Organic Cultivation of Large Cardamom (*Amomum subulatum* Roxb.) in Sikkim


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Sikkim region is emerging as India’s organic large cardamom hub. Most of the tribal farmers living in remote places of the state are following traditional methods of large cardamom cultivation, which are eco-friendly and less expensive due to utilization of local resources, family labour and traditional wisdom. This type of cultivation in traditional system is more viable than modern chemical farming which has various adverse effects on environment as well as human health. However, major limitation of organic cultivation is reduction in yield level at the initial stage which can be overcome by adoption of suitable agro management practices once the soil fertility reaches equilibrium.

**Introduction**

Large cardamom (*Amomum subulatum* Roxb.), a member of the family, Zingiberaceae under the order Scitaminae is the main cash crop cultivated in the sub-Himalayan state of Sikkim and Darjeeling district of West Bengal. It is also cultivated in parts of Uttarakhand and in some other North Eastern Hill states like Arunachal Pradesh, Nagaland, Mizoram, Manipur, Meghalaya and Assam. Nepal and Bhutan are the other two Himalayan countries where large cardamom is cultivated. Sikkim is the largest producer of large cardamom and constitute lion share of Indian and world market. It is a shade loving plant (Sciophyte) grown in tracts with well distributed rainfall spread around 200 days with a total of about 3000-3500 mm/year. The large cardamom plant is a perennial herb with subterranean rhizomes with leafy shoots. Stem is a pseudo stem which is called tiller. Inflorescence is spike. Generally, 30 to 40 flowers are observed in a spike. Flowers are yellow, bisexual, zygomorphic & pollinated by bumble bees. There are three petals with a labellum which is mainly for attracting insects for pollination. Stamens possess filament and anther. Anthesis occurs in the morning hours. Ovary inferior with ovules in axile placentation, stigma funnel shaped, fruit is capsule, achinated, maroon in colour with seeds which are whitish in immature stage and dark brown to black in mature stage.

![Fig. 1 Large cardamom plant during flowering stage](image)

Large cardamom is used as a spice and also in several Ayurvedic preparations. It contains 2-3% essential oils, possesses carnative, stomachic, diuretic and cardiac stimulant
properties and is also a remedy for throat and respiratory trouble.

**Crop Varieties**
There are mainly six popular cultivars of large cardamom viz., Ramsey, Ramla, Sawney, Varlangey, Serenna, Dzongu and Golsey. There are two high yielding varieties released by Indian Cardamom Research Institute, Regional Station in the year 2004 for cultivation in Sikkim are ICRI Sikkim 1 and ICRI Sikkim 2.

**Propagation**
Propagation of large cardamom is done through seeds and suckers. The Propagation through seeds enables production of large number of seedlings. Virus diseases are not transmitted through seeds and therefore the seedlings are free from viral diseases, if adequate care is taken to isolate and protect the nursery from fresh infection. Plants raised from seeds need not necessarily be high yielders even if they are collected from very productive plants due to cross-pollination. The major pollinator is bumble bees, even though honey bees also play a role in pollination. On the other hand, planting through suckers ensures true to the parents with a high productivity if they are collected from high yielding, disease free plants.

**Plantation Establishment and Management**
Large cardamom is generally grown in forest loamy soils having soil depth of few centimeters to several inches. Colour of large cardamom soil ranges from brownish yellow to very dark grayish brown. Texture varies from sandy, sandy loam, silty loam to clay. In general, large cardamom soils are acidic in nature and majority of soils have pH ranges from 4.5 to 5.5 and more than 1% organic carbon content. On an average, these soils have high available Nitrogen and medium Phosphorous and Potassium. Because of steepness of the terrain, chance of water logging is less, and water logged conditions are not suitable for the plants and adequate drainage is quite essential for the better stand of the crop. The ideal time for planting large cardamom in Sikkim is May to July, preferably during June-July when the intensity of South West Monsoon is low. By this time, the planting materials i.e., mature tillers with 1-2 immature tillers/vegetative buds become ready. Due to appearance of new leaves in the mother clump during this period, symptoms of Chirke disease, viral in nature, becomes prominent which helps not to collect such plants as planting materials.

**Selection of Site**
Large cardamom grows well in forest loamy soils with gentle to medium slopes. Luxuriant growth is observed nearby perennial water sources. However, water logged condition is detrimental to the plants. It performs well under partial shade (50%). Utis (Alnus nepalensis) is the most common shade tree and Utis-cardamom is a very good Agro-forestry system for sustainable production in the region. The other species of shade trees are Panisaj (Termalia myriocarpa), Pipli (Bucklandia sp.), Malito (Macaranga denticulate), Argeli (Edgeworthes gardneri), Asare (Viburnus eruberens), Bilaune (Maesa Cheria), Kharane (Smplocos sp.), Siris
(Albizzia Lebbeck), Faledo (Erythrina indica), Jhingani (Eurja tapanica), Chillowne (Schima wallichi) etc.

**Land Preparation**

The land selected for planting is cleared of all under growth, weeds etc. Old large cardamom plants, if any may also be removed. Pits of size 30 x 30 x 30 cm are prepared on contours at a spacing of 1.5 x 1.5 m from the centre of the pits. Wider spacing of 1.8 x 1.8 m is recommended for robust cultivars like Ramla, Ramsey, Sawney, Varlangey etc. While closer spacing 1.45 x 1.45 m is advised for non robust cultivators like Dzongu Golsey, Seremna etc. Pits are left open for weathering for a fortnight and then filled with topsoil mixed with cow dung compost / FYM @2-3 kg per pit. Pit making and filling operation should be completed in the third week of May before the onset of pre-monsoon showers.

**Planting**

Planting is done in June-July when there is enough moisture in the soil. A mature tiller with 2-3 immature tillers/vegetative buds is used as planting unit. For better production, quality planting materials are to be raised in the nurseries or to be collected from certified nurseries. Suckers/seedlings are planted by scooping a little soil from the centre of the pits and planted up to collar zone. Deep planting should be avoided. Staking is needed to avoid lodging from heavy rain and wind and mulching is done at the plant base.

**Soil Base Making and Mulching**

Deep well drained soils with loamy texture, medium availability of phosphorous and potash with pH 4.5 to 5.5 is best suited. Usually the soil is rich in organic matter and nitrogen as the plants are cultivated under alder trees and other local varieties of trees. A soil base with gentle slope from the plant is beneficial for application of inputs viz., FYM, vermicompost, etc to the plants. If the land is not terraced, soil base may be made by cutting top soil from the upper half & to be placed on the lower half followed by mulching. Mulching at the plant base with easily degradable organic materials is good for conserving both moisture and soil. Mulch improves the soil condition and the soil fertility. Dried organic matter, leaves, weeds etc. can be used as mulching materials.

**Application of Manure**

For sustainable good yield and to compensate the nutrient loss from the soil, replenishment of nutrients is very essential. Well decomposed cattle manure/compost or organic products @ 5kg/plant and at least twice in a year in April-May and August-September are beneficial.

**Watering / Irrigation**

Large cardamom plants cannot thrive well under water stress conditions. In the first year of planting watering is required at least once in 10 days during dry months in September to March for better growth in coming months. It is observed that productivity is higher in plantations where irrigation is provided. Depending on availability of water sources hose or sprinkler or flood irrigation through small channels is advised. Water harvesting pits made in between four plants of nearby
rows during rainy season can support the water requirement of the crop in the dry season to some extent and is cheap.

Shade Management
It is noticed that heavy shade or less shade hinders crop growth and production. About 50% shade is found ideal. The lopping of branches of shade trees is very important and should be done before onset of monsoon during June-July. But at the same time over-exposure to direct sunlight causes yellowing of leaves. Therefore judicious shade management is very important for good growth, timely flowering and for better crop.

Weed Control
Weed control in the plantations is the important operation for maximum utilization of available soil moisture and nutrients by the plants. Three rounds of weeding are required for effective control of weed growth in initial two to three years. Weeding is generally done by using a sickle or by hand depending upon the intensity of weed growth. From around the plant base weeds are pulled out by hand and in inter-space needs only slash with sickle. Clean weeding is not advised as the crop is found to be a good colonizer. While weeding dried shoots and other thrashed materials are used as mulch around the plant base which will help to conserve moisture in the ensuing dry months, cover the exposed roots and prevent weed growth around the plant base. During flowering period, the thrashed materials should not cover the inflorescences.

Biodiversity Management
The *Utis* (*Alnus nepalensis*) based cropping pattern is commonly practised. The tree is beneficial as it takes care of the nutrient requirements since *Utis* is a nitrogen fixing plant. Growing wild varieties act as a rodent repellent. There is no mechanical structure for water harvesting at the plantation site. However, as large cardamom is planted at the base of protected catchment areas, moisture is conserved in the ensuring dry season. Since cardamom is planted in good forested areas, it is observed that such plantation sites also become good habitats for wild animals and birds.

Disease and Pest Management
Major threat to large cardamom is the widespread occurrence of fungal and viral diseases causing considerable damage and consequent crop loss in devastating proportions. Among the insect pests that attack large cardamom, leaf caterpillar (*Artna chorista* Jordon) and stem borer (*Glyphipterix* sp.) are considered as important pests of the crop. Aphids are responsible for transmitting viral diseases viz., *chirke* and *foorkey*. White grub is also becoming an important pest and need attention for their control. Phyto-
sanitation, removal and burning of infested tillers is helpful for managing the pests. Environmentally safe and economically viable perspective would be adopted for effective management of the diseases. Monitoring of the plantation should be done every month particularly during rainy season and carefully identify the diseased plants. The diseased plants (especially viral diseases) may be uprooted and destroyed as and when they are seen. They should be taken to an isolated place, chopped into small pieces and buried in pits for quick decomposition. As an alternative, mass uprooting and burning of infected plants at the village / area level could be taken up for eradication of the disease. Never collect planting materials from an infected garden or apparently healthy plants from severely infected gardens. Establish nursery about 500 m away from main plantation in order to avoid aphid colonization. Maintain clean clumps by removing old tillers with loosened leaf sheath so that aphids will not colonize. During plantation monitoring, especially prior to harvesting, the plantation must be inspected carefully for identification of diseased plants. These plants may be uprooted and destroyed on priority. The knife and other implements used for the purpose should not be used on healthy plants since disease could be transmitted through sap. Dip the implements in hot water for half an hour for killing the inoculums before going to the healthy plants for harvesting.

Harvesting and Curing
The indication of time of harvest is when the seeds of top most capsules turn brown. As soon as the said colour appears and to enhance maturity bearing tillers are cut at a height of 30-40 cm from ground and left for another 10-15 days for full maturity. The spikes are harvested by using special knives known as “Elaichichhuri”. The harvested spikes are heaped and capsules separated and dried. The cured capsules are rubbed on wire mesh for cleaning and removal of calyx (tail). Traditionally cardamom is cured in Bhatti, where capsules are dried by direct heating. Under this system the cardamom comes in direct contact with smoke which turns the capsules to dark brown or black with smoky smell. Improved curing techniques are presently available in which cardamom is processed to give quality and appearance. One such method is ICRI Improved Bhatti curing system developed by Indian Cardamom Research Institute, Regional Station, Tadong where cardamom is dried through indirect heating. The system is available in 200 & 400
kg (fresh capsules) capacities. The **bhatti** has been popularized by Spices Board Regional Office at Gangtok and Zonal Offices at Tadong, Mangan, Jorethang and Kalimpong through subsidized development scheme. In this cardamom is dried by indirect heating at 45-50°C. Curing is done till moisture content of the produce is brought down to 12-14 % level & gives metallic sound while shuffling.

**Packaging and Marketing**
The properly dried capsules should be allowed to cool and then packed in polythene lined jute bags. The bags may be stored on wooden platform away from sidewall to avoid absorption of moisture and thereby to avoid fungal growth on the stored produce.

**Conclusion**
Large cardamom is widely grown and consumed spice that has got good international market demand. A large group of market participants are engaged in different activities of entire value chain of large cardamom right from production to its consumption. India is having major share in the international large cardamom export market. It not only contributes to the economy of these places but also play important role in the ecosystem and contribute to the human health. It is a spice crop of significant economic importance. It has various industrial, medicinal, nutritional and culinary uses. Being a multiple crop, there is an urgent need to increase the area under its cultivation for increasing the productivity of this crop.