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A GLIMPSE IN TO THE BOTANICAL FEATURES OF NUTMEG

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Abstract

Nutmeg, a major tree spice of Kerala, thrives in the wet tropical weather of the state. Its fruit yields two spices, nutmeg, and mace, both commanding high prices in domestic and international markets. Despite substantial domestic demand, India exports approximately 21% of its nutmeg output, with exports witnessing a remarkable 70% increase in the past decade due to unstable international prices. India, contributing over 11% of global nutmeg production, heavily relies on Kerala, which accounts for 96% of its total output.

Keywords: Nutmeg,Kerala,Export,Cultivation

Introduction

Nutmeg is a major tree spice of Kerala. The wet tropical weather of the state is ideally suited to its growth. The tree is important for two spices derived from the fruit, nutmeg and mace. Both nutmeg and mace are currently among the most expensive spices, which are in high demand both domestically and internationally. Actually, it is without even meeting the domestic demand to the full that the country exports around 21 per cent of the output. The exports have also increased by 70 per cent in the past decade, due to their high prices prevailing in the international markets. So, increasing the area and production of the crop will definitely serve as means of gaining the much valued foreign exchange earnings and also saving it by reducing imports.

India today accounts for more than 11 per cent of the world output in nutmeg. Ninety six per cent of its total production comes from the state of Kerala. The area of nutmeg plantation in India in the year 2020-21 comes to 22512 hectares, which produces 14342 million tonnes with a yield of 637.08 per hectare (Spices Board 2021). By exporting a quantity of 3280 million tonnes of nutmeg and mace, the country could bring in foreign exchange earnings worth US$ 24.82 million, in 2019. The area cultivated got extended to other states of India, especially Tamil Nadu and Karnataka, may be because of the sudden rise in the price during 1998-99 (Appendix 1). In the subsequent years, gigantic breakthrough in nutmeg cultivation occurred in these states and in Kerala, as the farmers were so attracted to it. However, though the rise in the area of cultivation and production of nutmeg helped increase its export from India, it was not sufficient to meet the growing demand. Such increased demand for nutmeg and the potential for high export earnings from its production has prompted the nutmeg farmers in India to go for the commercialized production of the crop. Apart from this, they do not have to spend much on the tree. The changing lifestyles and food habits have also boosted the demand for nutmeg in the country.

Botanical features of the plant

Botanically, nutmeg is an evergreen tree with 10-12 metres height. Its branches spread with shiny leaves which are oblong to oval in shape and have dark grey bark. The flowers appear in cymes, and each cyme has several branches on which a number of flowers bloom that hang down. These flowers are small, pale yellow, bell

shaped and is slightly aromatic. The fruits are fleshy, globose in shape, and are light brown in colour. Inside the fruit is the single glossy brown seed with a brittle shell over which is the beautiful, brilliant, scarlet and net like membrane aril known as mace, which is fragile and aromatic (Purseglove et al., 1981). Figure 2.2 depicts the fruit of a nutmeg tree with the nut and mace clearly visible inside.

Nutmeg trees are dioecious in nature, that is, male and female flowers occur in different trees. It is noticed that in female trees, in certain years, five per cent male flowers are also seen. Similarly, on a male tree, about five per cent of female flowers are observed occasionally. The exact reason for the different expression of sex is not known, and it may be perhaps due to the climatic variation and shade effects. The gender of the trees can easily be identified by an expert farmer, as the male trees have erect branches and the leaves are generally smaller in size. They are also conspicuously less leafy than the female trees. The shape of the tree is irregular. The bark is greyish black and slightly fissured longitudinally in the older trees; the twigs are glabrous, slender and greyish brown.

The nutmeg, mace, their oleoresins and essential oils are used in food and beverage industries (B. Krishnamoorthy and J. Rema, 2001) examined. The powder form of the spice is used in the food processing industry, its oleoresins are used in the preparation of confectioneries to flavour milk dishes and punches. Mace is an inevitable item in many of the savoury dishes either as a whole or in ground form and also used to flavour milk-based sauces and processed meats like sausages. It is also observed that the use of essential oils in aromatherapy is gaining importance.

Objectives of the study

To identify the botanical features of the nutmeg plant with a focus on understanding its soil and climate requirements, susceptibility to pests and diseases, and appropriate practices for successful cultivation.

Significance of the study

Understanding the botanical features of the nutmeg plant in relation to cultivation and management is crucial for farmers, agricultural researchers, and policymakers. This knowledge enables the development of nutmeg cultivation practices that optimize yield, quality, and sustainability. By identifying the specific soil types and climatic conditions conducive to nutmeg growth, as well as recognizing the plant's vulnerabilities to pests and diseases, growers can implement effective management strategies to mitigate risks and maximize productivity.

Literature Review

Pruthi(1979) described the principal elements of the spices nutmeg and mace are steam volatile oil (essential oil), fixed (fatty) oil, proteins, cellulose, starch, resin and mineral elements. The percentages of elements fluctuate between the spices and this is a result of geographical origin, quality and even growing locations.

Purseglove et al. (1981) stated Myristica fragrans is exceptional among spices as it produces twin spices, nutmeg and mace. Nutmeg was familiarized in India for quite a long period. It is seen largely in Kerala, Tamil Nadu and Karnataka. Nutmeg oils are classified as East Indian (Indonesia) or West Indian (Grenada and St. Vincent), distinct in odour, flavour, chemical and physical properties, based on the origin of nutmeg trees. Though it is dioecious, the same tree produces both male and female flowers .All parts of the fruit are aromatic. The root system of the plant is also unusual with a surface plate of roots. The branches are numerous and spreading. The leaves are alternate and smooth surface. The lamina has 50-150 mm length and 20-70 mm breadth.

Madhavan. L et al. (1991) observed myristicin is the major component of nutmeg volatile oil. The fatty acid composition of nutmeg fat is altered for different maturity stages .The changes in chemical composition of nutmeg and mace depend upon the time of harvesting.

Krishnamoorthy et al. (1996) focussed the vegetative propagation is increasingly practiced now due to the improved awareness on quality and yield of plant. In a seeding propagation, identification of sex is challenging. Vegetative propagation is essential to get high yielding plantations of good grade. He established that the weight of nutmeg fruit ranged from 60.5 to 80.0 g, the mace weight from 2.5 to 3.7 g and the seed weight from 8.4 to 12.2 g under Kerala conditions. The present crop improvement programme is restricted to selection of high yielding nutmeg types with good quality nut and mace.

B. Krishnamoorthy and J. Rema (2001) examined the nutmeg, mace, their oleoresins and essential oils are used in the food and beverage industries. The ground form of the spice is mainly used in the food processing industry, its

oleoresin are used in the preparation of meat products, soups, sauces, baked foods, confectioneries to flavor milk dishes and punches.

M.Anandharaj.et.al (2005) reported that artificial pollination in nutmeg would be beneficial over open pollination. The chief agent of the open pollination is the wind. He found that non-natural pollination helps in increasing fruit set and yield. He also observed the fruit development takes 8 months and maximum fruit drop was observed after 3 months of fruit set.

Haldankar, P.M (2007) observed that one year old seedlings raised in big bags are used for budding. In budding only orthotropic scions are used that results in erect growing grafts and are sold at high cost due the dearth of good mother trees. In order to reduce the cost of budded plants in situ budding of field planted seedlings in a plantation can be taken up. However lack of trained or experienced budders is a problem faced by farmers.

Parthasarathy (2010) reported the selection in nutmeg sapling will be effective, if trees are selected with maximum fruit number and moderately good seed weight.

Gupta A.D. (2013) established the effectiveness of lycopene as an antioxidant. As an antioxidant, it is twice as potent as Vitamin A and ten times as effective as Vitamin E. Thus the degradation of lycopene not only affects the attractive scarlet colour of mace, but also the nutritive value.

Patil K. (2017) observed nutmeg has many health benefits, show that it can help to stop diarrhea (in low dose), detoxify the body, and stimulate the brain, etc. It has rich in energy and Vitamins. It also contains electrolytes, minerals such as copper, zinc, iron, magnesium, manganese, and phosphorus and phytonutrients include cryptoxanthin B and carotene-B. Consuming a huge amount of nutmeg results in sudden attack, irregular heartbeat, and vomiting.

A. FEATURES OF THE PLANT

1 Nutmeg Cultivation Practices

The nutmeg tree thrives well in humid tropical climate and is grown in places up to an elevation of l, 000 metres. Average rainfall requirement ranges from 150 to 300 cm., temperature from 65° to 100°F and humidity from 50 to 95 per cent , a well-distributed 0.10 rainfall with about 20 cm in each month will be quite congenial, failing which irrigation should be given at least in summer months. Water table should not be within the root zone, even during the rainy season, for days together. Nutmeg thrives well in sheltered valleys, or hot moist tropical islands at elevations from sea-level to 100 metres, where it can 'Smell' the sea. Well-drained soils rich in humus are recommended (Shanmugavelu and Rao, 1977). Waterlogging or soils having inadequate moisture may be avoided (Purseglove et al., 1981). However, it is grown in different types of soil. In Moluccas, it is grown in rich volcanic loams with large quantities of humus. Nutmeg trees are found to grow in laterite clayey loam. In Indonesia and West Indies, nutmeg trees are reported to thrive well in clayey loams. Nutmeg is reported to grow well in comparatively poorer types of soil, provided the soil is not sandy and not too wet or dry. Well-drained, deep, rich alluvial, loamy and laterite soils are best suited. This crop comes up well under semi-shade conditions than in open places (Sait, 1974), and hence, it can be grown as a mixed crop in the coconut and areca nut farms. Climatic conditions prevailing in the sloped Western Ghats are highly suitable for its cultivation, and there is immense scope for increasing the production by bringing new areas under this crop both in west coast and north eastern regions.

2 Nutmeg plant growth

Nutmeg is a slow growing tree as compared to other perennial crops (Flach and Cruickshank, 1969). It attains an average height of approximately 3 m and a width of 15.7 cm to 40 cm above ground level in four years. Growth continues up to 60 to 80 years. Plants differ much in growth, vigour, productivity, sex of flowers, size and shape of leaves (Nazeem 1979). The shoot growth in nutmeg is cyclic. Under the climatic conditions in Kerala, six flushes with two peaks in May and September are generally observed. Further, the growth recorded in different trees did not differ significantly. The growth was found to be very slow with a mean extension of 11cm in a period of one year. In the Maharashtra region, the nutmeg vegetative growth is cyclic with two peaks, one in January-February and the second in May. Shoot elongation is rapid during 150-270 days after the emergence of shoot. Considerable variation among the genotypes with respect to growth was noticed (Haldankar et al., 2004). Nutmeg being a strictly cross-pollinated crop, the plants differs in growth.

3 Flowering and fruit set

Flowering and fruit set are very important in any horticultural crops. The nutmeg tree usually flowers throughout the year. The climatic factors are responsible for such variations although it is not possible to pinpoint any factor (Flach and Cruickshank, 1969). In New Guinea, Flach (1966) observed that approximately 50 per cent of the female flowers set fruits. There the flowers are fragrant, creamy yellow in colour, waxy and fleshy. M.Anandharaj.et.al (2005) reported that artificial pollination in nutmeg would be beneficial over open pollination. The chief agent of the open pollination is the wind. He found that non-natural pollination helps in increasing fruit set and yield. He also observed the fruit development takes 8 months, and maximum fruit drop was observed after 3 months of fruit set. Nazeem (1979) observed that male and female trees differed in their flowering pattern. In female trees, flowering continues from June to October and extends up to January-February, whereas in male trees, the flowering was throughout the year with varying intensities.

4 Fruit characters

Fruit is pendulous, broadly pyriform, yellow, smooth, 7-10 cm long, fleshy, splitting open into two halves when ripe, showing the ovoid 2-3cm long, dark brown, shining seed with hard seed coat that is surrounded by a laminate red aril attached to the base of the seed. Nutmeg fruit composes of fleshy pericarp, scarlet red mace and nut. These fruit components vary among the plants. Individual nutmeg fruits weighed on an average 60gm of which the seed weighed 6-7gm, mace 3-4 gm, and the rest is the weight of the pericarp (Shanmugavelu and Madhava Rao, 1977). The weight proportion of dried-shelled nutmeg to dried mace was approximately 20:3. During drying, nutmegs lose about 25 per cent of their weight (Purseglove et al., 1981). The colour of dried nut is greyish brown and varied in size up to 3 cm long and 2 cm wide. Krishnamoorthy et al., (1996) found that the fruit weight of nutmeg ranged from 60.5 to 80 gm, the seed weighed from 8.4 to 12.2 gm, and the mace weighed from 2.5 to 3.7 gm in Kerala.

5 Fruit Development

The nutmeg fruit becomes ready for harvest in about 9 months after flowering. The period required for development of the fruit is substantially long. The time required for the fruits to attain maturity from flowering was reported to be nine months.

As regards the nature of its yield, Nazeem, P.A. (1979) observed a nutmeg tree to bear fruits when five to eight years old. The productivity is supposed to gradually increase and the plant is expected to peak to its maximum production at 15 to 35 years after which the yield stabilizes. The fruit ripens in about six to nine months after flowering, usually with two peaks of fruiting annually. The ripe fruit splits open while still on the tree, and after two days the seed along with red aril falls to the ground. He also noticed that the development of nutmeg fruit was quicker during the period between 6th and 16th week after fruit is set, and thereafter, it decreased gradually till 18th week. The increase in growth was very low between 18th and 25th week, and there was no growth thereafter. The fruits start splitting in 206 to 237 days (Seven to eight months) after being set.

B. PROCESS OF CULTIVATION OF THE CROP

Krishnamoorthy et al. (1996) focussed on the nature of its propagation and found that generally vegetative propagation is practiced due to the improved awareness on the quality and yield of plant. In seeding propagation, identification of sex of the plant is challenging. So vegetative propagation is stated to be essential to get high yielding plantations of good grade.

1 Propagation

Nutmeg is generally propagated through seed. Well-matured seeds are collected for propagation. The fleshy pericarps of the seeds are removed and then the seeds are dried for a day before sowing. However, no difference was notified in the germination among various sizes of seeds except in the case of very small and immature seeds, which did not germinate satisfactorily. Seeds are sown immediately three days after extraction. Seeds are usually propagated at a spacing of about 30 cm apart and 2.5-5.0 cm deep.

Freshly harvested seeds are used for sowing. Seed beds are prepared in shade where irrigation facilities exist .The seeds are placed in Sandy nursery beds at distances of 25-30 cm and 2.5 to 5 cm deep. It takes about 2-3 months for germination. The seeds may be sown in baskets, polythene bags or other containers. Six month old

seedlings are transferred to polythene bags .When the seedlings attain an age of one and half to two years and height of 60 - 90 cm, they are used for planting.

Vegetative propagation is considered the ideal method of nutmeg propagation to achieve desired female trees with early bearing and it should also be possible to select and propagate high yielding clones.

a.Cuttings

Nutmegs can be propagated from semi hardwood or hardwood with a length of 30-37 cm and about 8 mm diameter at the base. The root growth can be encouraged by quick dipping of the cutting. The second dip after 8 weeks further promotes a branched root system. Root induction takes approximately four months, but well branched root system are formed in three months. However, this method never became an established commercial method of propagation.

b.Air layering

Nowadays, this method is used in Grenada for the propagation of nutmeg. Healthy branches of about 1.5 cm in diameter and 90-100 cm in length are selected for air layering. A section is made by removing or splitting the bark in the middle of the stem about 80 to 90 from the tip.

c.Approach grafting

Grafting may be made on seedlings of other species of the genus Myristica. In approach grafting, seedlings of about 45 cm height and pencil thickness in the collar region are approach grafted to scion of similar thickness. The graft takes about four months to unite, after which the scion is detached below the union and placed for hardening.

d.Epicotyl grafting

Grafting is the system of connecting together of portions of two plants (scion and root stock) that will endure their growth after union as one plant. This forms the basis of asexual method of plant propagation with great advantages in breeding programmes for developing superior genotype. Epicotyl grafting is the same as grafting in terms of methodology, and is a simple, cheap and quick method of propagation.

e.Softwood grafting

Softwood grafting is possible in nutmeg. It was revealed that May was the best season for softwood grafting. The medium matured to fully matured scion sticks of 4 to 6 months old were preferred for softwood grafting. Retention of one terminal leaf on the scion sticks recorded 75 per cent success. The success in softwood grafting differs according to the scion variety. The variation among genotypes for sprouting, survival and growth parameters was statistically significant.

2 Land preparation and planting

Planting in the main field is done at the beginning of the rainy season. Pits of 0.75 m x 0.75 mx 0.75 mares dug at a spacing of 9 m x 9m for seedlings and 5m x 5m for bush/ lateral grafts and filled with organic manure and soil 15 days before planting. If male trees are not available, one male graft has to be planted for every 10 female grafts. Alternately, one male branch can be grafted to each female graft to provide enough pollen. The plants should be shaded to keep them from sunlight during early stages in summertime. In the hilly slope area, when the tree is planted as a monocrop, it requires shade trees to control the sunlight. Nutmeg can best be grown as an intercrop in coconut garden more than 15 years old where shade conditions are ideal, especially along river buds and adjoining areas (Nagawekar et al. 2002).

3 Application of Fertilizers and Manures

After planting, periodical irrigations are given at least for 3-4 years in the beginning, and thereafter, the trees are to be manured every year. Compost (15 kg) and 100 g each of ammonium sulphate, super phosphate and muriate of potash are given, in two split doses--the first with the onset of southwest monsoon along with the compost or cattle manure and the second during weeding. For eight years old bearing trees, 50 kg of compost, one kilogram each of ammonium sulphate, superphosphate and muriate of potash are applied and half of the dose for young and non-bearing trees. Manures are applied at the circular basins of 40-cm width and not more than 30-cm

depth. It is necessary that Manures should be covered with soil and basins should not be kept open during rainy season, as plants cannot withstand waterlogged conditions. Basins of the trees can be mulched with dry leaves during summer to conserve moisture. Digging the ground has to be avoided, as the lateral roots spread near the surface.

This article has revealed that nutmeg requires a warm and humid climate and adequate shade for its proper growth and development. Previously, it was cultivated by sexual propagation. However, because of long bearing age, wide variability in fruit characters and yield, the vegetative propagation methods like epicotyl and softwood grafting are developed. The grafts prepared by using vertical branches results in bushy growth. It is an excellent mixed crop in coconut plantation. Fruit rot and shot holes are the major diseases, in this precious crop. Nutmeg yield varies between few fruits to few thousand fruits.

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