

ORGANIC FARMING IN COCOA

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The natural habitat of cocoa is the tropical rain forests, predominantly of alluvial nature, within the sphere of influence of rivers. It is a small understorey tree of the primary forest. The yield of certain cocoa plants under such a natural ecosystem is superb revealing its high adaptability to undisturbed system of organic cultivation. Cocoa is now grown in 58 countries on more than 7.0 million ha worldwide with a production of 4 million tonnes. In terms of global production, the International Cocoa Organization (ICCO) estimates that the organic cocoa production is around 15,500 tonnes which is less than 0.5 percent of the global market share. In West Africa, which produces more than 70 % of the global production, organic certification is less despite much of the land being farmed organically. The organic cocoa market registered a strong growth in demand as mirrored by the increase in turn over of Green & Blacks, the UK's leading organic chocolate maker by 69% as against a growth rate of 2% for the chocolate industry as a whole. However, despite the strong growth that occurred over the past 5 years, the share of organic cocoa remains small in the market.

Organic cocoa - cost factor

Organic cocoa commands a higher price than conventional cocoa so that it compensates the extra cost incurred by the grower/ organization/ exporter to fulfill organic certification requirements and certification fees. The cost of compliance to organic standards includes the fee

paid to the certification body and indirect costs to comply organic requirements. The average certification fee comes to 3% of the farm turn over. In addition, the farm organizations have to bear additional administrative costs, labour and opportunity costs associated with loss in yields after switching over to organic production. Before restoration to full organic system, pest suppression and fertility problems are common. The degree of yield loss varies and depends on the biological attributes of the farm, farmer expertise and the extent to which synthetic fertilizers were used under the previous management regimes.

Demand for organic cocoa

Consumption of organic cocoa is growing quickly in European countries, UK, US, and North America. 70 percent of the organic cocoa is produced in South America with Dominican Republic as the leading producer. Several countries are in the process of converting to organic production like Cameroon, Ivory Coast, Guayana, Haiti, Honduras, Indonesia and the Philippines. ICCO surveys (2005 & 2006) shows that the total production and export of organic cocoa in India was 12 tonnes. In Kerala, some NGOs procure organic cocoa from the organic certified growers by paying Rs.2/-extra per kilogram of dry cocoa. It is indicated that there is very high demand for organic cocoa from chocolate companies all over the world. Organic cocoa at present provides a premium of between 10 and 40 percent over conventional cocoa.

Cocoa farming in Kerala and major producing countries - a comparison

As against the practice of growing cocoa in agro forestry ecosystem prevalent in major producing countries of the world, cocoa is grown as an intercrop under coconut and arecanut in India. The soil is acidic and poor laterite or sandy loam deficient in major nutrients. The soil texture is often coarser and gravelly with low moisture retention capacity and poor fertility as compared to those of other countries. Most of the cocoa soils of major producing countries are derived from freshly cleared forest vegetation thus making them fertile especially with respect to organic matter and nitrogen contents. For the mixed cropping situation in India where the soils are heavily depleted due to long periods of continuous cultivation, manuring is an essential component of crop management. A comparison will indicate that the average nitrogen content of Ghanaian cocoa soil is nearly five times that of Kerala soil.

Nutrient needs of cocoa

Unlike other crops, there is no critical stage of nutrient requirement in cocoa. Since flowers are produced throughout the year, it is essential that a nutritionally rich environment is provided in the feeding zone throughout the year to realize adequate yields.

Research on organic farming of cocoa

A study on organic farming was initiated during 2005 in CCRP and the results obtained so far did not indicate any conclusive results. No other detailed study seems to have been conducted on this aspect in Kerala Agricultural University. A report by Moorthy *et al.* (2002) from a private estate in Karnataka showed that application of varanashi Co- compost (coir pith compost with bio control agents, P- solubilizers and N fixers) @ 12 kg per plant increased the yield by 78.8% over a period of nine years.

Fertilizer recommendation for cocoa in Kerala

In a coconut based cropping system, the extent of depletion of nutrients from soils is very high. Coconut returns practically nothing to the soil by way of crop residues as all the plant parts are economically important and useful. Cultivation of short duration inter-tillage intercrops like tapioca has further led to the loss of soil nutrients, especially as these intercrops are not often manured adequately. It follows therefore, that for cocoa in India, manuring is a must. In the absence of sufficient number of field experiments on manuring of this crop, the recommendation has to be necessarily based on crop removal. This is worked out based on the quantities of nutrients removed by way of pod removal assuming that the remaining residues from the crop go back to the soil.

The quantities of N, P and K removed by cocoa pods per kg of dry beans will work out to be 43.80, 8.04 and 64.29 g, respectively. For a crop yielding about 2 kg of dry beans per plant (about 60 pods) per year, the average crop removal by pods would be around 85, 37 and 154 g each of N, P₂O₅ and K₂O. The recommendation for cocoa under average management is 100:40:140 g of N, P₂O₅ and K₂O per plant for a year, which tallies with the crop removal figures. For cocoa yielding over 60 pods/ year, double this dose is recommended.

Cultivation practices for successful organic production of cocoa

Upto 4-5 years, growing green manure crops like *Calapagonium* and *Pueraria* in open patches and along coconut basins can provide about 5-6 tonnes of green leaf for cocoa. These can be cut at regular intervals and incorporated on the basins. With increasing age, the canopy of cocoa closes and the quantum of light falling on to the ground becomes so small that raising these cover crops

has to be restricted to the coconut basins and some scattered patches reducing the green leaf yield to 2-3 tonnes. Border planting of *Glyricidia* would also supply some amount of green leaf manure.

By promoting the turnover of organic material within the plantation, soil fertility can generally be maintained for successful organic cocoa production. By regular pruning of trees and depositing the prunings on the basins the organic matter content of the soil can be improved. From a grown up cocoa plantation, it is observed that 818 and 1785 kg/ha/yr of dry leaf litter become available from single hedge and double hedge system of planting respectively. About 50 kg N, 12 kg P₂O₅ and 35 kg K₂O respectively could be returned to soil every year under double hedge system. Sreekala (1997) studied the organic recycling through cocoa litter. The quantity of litter was significantly influenced by the season, shade level and their interaction. The total annual litter fall was 5.3 t/ha in the shaded field and 8.2 t/ha in the open. Nutrient return through litter fall was high in the open (109.7, 6.8, 104.2, 103.7 and 57.4 Kg NPK Ca and Mg respectively). Under shade, nutrient return worked out to 66.9, 5.0, 59.7, 84.9 and 40.3 Kg N,P,K, Ca and Mg, respectively.

Apart from the nutrient recycling through cocoa litter, the plant needs 100:40:140 g of N, P₂O₅ and K₂O per plant for a year, which is to be met through organic means. *In situ* composting of pod husk (3600 kg/ha) and incorporation into the basin @ 7.2 kg/plant provides 7.2 g N, 3.6 g P₂O₅ and 18 g K₂O. In order to ensure balanced supply of nutrients, organic manures like farmyard manure, compost, coir pith compost, vermi compost, oil cakes, ash and bio fertilizers can be added at frequent intervals depending upon the availability. When farm yard manure is available in plenty, it can be applied @ 40 kg/plant in four equal split doses in May, September, December and February under irrigated conditions or in two equal splits in April - May and September -

October under rainfed conditions. To meet the potassium requirements, in full 1.0 kg /plant of wood ash may also be applied. Bio fertilizers like Azospirillum, Azotobacter, Trichoderma, Phosphorus solubilizing bacteria, *Pseudomonas fluorescens*, VAM, KMB etc may be applied directly or after incubation to improve availability of macro and micro nutrients. Use of *Pseudomonas fluorescens* will reduce incidence of fungal diseases also. For cocoa under better management where the average annual yield is over 60 pods, double this dose is tentatively recommended.

For young cocoa in the field, one-third the annual dose for adult plant is recommended for the first year and two-third for the second year. As cocoa under good management will start giving reasonable yield from the third year, it is essential to supply full dose from third year.

Irrigation plays a major role in deriving full benefits of organic farming. Though drip, sprinkler, basin or flood irrigation methods can be adopted, drip irrigation is preferable.

Pest & disease control

Cocoa is reported to be affected by over 1,500 insects in different cocoa growing countries of the world. However, only a small number is of economic importance. In India, cocoa is a crop of recent introduction and as such, the number of pests actually involved is less.

Among the pests infesting cocoa, the major ones are the red borer, tea mosquito, mealy bug, grey weevil, cock chaffer beetle etc. These pests are not of very disastrous and these can be effectively controlled by mechanical means.

Rats and squirrels cause considerable damage to ripening pods. Continuous trapping using attractants will be effective to check the squirrel and rat population in the field. As these cause damage to ripe fruits only, damage can be reduced by harvesting regularly and not allowing the ripe

Pods to remain on the trees for long periods. Mechanical protection of the pods by covering with punched polybags (150 gauge) smeared with bitumen - kerosene mixture can also be effective. Covering individual pods using wire mesh also ensures protection from rodents and squirrels.

Among the diseases affecting mature plants, black pod caused by *Phytophthora palmivora* and Vascular Streak dieback caused by *Oncobasidium theobromae* are important. The measures recommended to control black pod are :

1. Periodic removal and destruction of the infected pods will help to reduce spread of the disease.
2. Cultural practices like proper pruning and regulating the overhead shade to reduce humidity and to improve aeration have been recommended for the control of the disease.
3. Spraying of 1 % Bordeaux mixture at 15 days intervals starting from the onset of monsoon along with periodic removal of infected pods is effective in controlling the disease in severely affected gardens.
4. Attempts have been made to control the disease with plant extracts and antagonistic microbes. Extracts of *Allium sativum*, *Cinnamomum zeylanicum*, *Lawsonia inermis* and *Adenocalymma allicea* have been found to be effective in inhibiting lesion development on detached cocoa pods.
5. Antagonistic effect of *Pseudomonas fluorescens* against *Phytophthora palmivora* has also been reported and periodical spraying of 2% *Pseudomonas fluorescens* is very effective in checking the disease.

Vascular streak dieback is a very serious disease affecting cocoa in Kerala. Since the pathogen is systemic and has a slow rate of natural spread, quarantine measures to restrict the transport of apparently healthy planting material

containing the fungus is important in restricting the spread of the diseases. It has been shown that when infection passes through approach grafts, the grafts fail. Establishment of cuttings and bud patches taken from infected branches also has not been observed. Studies conducted in Kerala have revealed failure of buds/scion taken from infected twigs or branches. There is no evidence that the disease is transmitted through seed.

Cocoa nurseries should not be maintained near diseased trees because young plants are easily affected by the disease. Regular pruning of infected branches is recommended to maintain a very low level of infection. During pruning, the branches should be split open to detect the extent of streaking in the wood. The branches are then to be cut 30 cm below the last detectable streak. Eradicative pruning will be more effective if carried out at least one month prior to the wet season. Removal of prunings from the cocoa field is not necessary because the fungus cannot survive or produce spores in the dead wood.

Genetic resistance offers good prospects of controlling VSD. From Kerala Agricultural University, 10 disease resistant clones have been released, the budded plants of which offer a considerable degree of resistance. The hybrid seedlings produced from the clonal gardens of the University are also tolerant to this disease.

References:

Moorthy, V.K, Moorthy, A.K. and Rao, K.B. Organic farming improves cocoa yield. *Extended summaries of the National Seminar on Technologies for enhancing productivity in cocoa*, Central Plantation Crops Research Institute, Regional Station, Vittal- 574243, 29-30 November 2002 p 76-77

Sreekala, N.V. 1997. Organic recycling through cocoa litter. MSc (Ag.) thesis submitted to Kerala Agricultural University, Vellanikkara, Thrissur.