

## Cultivation of cardamom (*Elettaria cardamomum*) in valley bottoms under evergreen forest shade

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### Abstract

A field trial was conducted at Hakathur, Coorg (Karnataka) to study the production potential and economics of cultivation of cardamom in valley bottoms under evergreen forest shade situations. The highest yield of 1473 kg dry capsules/ha was recorded during the third year after planting as against an average seven crop seasons yield of 735 kg/ha. Cultivation of cardamom was found to be highly labour intensive as an average 1120 man days per ha were required during bearing period, which accounted for 61.6 % of the total expenditure incurred on the various inputs required for a total seven crop seasons (1988-89 to 1994-95). A net income of Rs. 1, 45, 065.7/ha was obtained with an average production cost of Rs. 87/kg. The discounting cash flow measures viz. Net Present Worth (NPW) of Rs. 5,23,455/ha; Benefit Cost Ratio (BCR) of 3.53; Pay Back Period (PBP) of 2.14 years and Internal Rate of Return (IRR) of 59.08% showed that cardamom is an economically viable and feasible crop for cultivation under valley bottoms which retain soil moisture round the year, most suited for optimum growth and yield.

**Key words:** *Elettaria cardamomum*, cardamom, evergreen forest, swampy areas, bearing period.

### Introduction

Cardamom (*Elettaria cardamomum* Maton) known for its distinct flavour and aroma is an acclaimed spice in the world. It is a native of high ranges of evergreen forests of south India. Its cultivation is mainly confined to Kerala (60%), Karnataka (31%) and Tamil Nadu (9%). Until late seventies, India was enjoying near monopoly both in production and exports of cardamom. India's share in world trade from 70% came down to 41% during 1984-85 [1]. Guatemala emerged as the main competitor both in production and exports of cardamom in the international market. Due to the efforts of various research organisations in the country, Spices Board [2], and the keen interest shown by the farmers to adopt High Production Technology (HPT) in recent years, the cardamom yield has increased from 41 kg (dry) capsule per ha during (1982-83) to 140 kg/ha (1998-99) [10]. In spite of significant increase in the productivity, the area under cardamom plantation has come down to 80,000 ha from 105,000 ha during 1987-88. The reasons for decline in the area may be due to highly fluctuating price and comparatively better price of cardamom

offered by coffee and pepper in the last 5-6 years. As a consequence, coffee and pepper have made fast inroads in the traditional cardamom growing areas.

In recent years, mounting population pressure on land and more so on the high value plantation areas warranted the intensification of cropping systems, bringing even the marginal and wastelands for productive use. It is not very uncommon to come across some of the low lying swampy areas in the high ranges of Western Ghats of India which are not found suitable for cultivation of plantation crops like tea, coffee, rubber etc. Since, cardamom is a moisture and shade loving crop, it is worth attempting to study the production potential and the economics of production so as to utilise the swamps situated in the valley bottoms for profitable cultivation of cardamom. Interest in its cultivation has, therefore, been widespread and sustained efforts have been made in the recent times to grow cardamom on previously unutilised swamp lands and ravines which abound in the cardamom growing tracts of India. Remarkable success has been achieved as early as in 1966 in the swampy areas situated in tea gardens in

Kerala [15]. Since, no such published information on the possibility of economic utilisation of marshy areas (valley bottoms) located in the coffee plantations is available, a field investigation was undertaken in farmers plantations in M/s Kumaran Estate, Hakathur, Coorg (Karnataka) to assess the ecological feasibility, yield performance and the economic viability of cardamom cultivation.

## Materials and methods

### General features

A low land marshy area of one ha was selected at M/s Kumaran Estate, Hakathur, North Coorg, Karnataka for the study. This swampy area is located in the valley bottoms covered on either sides with moderate hill slopes, planted with robusta coffee (*Coffea arabica*) and pepper (*Piper nigrum*). This estate receives a well distributed annual rainfall of 2500 to 2800 mm in about 135-140 rainy days. The soil is a sandy loam, moderately acidic, rich in available nitrogen, low in phosphorus and medium in potash.

### Agro-techniques adopted for cultivation

#### Provision of drainage

Since, the area was swampy and laden with excess moisture and lying all along the perennial stream of water with a slope from top downwards, adequate drainage was provided by opening the leader (main) and lateral (subsidiary drains) to drain out the excess moisture during 1986-87. Since the study area had a mixed evergreen forest shade trees, adequate lopping of trees was resorted to create optimum shade. The elite cardamom seedlings of clone-37 (cv. Malabar type, with prostrate panicles), well suited to agroclimatic conditions of Karnataka, were planted at a spacing of 1.8 m x 1.2 m (4630 plants/ha) during August, 1986.

#### Input management and cultural operations

The High Production Technology (HPT) followed in the plantations (study area) consisted of: regular cleaning and deepening of drains to avoid water stagnation; regulating over head shade to allow 60-65 per cent of filtered sunlight; opening and filling of pits (45 x 45 x 30 cm) with forest top fertile soil and organic wastes like decomposed coffee husk; planting with 10

months old seedlings of the popular Malabar cultivar (CI-37); providing 8-10 rounds of irrigation during summer right from first week of February till the commencement of regular monsoons (first week of June) by using the overhead sprinkler irrigation system; application of fertilizers 120: 120: 240 kg of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O/ha in four splits at quarterly intervals; application of coffee compost 10 kg/plant and neem cake 250 kg/ha during first year and 500 kg/ha in second year of establishment period and 1.5 tonnes/ha from third year onwards; adequate plant protection measures, 4 rounds of insecticides, 2 rounds of fungicides, tracing and removal of mosaic virus disease locally known as *katte* (meaning a disorder in Kannada language) disease affected plants (spread by the vector aphid *Pentalonia nigronervosa f. caladii*) once in a month; regular schedule of aftercare, cultural operations viz., weeding, mulching, light earthing up; and 3 rounds of trashing to facilitate better pest control, aeration and light infiltration, harvesting (picking) at right stage, drying and processing to retain green colour. Besides the above mentioned cultural operations and input management, various other routine and need based operations were carried out during prebearing and bearing periods [11].

### Economic analysis

The data relating to various farm operations and inputs during pre-bearing (establishment) and bearing periods were computed based on actual mandays employed and expenditure incurred on various other inputs. The total expenditure was calculated on the basis of prevailing wage rates as per the plantation act of Karnataka state during the corresponding years. Apart from regular daily wages, the labourers were also paid 40% fringe benefits (on actual wages paid) viz., bonus, provident and pension fund, gratuity, medical expenses, housing etc. Tabular analysis of data was performed to arrive at the cost of cultivation. In order to assess the feasibility of investment, discounting cash flow measures viz., Net Present Worth (NPW), Benefit Cost Ratio (BCR), Pay Back period (PBP) and Internal Rate of Return (IRR) were calculated. Expression of these short forms is as follows.

1. Net Present Worth (NPW): It is the difference

between present value of benefits and present value of costs. If NPW is greater than zero, the project is said to be economically viable.

$$\text{Discounted net returns} = \text{Discounted gross returns} - \text{discounted cost}$$

2. Benefit Cost Ratio (BCR): It is the ratio of discounted gross returns to discounted costs. For an investment to be worth while, the BCR must be more than unit.

$$\text{BCR} = \frac{\text{Discounted gross returns}}{\text{Discounted cost}}$$

3. International Rate of Return (IRR): It is the rate of return at which Net Present Value (NPV) is equal to zero.

$$\text{IRR} = \frac{\text{Lower discount rate / difference between two discount rates NPV/NPW at lower discount rate}}{\text{Difference between (NPV/NPW) at two discount rates}}$$

4. Pay Back Period (PBP): It is the period at which the initial investment will be recovered.

$$\text{PBP} = \frac{\text{Initial investment}}{\text{Annual net return}}$$

## Results and discussion

### Prebearing period

#### (a) Labour utilisation

It was observed that the requirement of men labourers (484/ha) was higher than the women labourers (323/ha) in pre-bearing (establishment) period of cardamom due to strenuous operations like land clearing, shade regulation, pitting, planting etc. of the 807 labourers/ha required for various operations, about 60% were men and remaining 40% were women labourers. This is similar to the findings with regards to the requirement of labour for coffee (in arabica and robusta) plantation during the first and second years of establishment [3].

A total cost of Rs. 10,064/ha towards 807 labourers was incurred as the total labour charges. A major part of 28.57 per cent of total cost made towards labour including benefits @ 40% on the actual wages paid amounting to Rs. 4, 025/ha is a noticeable feature. Out

of total cost of Rs. 14, 089.74/ha (labour charges + benefits @ 40%) as represented in Table-1, with the exception of benefits paid labourers, the percent share of expenditure was highest for pitting and planting followed by plant protection measures, fertilizer application, weeding, likewise.

#### (b) Input requirement

A total cost of Rs 55, 481.50/ha was incurred on various inputs including maintenance of irrigation pump, sprayers, traylor, etc and depreciation of capital assets in the first and second years of establishment period (Table-2). Between the first two years the expenditure in the first years, Rs. 33009.50/ha was higher than in second year (Rs. 22, 472.00/ha). A major part of 55.40 per cent of the total cost was made towards labour costs (labour charges + @40% benefits) followed by depreciation on fixed assets/or plant materials as the case may be (17.1%) cardamom seedlings cost (9.4%) and so on which corresponds to the earlier findings on better input estimate/expenditure [9]. Since the yield of cardamom depends on the formation of adequate number of tillers and development of rhizomes, carrying out of appropriate cultural operations is imperative especially during the first 10 months of plantation [6].

### Bearing period

#### (a) Yield

A maiden and highest yield of 1473 kg dry/ha (Table-3) was obtained in the third year after planting (1988-89) which is the general phenomenon in cardamom (Malabar type) to get a peak yield either during third or fourth year after planting [5, 14]. An average of 734.86 kg/ha yield was recorded for the 7 crop seasons (1988-89 to 1994-95) which is five folds higher than the national average of 140 kg/ha [12]. The yield level has suddenly slumped down to 349.50 kg/ha in 1989-90 (second crop year) and it has been inconsistent over the years with a low (lean) yield level of 487.80 kg/ha in 1994-95. The reasons for sudden slump in the yield after peak yield could be attributed to the rhizomatous nature of cardamom. Therefore, most of the vegetative buds would have expressed their full potentiality due to conversion of suckers into bearing suckers in a particular year during that year of highest yield. Since the suckers which would have already undergone production decay during the following season

**Table-1. Labour requirement during prebearing period of cardamom cultivation (1986-87 and 1987-88)**

(Per ha)					
Sl. no.	Nature of operations	Men (days)	Women (days)	Amount (Rs)	Percentage of expdr.
1.	Uprooting and disposal of all cardamom and cleaning the area	20	-	238.00	1.69
2.	Shade regulation	14	5	232.50	1.65
3.	Preparation of pegs and peg marking	24	10	411.00	2.92
4.	Opening and filling of pits	98	-	1175.50	8.35
5.	Light digging and earthing up	38	-	492.20	3.21
6.	Planting and staking of seedlings	27	51	936.20	6.64
7.	Slash weeding (3 rounds)	-	94	1173.00	8.33
8.	Mulching (2 rounds)	-	40	492.00	3.49
9.	Opening and regular maintenance of drainage	18	-	227.00	1.61
10.	Shade covering (in open areas) with tree twigs	32	-	400.00	2.84
11.	Fertilizer and manures application charges	60	53	1448.70	10.28
12.	Planting of fast growing shade trees	5	-	59.50	0.42
13.	Plant protection measures				
	i) Chemicals application	70	60	1699.00	12.06
	ii) Katte tracing	16	10	331.80	2.35
14.	Assembly of irrigation pipelines	62	-	787.40	5.59
Total labour charges 40% benefits on actual wages paid		484	323	1003.8	71.43
Total cost				4042	28.57
				14896	100.00

by giving rise to sister/daughter suckers, the yield comes down drastically subsequently [9].

**(b) Labour utilisation**

During the 7 crop seasons, an average of 1119.60 labour days/ha was required, of which women labour constituted highest (79.68 per cent) when compared to men labour (20.32 per cent). A similar finding was observed in the earlier studies both in case of mono crop of cardamom and mix cropping of pepper and coffee [9, 13]. A maximum of 47.05 per cent of labour was utilized in harvesting/picking followed by fertilizers and manures application (12.30 per cent) likewise (Table-4). Harvesting is a skilled and specialised job and it is normally done better by women labourers.

Harvesting involves picking of mature (ripened) and physiologically mature fruits from panicles. The studies [7,11] indicated that the per cent share of 29 when harvested at ripened stage and 24 at physiologically mature stage as against 14 at immature stage was observed. So, to get high recovery and better returns, mobilisation of skilled and experienced labourers is a must for timely harvesting.

**(c) Partitioning of input requirement**

It is evident from the Table-4 that an average of Rs.21,853.93/ha (establishment period: 1986-87 and 1987-88, bearing period: 1989-90 to 1994-95) was incurred on labour force for the 7 crop seasons. The average requirement of labour stood at 1119.60/ha

**Table-2. Input requirement during prebearing (establishment) period of cardamom (1986-87 and 1987-88)**

(Per ha)					
Sl. no.	Input	I year (Rs.)	II year (Rs.)	Total (Rs.)	Percentage expenditure
1.	Cardamom seedlings (10 months old)	5000.00	200.00	5200.00	9.37
2.	Fertilizers	742.90	1485.80	2228.70	5.48
3.	Manures (neem cake)	262.50	625.00	887.50	1.60
4.	Pesticides	1137.50	1768.70	2906.20	5.24
5.	Electricity charges for irrigation	225.00	225.00	450.00	0.81
6.	Labour				
	Total labour wages (actual daily wages + 4% of other benefits)	19241.60	11497.50	30739.10	55.40
	Total salary of supervisory staff (salary + 40% other benefits)	700.00	770.00	1470.00	2.65
7.	Maintenance of irrigation pump, jeep, traylor, sprayers, etc.	1000.00	1400.00	2400.00	4.33
8.	Depreciation	5000.00	4500.00	9500.00	17.12
Total		33009.50	22472.00	55481.50	100.00

**Table-3. Yield of dry cardamom capsules during various stages of its growth**

Year after planting	Crop number	Yield (kg (dry)/ha)	Per of yield
3 (1988-89)	First	1473.00	28.64
4 (1989-90)	Second	349.50	6.79
5 (1990-91)	Third	702.30	13.65
6 (1991-92)	Fourth	604.70	11.76
7 (1992-93)	Fifth	834.00	16.21
8 (1993-94)	Sixth	692.70	13.47
9 (1994-95)	Seventh	487.80	9.48
Total		5144.00	100.00
Average		734.86	

during bearing period. Apart from the actual daily wages paid, benefits @ 40% of the actual wages was paid to the labourers which amounted to an average of about Rs. 8, 737.28/ha for the 7 crop seasons with a total average cost of Rs. 35, 580.49/ha including both actual labour charges and benefits accrued to the labourers. A

total of Rs. 49,620.08/ha was incurred on an average for the seven crop seasons on various inputs utilised in the bearing period, of which about 61.63 per cent (Rs. 30, 580.49/ha) accounted for labour costs alone.

**(d) Economic analysis**

A total investment of Rs. 72, 413.63/ha was made for establishing the plantations. It includes both actual investment/establishment cost (Rs. 55, 481.50) and compound interest on investment Rs. 16,932.13 (Table-6). An annual maintenance cost during bearing period was Rs. 49,620.08/ha (Table-5) and the total cost per year stood at Rs. 64, 258.06/ha. The average production for the seven crop seasons from 1988-89 to 1994-95 was 734.86 kg (dry)/ha accounting to Rs. 2,09,323.79/ha with a net return of Rs. 1, 45, 065.73/ha. The cost of production of cardamom was Rs. 87.44/kg. Higher yields are known to bring down the cost of production in cardamom. The discounting cash flow measures viz., Net Present Worth (NPW) of Rs. 5,23, 455.13/ha; Benefit Cost Ratio (BCR) of 3.53; Pay Back period (PBP) of 2.14 years and Internal Rate of Return (IRR) of 59.08% showed that it would be remunerative to go for cultivation of cardamom in valley bottoms under natural forest evergreen shade trees. To obtain higher yields and

**Table-4. Labour requirement during bearing period of cardamom (average of 9 crop seasons: 1986-87 to 1994-95) (Per ha)**

Sl. no.	Nature of work	Men (days)	Women (days)	Amount (Rs)	Percentage of expdr.
1.	Mulching (2 rounds)	-	29.3	563.22	2.58
2.	Trashing (3 rounds)	-	93.86	1832.93	8.39
3.	Cleaning the base of clump and exposing panicles	-	24.43	475.79	2.18
4.	Light earthing up	18.30	10.00	558.04	2.55
5.	Slash weeding (two rounds)	-	16.57	311.36	1.42
6.	Shade regulation	13.43	-	259.40	1.19
7.	Cleaning of drainage and maintenance	20.00	-	407.11	1.86
8.	Fertilizer and manures application charges	41.00	97.14	2690.01	12.30
9.	Plant protection application charges	44.71	40.71	1670.90	7.65
10.	Assembly of irrigation pipelines	21.3	12.00	662.90	3.03
11.	Harvesting	-	530.30	10281.50	47.05
12.	Processing and grading	68.71	38.14	2140.77	9.80
Total		227.45	892.45	21853.93	100.00

**Table-5. Partitioning of total input requirement during bearing (yielding period of cardamom) average of 7 crop seasons (1988-89-1994-95) (Per ha)**

Sl. no.	Input	Amount	Percentage of total expenditure
1.	Fertilizers	1625.50	3.28
2.	Manures (neem cake/ coffee compost)	5924.81	11.94
3.	Pesticides	4979.71	10.04
4.	Electricity charges for irrigation	319.71	0.64
5.	Labour		
	Total labour wages (actual daily wages + 40% other benefits)	35042.74	61.63
	Total salary of supervisory staff (salary + 40% of other benefits)	1270.00	2.56
6.	Maintenance of jeep, trailer, drying kiln, irrigation, pump, sprayers etc.	1901.43	3.83
7.	Depreciation	3018.43	6.08
Total		49620.08	100.00

income, regular monitoring of farm operations and input management is required [4] as this plantation started yielding within 30 months of planting (in the third year).

The cultivation of cardamom is ecologically feasible and economically viable proposition [8] in valley bottoms under evergreen forest ecosystem.

**Table-6. Economics of cultivation of cardamom**

Sl. no.	Expenditure>Returns	Amount (Rs.)
1.	Establishment cost	55,481.50
2.	Compound interest on investment (Rate of interest on 14%)	16,932.13
	Total investment	72,413.63
3.	Annuity value @ 14%	14,637.89
4.	Total cost per year	64,258.06
5.	Average production value (734.86 kg dry capsules/year)	2,09,323.79
6.	Net return (sale rate)	1,45,065.73
7.	Cost of production/kg dry capsule	87.44

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**Table-7. Financial feasibility measures**

(Per ha)		
Sl. no.	Particulars	Value
1.	Net Present Worth (NPW)	Rs. 5,23,455.13
2.	Benefit Cost Ratio (BCR)	3.53
3.	Pay Back Period (PBP)	2.14
4.	Internal Rate of Return (IRR) (%)	59.08

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