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COFFEE

Coffee cultivated and processed in a sustainable and viable agro-ecosystem without using any synthetic chemicals is generally referred to as organic coffee. Further, it has to be certified to claim as organic. In high value plantation commodities like coffee, tea and spices there is a very good scope for switching over to organic farming. Because, many of these commodities are exported, it is possible to realise higher returns from unit quantity exported, when produced by organic means. Secondly, as these crops are generally grown in ecologically sensitive hilly tracts, adopting organic farming methods would entail not only protection of the environment but also in preventing contamination of rivers that originate from these hills.



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Site Selection: In choosing a site for a new plantation due consideration should be given to the altitude, aspect, rainfall, exposure to wind, slope of land, sources of water and approach etc. Arabica coffee grows well at an elevation of 1000-1500 m above MSL, while robusta coffee comes up well at lower altitudes of 500 -1000 m above MSL. Locations with gentle to moderate slopes covered with a good canopy of evergreen trees are to be preferred. Southern and western aspects should be avoided especially at lower elevations. In unavoidable circumstances, such areas should be provided with more shade to protect coffee from afternoon sun. In wind prone areas, wind belts consisting of tall trees like silver oak, tree coffee etc. should be raised. The site selected for planting of organic coffee should be provided with appropriate isolation distance (it varies from 3-10 m) or buffer zone which is decided by the Inspector depending upon the probability of contamination from the conventional estates/ blocks, to prevent contamination with chemicals.



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Varieties: The varieties selected for organic coffee production must be well adapted to local conditions and tolerant/resistant to pests/diseases. In case of Arabica, varieties with wider adaptability such as S.795, Sln.5-B, Sln.6 and Sln.9 may be preferred, while in case of robusta improved varieties like S.274 and CxR may be selected.

Raising a nursery: Seeds for raising nursery should be collected from organic estates/ blocks only. However, if not available, seeds from conventional estates/ blocks not treated with any chemicals can be used. The organic nursery should be clearly separated from conventional nursery, if both the activities are carried out in the same estate.

Land preparation: Clean felling of trees is not advocated when land is prepared for planting coffee. Selective retention of evergreen trees providing filtered shade at a spacing of 9 - 12 m is desirable. The land should be divided into blocks of convenient size by laying out footpaths and roads in between. Uprooting and in situ burning should clear the ground level bushy growth. Land preparation should be completed well ahead of commencement of South - West monsoon (June).



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Planting: In each block, the spots for planting of coffee and shade trees should be marked at recommended spacing soon after land preparation. The following spacing is suggested for different coffee varieties. Arabica - (Tall varieties) - 1.8 x 1.8 m / 1.8 x 2.1 m / 2.1 x 2.1 m, Robusta - S.274 - 3 x 3 m, C x R - 2.4 x 2.4 m. Pits of size 45 cm x 45 cm x 45 cm are to be opened during the months of April- May and exposed to sun for about a fortnight to kill soil pests like cockchafers (root grubs), nematodes etc. Later, they should be filled with top fertile soil and well-decomposed farmyard manure or compost (1-2 kg/ pit) prepared on the estate.

It is advisable to plant **temporary shade trees like dadap** at closer spacing initially, for providing optimum shade to young coffee plants. In large open spaces, evergreen permanent shade trees such as *Ficus sp.*, *Albizia sp.*, *Artocarpus* etc. should be planted at suitable intervals. The recommended spacing for shade trees is as follows. **Temporary shade trees – 4.5 - 6 m apart, permanent shade trees – 9 – 12 m apart**, For planting shade trees, pits should be taken out during pre-monsoon period and filled with top soil after exposing for about a fortnight. Planting of shade trees should preferably be completed before the onset of **South - West monsoon.**



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After care of young plantations: During the year of planting, the following operations help in better establishment of coffee and shade plants. After planting, the coffee seedlings should be provided with staking and mulching to protect against wind damage and to conserve soil moisture for the ensuing dry period. Towards the commencement of dry period, erecting temporary shade huts with jungle tree twigs should protect the young plants in open area. Stems of young dadap plants should be coated with lime solution to prevent sun scorching.

Maintenance of new plantations

Green manuring for soil enrichment: In newly planted fields, green manure crops like cow pea and horse gram could be cultivated for two or three years to build up soil fertility. These crops should be grown during kharif season (June-September), so as to prevent competition for soil moisture. These green manure crops contribute around 6-10 t/ha of dry matter and also effectively suppress weed growth in the early years. As most of these crops are leguminous in nature, they fix nitrogen from atmosphere. The green manure crops should be cut before flowering and incorporated into soil to improve soil fertility.



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Nutrition management: The following practices would be essential for meeting the nutrient requirement of young coffee holdings. Correction of soil pH using agricultural lime or dolomite, based on soil test values, at least once in 2-3 years. Application of farmyard manure or compost prepared on the farm @ 500 kg/acre per year. Deficiency in nutrient supply can be met by using other permitted products like rock phosphate, bone meal, wood ash etc. Use of bio-fertilizers may also be resorted to, in a restricted manner to improve nutrient use efficiency.

Weed control: Weeds pose a serious problem especially in new coffee clearings. Grasses need to be controlled in the initial years itself. The following measures are suggested for controlling weeds. In new clearings, cultural practices such as cover digging (30 cm deep) during the year of planting and scuffling (10 - 15 cm)• for the next two to three years carried out during post-monsoon season, would not only bring down the weed growth but also help in conservation of soil moisture. However, in sloping terrain, avoid soil digging to prevent soil erosion. In such areas, adopt only slash weeding.



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Plant training and pruning: The young coffee plants should be trained to provide proper shape to the bushes and to improve efficiency of operations like spraying, harvesting etc., at later stages. Generally, single stem system of training is recommended for coffee grown under shade. In this system, the plant height is restricted by topping (capping) at prescribed heights. The tall arabica varieties are topped at two stages (two-tier system) while the dwarf arabicas as well as the robustas are capped at single level (single tier system).

The prescribed topping heights for different coffee varieties are: a. Tall arabicas - 1st topping at 0.75 m. 2nd topping at 1.35 - 1.50 m (second topping is done after harvesting 4-5 crops, when the spread of lower canopy is complete) b. Dwarf arabicas - Single topping at 0.9 – 1.5 m depending on soil fertility, wind proneness etc. c. Robustas - Single topping at 1.35 – 1.50 m. In topping operation, the terminal portion of main stem is decapitated at the prescribed height, by providing a slant cut. In case of arabicas, one of the top most primary branches is also cut near to the base so as to prevent splitting of main stem due to crop load. After topping, all the new suckers produced on the main stem are to be removed periodically. Apart from periodic removal of suckers, the young plants require very little pruning.



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Pest management: No serious pest attack is observed in young coffee plantations except for sporadic incidence of some foliar and soil borne pests. The damage by sucking pests like mealy bug, green scale and foliar pests like leaf miner and grasshoppers could be avoided by spraying neem kernel extract, other plant based extracts and other permitted products. Application of neem cake @ 250 g/plant can be effective against soil borne pests like cockchafers (root grubs) and nematodes. .

Disease management: Young coffee plants are usually free from major diseases. However, in exposed areas, brown eye spot disease may cause defoliation. Providing adequate shade against exposure, mulching to conserve moisture and spraying with 1% Bordeaux mixture can take care of this minor disease



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RUBBER

Rubber is a prominent plantation crop of considerable significance to the Indian economy. This industrial crop has since emerged as an icon of small holders' stake in the plantation sector of our country. Natural Rubber tapped from the bark of the tree *Hevea brasiliensis* which is the raw material for an industry manufacturing about 50,000 products. The consumption pattern of rubber in our country is highly in favour of natural rubber (76 %), quite contrary to the global consumption of synthetic rubber of about 53%.



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Climate and Soil Requirements: Rubber exacts in its climatic requirements. The regions lying within 100 latitude on either side of the Equator is highly suitable for rubber cultivation. It requires a temperature ranging from 200 to 300C with a well distributed rainfall of 200-250cm over the year. It comes up in plains and also in slopes of mountainous regions ranging from 300-800m above sea level. This specific climate is available only in Kanyakumari district, Tamil Nadu and Kerala, which constitute the traditional area. It thrives well in deep well drained acidic soils of red lateritic loams or clayey loams with a pH varying from 4.5 to 6.0.

Varieties: Rubber Research Institute of Malaya, Rubber Research Institute of India, Kottayam and other institutes have developed clonal varieties. These clones are broadly classified into three categories viz., primary, secondary and tertiary, based on the method adopted for the development of their mother trees. When mother trees are selected from existing seedling populations of unknown parentage and are multiplied vegetatively to give rise to the clones, they are called **primary clones**. When the mother trees clones and are then multiplied vegetatively, they are known as **secondary clones**. They are **TJIR – 1, G.T.1, G.I.1, P.B. 86, PRIM-600, RRIM. 628, RRIM – 703, PR.107, PB.5/51, RRIM.118, RRII-203 and RRII 208.**



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AGRO CLIMATIC REQUIREMENTS

- Can be grown- 10⁰N to 10⁰S latitude
- Rainfall->2000mm
- Temperature-25-28⁰C
- Humidity-80%
- Sunshine-2000hrs/year @ 6hrs/day
- Weather condition-warm & moist
- Cold weather & high wind speed-affect production

SOIL:

- Rubber grows well in highly weathered soils consisting of lateritic soils.
- It prefers well drained porous soils which are moderate to highly acidic in nature.
- Soils must have a minimum depth of 1 m without any intervening hard pan or impenetrable layer.
- Water table should be well below 1 m to ensure good aeration for root penetration.
- Ph-4.5-6



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PROPAGATION:

Prepare a raised bed by cultivating and pulverizing the soil into fine tilth and raising it to 15 cm high from the ground level and 10 cm thick fine river sand or aged sawdust is added into it. The seeds are spread in the seedbed. The seeds are covered by putting a layer of fine river sand or aged sawdust to a thickness of about 1.5 cm.

Budding: The scions of a particular clone is maintained in the bud wood nursery by planting the budded stumps or by budding the clone on the seedlings in situ at nursery. Budded stump often refers to the budded plant whose scion shoot is cut very close to the budding zone leaving few dormant buds in the scion shoot. On the other hand, if the root stock is cut as a stump and budding is done, usually green budding at four to five months stage, then it is known as stumped budding. When the budwood nursery plants are one year old, about 1m of usable budwood can be obtained. The budwood is cut when atleast 1m of brown bark has developed. The immature green portion should be removed to a point about 1m below the terminal bud, leaving the leaf stalks in position. The budwood may be cut off about 15cm at the base, leaving a few dormant buds to develop into bud shoots for the subsequent season. Two such sprouting shoots may be allowed for next year, from one metre shoot, 15 to 20 buds may be obtained.



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Modified forket method is followed and is done during April-May, when the weather is not dry or wet. Two types of budding techniques are practiced. Brown budding is done by using buds taken from bud wood of one year growth on to a stock plant of ten months old. Green budding on the other hand involves young green budwood and stock. Bud wood of 6-8 weeks old is used on stock seedlings of 2 to 6 months old.

Recently, polybag plants are raised as such plants reach tapping stage quickly. Black polythene bags of 60x30cm with 400 guage are filled with topsoil alone along with 25g of rock phosphate. Green budded stumps are planted in these polybags and the scions are allowed to develop 2 to 3 whorl of leaves.

Planting: For new plantings, jungle clearing with felling of trees has to be done first. Pits are usually dug to the size of the 1x1x1m³ and are filled up with soil and compost. Planting may be done in a rectangular or square or quincunx system during June-July. The common spacing adopted for budded plants are

In hilly areas - 6.7 x 3.4 m

In flat areas-square - 4.9m x 4.9m

Triangular - 4.9m x 4.9m



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Interculture:

Cover cropping: Growing cover crops is important in rubber plantations to prevent soil erosion, conserve soil moisture, keep down the soil temperature and add mulch and organic matter to the soil. Some of the cover crops commonly used in South India are *Pueraria phaseoloides*, *Calopogonium mucunoides*, *Centrosema pubescens* and *Mimosa invisa var. inermis*. It is often desirable to establish a mixed cover to simultaneously get the benefits of these cover crops. A mixture of *Calopogonium*, *Pueraria* and *Centrosema* seeds in the ratio of 5:1:4 is used for sowing. In this mixed cover, *Calopogonium* grows much rapidly and covers the ground quickly during the first year itself. Then *Pueraria* and *Centrosema* start dominating. Dense and vigorous growth of *Pueraria* suppresses weeds. But it starts fading out when the canopy closes. Subsequently, *Centrosema* continues to grow under shaded conditions while the former two cover crops fail to thrive. Thus, complete benefits of cover crops starting from the first year of planting could be obtained if mixed cover crop is established in rubber plantations.



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Weeding: The weeds can be eradicated either by labour or by employing weedicides. When weedicides are employed, care should be taken that the cover crops are not affected. 2,4-D formulations (Fernoxone @2kg in 450 litres of water) may be sprayed early in the season to eradicate the weeds.

Manures and fertilisers: Three stages of growth namely nursery, immature and mature can be recognised in the life of a rubber tree. The manuring differs according to the stages of growth. The Rubber Research Institute in India recommends the following manurial schedule.

Seedling nursery: Application of 25kg of compost and 2.5kg of rock phosphate once in three years per 100m² of the nursery bed is practised. Application of 25 kg of 10:10:4:1.5 NPKMg mixture per 100m² of the nursery bed 6 to 8 weeks after planting and application of 12.5kg of the mixture per 100m² 6-8 weeks after the first application but before mulching are followed.



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Budwood nursery: Powdered rock phosphate 1.5kg per 100m² of the nursery bed is applied as a basal dressing at the time of preparing the nursery bed. Besides 250g of 10:10:4:1.5 NPKMg mixture per plant in two split doses of 125g each, the first dose is applied two to three months after planting the budded stumps or cutting back, if budding is carried out in situ and the second dose eight to nine months after planting.

Rubber trees under tapping: Application of NPK 12:6:6 grade mixture at the rate of 400kg per hectare per year in two split doses is recommended. In plantation where the trees show deficiency symptoms of magnesium (interveinal yellowing of leaves) addition of 10kg commercial magnesium sulphate to every 100kg of the mixture is recommended during September-December.



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Tapping: The rubber trees attain tappable stage in about seven years provided they possess the required girth of the trees. Seedling must attain a girth of 55cm at a height of 50cm from the ground. In the case of budded trees the girth should be 50 cm at a height of 125- 150cm from the bud union. Tapping is the periodical removing of thin slices of bark to extract rubber latex. Tapping is done by skilled men. While tapping the depth should be 1mm close to cambium without any damage to it, otherwise callus formation will take place causing swellings. Tapping has to be done on a slope of 30° to the horizontal zone in the case of budded trees and 25° in the case of seedlings. Tapping is done early in the morning, as late tapping will cause reduction in the flow of latex. In the early morning the turgor pressure in the latex vessels is high and rapid flow of latex occurs.



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Yield: In South India, the annual yield of rubber is about 375kg per hectare per annum from the seedlings, whereas budded plantations yield 900 to 1000kg of rubber/ha.