

## Rapid clonal multiplication of cardamom (*Elettaria cardamomum*) : Technique and economics

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### Abstract

Most important reason for low productivity of cardamom in India is the use of unselected (random) and heterogeneous planting material raised from seeds. Planting of propagules multiplied from elite plants can raise the cardamom productivity. Here a method is described which was used in 0.05 ha land of a farmers' field to multiply elite plants 20 fold in 10 months. The cost of a propagule came to Rs.1.11. A clonal multiplication method that will ensure genetically uniform planting material is required to be practiced. This simple, reliable and cost effective method can be practiced by farmers.

**Key words :** *Elettaria cardamomum*, selection, clonal propagation, economics.

### Introduction

Cardamom (*Elettaria cardamomum* Maton) acclaimed as the "Queen of spices" belongs to the family Zingiberaceae. The original home of cardamom is the mountainous regions of southern parts of peninsular India and the islands of Sri Lanka. Cardamom has a wide range of uses, including as an item for the seasoning of foods and confectionary, pharmaceutical, cosmetics and perfumery industries.

During the year 1995-96, 84,041 hectare of land was under cardamom cultivations with a record production of 7500 million tonnes; India earned foreign exchange of Rs 124 million by exporting about 500 million tonnes of cardamom that year. In the recent years, there has been a considerable increase in domestic consumption of cardamom. India has lost its near monopoly in production and export to Guatemala which has emerged as a keen competitor of India in the cardamom international trade. This trend is the result of the average per hectare productivity of cardamom in Guatemala being about twice that of in India, providing competitive advantage to Guatemala. There is need to increase the productivity and lower the cost of production of cardamom in India.

One of the important reasons for low productivity of cardamom in India has been the use of unselected (random) planting material. Large scale propagation of cardamom in most of the cardamom growing areas is

through seeds [6]. The inherent drawback of this method is the production of heterogeneous progeny due to cross pollination [2]. A high degree of variability was observed and only 4.4 percent plants were of high yielding capacity [3,7]. This necessitates selection of elite clones.

Clonal multiplication of cardamom ensures genetically uniform planting material. Vegetative propagation can be resorted to by the rhizome propagation and by micropropagation in tissue culture. The protocol for the micropropagation of high yielding cardamom strains through tissue culture developed at this centre has been commercialized already by several firms. However, the cost of these plants is high and not within the reach of small and marginal farmers (less than 2 hectares) who constitute about 80% of the 40531 cardamom holdings [2]. Besides this limitation, the selections/clones in cardamom are highly location specific [5]. Under such limitations the clonal multiplication of elite clumps identified on farmers' fields provides an easy way out for the planters. Moreover, plants raised from rhizomes bear earlier by one year compared to seedling population, thus helping in the early recovery of the initial investment [2]. In view of these practical problems, a rapid clonal multiplication technique using rhizomes was evolved [2] at the Cardamom Research Centre, Appangala. Here are presented the economics of this method based on a field investigation undertaken in the farmers' field.

### Materials and methods

Twelve high yielding clumps of cardamom (Malabar type) free from pests and diseases with bold and green capsules were selected from 2.0 hectare area bearing about 5750 plants on the basis of observations over 6 crops seasons (1982-83 to 1988-89) in a plantation at Chettoli Estate, Chettalli, Kodagu district, Karnataka. These were clonally multiplied over a 10 month period using the following procedure :

**1. Selection of site :** The clonal nursery site was selected on a gentle eastern slope with adequate drainage nearer to the farm pond in an area of 0.05 hectares.

**2. Land preparation :** Trenches of 45 cm width x 45 cm depth and convenient length were made across the slope, 1.8 m apart (Figure 1). The top 15 cm depth of soil was excavated and heaped on the upper side of the trenches. The lower 30 cm depth of soil excavated and heaped on the lower side of the trench all along the line to prevent soil erosion by pressing and forming a bund with a gradient. The soil excavated first at 15 cm depth along with equal proportion of humus rich top fertile forest soil, sand and coffee compost @ 5 kg per plant were filled layerwise upto depth of 2.5 cm one after the other and scuffled (mixed) thoroughly by leaving a depression of 5 cm at the top, to facilitate mulching and retention of soil moisture.

**3. Mother clumps and derivation of planting material :** A part of the selected clump (38-40 planting units, each comprising of a grown up sucker and young shoot (Figure 2) was uprooted leaving behind at least 15 suckers in the mother clump. Fertilizer, pesticides and irrigations were applied timely to the promother clumps to ensure vigorous proliferation of mother plants for further extraction of propagules.

**4. Spacing and planting :** In the clonal nursery, the rhizomes (planting units) to be multiplied were placed at a spacing of 1.8 m x 0.6 m in trenches made 1.8 m apart, thus accommodating 463 plants in 0.05 ha. The rhizome to be planted was treated for 5 minutes with Emisan (ethyl mercury chloride mixture) 0.2%. Adequate mulch (2.5 - 4.0 cm thick) with dried fallen leaves of shade trees was applied immediately after planting followed by proper watering. The establishment and proliferation of suckers in clonal nursery after 75 days of planting is depicted in Figure 3. The nursery planting was done in September 1997 and the nursery was maintained for 10 months.

**Table-1. Partitioning of the inputs for the rapid clonal multiplication of cardamom lines for generating their planting material in 10 months in 0.05 ha of land**

Sl. No.	Input	Cost of input (Rs.)	Per cent of the total
1.	Planting material (463 planting units @ Rs.2.5)	1157	13.8
2.	Pandal material	360	4.3
3.	Fertiliser	294	3.5
4.	Manure (compost)	250	3.0
5.	Pesticides	780	9.3
6.	Labour charges	4165	49.7
7.	Fuel charges to run irrigation pump set	285	3.4
8.	Maintenance of farm machinery	380	4.5
9.	Interest on working capital @11%	703	8.4
Total		8374	100

**5. Shade management :** An overhead pandal was erected at a height of 4m (Figure 4) and covered with locally available silveroak twigs to allow 50 per cent filtered sunlight. The shading material on the pandal was removed with the onset of monsoon rains in June for better tillering and growth as the sky remained cloudy with intermitant rains during this period.

**6. Plant protection :** Clumps were drenched with copper oxychloride (0.2%). Phorate 10 G@ 30 g/plant was applied at quarterly interval to control nematodes and root grubs. Quinolphos and methyl parathion (0.5%) or monocrotophos (0.5%) were sprayed to control thrips, borers and shoot fly.

**7. Cultural practices :** Fertilizer was applied @ 100:50:200 kg NPK/ha in equal six splits commencing from 60th day after planting at an interval of 40 days. DAP was preferred for the first two rounds. Neem cake was applied @ 250 g per plant along with the split fertilizer dose. Irrigation was provided twice a week with hose pipe.



Figure 1. Trench system of planting for rapid clonal multiplication



Figure 3. High density planting in clonal nursery

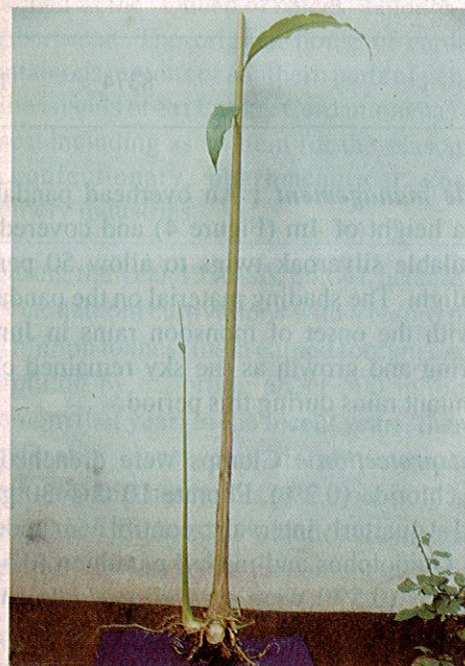


Figure 2. Clonal planting unit - grown up sucker along with a growing shoot



Figure 4. Erection of over head pendal for shading during December-May.

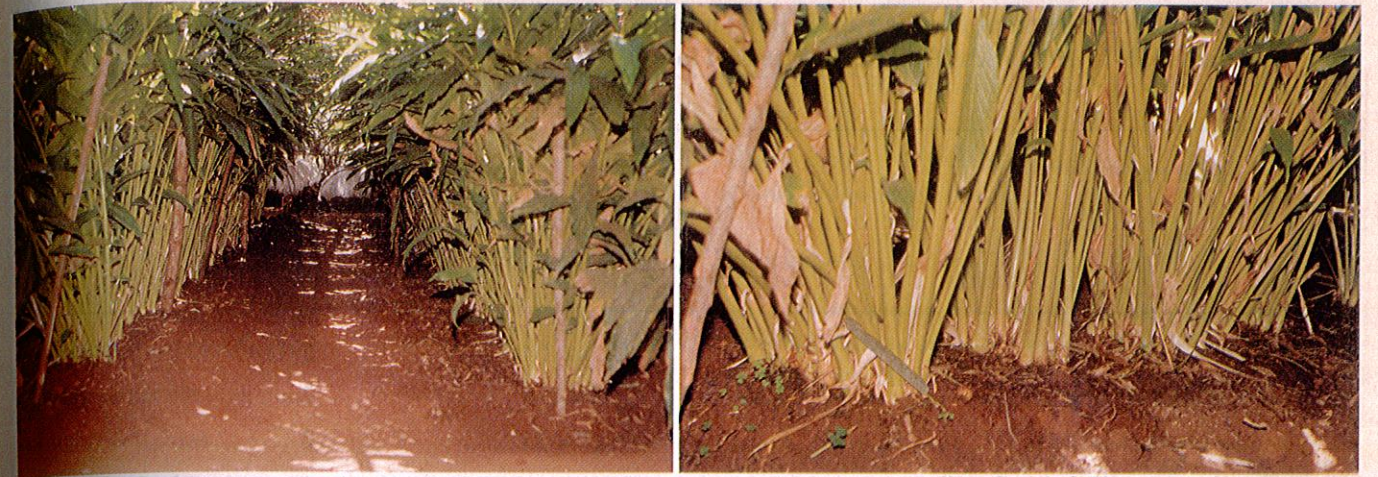


Figure 5 and 6. Proliferation of suckers (Tillers) in clonal nursery - Ten months old.



Figure 7. Separated planting units (Ten months old) from clonal nursery ready for planting the main field

**Table-2. Labour requirement for the rapid clonal multiplication of cardamom lines for generating planting materials in 10 months for 0.05 hectares of land**

Sl. No.	Work operations	Number of days for which labour deployed		
		Men @ Rs 17	Women @ Rs 17	Amount Rs
1.	Cleaning the open area	4	2	102
2.	Layout of land at 1.8 x 0.6 m opening trenches	3	2	085
3.	Opening of trenches (45 m x 45 cm x 25 m x 12 lines)	35	2	629
4.	Collection of top fertile jungle soil, transporting and filling the trenches	32	6	646
5.	Collection of clonal material (suckers) from elite plants and planting the same in the trenches	12	8	340
6.	Mulching	—	5 x 3	255
7.	Staking and tying of cardamom suckers	4	2	102
8.	Weeding	—	4 x 3	204
9.	Application of fertilizer	4	2	102
10.	Application of manure (compost)	6	3	153
11.	Collection of poles, cross bars, erection and covering of overhead pandal	32	14	782
12.	Trashing (twice)	—	3 x 3	153
13.	Clearing of roads and drains	2	—	034
14.	Plant protection	8	8	272
15.	Uprooting and apportioning into suckers (planting units)			
	<b>Total</b>	<b>152</b>	<b>93</b>	<b>4165</b>

**8. Uprooting of clumps :** At the end of 10th month, the clumps in the clonal nursery were uprooted with a digging fork and the planting units were separated carefully (each unit containing a grown up sucker along with a growing young shoot) for further planting in the main field for large scale cultivation of cardamom.

**Results and discussion**

A total of 9260 planting units were obtained from 463 mother clonal units in an area of 0.05 hectares in 10 months (Figures 5 and 6). There was thus 20 fold multiplication in the conditions used. The pseudostem, with swollen base along with this food storage organ rhizome, serves as a new planting unit under the macro

propagation practiced in this study. The new organs emerging directly from the rhizome obtain their supply of photosynthates from the rhizome which is the major sink in a tiller [8]. New tillers and panicles emerge from the swollen base of pseudostem throughout the year [4]. The Table-1 gives a distribution of inputs made of the production of the planting material in 0.05 hectare of land. It will be seen that 50% input is that of labour cost, which is presently imperative in the absence of mechanisation [1]. The Table 2 defines the labour deployment for the different operations. The economics of nursery operations is presented in the Table-3.

The cost per planting unit of macropropagated planting was Rs.1.11. The rapid clonal multiplication

**Table-3. Economics of the clonal multiplication of cardamom lines for generating planting material in 0.05 hectares of land**

Sl. No.	Parameter	Value (Rs)
1.	Number of planting units	9260
2.	Price per planting unit	2.50
3.	Gross income	23150
4.	Cost of cultivation	8374
5.	Net returns	14776
6.	Benefit cost ratio (BCR)	2.76
7.	Cost per planting unit	1.11
8.	Net return per planting unit	1.60
9.	Return per rupee invested on labour	4.55
10.	Per day return	47.66

worked out to be much lower than the cost (price) of tissue cultured plantlets (Rs.12/plant) and even the open pollinated seedlings (Rs.2.50/seedling). The labour requirement for various operations is shown in the Table-2.

The method of clonal multiplication of cardamom given above is a simple, reliable and economically feasible technique for the production of quality planting material. It can be easily adopted by farmers right on their own plantations as most of the estates are still inaccessible and spread over in far flung interior ever green forests.

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