VEGETATIVE PROPAGATION OF TREE SPICES

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Nutmeg (*Myristica fragrans* Houtt.) Cinnamon (*Cinnamomum verum* Presl.), Clove (*Eugenia caryophyllus* (Sprengel) Bullock & Harrison) and Allspice *Pimenta dioica* (L.) Merr.) are the tree spices grown in India. Up to date statistics of area and production of these spices are not readily available. The latest available figures of these crops. in India is given in Tabie 1.

Table 1. AREA AND PRODUCTION OF TREE SPICES IN INDIA

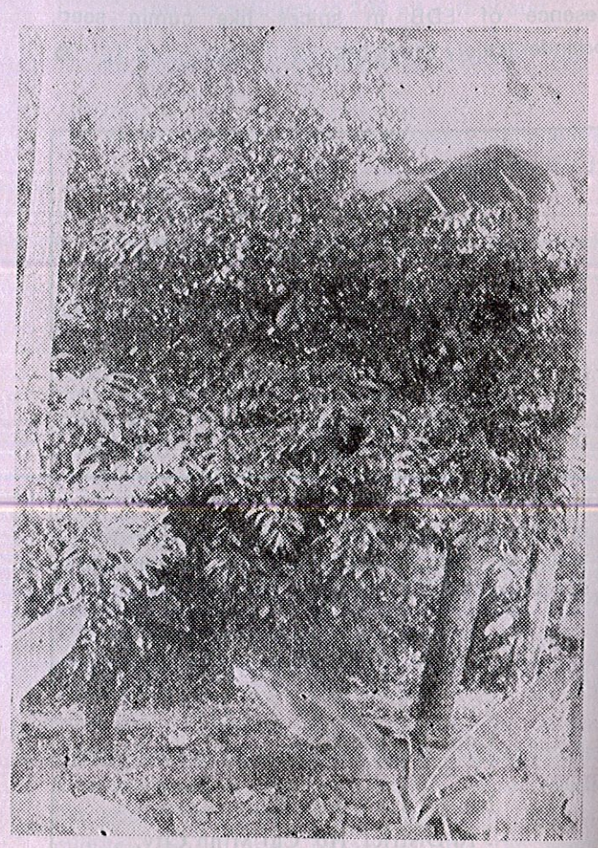
Crop	Area (hectares)	Production (tonnes)
Nutmeg	3,130	1,000
Cinnamon	625	300
Clove	1,600	1,300
Allspice	NA	NA

Annually, nutmag, cinnamon and clove worth Rs. 25 crores is imported into India. To achieve self sufficiency in tree spices, the area under these crops has to be increased by planting superior quality materials in traditional and non-traditiona| areas, besides following other improved cultura| operations. Standardization of vegetative propagation methods will help in rapid multiplication of the superior materials available at present and also to reduce the pre-bearing period which is not otherwise possible by seed propagation

Very little work has been carried out on the vegetative propagtion aspects of tree spices. A review on the present status of vegetative propagation of each of these crops is presented here.

Nutmeg

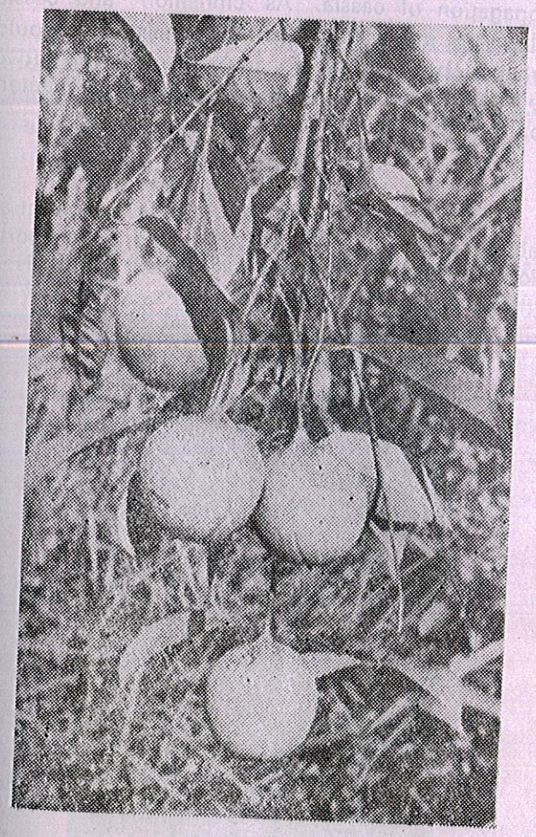
Nutmeg is usually propagated through seeds. The trees are dioecious in nature and the segregation of the sex into male and female is in the ratio 1:1 (Nichols and Pryde, 1958). Identification of the sex of the tree until it comes to flowering is difficult. Eventhough, there are numerous reports regarding the identification of sex at the seedling stage, on the basis of leaf form and venation (Prestoe, 1948), colour of young sprouts, seedling vigour, chromosome morphology (Flach, 1966) and shape of calcium oxalate crystals on leaf epidermis (Nayar *et al.*, 1977), chemical methods (Phadnis and



Choudhari, 1971, Zachariah *et al.*, 1986), none of these methods seems to be reliable. Being a cross pollinated crop, large variation exists in the seedling progenies and due to this heterogenous nature, most of the unique characters are lost, if they are propagated by seeds. To get a uniformly high yielding population of nutmeg vegetative propagation is the only alternative at present.

As early as 1894, grafting experiments were carried out in the Botanical Gardens at Bogor (Indonesia) (Deinum, 1932). Various vegetative propagations such as approach grafting (Ridley, 1912; Sundararaj and Varadarajan, 1956), budding (Postma, 1935, Deinum, 1949) airlayering (Mac Millan, 1954); cuttings (Nichols and Pryde, 1958) and epicotyl grafting (Mathew and Josy Joseph, 1982) have been successfully carried out.

Nutmeg can be propagated using semihard wood and hard wood cuttings 12-15" long and ¼" diameter at the base (Nichols and Pryde 1958). The cuttings took about 6 months time for rooting and the growth of the plant was very slow in the field. Air layering was proved to be possible in Moluccas and New Guinea. In New Guinea about 60 per cent showed rooting in six months, but did not establish in the field. (Deinum 1949). Nichols and Cruickshak 1964 reported a percentage success of 8-48 by air layering.



Budding and grafting techniques gave better results. A moderate success of 26-82% was obtained when *Myristica fragrans* was budded on to *Myristica succedanea* (Postma 1935). Of the different root stocks tried success was maximum when *Myristica fragrans* was budded on to its own root stock followed by *Myristica beddomei* and *Myristica malabarica* (Anonymous 1984).

Inarching of *Myristica fragrans* on to *Myristica fragrans, Myristica beddomei* and *Myristica malabarica* was found to be possible and it gave 40-80% success depending on the season (Sundararaj and Varadarajan 1956). Inarching of *Myristica fragrans* on its own root stock gave 62% success and the grafts took 180 days for perfect union (Chellappan and Roche 1982). Inarching though proved to be a good method, is expensive, cumbursome and laborious as benches have to be erected and the root stocks have to be brought to the mother plant. Soft wood grafting also showed good success during rainy season (Anonymous 1984). Production of epicotyl grafts in *Myristica fragrans* using *Myristica beddomei* and *Myiistica malabarica* as root stock had been reported by Mathew and Josy Joseph (1982). Extensive trials conducted at National Research Centre for Spices, have shown that the cultivated type of nutmeg *Myristica fragrans* is an ideal root stock for epicotyl grafting and the percentage success was comparatively more in August (80%) and September (74.1%) Krishnamoorthy and Mathew 1985) (Table 2).

However, top working of male trees did not show much success (Anonymous 1984). The inarch grafs had an added advantage-besides higher yield, early bearing and heavy fruit weight-of producing dwarf plants, round in shape, making them suitable for high density planting and farm operations (Chellappan and Roche 1982)

Nutmeg shows branch dimorphism exhibiting orthotropy in the trunk and plagiotropy in the branches. An orthotropic shoot when used gives rise to a graft which resembles the mother tree in

Table 2 : PERCENTAGE SUCCESS OF EPICOTYL GRAFTS IN DIFFERENT MONTHS USING *Myristica fragrans* AS ROOT STOCK.

Months	Percentage success
January	64.3
February	61.5
March	53.8
April	53.3
May	51.7
June	63.6
July	56.5
August	80.0
September	74.0
October	67.1
November	67.4
December	65.3

appearance whereas a plagiotropic scion gives rise to a tree which is more of spreading nature. The less availability of the orthotropic branches poses a problem for grafting. Mathew (1985) reported that bending of the root stocks at the budded portions gives rise to orthotropic shoots, solving the problem to a certain extent.

Cinnamon and Cassia

Cinnamon is the dried inner bark of *Cinnamomum verum*. Cassia, which is considered inferior to true cinnamon, is obtained from different species of Cinnamomum. These include *Cinnamonum burmannii*, *Cinnamomum cassia* and *Cinnamomum loreirii* (Puresglove *et al* 1981).

At present seed propagation is the common method of raising cinnamon and cassia. The indigenous varieties now available show wide variation (Ponnuswami *et al* (1982) in their yield and other characters as they are not purely self pollinated. In cinnamon apart from yield, the quality of the produce and the oil content vary considerably. NRC for Spices recently selected through screening a few cinnamon types including exotic ones having high quality. To preserve such qualities clonal propagation has to be standardised.

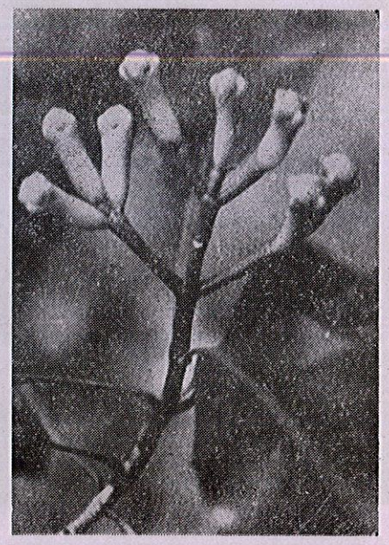
Attempts made so far indicate that air layering and rooting of cuttings are possible. Single noded cuttings with 1 or 2 leaves could be made to root within 40 days under humid conditions (Anonymous 1984). Young two noded cuttings took 12-18 months before they were ready for planting (Anonymous 1970). For propagation, growth regulator IBA was more effective than NAA or IAA, in promoting rooting or cinnamon. Soft wood cuttings treated with NAA 5000 ppm gave 22.5% rooting (Vadivel *et al* 1981) whereas hardwood cuttings treated with 2500 ppm IBA gave 45% rooting and IAA 2500 ppm gave 35% rooting (Irulappan *et al* 1981). Air layering using 100 ppm gallic acid gave 80% rooting (Banerjee *et al* 1982).

The clonal propagation of cinnamon from seeds and seedling explants by tissue culture was found possible (Ravishankar Rai and Jagadish Chandra 1987).

Cassia is commercially propagated by seeds and no information is available about the vegetative propagation of cassia. As cinnamon and cassia belong to the same genus (*Cinnamomum*) it would perhaps be possible that same vegetative propagation methods found successful in cinnamon would be feasible for cassia.

Clove

Vegetative propagation in clove is important as viability of clove seeds is very low and transportation for raising seedlings at far off places is a difficult proposition.



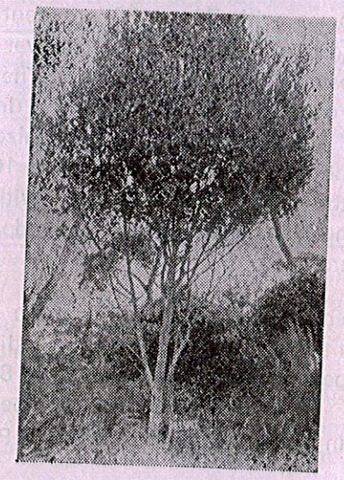
Clonal propagation of clove has been difficult and attempts in many regions failed (Purseglove *et al* 1981). Grafting on related species gave negative results. Attempts of grafting on other species of *Eugenia* have been unsuccessful (Tidbury 1949). The reports from India show that no graft union could be established between *Syzygium cumini* and clove (Anonymous 1984). Eventhough compatibility was found between *Psidium quajava* and clove belonging to the same family, only one of the grafts survived (May 1949).

However, soft wood cuttings taken with a heel (Fernie 1946) and inarching (Yegna Narayana Aiyer 1960) were found to be successful. May (1949) succeeded in approach grafting the branch tip of mature tree on to young clove seedlings. Approach grafting of twigs 4-8" diameter on to *Syzygium cumini* was obtained in Madagascar (Dufournet and Rodriquez 1972). Air layering can be done on young branches (Francois 1936, Maistre 1964).

In vitro propagation in clove has shown some initial success. Callus bud development was achieved from axillary buds of 8 year old clove (Mary Mathew *et al* 1987).

Allspice

Allspice is polygamodioecious in nature i. e. the plants are structurally hermophrodite but functionally dioecious in which, there are barren trees which do not produce fruits and are functionally male and fruiting trees which are functionally female (Purseglove *et al* 1981). This character makes it difficult for the identification of functional male and female till it comes to bearing.



Vegetative propagation is possible by chip budding (30% success) and approach grafting (90% success) (Chapman 1967. — 1968). Semihard wood Cuttings rooted in a period of 6-7 months. Bottle grafting techniques did not show any success (Anonymous 1984).

Rooting of cuttings need more investigations so also root stock effect of other related members of Myrtaceae, as stock-scion incompatibility has been observed (Chapman and Gasglow 1961).

Conclusion :

Superior individuals can be selected as cultivars and maintained through vegetative propagation as clonal stability is ensured. No systematic attemptsis done in the field of vegetative propagation of tree spices than it would merit and because of this standardization of commercial vegetative propagation method is lacking in clove, cinnamon and allspice.

If any worthwhile progress has to be made in future reliable and economic methods of vegetative propagation will have to be evolved. The growing importance of these crops points to the need for superior cultivars and easy methods for their propagation. ●