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27 FEB 2002
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Patchouli (*Pogostemon cablin*) - A Potential Aromatic Crop for Intercropping in Coconut Gardens

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Patchouli is an herbaceous aromatic crop native to South and South-East Asia. The leaves and stem yield patchouli oil, which is of great demand in perfume and flavour industry. In India, the leaves of patchouli have been used traditionally to perfume textiles such as shawls and carpets, both for its sweet smell and its insect repellent properties. The leaves are also used in traditional medicine of South and South East Asia. Today, the world over, the oil of patchouli is used in the manufacture of soap, cosmetics, perfumes and flavours. At present the global requirement of patchouli oil is 1000 tonnes per annum, which accounts for Rs. 200 crores of global trade. The Indian perfumery market consumes 70-80 tonnes of patchouli oil annually. This entire requirement is mainly met through production from Indonesia. However, due to disturbances in Indonesia, the supply of oil is irregular. The plant grows well in many parts of India, particularly in the coastal regions with high humid climate, and hence there is a good potential for India to grow it as a main crop, or as an intercrop along with plantation crops to produce and market this oil.

Opportunities for Intercropping in Coconut Gardens

In India, coconut is grown over an area of about 1.78 million hectares (1999-2000). This crop, which occupies the land continuously, utilizes the natural resources only to a very limited

extent producing less than 10 per cent of the potential dry matter production in the tropics. Studies conducted at Central Plantation Crops Research Institute (CPCRI), Kasaragod have shown that the effective root zone of an adult bearing coconut palm growing under normal management is confined laterally within a radius of 2 m around the base of the palm (Kushwah *et al.* 1973). The vertical distribution of roots have shown that the top 30 cm layer soil was practically devoid of functioning roots and that about 86 per cent of the roots were found between 30 and 120 cm depth from the surface. However, the morphological feature of the coconut palm necessitates its planting at 7.5 x 7.5 m spacing. These observations indicate that 77.7 per cent of the total available land area in a pure stand of coconut is not effectively utilized by the coconut roots. The venetian structure and orientation of coconut leaves permit sizeable amount of solar radiation incident on the crown to penetrate to lower levels. The light intensity at ground level was always higher than 6700 lux at all parts of the year (Nair, 1979). Of the solar radiation received, on an average about 50 per cent alone is intercepted by the coconut canopy. Making use of the underutilized soil space and solar radiation in

monocrop stands, patchouli can be intercropped in the interspace of coconut. Further, more than 90 per cent coconut holdings in the country are small and farmers are directly depending on coconut for their livelihood. Due to the recent crash in coconut prices, the income derived from such smallholdings is not sufficient to sustain even the small families. In addition, coconut as a monocrop provides employment only for about 135 mandays/ha under rainfed conditions and consequently the family labour remains unemployed for larger part of the year. The patchouli plant can be easily established under coconut shade with irrigation during summer months in India, particularly in the coastal regions of Kerala and Karnataka. A study conducted at Vellanikkara, Kerala revealed that herbage and oil yields in patchouli increased with increasing shade and the highest (172.82 kg/ha) and the lowest (75.82 kg/ha) oil yields were obtained at 50 and 0 per cent shade respectively (Radhakrishnan *et al.* 1991). Even intercropping of patchouli



Patchouli intercropped in coconut garden



with papaya (2x1 m space) improved the oil yield by 76 per cent and the quality of oil by 8-11 per cent compared with patchouli monocropping (Ram *et al.* 1999). Realising the potential of patchouli as an intercrop in coconut gardens, Central Plantation Crops Research Institute at Kasaragod has taken initiative to work out the yield potential and quality aspects of patchouli oil when grown as an intercrop in coconut gardens. The cultivation practices for growing patchouli as an intercrop in coconut garden are described below.

Soil and Climate

Patchouli is well suited to the coastal regions with humid climate. It thrives at a temperature range of 25^o C to 35^o C, with an annual rainfall of 1500 to 3000 mm. The crop does not tolerate water logging, and hence requires well-drained soils with medium fertility.

Plant Materials

In India, various species of *Pogostemon* are found. There are many cultivars of patchouli introduced from other countries such as Java, Singapore, Malaysia, Jahore and Indonesia (named after their provenance). The various species and varieties vary in their oil content and quality. The selections grown commercially are those selected for their superior oil yields from an Indonesian variety. Through cutting, the patchouli could be easily propagated. The primary cause of high incidence of yellow mosaic virus of patchouli is due to infected cuttings. Therefore, use of mosaic free plant material for multiplication is essential. It is recommended to use tissue-cultured plants as mother plants for propagation.

Top cuts, 10-15 cm in length, with 3 to 4 nodes give the best results (Vijayalalitha and Rajasekaran, 1977). The cut ends are planted in raised nursery beds or polybags. Before planting of cuttings in nursery bed or polybag, the cut ends of the stem may be dipped or treated with 1000-ppm indol butyric acid (IBA) or rootex powder and then planted. While planting, about one inter node length may be dibbled in the soil. Rooting will be good during November to February months when the atmospheric temperature would be low. Experiments on rooting of patchouli cutting under different environments revealed that best rooting (100%) and survival (100%) were obtained with soft wood (terminal shoot) cutting treated with IBA (500-1000 ppm) or NAA (500-1000 ppm) and raised in the mist chamber (Selvarajan and Rao, 1982). The farmer can easily propagate nursery in natural tree shade or shade house. The cuttings are to be irrigated daily. The cuttings are ready for transplanting to the main field in 1½ to 2 months, when they reach a height of 25 to 30 cm. Transplantation can be done all round the year, except in hot summer months.

Field Preparation and Planting

The coconut garden is ploughed and weeds are removed. Leaving 2 m radius around the coconut bole, rest of the interspaces in coconut garden may be used for planting patchouli. In case of high rainfall regions and low-lying areas, raised beds of convenient light and width are prepared. The field must be irrigated one day prior to planting. At the time of planting, neem cake is preferably added into the root zone to prevent nematode attack. Around 5000-

6000 plants are required per acre of coconut garden with a spacing of 45 x 45 cm. Once planted, the plants give good yield of leaves for 2 to 3 years.

After Care

The crop requires 10 to 12 tonnes of FYM at the time of planting and fertilizer application at the rate of 150:60:60 kg NPK/ha/year. The fertilizers are to be broadcasted every time after the harvest of the leaves. Weeding is necessary during the first 3-4 months of growth until canopy close the ground. The weeds can be controlled by application of pre-emergence herbicides like diuron, linuron and simazine. The best weed control with diuron at 2-3 kg/ha was found to give highest essential oil yield in patchouli (4.25%), when grown as intercrop in rubber plantation (Mangoensoekarjo and Nurdin, 1988). Normally, 3 to 4 crops can be harvested in a year depending on irrigation and soil fertility. The crop needs to be irrigated regularly during rainless months. Drip or perfo methods of irrigation can be employed for easy and efficient irrigation. Experimental evidences have shown that irrigation at 1.0 IW:CPE ratio gave significantly higher herb and oil yield in patchouli than the irrigation at the other lower ratios (Singh, 1996).

Disease and Pests

The crop requires relatively less plant protection measures. Because of its smell, it serves as an insect and animal repellent. The golden nematode (*Meloidogyne incognita*) and root and stem rot (*Fusarium* spp.) have been reported to affect the crop. These can be successfully controlled by prevention of water stagnation, soil application of



neem cake for nematode and timely application of fungicides like captan or carbendazim to the soil around the stem for the stem rot. The leaf blight and premature death of plant caused by *Alternaria alternata* fungi can be controlled by dithane M45 and captan (Parameswaran *et al.* 1987).

Yield

Once planted, the plants have the capacity to give a good yield for up to three years, and can be regularly harvested at an interval of 3 to 4 months. The entire stem may be cut leaving 10 to 15 cm length from ground for ratoon crop, and air-dried for 3 to 5 days under shade, so that, they lose excess moisture and can be stored without deterioration. At this stage, the moisture content of the leaves will be about 5-6 per cent. If the harvesting is done during rainy periods, the foliage is to be dried up to 8-10 days. The stem of the first crop should not be cut to ground level as it may affect the sprouting for the ratoon crop. Also, the new sprouts from the stem should not be harvested. One acre of coconut plantation can produce 2 to 3 tonnes of dried foliage per year. At the cost of Rs. 20/kg herbage, the farmer can get a gross returns of Rs. 40,000 to 60,000/acre of coconut garden. The cost of cultivation would be around 20,000/acre/year. Thus, the farmer can earn 20,000 to 40,000/acre/year by cultivating patchouli as an intercrop in coconut gardens.

Oil Extraction

The dried leaves are packed in bales and cured by aging for a few months before oil extraction. The process of aging is essential to patchouli as it imparts a characteristic odour to the oil,

which is preferred by the perfumer. The oil is extracted by steam distillation. The essential oil content will be 4 per cent on leaf dry weight basis or 0.4 per cent on fresh plant material basis. The patchouli oil is a viscous liquid, yellowish green to brownish in colour and possesses a warm powerful sweet aromatic spicy fragrance. More than 16 compounds were detected of which 11 were identified as alpha-, beta- and delta-patchoulene, beta-elemene, beta-caryophyllene, alpha- and delta-guaiene, seychellene, alpha-bulnesene, delta-cardinene, pogostol and patchouli alcohol. Patchouli alcohol content was 32-37 per cent and found to be the most odour intensive constituent of the oil (Dung *et al.* 1990). The oil quality improves upon aging. The oil has earthy, camphoraceous cum herbaceous properties.

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