Efficient Management of Ever Green Forests for Cultivation of Cardamom (*Elettaria Cardamom* Maton)

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Cover Story

Cardamom (*Elettaria cardamomum* Maton) known as 'Queen' of spices is cultivated in a self sustainable forestry system by using natural resources of tropical evergreen forest of Western Ghats in South India. Cardamom needs overhead filtered shade and cultivated as an under growth with least disturbance to the natural tree flora, compared to other plantation crops like tea and rubber which require clear felling of natural forest trees for their cultivation. The forest area when grown with cardamom gives a total net profit of Rs. 450 lakhs and employment opportunities created will be approximately 80 lakh man days for a period of 20 years as compared to the net profit of sevenlakhs and five lakh man days under pure forest system (Joseph, 1978).

Tall trees having well distributed branching habit and small leaves are ideal for cardamom. Naturally available leaf fall of the shade trees can be conveniently used for mulching. In forest the fertility of the soil is well maintained due to biocycling of nutrients. On an average five-eight tonnes of dry leaves are shed from trees annually in a hectare of cardamom estate, adding 100-160 kg N, 25-40 kg P_2O_5 and 100-160 kg K_2 O/ha besides several other micronutrient.

The results of large scale field trials have revealed that the cardamom yields as high as 538-778 kg/ha (average of four-five years) could be obtained as against a national meagre yield of hardly 140 kg/ha. The net returns under intensive care was Rs.1, 09, 967.11/ha with the cost of production of Rs. 57.22/kg of dry cardamom.

Recent studies have shown that low lying areas can be converted successfully for cultivation of cardamom (yields 500-1350 kg/ha) by afforesting with redgum. The redgum also provides adequate fuel for some of the tree factories.

With the denudation of forests in the Western Ghats the natural ecosystem has been affected in cardamom tracts. Due to indiscriminate deforestation the receipt of premonsoon showers during February to May has been often erratic which ultimately speaks on the poor crop performance as nearly eight percent of plantations are under rainfed condition. Every effort should be made to stop deforestation and conserve ever green Western Ghat for successful cultivation of cardamom and to conserve balanced Agroforestry system.

1. Introduction

The natural habitat of small cardamom (*Elettaria cardamomum* Maton) is the ever green rain forests of Western Ghats in South India. In India presently cardamom is cultivated in an area of 84,000 ha in three states viz., Kerala, Karnataka and Tamil Nadu, each of which contributes to 59,34 and 7 per cent of total area respectively and produce over 7000 MT(1998). India used to export cardamom to more than 60 countries in the world inspite of stiff competition from Guatemala.

Cardamom is a pseophyte (shade loving) and is commonly cultivated under the shade of the forest trees. It is very sensitive to moisture stress and performs comparatively better in cool environment. Shade regulates moisture as well as temperature and provides a congenial microclimate to cardamom for proper growth and yields. Cardamom is one of the few plantation crops which can be cultivated with least disturbance to the natural forest growth.

Forestry is one of the many possible ways of land use. Cardamom as an undergrowth in evergreen forests coexist with over head shade trees utilising different layers of soil and air space. Forests when brought under cardamom will become financially viable for management and benefits from both cardamom and tree culture (Agroforestry) can be derived with a congenial sustenance of the natural environment and protective quality of forest.

An attempt is made in this paper to cover various facets of Agroforestry system with cardamom viz. co existence of cardamom in a natural forest flora, impact of shade trees on cardamom, ideal shade trees, shade regulation to suit cardamom cultivation, recycling of organic wastes, production potentialities of cardamom with economic analysis, diversification of cardamom with coffee (mix cropping), afforestation of cardamom with coffee (mix cropping), afforestation with redgum for climate in cardamom growing tracts.

II. Cardamom in evergreen forests:

1. Impact of shade trees on cardamom

One of the three fundamental requirements for normal development of cardamom crop in South India is shade from evergreen trees. The shade canopy provides a suitable environment by maintaining humidity and evapotranspiration at a suitable levels (Abraham, 1965). Comparatively less shade is required on northern and eastern slopes. In areas where well distributed and adeq-uate rainfall is received cardamom plants can afford less shade. In general, Malabar type of cardamom is less sensitive to sunlight and less susceptible to drought conditions than Mysore type.

Usually many planters are averse to regulating shade as they believe that cardamom is shade loving plant. While this is true as far as the summer months are concerned, cardamom plant could put out better growth and fertiliser only if sufficient sun light reaches it.

In Guatemala, cardamom is grown practically in the open with either no shade or two odd trees and there (Anonymous, 1977). The interference of man into this environment by way of cutting trees is threatening the very existence of cardamom plantations. There is also another side of this shade aspect where excessive shade is also detrimental to the proper growth and yield of cardamom plants.

2. Ideal shade trees:

An ideal shade tree in cardamom plantation is expected to have the following charateristics (i) Wide canopy (ii) Minimum side branching to provide diffused light to cardamom plants (iii) No shedding of leaves during the flowering phase of cardamom so that the pollination is not affected by the leaves falling on the panicles (iv) Shedding of leaves during monsoon and production of flush or new growth before the commencement of dry season (George *et al*, 1984).

It is rather difficult to get trees which have all the desirabl characteristics in a cardamom plantation. Tall trees having well distributed branching habit and small leaves are ideal for cardamom. It is desirable to maintain also a few medium sized shade trees which facili-

tate shade regulation. It is preferable to have a system of mixed shade trees so as to maintain more or less optimum conditions through out the year. The main considerations while selecting the shade trees are adaptability to the climate, rate of growth and ease of establishment.

In the open areas, where sufficient shade is not available, suitable fast growing shade tree species should be planted to ensure adequate shade for cardamom.

3. Shade regulation to suit cardamom cultivation

Though shade is an essential and integral prat of cardamom cultivation an excess shade is always detrimental and undesirable for getting adequate growth and yield of cardamom. Shade is often called as a 'necessary evil'. Before raising cardamom plantations in virgin forest area, the undergrowth is cleared and overhead shade is regulated by lopping the tree branches to provide adequate shade to cardamom plants. Filtered shade is essential specially in the early year for production of tillers and vigorous growth of cardamom plants. To provide adequate light during rainy season when the intensity of light is less, it is necessary to carry out shade regulation before the onset of monsoon. It is equally important to see that shade trees put sufficient flush of leaves and provide adequate shade by. the time summer sets in. The overhead canopy should therefore be regulated once in a year during May-June.

4. Mulching and recycling of organic wastes in cardamom plantations

Naturally bestowed leaf fall of the shade trees can conveniently be used for mulching. Mulching helps in conserving soil moisture which is quite necessary particularly during summer months to combat dry spells. It minimises fluctuations in temperature, improves physical properties of soil and suppresses weed growth.

The presence of shade trees is an important factor responsible for the high fertility status of soil through addition of leaf fall. It is estimated that on an average 5-8 tons of dry leaves are shed from shade trees annually in a hectare of cardamom estate, adding 100-160 kg N, 25-40 Kg P_2O_5 and 100-160 kg K_2O/ha, if a modest estimate of nutrient in forest leaf litter is taken at N2.%, P0.5% and K 2.0% respectively (Zachah, 1978). Under the forest conditions, the fertility of the soil is well maintained due to biocycling of nutrients. The high organic matter status of the forest soils, the presence of forest trees and the forest litter cover help in the preservation of soil moisture and in keeping down the soil temperature.

III Production potentialities of cardamom under intensive cultivation

Cardamom responds very well to the intensive cultivation. The national average yield of Indian cardamom is 140 kg/ha as against 250 to 300 kg/ha in Guatemala. Though there has been a steady decrease in area under cardamom in India the production and productivity has gone up to 7000 tonnes/ha and 140 kg/ha respectively. The rate of growth of production of cardamom in Guatemala since the late seventies has been over 14 per cent against 0.7 per cent in India. India growers continue to depend on rainfall (80-85 percent of estates are rainfed), productivity is very low and as a result the cost of production is high. Thereby competitiveness in the world market has also suffered (Chandrashekhar, 1988).

As the international market become increasingly competitive, only High Productivity and low cost of production per unit area would ensure the survival of this industry. In view of the above facts, Indian Institute of Spices Research (ICAR), Cardamom Research Centre, Appangala, Kodagu, made attempts to increase the production per unit area and bring down cost of cultivation. Thus set an example to tap a better crop potential by evolving strategy for intensive cultivation. Two examples of the achievements of record yields after adopting intensive cultivation of cardamom are as follows:

1. Conventional to intensive cultivation of Cardamom

Large scale adoption of HPT onfarm trial in cardamom was conducted during 1983 to 1993 in the real farmer's situation in an area of 10 ha at M/S Lakshmi Estate, Kandankolli, in North Coorg, Karnataka by switching over from conventional management (1972-82) to High Production Technology (HPT) from 1983-93. As against the maiden crop of 52 kg/ha under conventional farmer's practices, a maximum record yield of 850 kg (dry)/ha was obtained by adopting HPT. In HPT plot an average yield of 438 kg/ha was obtained against 116.5 kg/ha under conventional management for 8 crop seasons (1985-86 to 1992-93). The net return (Rs. 77350 ha/year) under HPT was 8.04 times more than conventional cultivation returns (Rs. 8651.12/ha year). In the conventional management the reported labour requirement was 299 and 306 during pre-bearing and bearing periods as against 594 and 875 man days in the IIPT plots. Under the HPT, the increase of employment opportunity was 69 per cent in the pre-bearing period and 170 per cent in bearing stage as compared to conventional management (Korikanthimath, 1996).

2. Sustained production of cardamom

Large scale field trials were conducted by adopting High Production Technology at Chettalli (Coorg Distric, Karnataka, India) to study labour utilisation, input requirement and economics of cultivation of cardamom (*Elettaria cardamomum* Maton). A highest yield of 1625 kg/ha (dry) was recorded during the fourth year after planting. The average of nine crop seasons 695.66 kg/ha (dry) obtained in the trials was 12 times more than the national average yield of 58 kg/ha. Cultivation of cardamom was highly labour intensive. Out of 747.42 labour days required per ha/year during bearing period, the requirement of women labourers was higher (64.05 per cent); 63 per cent of the labour requirement was for harvesting and processing alone. The annual maintenance cost was Rs. 35, 148.00/ha. Partitioning of various inputs indicated that maximum expenditure was incurred towards labour (including supervisory charges) i.e., Rs. 19,574.50/ha (55.69 per cent). A net income of Rs. 1, 09, 967.11/ha (average of nine crop seasons) was obtained with a production cost of Rs. 57.22/kg (dry). (Korikanthimath, 1995).

IV. Mix cropping of cardamom with coffee

Cardamom can be cultivated as a mixed crop with coffee (Korikanthimath, 1988). The studies carried out on these crop combinations have revealed great potentialities.

A study carried out for four years (1990-91 to 1993-94) on mixed cropping of cardamom, pepper and Coorg mandarin with robusta coffee v/s mono (sole) crop of robusta coffee, revealed that the cost of cultivation was Rs. 46322/ha in mixed cropping as against Rs. 27678/ha under monogropping. The net returns of Rs 105213/ha realised in mixed cropping was 3.69 times more than monocropping. The incremental net gain in mixed cropping was Rs. 76723/ha (269.30%) over the monocrop. The financial criteria such as net present worth and benefit cost ratio were also found to be higher by 3.55 and 1.56 times respectively in mixed cropping. The mixed cropping of cardamom with robusta coffee generated income to the farmers over a period of ten months (July-April) and gainful employment for family members all around the year. (Korikanthimath, *et al.* 1998)

In view of fluctuating price structure and rainfall pattern mix cropping of cardamom with coffee is gaining a lot of importance in Coorg and adjoining areas of Karnataka. Soil