

CLOVE AND NUTMEG

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THE total estimated area in this country under clove, *Eugenia caryophyllus* (Sprengel) Bullock et Harrison, is 108 ha out of which 89 ha is on the eastern slope of Western Ghats in Kanyakumari, Tirunelveli and Nilgiri districts in Tamil Nadu. The rest of the area is in Kottayam, Ernakulam and Trivandrum Districts of Kerala. The yield records are scanty, though average yields as high as 3-4 kg per adult tree of 15-20 years age are reported.

Estimates of internal demand for clove in India vary from 50 tons to over 100 tons and import has ranged from 942 tons in 1967-68 to less than 20 tons during 1974-76. However, internal production does not amount to more than 20 tons.

Clove grows luxuriantly in dark loamy soil rich in humus, in the warm humid climate of the tropical belts in India. However, some of the recent plantations are also found even in sandy soils. Clove plantations within this country are reported to have originated from a few seedlings obtained from Mauritius. A survey of germ-plasm within the country has not yielded any appreciable variability due to this inherent limitation.

Crop Management and Primary Processing

To raise seedlings, it is important that seeds are collected from fully ripe fruits to obtain good germination. Fruits for seed collection—known popularly as "mother of clove" are allowed to ripen on the tree itself and drop down naturally. The fruits collected from the ground are sown directly in nurseries or soaked in water overnight. The fleshy pericarp is then removed and seeds separated without injury to embryo. The seeds are washed in water to remove pericarp. Only fully developed and uniform seeds which show signs of germination by the presence of a pink radicle are selected for sowing. Though the ripe fruits can be stored for a few days the seeds should be sown immediately.

The seeds are generally sown in sand beds and transplanted to polythene bags after 2 to 3 months where they will remain for 12 to 18 months. The nurseries are usually shaded and daily irrigation is given to ensure uniform germination and stand.

Planting of seedlings to the main field is done preferably in June or towards the end of rainy season in

October-November. The selected site is cleared of all jungle growth before the monsoon and pits measuring 0.75 m cube are dug at a distance of 6 to 7 metres filled with green leaves, compost or cattle manure and topped with rich organic forest soil. The first 2-3 years after transplanting is most critical period in the establishment of clove plantations and during this time irrigation is needed from October to April-May. Clove prefers partial shade and adequate protection from heavy rains and wind. At higher elevation (over 1,000 metres) with well distributed rainfall, clove comes up well as a pure crop without any shade tree. Cover crops like



Clove buds ready for harvest

bearing stages. In some plantations fast growing shade trees like *Albizia* spp. and *Erythrina* spp. are also found.

The main problem facing the nutmeg cultivation in India at present is the segregation of seedling progenies into females and unproductive males in the ratio of 1:1. Though the determination of sex at seedling stage based on leaf form and venation, the colour of young sprouts, vigour of seedlings and shape of calcium oxalate crystals in leaf epidermis has been claimed to be successful, none of them have been tested on a field scale till now. The only alternative at present seems to be vegetative propagation converting the male trees into productive female by either budding or grafting. As soon as the young male trees are identified they can be cut back at the beginning of the monsoon season and patch budding done towards the end of rainy season. Both for budding and grafting, it is desirable to use an erect growing scion. Even old trees can be converted into females by patch budding provided the budding is done on an erect shot.

Experimental evidence regarding the fertilizer requirement of the crop are lacking though in few cases luxurious growth and heavy bearing have been observed with fertilizer application. However, the Agricultural Department of Kerala recommends 20 g N, 18 g P and 50 g K in the first year which is increased gradually to 500 g N, 200 g of P and 1000 g of K per year for an adult plant of about 15 years.

The nutmeg generally starts bearing from the sixth year onwards though the peak bearing period is reached only after 20 years at the present level of management. When the pericarp splits open exposing the scarlet aril, the fruit is ready for harvest. It is either picked from the tree by a long bamboo or collected after dropping to the ground. The fruits are then cut open to remove the outer fleshy portion and to separate the nuts

and mace. The nuts and mace are dried separately in the sun. On drying the scarlet aril gradually turns yellowish brown and becomes brittle when it is ready for packing. Because the peak harvest season in India happens to be during the rainy months, farmers often dry the nuts and the mace in their kitchens where they use firewood.

Pests and Diseases

Immature nut split, fruit rot and fruit drop are the serious problems in a majority of the nutmeg gardens in Kerala. Immature nut split and shedding without any infection is noticed in some plants. Nut split associated with dark brown lesions is also a common feature resulting in fruit rot, thus spoiling the mace. Rot of mature fruits and the nuts without any splitting is also noticed. The mace of such fruits loses its lustre. *Diplodia* spp., *Gloeosporium* spp. and *Fusarium* spp. were isolated from the affected fruits. No control measures have been evolved so far.

Research Programmes

The current research activities and extension programmes are yet to make an impact on the improvement of nutmeg crop in the country. The survey conducted by the Central Plantation Crops Research Institute, Regional Station for Spices has indicated wide variability for morphological and yield characteristics and there appears to be great scope for improving yields through mass selection and cross breeding among identified types. Additionally, vegetative propagation techniques for large scale multiplication of high-yielding types as well as for the conversion of male trees into female need to be standardised. These aspects are being given priority in the research activities of the Central Plantation Crops Research Institute, Regional Station for Spices.

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October-November. The selected site is cleared of all jungle growth before the monsoon and pits measuring 0.75 cm cube are dug at a distance of 6 to 7 metres filled with green leaves, compost or cattle manure and topped with rich organic forest soil. The first 2-3 years after transplanting is most critical period in the establishment of clove plantations and during this time irrigation is needed from October to April-May. Clove prefers partial shade and adequate protection from heavy rains and wind. At higher elevation (over 1,000 metres) with well distributed rainfall, clove comes up well as a pure crop without any shade tree. Cover crops like



Clove buds ready for harvest

Calabagonium and *Mimosa* are grown in clove plantations to avoid soil erosion and to prevent the growth of weeds. Regular manuring is not practised in India. However, application of river silt at the rate of about 100 kg per tree is practised by some cultivators. Cattle manure or compost at the rate of 20 to 50 kg and bone-meal or fish-meal at the rate of 2 to 5 kg per seedling are the popular manurial schedule followed by the growers.

The clove trees start flowering from the 5th year though the peak bearing stage is reached only after 15 to 20 years. The flowering season varies from September to October in the plains to December-January at high altitudes. The harvesting commences from January in the plains and March-April in the high ranges.

The unopened buds are harvested when they begin to turn slowly pinkish to obtain the clove of commerce. Cloves are picked with great care since fully opened flowers are no longer valued as a spice. Also the tree branches should not be broken in which case the succeeding harvest is reported to be affected. It is believed that allowing the flowers to develop into fruits have adverse effect on subsequent flowering and growers take care to prevent fruit set.

After picking individual buds are separated from clusters by hand and spread on mats for sun-drying for several days. The correct stage of drying is reached when the stem (pedicel) attains dark brown colour while the rest of the bud still remains light brown in colour. The properly dried clove will be only about 1/3 the weight of original. It takes about 11 to 15 thousand dry cloves to make 1 kg. Artificial drying of clove is not being practised in India at present.

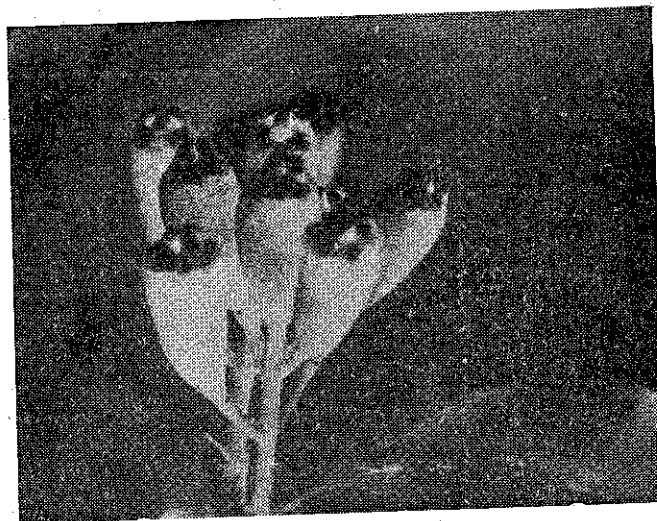
Clove trees are usually alternate in the bearing habit. The factors responsible for this alternate bearings are suspected to be the physical shock due to heavy bearing and shock of picking probably resulting in physiological imbalances in subsequent bearing habit.

Pests and Diseases

Die-back. This disease affects young as well as old trees in less fertile soils with poor drainage. The causal organism is reported to be an algae.

Leaf-rot. Both in mature trees and seedlings, leaf rot starts as dark patches from the edges and spreads over the whole leaf resulting in severe defoliation. *Cylindrocladium quinqueseptatum* has been identified as the causal agent of this disease.

Seedling wilt. Wilt is a serious problem in majority of the nurseries resulting in the death of 5-40 per cent of the seedlings. The leaves of affected seedlings lose natural lustre, tend to droop and ultimately die. The root systems and the collar of the seedling show varying degrees of discolouration and decay. *Cylindrocladium* spp., *Fusarium* spp., *Collectotricum* spp., *Rhizoctonia bataticola*, *Trichoderma* spp., and *Phytophthora* spp.



Clove fruits—'mother of clove'

have been isolated and the causal agent is yet to be determined.

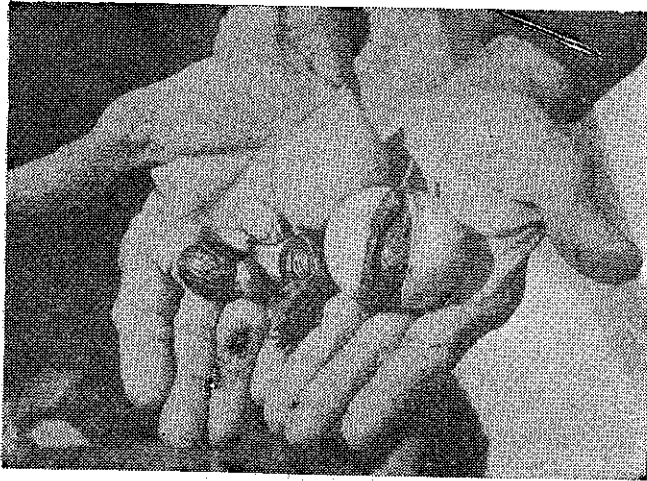
Pests. No major pests of clove have been reported so far from India. A recent survey of the clove plantations has indicated that scales are the major problems in the nurseries.

Research Programmes

Research on improvement of clove has been initiated only recently with the establishment of CPCRI Regional Station at Calicut in 1975. An extensive survey of the germplasm material available within the country has indicated limited variability. This is to be expected since self-pollination is predominant and the original introduction is limited. In view of this, it is essential to introduce variability from Indonesia, Zanzibar and Malagasy Republic. Though self-pollination and self-compatibility are reported to be the common feature in clove, occurrence of self-incompatibility in some type has been suspected in other countries and if this could be increased, it will help in evolving hybrid varieties. At present the long juvenile phase and irregular bearing habit are the main drawbacks that limit investments in clove plantations. Therefore, suitable vegetative propagation methods will have to be attempted to overcome these problems.

Nutmeg

Myristica fragrans Houtt. (Family. Myristicaceae), which yields two products of commercial value, nutmeg and mace, is a tropical evergreen tree with dense foliage. The total area under this crop in India is estimated to be 262 ha producing 180 tons of nutmeg and 14 tons of mace. The cultivation of this crop is confined to the southern states of Kerala (134 ha) and Tamil Nadu. In Kerala, the distribution is mainly confined to Trichur, Ernakulam and Kottayam Districts with about



Nutmeg fruits—nut and aril separated

47 per cent of the area in Kottayam District. In Tamil Nadu, it is cultivated in the hilly regions of Kanyakumari, Tirunelveli and Nilgiri Districts. It is estimated that nearly 14,500 trees are in bearing at present in the country, though large scale planting has been initiated only during the last 3 to 4 years in view of increased remuneration. The entire quantity produced in India is consumed locally and it is estimated that India imports about 40 tonnes of nutmeg and mace annually.

On an average, a good tree yields about 1000 fruits per year, though yields may vary from few hundreds up to 10,000. A single fruit yields on an average 8 g nut and 2 g mace and at the present market rates the income from individual trees may vary from Rs 125 to more than Rs 2,500. With 150 trees/ha in a pure plantation, average yields of 900 kg nuts and 200 kg of mace can be obtained. The largest plantation of nutmeg in India is only 4.5 ha found in Kalady, Kerala.

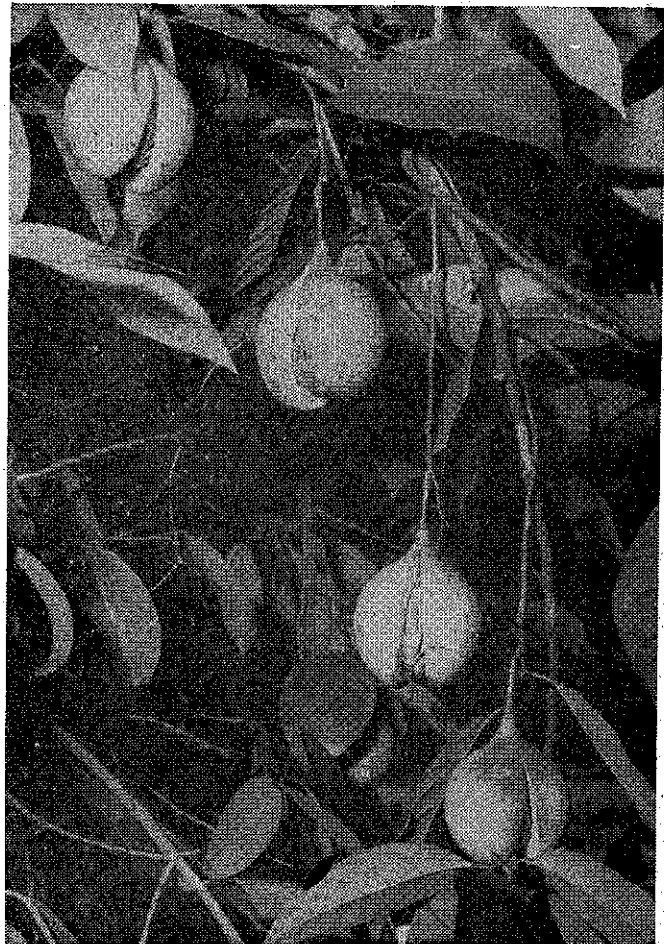
Agronomic Practices and Processing

Nutmeg requires a warm and humid tropical climate with an annual rainfall of 150-300 cm. It grows well from the sea level up to an elevation of 1300m above MSL. River banks and hill valleys with plenty of humus and irrigation facilities are ideal for cultivation of nutmeg. The area is first cleared of wild growth before the monsoon and 60 cm × 60 cm × 60 cm pits are dug. The bottom 10 cm of the pits are then filled with a mixture of compost and top soil before planting seedlings.

The nutmeg fruits are ready for harvest in about nine months after flowering. Though the crop is available throughout the year the peak harvesting period is June to August. For raising a nursery, naturally split healthy fruits from the June-July harvest are selected and seeds are extracted from the fleshy pericarp and sown immedi-

ately in nursery beds or alkathene bags/tile pots. Seed beds of convenient sizes are prepared with a mixture of garden soil and sand in the ratio of 3:1. A thin layer of sand is spread over the beds. The seeds are sown at a distance of about 10 to 15 cm and covered with a layer of sand or soil. Germination commences in about 60 days and for complete germination it may take 90-100 days. Seedlings from the nursery are transplanted to alkathene bags when they are about 6 months old and allowed to remain in alkathene bags or earthen pots for 18 to 24 months before transplanting.

The planting in the main field is done at the beginning of the rainy season (June-July) and the spacing adopted by the farmers in Kerala and Tamil Nadu varies very widely. The maximum spacing adopted by farmers at present is 6 to 7 metres and even this appears to be inadequate. Record yields in nutmeg are observed often in the case of isolated trees which indicate the inadequacy of spacing adopted at present. Besides providing artificial shade with coconut leaves, banana is often planted as an intercrop during the first few years which will provide sufficient shade in the pre-



Nutmeg fruits split open exposing the aril inside—correct stage for harvesting

bearing stages. In some plantations fast growing shade trees like *Albizzia* spp. and *Erythrina* spp. are also found.

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