, planters and media men attended the symposium.

Dr. Bagadi Gautham IAS, Deputy Commissioner, Chikkamangaluru District inaugurated the Symposium. Mr. M. S.Gowda, Chairman, Coffee Board was the guest of honour and presided over the inaugural function. 'The Coconut Palm (*Cocos nucifera*)-Research and development perspectives' edited by Dr. K. U. K. Nampoothiri, former Director ICAR - CPCRI, was released by Dr. Bagadi Gautham IAS.

The inaugural session was followed by a thematic session on 'Climate Resilient Technologies for Plantation Crops' chaired by Dr. P. Rethinam, former Assistant Director General (Plantations), ICAR and Director, Indian

Institute for Oil palm Research. Prof. K. N. Ganeshiah, former Dean of UAS, Bangalore delivered keynote address on 'Consequences of climate changes on plantation and wild ecosystems and their functioning: Patterns, Processes and Mitigation strategies'. The presentations by Directors of Plantation Crops Research Institutions which lead to discussions on present challenges and prospects in cultivation of plantation crops due to climate change.

In the course of the symposium, various sessions on Genetic Enhancement, Natural Resource Management, Abiotic and Biotic Stress Management, Post Harvest Technology and Value Addition and Transfer of Technology and Market Dynamics were conducted.

The 23rd **PLACROSYM** resolved that there is an urgent requirement to provide adequate support for strengthening of Research and Development in plantation crops. It was also resolved that the Commodity Research Institutes shall be brought under the ICAR under a special division of plantation crops.





Fish Mint Plant

Add Fishy Taste to Dishes

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Prefer fish taste but not the fish? Then this underutilized spice comes handy! *Houttuynia cordata* or fish mint plant is an edible plant of family Saururaceae native to the mountainous regions of Eastern Asia, occurring up to an elevation of 2500 MMSL. The plant is wide spread in North Eastern India. The leaf of *Houttuynia* possess an unusual fish smell / taste that has often been described 'fishy' (hence the name fish mint plant). Other names of the species include, Fish leaf, Rainbow plant, Chameleon plant, Heart leaf, Lizard tail or Bishop's weed in English besides *Ja-myirda* or *Jmyr-doh* in Khasi; *Machha-turi* in Garo; *Ashunday*, *Tengalai*, *Dimasa-Mojoukhmo*,

Hmar- Aithang and *Pnar- Jarmendo* in Assam; Mumbre, Siiya hamang, Muchandariin in Arunachal Pradesh; *Toning khokin* in Manipur; *Uithinthang* in Mizoram; *Nuichua* or *Nokana* in Nagaland and *Ghandhay jhar* in North Bengal and Sikkim.

H. cordata is a perennial rhizomatous herb grown up to 60 cm height. Rhizomes are thin and creeping in nature. Leaves are alternate, broadly ovate to cordate, 4-9 cm long and 3-8 cm broad. Flowers are greenish yellow and borne on a terminal spike with four to six large white basal bracts.

The plant is usually propagated through rhizomes, root balls or seeds. The rhizomes are cut into small pieces of 3-5 cm and placed at about 5 cm below the surface soil for propagation. Generally it is planted during the first week of February in Assam. It starts flowering in the month of April and continues up to November. Fruiting period is between May to December. Juvenile plants of about one and half month old are preferred in the market for consumption.

It is commonly grown as a leafy vegetable and used as a fresh herbal garnish. In Assam people make chutney from the leaves which



Fig-1. Bundles of *H. cordata* in a local market in Haflong, Assam



Fig-2. *H. cordata* established at conserved at IISR Farm, Peruvannamuzhi

gives a “fish’ taste. Manipuri people eat both raw and cooked leaves. Besides its culinary uses *H. cordata* is having many ethno botanical uses. It acts against allergies, asthma and bacterial infection. The whole plant is dried and used for treatments in antipyretics, diuretics, cold, detoxification, swelling, hypertension etc. Leaf extract is used in dysentery and rhizomes are used for stomach ulcers. Boiled extract of rhizomes is consumed for muscular pain due to over strain.

It is sold in the local markets as small bundles of rhizomes and

leaves (Fig-1) weighing approximately 50-100 g at a price of ₹ 10-20. Considering the importance of this underutilized spice, it is collected (Fig.2) and conserved at the ICAR-Indian Institute of Spices Research (IISR). The plant will come up in Kerala climate and will have good potential as the native people prefer fish tastes in many cuisines. The sizeable population of North East Indian work force in Kerala also will prefer the plant for their culinary preparations.



Calendar of Operations

MAY 2019

Timely planning and execution of farm operations based on agro-climatic conditions of the area is important for successful farming for higher productivity and sustainability. To facilitate this, a calendar of operations in respect of important spice crops for May 2019 is given below:

Small Cardamom

I Agronomic Measures

NURSERY

- Regular watering may be given to bed/ polybag/ sucker nursery based on necessity.
- To control damping off/seedling rot diseases in nursery, soil drenching with 0.2% Copper oxychloride or 0.2% Mancozeb may be taken up.
- As bio-control measure, *Trichoderma* or *Pseudomonas* or *Bacillus* species may be applied in the soil.
- For controlling leaf rot disease, spray 0.3% Carbendazim and for controlling leaf spots, spray 0.2% Carbendazim after noticing early symptoms. Clipping and destruction of severely affected leaves after spraying is to be done to avoid further spread to healthy leaves.



MAIN FIELD

- In densely shaded areas, regulate the shade selectively to provide more sunlight during monsoon period. It may be about 60% of filtered sunlight for better performance.

- Likewise, in open patches, planting of shade tree saplings like *Cedrella toona* (Chandana viambu), *Vernonia oxbergia* (Karuna), Jack can be done to reduce the problems of root grub proliferation and better performance of cardamom.
- During the end of May or early June, after the receipt of sufficient summer showers, planting of seedlings/clones can be started in the main field. Planting in a cloudy day with intermittent drizzling is very ideal for cardamom for its better establishment.
- After planting, stake the plants with stick and mulch the plant base with dried leaves or weeded materials.
- Always ensure that no water logging is there at the base of the plants, by providing better drainage.
- Just prior to monsoon showers, trashing operation may be completed and make all the panicles be above the mulch materials.
- Application of first round manure for irrigated areas can be done, after getting one or two good showers at the end of May or early June. This may be done with 90 kg urea, 207 kg rock phosphate and 137 kg muriate of potash/ha (1/3rd dose of 125:125:250 NPK/ha/year).
- For rainfed areas, apply @ 81 kg. urea, 187 kg. murroriphos and 125 kg. muriate of potash as first round(1/2 of 75:75:150 kg NPK/ha/year).
- The above two recommendations are made only if no soil test recommendations are available. If available, apply based on soil test results only.

- The said inorganic fertilizers may be applied along with any one of the organic manures like FYM or compost 5 kg or neem cake 1-2 kg per plant in 20 cm wide circular band about 30-40 cm away from the plant base.

In the case of young plants, 1/3rd and 2/3rd of the recommended dose of the fertilizer may be applied for 1st and 2nd year respectively.

II. Pest Management

- For Integrated Pest Management, prune dry leaves without removing green leaf sheath.
- Apply Quinalphos @ 200 ml per 100 l of water (spray may coincide shoot borer moth emergence).

III. Disease Management

- Provide adequate drainage if water stagnation is noticed.
- Integrated Disease Management against azhukal and rhizome rot in severely affected areas, phytosanitary measures and application of fungicides/bio-control agents may be taken up.
- COC (0.2%), drenching + 1% Bordeaux mixture spray is effective as prophylactic spray. 15 days later, apply Trichoderma alone or with *Pseudomonas fluorescens* at plant base. Repeat bio agent application and foliar spray with Potassium Phosphonate 0.4%.
- If bio-control measure is followed, basal application of *Trichoderma harzianum* alone or with *Pseudomonas fluorescens* is recommended.
- Katte infected plants if found must be rouged and destroyed.

Large Cardamom

I Agronomic Measures

Nursery

- Disease/pest infected suckers may be removed
- Each and every large cardamom farmer is necessary to raise his own large cardamom nursery for planting in his field at least 500 meter away from large cardamom field.
- Regular watering and weeding may be continued in the existing sucker nursery.
- Nursery site meant for sucker multiplication may be cleaned by removing all the weeds; debris and soil may be brought to fine tilth.
- Trenches of 45 cm width and 30 cm depth may be opened at convenient length with an inter space of 30 cm well decomposed cattle manure or compost may be mixed with the soil and the trenches are filled. Disease-free, high yielding, one grown up shoot with an emerging bud may be planted at 45 cm apart in the trenches during May-June, and then the base may be mulched with forest leaves. To support the suckers, bamboo/ wooden stakes may be provided.



- The large cardamom fields may be visited regularly and chirkey/foorkey etc. diseased plants may be uprooted and destroyed by burning/burial in the soil.
- For replanting/gap filling, the site may be cleared by removing all old & diseased plants and by clearing all weeds and debris.
- Pits of 30 x 30 x 30 cm may be opened at a spacing of 1.5 x 1.5 meter on the receipt of rains and then the pits are to be filled with top soil/compost/cow dung etc.
- The planting materials may be selected from high yielding sucker nurseries, free from pest & diseases for replanting/gap filling.
- Suitable shade tree saplings may be selected and used for planting in the areas where the shade is less and to protect from hail storm damage.
- Application of cattle manures/organic manures/fertilizers to cardamom fields will help in getting sustained production, improving productivity and better quality of the crop.
- Application of 1% Bordeaux Mixture to the cardamom plants will help to control the fungal diseases before one set of rains.

Plantations

- One round weeding may be attended for easy movement of wild bees for better pollination and fruit setting.

Pepper

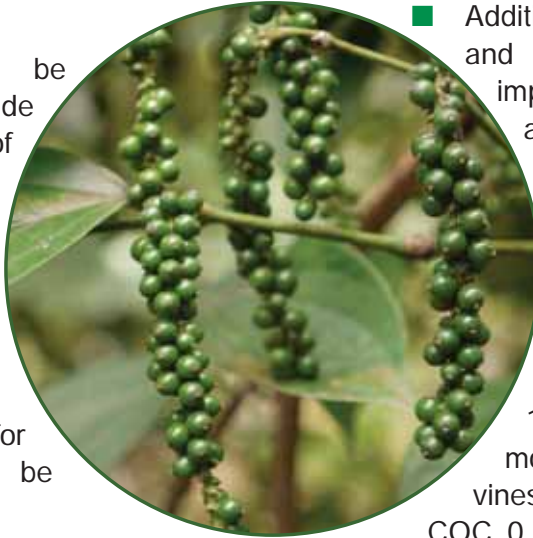
I Agronomic Measures

Nursery

- Watering may be continued in the nursery based on necessity.
- Shade may be reduced in the nursery on receipt of 1 or 2 good summer showers.

Main Field:

- Shade regulation may be done to reduce the shade intensity just at the onset of monsoon showers.
- On receipt of good showers, the shade protection given to young vines may also be removed.
- Planting of standards for new planting may also be done now.
- Apply FYM or compost @ 10 kg/vine.
- In areas where liming is not done last season, lime @ 600 g/vine may also be applied around the plant basin separately.
- For controlling *Phytophthora* foot rot, phytosanitary measures, biological control measures and chemical control measures may be taken up.
- Application of *Trichoderma harzianum* and *Pseudomonas fluorescens* would help in reducing intensity of the disease.



- Addition of organic mulches and oil cakes in the basins improves the texture of the soil and enhances the growth of antagonistic micro organisms.

■ If chemical control is resorted to, any one of the following can be adopted:

- 1) After the receipt of few monsoon showers all the vines are to be drenched with COC 0.2% @ 5 to 10 l per vine. Foliar spray with 1% Bordeaux mixture.
- 2) Drenching with Potassium Phosphonate 0.3% @ 5 to 10 l per vine. Foliar spray with 0.03% Potassium Phosphonate.
- 3) Drenching with Metalaxyl / Mancozeb 0.125% @ 5 to 10 l per vine and foliar spray with same concentration.

In case bio-control agents are applied only aerial sprays with chemicals is to be resorted and soil drenching should be avoided

Vanilla

Main Field:

- Continue irrigation based on necessity, if monsoon rain delays.
- Apply vermi compost @ 1 kg/vine or FYM or compost @ 2 kg/vine in the base of the vine and then cover with mulch materials like weed wastes or shade tree lopping and other plant residues.
- If flowering is still observed, continue pollination between 6.00 am to 12 noon with skilled labour.
- Prophylactic spray with 1% Bordeaux mixture may be given or 2% spray with *Pseudomonas* sp. (in Talc base) (2 kg/100 l. water) or 1% spray with *Pseudomonas* sp. (in liquid culture) may be given.





Ginger

- Weeding may be done based on necessity.
- After 40 days from the date of basal dressing top dressing with 80 kg of urea has to be done per ha.
- Earth up the beds after top dressing of fertilizer.
- Repeat the mulching of beds with green leaves/weeded materials @ 5 MT/ha.

Turmeric

- Weeding may be done based on necessity.
- After 40 days from the date of basal dressing, top dressing with 65 kg of urea has to be done per ha.
- Earth up the beds after top dressing of fertilizer.

Repeat the mulching of beds with green leaves/weeded materials @ 5 MT/ha.



Chilli

- On completion of harvesting, green manuring can be practiced by sowing pulse crops (pillipesara, cowpea or sunhemp) in the land proposed for next season cultivation.
- Wherever chilli is inter cropped with cotton, dried chilli and cotton plants after harvest are to be uprooted and cut into small pieces and incorporated into the soil for enhancing the fertility and water holding capacity of the soil.
- If needed, soil testing can be taken up during the month.



Monthly Average Prices of Spices for March 2019



SPICE	CENTRE	GRADE	PRICE RS/KG
Black Pepper	Kochi	Ungarbled	343.58
		Garbled	363.58
Cardamom small	Vandanmettu/		
	Bodinayakanur	bulk e-auction	1297.53
Cardamom (L)	Gangtok	Badadana	483.33
	Gangtok	Chotadana	412.50
Chillies	Virudhunagar		71.25
	Guntur		76.37
Ginger(Dry)	Kochi	New	250.00
	Kochi	Old	285.00
Turmeric	Kochi	Salem	82.50
		Agmark	85.83
	Chennai	Erode	95.00
Coriander	Chennai	Rajasthan Green	86.25
	Chennai	Deluxe	76.25
Cumin	Chennai	Ordinary	181.37
Fennel	Chennai	-	102.50
Fenugreek	Chennai	-	53.75
Mustard	Chennai	Small	51.25
Garlic	Chennai	Medium	43.62
Clove	Cochin	-	693.18
Nutmeg(with shell)	Cochin	-	219.73
Nutmeg(without shell)	Cochin	-	422.63
Mace	Cochin	-	900.00

Prices are collected from secondary sources like Agricultural Produce Market committees, Kirana Merchants Association, India Pepper and Spice Trade Association, Licensed Cardamom Auctioneers etc.

ALL INDIA CARDAMOM E-AUCTION SALES AND PRICES FOR MARCH 2019 COMPARED WITH MARCH 2018



PERIOD	March 2019		March 2018	
	Quantity sold	Average price	Quantity sold	Average price
	(Kg)	(Rs./Kg.)	(Kg)	(Rs./Kg.)
First week	156301	1396.89	458844	967.39
Second week	368631	1432.49	550299	956.87
Third week	442508	1422.43	450315	951.54
Fourth week	343741	1494.33	410975	930.52
Fifth week	367878	1507.41	91294	940.45
Total	1679059	1455.60	1961727	951.82

Source: Auction reports received from licensed cardamom auctioneers

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Languages	: English, Kannada, Tamil, Malayalam, Hindi monthly magazines and Telugu quarterly
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Back Inside	8,000	20,000	40,000	80,000
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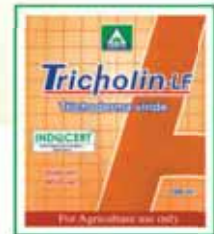
- **Azospirillum**
- **Azotobacter**
- **Rhizobium**
- **Phosphate solubilizing bacteria**
- **Potash solubilizing bacteria**
- **Zinc solubilizing bacteria**
- **Vesicular arbuscular mycorrhiza (Vam)**
- **Gluconacetobacter**
- **Methylobacterium**

- Bio Control Agents —————
- **Pseudomonas fluorescens**
 - **Trichoderma viride**
 - **Paecilomyces lilacinus**



- **BIO COMPOSTER : Composting Micro Organisms**
- **SEP CLEAN : Septic Tank Cleaner**

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