

GOOD AGRICULTURAL PRACTICES FOR LARGE CARDAMOM SEEDLING NURSERY



स्पाइसेल बोर्ड
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All India Coordinated Research Project on Spices (AICRPS)
Indian Cardamom Research Institute
Regional Research Station, Spices Board
Tadong-737102, Gangtok, Sikkim

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Large cardamom (*Amomum subulatum* Roxb.) is an important spice crop cultivated in the Sikkim Himalayan region and other northeastern states of India. Due to its higher market value compared to other spices, this cash crop significantly enhances farmers' incomes. For the successful establishment of large cardamom plantations, disease-free and high-yielding planting material plays a crucial role. Large cardamom planting material can be produced through seed propagation, sucker propagation, and micropropagation.

Seedling production from seeds is an important propagation method and farmers in Arunachal Pradesh and Nagaland mostly emphasize on planting material production through seeds. Although there are both advantages and disadvantages to seedlings produced from seeds, in regions with a high incidence of viral diseases, raising seedlings from seeds is recommended as a strategy to reduce viral disease transmission.

Merits of Seed Propagation in Large Cardamom:

- Enables the production of a large number of seedlings.
- Seedlings produced from seeds are free from viral diseases.
- Provides genetic variability, which can sometimes result in superior planting material due to the highly cross-pollinated nature of large cardamom.

Demerits of Seed Propagation in Large Cardamom:

- Seedlings obtained through sexual propagation are not true to the type of the mother plant from which the seeds were collected.
- Seedlings take longer to reach the bearing stage compared to those propagated vegetatively i.e sucker propagation
- Since seedlings remain in the nursery for a longer period, the input and labour requirements are higher, increasing the overall cost of seedling production.

Steps and Measures for Planting Material Production

Selection of Cultivar/Variety

- a. Large cardamom is highly location-specific, meaning that the performance of a cultivar/variety varies with altitude. Therefore, extra attention must be given to selecting the appropriate cultivar/variety to establish a productive plantation. The selection of cultivars/varieties should be based on altitude suitability, yield potential, and tolerance to pests and diseases.
 - High altitude (>1515 m amsl): Ramsey, Varlangey, Ramla, and ICRI Sikkim-1
 - Medium altitude (975–1515 m amsl): Sawney, ICRI Sikkim-2
 - Low altitude (<975 m amsl): Golsey, Seremna
- b. Large cardamom is highly cross-pollinated, and the presence of other cultivars/varieties or wild relatives of cardamom in the vicinity can deteriorate seed quality. As a result, the seedlings may not exhibit the true characteristics of the selected cultivar/variety.

Selection of Plantation

- The plantation should be disease-free.
- It should have a high yield for at least three consecutive years.

Mother Plant Selection

- The selected plant must be free from diseases and insect pests.
- Productive or bearing tillers should range between 40–60 per plant or clump.
- It is preferred that each plant or clump has 40–50 spikes.



Mother plants with high production

Selection of Capsules

Studies revealed that seeds collected from bottom capsules had the highest germination rate (60.2%), followed by those from middle capsules (55.7%) germination.

- Collect capsules from high-yielding and well-maintained plantations.
- Harvest the spike when it is fully mature.
- Select capsules from the middle portion of the spike, as they tend to be larger in size.
- Extract capsules from spikes where the average number of capsules per spike is more than 15–20, and the fresh weight of each capsule is not less than 5–6 g.
- Capsules should be extracted from the spike within 2–3 days after harvest, and seeds should be extracted immediately.
- The number of seeds per capsule should not be less than 30–45.



Spike, Capsules and Seeds of Large Cardamom

Process of Seed Extraction

Seed extraction in large cardamom is a tedious process that must be carried out meticulously, as the seeds are covered with sticky mucilage, which needs to be removed.

- Select fully matured and ripe capsules.
- Separate the seeds from the pericarp or husk.
- Rub the seeds with sand or other suitable materials to remove the mucilage.
- Wash the extracted seeds with clean water until the mucilage is completely removed.
- Separate light, floated, shriveled and immature seeds from the desired fully matured, dark brown to black-colored seeds.
- Coat the selected seeds with wood ash and dry them under shade for 2 to 3 days.
- The dried seeds can be sown immediately or stored in a cool and dry place.
- To ensure better germination, seeds should be sown within 65 days of extraction in seedbeds.

Pre-Sowing Seed Treatment

Large cardamom seeds exhibit dormancy due to their hard seed coat. Germination depends on temperature and humidity in the nursery. Under high-elevation conditions with lower temperatures, seed germination begins within 5-7 months after sowing. In lower elevations with higher temperatures, germination occurs within 3-4 months.

Methods to Enhance Germination

- Non-Organic Method

Seed scarification with 25% nitric acid (25 ml nitric acid + 75 ml water) for 10 minutes, followed by thorough washing in running water, improves germination. This method should be used only in non-organic farming.

- Organic Method

In organic farming, seeds soaked in a 25% cow dung solution for five days showed better germination rates compared to air-dried seeds. Studies also found that bio-priming with microbial inoculants (*Azotobacter* + PSB + K mobilizer) significantly improved seed germination and seedling growth in large cardamom. The germination percentage of seeds extracted through these methods ranges from 30% to 50%.

PRIMARY NURSERY MANAGEMENT FOR LARGE CARDAMOM

Site Selection for Nursery

- The nursery site should not have grown any Zingiberaceae crops for at least 3–4 years previously to prevent disease buildup.
- It should have sufficient sunlight and water availability for irrigation and be well-connected for monitoring and input application.
- South-facing nurseries receive more light and heat; however, east or northeast-facing sites are generally preferred.
- The site should be at least 500 meters away from the main plantation to prevent

the transmission of pests and diseases.

- Loamy soil with sufficient organic matter, neutral pH, and no waterlogging is ideal for the nursery.
- Soil testing should be conducted, and appropriate measures should be taken to improve soil quality.
- No large trees should be around the nursery, as they may block sunlight or serve as alternate hosts for pests and diseases.

Nursery Bed Preparation

- The nursery bed should not be more than 1 meter wide and the length should be adjusted based on land availability and convenience.
- Raised beds (25–30 cm from the ground) should be prepared to facilitate drainage.
- One meter gap should be maintained between two nursery beds.
- The seedbeds should be free from clods, weeds, and have a fine soil texture.
- Adequate manure should be applied to well-prepared nursery beds.
- For every 2 square meters of nursery bed, apply 20–25 kg of well-rotted compost, 1 kg of ash, and 10–15 kg of sand (if the soil is clayey), incorporating them properly.



Nursery Bed Preparation and Line Marking

Seed Sowing

- Seeds should be sown immediately after extraction.
- The best time for seed sowing is from the last week of September to mid-February.
- Seeds should be sown at a depth of maximum 1 cm, maintaining a 10 cm row-to-row distance.
- 10 gram of treated/extracted seeds is recommended per square meter of nursery area.
- About 80–100 g of seeds can be sown in a 10 m × 1 m nursery bed.
- The sown seeds should be thinly covered with fine-grained soil.

Mulching

Mulching helps retain soil moisture and reduces weed growth in the nursery.

- After sowing, the beds should be mulched using straw or other suitable materials.
- If straw is used, it should be applied at a thickness of 3–4 cm.



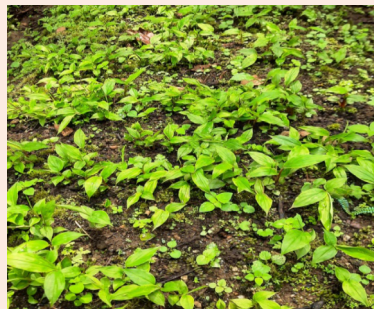
Seed bed mulched with paddy straw

Irrigation

- Irrigation should be done at 3 to 4-day intervals from November to March, depending on soil moisture and rainfall.
- Overhead sprinkler or drip irrigation can be installed for efficient watering and to reduce labor requirements.
- Waterlogging must be avoided at all costs.

Germination

- The time required for large cardamom seed germination depends on the seed treatment method used, typically taking 3 to 7 months.
- The germination percentage ranges from 30–50%.
- Mulching should be removed as soon as germination begins to facilitate photosynthesis.
- Once the seedlings reach the 3–4 leaf stage, they should be transplanted to secondary beds/nurseries.



Germinated seedlings in nursery

Shade Management

- Shade is essential to protect young seedlings from direct sunlight, hailstones, heavy rain, frost, and snow.
- 50% shade should be provided using shade nets or bamboo roofing.
- Proper shading also reduces insect pest and disease incidence, ensuring healthier seedlings.



Nursery covered with shade net

SECONDARY NURSERY MANAGEMENT FOR LARGE CARDAMOM

In the primary nursery, once seedlings reach the 3–4 leaf stage, they must be transplanted into the secondary nursery for further growth. The secondary nursery is of two types:

1. Bed Nursery
2. Polybag Nursery

a) Bed Nursery

- The secondary nursery bed is prepared similarly to the primary nursery.
- Beds of 20–30 cm in height and 1 m in width with a convenient length are prepared. Well-decomposed cattle manure is mixed into the soil to create an even surface.
- A nursery bed mixture of soil, sand, and cow dung (4:1:1) has been found to promote healthy seedling growth.
- Seedlings are transplanted in April–May, maintaining a spacing of 15–20 cm between them.
- The interspaces between seedlings are mulched with chopped rice straw or dry leaves to reduce weed growth and maintain soil moisture.
- Overhead shading (50% shade net) should be erected to protect seedlings from direct sunlight exposure.
- The soil should be kept moist with regular irrigation, especially between November and March, based on soil moisture levels.

- Nutrient Management: Apply well-decomposed cow manure fortified with *Trichoderma* spp. once during December–January, along with vermicompost. Additionally, Vesicular Arbuscular Mycorrhizae (VAM) at 10 g/plant enhances root and shoot development.
- Nursery beds should be kept weed free.
- Pest and Disease Management: Implement appropriate plant protection measures based on pest and disease occurrence.



Bed nursery

Transplanting to Main Field

- Seedlings attain a height of 45–60 cm with 6–8 tillers and are ready for planting in the main field after 10–12 months in the subsequent year.

b) Polybag Nursery

For those who can afford it, polybag nurseries are an excellent alternative as they allow easy seedling transport. However, the cost of setting up a polybag nursery is higher than a bed nursery.

- Polythene bags (15 × 15 cm) are used for transplanting 3–4 leaf stage seedlings.
- The base of the bags should be perforated to allow excess water drainage.
- The bags are filled with a soil, sand, and cow dung mixture (4:1:1). Potting mixture 1:1:1 ratio of forest soil, FYM (farmyard manure), and vermicompost with 10 g of VAM per polybag resulted in maximum tiller and root growth.
- Seedlings with 3–4 leaves are transplanted into polybags in April–May.
- Overhead shading (50% shade net) should be provided to protect seedlings from direct sunlight exposure.

- Irrigation should be done at regular intervals, especially from November to March, based on soil moisture levels.
- Poly bag with seedling should be kept weed free.
- Apply appropriate plant protection measures as needed.



Polybag nursery

Transplanting to Main Field

- Seedlings grown in polybag nurseries are ready for field planting after 10–12 months.

Maintenance of the Nursery

- Labeling and tagging of different cultivars should be done.
- Soil testing should be carried out once in two to three years, and soil amendments should be made accordingly.
- Although seedlings are initially free from viral diseases, utmost precaution is required to minimize the chances of disease transmission from affected plants.
- Plant protection measures should be adopted to prevent insect pest and disease incidence.
- A calendar of operations should be displayed in the nursery.
- Day-to-day activities should be recorded.
- Stock and sales registers should be maintained and regularly updated

Estimated Cost for Raising a Large Cardamom Nursery from one Kg Seed (in Sikkim)				
Sl. No:	Particular	Quantity	Rate/unit (₹)	Total cost (₹)
I				
	Seed bed preparation	6	500	3000/-
	Seed sowing	4	500	2000/-
	Potting mixture preparation	10	500	5,000/-
	Poly bag filling	30	500	15,000/-
	Transferring sapling to poly bag	30	500	15,000/-
	Irrigation and plant protection measures	25	500	12,500/-
	Mulching & weeding	10	500	5,000/-
	Pendal Installation	10	500	5,000/-
	Total (A)			62,500/-
II	Inputs			
	*Seed cost	1 kg	4000	4000/-
	**Polybag cost (approx. 70 piece/kg)	200 kg	250/kg	50,000/-
	Plant protection inputs			10,000/-
	***Agroshade net (@ Total Rs.30000/- for 1500 sq m with Rs.20/-per sqm)			6,000/-
	***Bamboo poles for Pendal (50 nos. @ Rs.300/piece, so total Rs.15000/-)	50	300/piece	7500/-
	Irrigation equipments			6,000/-
	FYM	3000 kg	5/kg	15,000/-
	Vermicompost	1500 kg	15/kg	22,500/-
	Total (B)			1,21,500/-

III	Others			
	Miscellaneous			10,000/-
	Total (C)			10,000/-
IV	Total cost of production (A+B+C)			1,93,500/-
V	Total number of seedling produced (approx.)	13,500		
VI	Cost per seedling produced (approx.)			14.33

- **Seed Quantity and Expected Seedling Yield:**
1 kg of large cardamom seeds contains approximately 60,000 seeds.
Germination percentage: 25% (without acid treatment).
Seedling mortality rate: ~10%.
Final expected seedlings: ~13,500 per kg of seed.
Seed Cost: At the current market rate, 1 kg of large cardamom seed costs ₹4,000.
- **Polybag Nursery Considerations:**
Polybag costs are calculated based on a single-use nursery setup.
- **Fixed Costs Considerations:**
Agro-shade nets and irrigation equipment are considered fixed costs, with an estimated usable lifespan of five years.
Bamboo poles can be reused for two years before replacement is needed.

Key Considerations

- For a bed nursery, polybag costs can be excluded, reducing costs by approximately ₹11,500.
- If nursery infrastructure (shade nets, irrigation, etc.) is already available, the cost can be further reduced.
- Seedlings are ready for transplanting in 10–12 months, so additional maintenance costs may apply depending on location and management.



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