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Agro-economically cultivation technology for obtaining high yield of Patchauli (*Pogostemon patchouli*)

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Introduction

Patchouli (*Pogostemon cablin* Benth.) is indigenous to South and Southeast Asia. It is mostly grown for its essential oil, which is mostly concentrated in the leaves but is also, to a lesser degree, present in the sensitive parts of the plants, such as the stem and root. In the fragrance industry, patchouli oil is widely used to create a range of medical products, such as body lotions, detergents, soaps, and fragrances. Previous research has highlighted the presence of several important compounds in the oil of patchouli which have numerous potential therapeutic properties which include anti-microbial, anti-oxidant, analgesic, antidepressant, antithrombotic, antimutagenic, fibrinolytic, activities etc. These attributes makes patchouli a commercially valuable crop with significant industrial application around the world for a variety of purposes. But poor agronomic practices leads to the deterioration in crop and oil yield and adoption of scientific cultivation practices could be a possible solution for improving crop and oil productivity.

Plant description

Patchouli is a flowering plant that grows wild throughout most of South Asia. In many regions of India, China, Malaysia, Singapore, and Indonesia, where it is cultivated extensively, it is currently regarded as a lucrative crop. It belongs to the Lamiaceae family of mints. Reaching heights of 1-2 meters, this fragrant herb or under-shrub grows in an erect, ascending, or branching manner. The size of its leaves is 0.85 inches wide by 2-4 inches long. The margins of the lobes are crenate-serrate, and the leaf margins are slightly lobed. The oil is deposited in various internal structures as well as the glandular trichomes of the leaves.

Agro-Climatic Requirements

Patchouli is a tropical plant can be grown in subtropical areas as well. Patchouli grows well at elevations between 800 and 1000 meters above sea level. Its ideal environment is warm and humid. Ample and evenly distributed rainfall (150 to 300 cm) is usually necessary for the crop to be grown successfully. Although patchouli is known to grow in a variety of soil types, deep, well-drained, fertile, slightly acidic, loamy soil that has been enriched with humus and nutrients is ideal for it. Maintaining a soil pH level between 5.5 and 7.5 is crucial for optimal growth. Patchouli is a plant that thrives well even in the shade. To provide the necessary shade, it's advisable to pre-plant trees like Gliricidia or Erythrina at 5 X 5 meter spacing within the patchouli field.

Potential Belts for Patchouli cultivation in India: Patchouli is grown along the coasts of West Bengal, Assam, Tamil Nadu, and Karnataka in India. Its cultivation ought to be encouraged along the southern states' coasts, where there is year-round, heavy rainfall that keeps the air humidity levels steadily high.

Improved varieties- Here are some of the improved varieties developed by CSIR-Central Institute of Medicinal and Aromatic Plants, Lucknow (UP), which are currently being cultivated by Indian farmers:

1. **CIM-Samarth**
2. **CIM-Utkrith**

Nursery: The nursery for cultivating Patchouli should be developed in a partially shaded area. Cuttings from well-developed branches, possessing a crown of 2-3 leaves and a length of 4-5 nodes are good for planting in the nursery. With the use of an appropriate dibbler, the cuttings should be planted at a spacing of roughly 5-10 cm in polythene bags or nursery beds. Early

roots development requires proper aeration, moderate shade, and consistent watering. For rooting in cuttings requires roughly 30 to 35 days.

Propagation

Cuts are used to propagate patchouli. In order to maintain moisture in the seed beds, nursery is grown in a shaded area during the growing season by planting 10- to 12-cm-long cuttings at 10-by-10-cm spacing. In six to eight weeks, under ideal circumstances, 85–90% of cuttings will be ready for field planting after producing roots for two weeks. Rooted cuttings are typically transplanted in the evening in the field. Planting is usually done at at 60 × 60 or 60 x 90 cm spacing intervals. A population of 12000 plants per acre regarded the most appropriate plant density within this spacing.

Figure 1: Patchouli Nursery

Land Preparation: The primary field needs to be thoroughly tilled and disced. Therefore plowing and harrowing should be done. When preparing the ground, 10 to 20 tonnes of FYM or compost should be used. A suitable nematicide, such as Furadan @20 kg/ha (a.i. 30%), should be broadcast and thoroughly mixed into the soil a few days prior to transplanting the rooted plants. The plot is then split into ridges and furrows. The ridge should have rows spaced 60 centimeters apart, measuring 20–25 cm high and 18–22 cm wide. Watering the beds the day before transplantation is recommended. Commercial periwinkle cultivation is recommended as it provides protection against nematode infestation for the crop when grown along the sector's edges.

Irrigation: It is important to immediately irrigate the field after transplanting. In their early stages, plants' most basic requirements for survival are shade and the right kind of moisture. The plants should be watered every day for the first three to four days after transplanting, then every other day for the next ten to fifteen days in order to meet these needs. The irrigation schedule is then lowered to once or twice a week for the next three weeks, depending on the particular soil type and surrounding circumstances. It's crucial to remember that the crop is seriously threatened by waterlogging.

Nutrition: Soil rich in nutrients is necessary for patchouli to produce the highest quality oil and yield. Typically, a basal dose of 25 kg N, 50 kg P_2O_5, and 50 kg K_2O per hectare is provided by urea, superphosphate, and potash muriate. 25 kg N in the form of urea is sprayed as additional fertilizer after about two months. For every harvest, 50 kg N is also given in two divided doses; the first is given soon after the harvest, and the second is given about two months later. Every year, 150 kg of nitrogen are applied per hectare to the crop. Application of 25 to 50 kg of zinc sulphate per acre is recommended for soil lacking in zinc. Micronutrients and growth regulators should be applied after every harvest and after soil tests.

Intercultural Operations

Weeding the field prior to the first harvest and doing one weeding or hoeing after each harvest are necessary to keep the crop weed-free throughout its growth cycle. Wheel hoeing (two to three times) or hand weeding should be used to keep the field free of weeds during the first two to three months of crop growth. It is also necessary to do periodic weeding a few months following each harvest.

Plant Protection: knotted roots Attacks by nematode (Meloidogyne incognita) are possible in the crop. Strongly impacted plants grow slowly and eventually wilt. The impacted plants droop and eventually die in two or three months. Dasanit 150 kg/ha (5 percent) or Furadan @ 20 kg/ha (3 percent) can be used to control the infection in order to address the problem. It is advised to apply a first dose of nematocide treatment prior to planting and a second dose one year after transplanting. Healthy mother stock should be used to raise nursery animals in environments free of nematodes.

Diseases

The crop may develop Cercospora sp.-caused leaf blight. Brown patches start to show up around the leaf margins or at the apical portion of the leaves when the plants are almost a year old. The leaves dry out as a result of spots that grow erratically, coalesce, and cover the entire lamina. Applying two sprays of Dithane Z-78 (0.5 percent) every month is the advised preventive measure.

Figure 2: Patchouli at maturation stage

Harvest: 4 to 6 months following transplanting, the first crop becomes ready for harvest. Depending on the soil fertility, climate, and management approaches, subsequent harvests typically occur at every 3-4 months.

The first two or three harvests of new plants produce good yields and high-quality oil. The crop is usually kept for three years. Premature harvesting of crop can led to lower yield and worse quality oil. A robust crop stand produces about 2 tonnes of dry leaves annually. Three harvests yield approximately 8,000 kg of fresh leaves per acre per year; this amount drops to 1600 kg after shade drying, and an additional 40 kg of oil is produced during distillation.

Drying: To ensure proper drying, the harvested material is spread out in thin layers in the shade and rotated frequently. Herbage should have a moisture content of 8–10% for optimal recovery and oil quality. Drying usually takes three to six days. The aroma of patchouli develops in properly dried leaves. Because ageing the leaves in storage improves their odour and therefore for imporving odour the crop is kept for 6 months before distillation.

Distillation: The dried herb's oil is usually extracted using steam or hydro distillation. The amount of the shade-dried herb that is recovered ranges from 2.5 to 3.0%. The distillation process takes 8–10 hours to recover 100% of the oil. When leaves are dried properly, there is an improvement in both oil output and quality. An increased yield of 60 kg/acre annually has been attained.

Oil storage and packing: Before storing, it is important to make sure that the volatile oil is completely free of water. The oil should be kept in an aluminum or steel drum or glass container. The brimmed containers ought to be securely sealed and kept in a cool, dry, and dark location.

Demand and Supply Patterns: Compared to other essential oils, patchouli oil is gaining popularity more quickly. Over the past few years, the price of patchouli oil has varied internationally, ranging from US$ 25/kg to about US$ 150/kg. The cost per kg in India ranges from US$ 30 to US$ 33. India has a high demand for patchouli oil, and it currently imports the oil to meet its needs. Over 175–200 t of patchouli oil are imported by India annually from Singapore, Malaysia, and Indonesia.

Analysis and Future Strategy:

common application in the perfumery industry is patchouli oil. The fragrance industry is experiencing a steady increase in demand for this oil due to the lack of a synthetic substitute. The two biggest oil producers at the moment are China and Indonesia. India is able to produce the oil needed to satisfy the world's demand. When it comes to quality, local oil is far better than imported oil. The West Coast of India's coastal regions are perfect for growing patchouli because they have plenty of rainfall, effective drainage, and temperatures between 20 and 35°C. Therefore, India may be able to play a significant role in the production of this vital aromatic oil with the appropriate focus and investment.

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