

4. The amount of soil required is less; however the soil is to be ground to very fine particles.

The modified technique is cheaper and also can be done with petridishes. This method can be adopted for reliable estimation of soil available N.

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Long term performance of cardamom - an economic appraisal

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Abstract : Field trials were conducted by adopting High Production Technology (HPT) at Chettalli (Coorg District, Karnataka) to study the sustained yield, various input requirement and the economics in cardamom (*Elettaria cardamomum* Maton) cultivation in the long term. Highest yield of 1,625 kg ha⁻¹ (dry) was obtained during the fourth year of planting. On an average for ten crop seasons, 662.72 kg ha⁻¹ (dry) capsules was obtained in the trials which is almost five times more than the national average yield of 140 kg ha⁻¹. Cultivation of cardamom is found to be highly labour intensive. Out of 729.59 labour days required per ha per year during bearing period, the women labourers constituted a major chunk (64.08 per cent). About 55.56 per cent and 11.01 per cent of labour requirement was for harvesting and trashing operations respectively. A net income of Rs.1,09,147.53/ha (average of 10 crop seasons) was obtained with a production cost of Rs.60.92 per kg (dry). (Key words: Cardamom, Long term performance, Economics).

Cardamom (*Elettaria cardamomum* Maton) known as 'Queen' of spices is native of India which is invariably cultivated in the high ranges of western ghats of South India in a self sustainable forestry system. It is cultivated with least disturbance to the natural forest flora as compared to other plantation crops like tea and rubber which require near clear felling of trees (Korikanthimath, 1993). It was grown in an area of 72,444 ha mainly in Kerala (56.91 per cent), Karnataka (35.96 per cent) and Tamil Nadu (8.13 per cent) during 1998. Due to an intensive competition from Guatemala, India lost its premier position in cardamom production. The rate of growth of cardamom production in Guatemala during the late seventies has been over 14 per cent compared to India's growth rate of 0.7 per cent. Thus India's competitiveness in the world market also suffered (Chandrashekhar, 1988). Sixty nine per

cent of cardamom plantations in India are below 2 ha and are the main source of employment to small and marginal farmers (Cardamom Board, 1985). Hence, adoption of intensive cultivation practices for higher yields especially in small holdings and efficient utilisation of labour needs no emphasis (Bavappa 1977; Korikanthimath *et al.*, 1989). Only way out for the stiff international market competition is 'high productivity and low cost of production per unit area' to ensure survival of cardamom industry in India (Korikanthimath, 1990b). This would be of paramount importance to the wide range of users and planners for cost analysis so as to decide upon the long term benefits of cardamom cultivation.

Hence, studies were undertaken at M/S Chettalli estate, Chettalli (Coorg district, Karnataka) from 1982 onwards for evaluating the long term

Table 1. Labour utilisation during pre-bearing (establishment) period of cardamom (1981-82 and 1982-83).

Operation	(Per ha)			
	Man days	Women-days	Amount (Rs.)	% of expenditure
Land preparation (uprooting and removal of old coffee stumps)	21	152.25	4.84	
Pitting and planting	100.8	10.0	803.30	25.53
Mulching (2 rounds)	-	54.0	391.50	12.44
Weeding (3 rounds)	-	90.0	652.50	20.76
Trashing	-	15.0	108.75	3.46
Cleaning of roads and drains	25.0	-	181.25	5.76
Application of fertilizers	8.2	24.0	233.45	7.42
Assembly of irrigation pipe lines	12.0	-	87.00	2.76
Plant protection	40.0	34.0	536.50	17.05
Total	207.0	227.0	3146.50	100.00

Table 2. Input utilisation during pre-bearing (establishment) period of cardamom (1981-82 and 1982-83). (Per ha)

Input	Ist year (Rs.)	IInd Year (Rs.)	Total (Rs.)	Percentage of expenditure
Cardamom seedlings	1080.00	-	1080.00	6.73
Fertilizers	2208.60	4282.25	6490.85	40.46
Pesticides	85.00	235.00	320.00	1.99
Fuel (diesel) charges for irrigation	90.00	200.00	290.00	1.81
<i>Labour</i>				
Total labour wages (actual daily wages + 63% other benefits)	3214.36	1914.43	5128.79	31.97
Total salary Supervisory staff (Salary + 63% other benefits)	228.20	391.20	619.40	3.86
Maintenance of jeep, trailor, irrigation pump, sprayers, etc.	325.00	582.00	907.00	5.65
Depreciation on irrigation pump, sprayers and other farm accessories as accepted by AITO	525.00	683.00	1208.00	7.53
Total	7756.16	8287.88	16044.04	100.00

Table 3. Yield of cardamom during various stages

Year after planting / crop			Yield (kg ha ⁻¹) dry	Per cent of yield (%)
3	1983-84	I crop	290	4.38
4	1984-85	II crop	1625	24.54
5	1985-86	III crop	400	6.04
6	1986-87	IV crop	775	11.70
7	1987-88	V crop	800	12.08
8	1988-89	VI crop	450	6.80
9	1989-90	VII crop	782	11.81
10	1990-91	VIII crop	455	6.87
11	1991-92	IX crop	684	10.33
12	1992-93	X crop	360.18	5.45
Total			6621.18	100.00
Average			662.12	

Table 4. Labour utilisation during bearing (yielding) period of cardamom (average of 10 crop seasons : 1983-84 to 1992-93)

(Per ha)					
Nature of work		Men days	Women days	Amount (Rs.)	Percentage of expdr.
1	Mulching	—	16.40	272.89	2.43
2	Trashing	36.00	40.70	1236.39	11.01
3	Weeding	—	10.00	159.68	1.42
4	Light earthing up	25.60	4.00	510.70	4.55
5	Cleaning the base of clumps and exposing panicles	—	16.39	273.45	2.44
6	Shade regulation	1.70	—	2.84	0.03
7	Cleaning roads and drains	12.60	—	206.12	1.84
8	Fertilizer application	24.60	20.20	713.48	6.36
9	Plant protection	12.10	41.70	880.41	7.84
10	Assembly of irrigation pipelines	18.40	—	297.12	2.65
11	Harvesting	106.60	316.10	6236.74	55.56
12	Processing and grading	24.50	2.00	434.85	3.87
Total		262.10	467.49	11224.67	100.00

performance and economics of cardamom cultivation by adopting High Production Technology (HPT), developed at the I.I.S.R., Cardamom Research Centre, Appangala.

Materials and Methods

General features

A plot of 2.2 ha was selected at M/S Chettoli Estate, Chettalli for the investigations on long term performance of cardamom and its

economic appraisal. A well distributed rainfall of 1200 to 1500 mm in 120-140 rainy days was noticed in this estate. Adequate shade tree species comprising of *Ficus* (*Ficus glomerata*), Garagathi (*Ficus asperrima*) and 'Neeale' (*Syzigium cumini*) were planted at 13.5 m x 13.5 m spacing in this research cum demonstration plot. The soil was moderately acidic, rich in available nitrogen, low in phosphorus and medium in potash.

Ten months old cardamom seedlings were planted in the centre of existing four coffee plants (*Coffea arabica* L. var. Kent) during 1982 at a spacing of 2.1 m x 2.1 m. In the following year coffee plants were removed to facilitate the growth of cardamom.

Input management and cultural operations

The High Production Technology (HPT) followed in the plantation consisted of overhead shade regulation to allow 60-65 per cent filtered sunlight; opening and filling of pits (45 cm x 45 cm x 30 cm) with forest top soil and organic wastes like coffee husk; planting 10 months old seedlings of cardamom (Malabar type); providing 12 rounds of summer irrigation from mid January to last week of May/June till the commencement of monsoons; application of fertilizers @ 120:120:240 kg N, P₂O₅ and K₂O/ha along with 375 kg neem cake in 4 splits at quarterly intervals; adequate plant protection measures viz. application of 5 rounds of insecticides and 2 rounds of Bordeaux mixture, 3 rounds of dusting with BHC 10% @ 12.5 kg ha⁻¹, 10 rounds of 'katte' disease tracing and removal of affected plants; regular schedule of after care viz. weeding, mulching, light earthing up, 3 rounds of trashing to facilitate better pest control, aeration and light infiltration, picking at right stage; drying and processing to retain green colour. Besides these cultural operations and input management, various other routine and need based operations were also carried out during the pre-bearing (establishment) and bearing (yielding) periods (Korikanthimath and Venugopal 1989). The data pertaining to various farm operations and inputs during pre-bearing and bearing periods (third year onwards) 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. The total cost towards various farm inputs was calculated based on the price prevailing during each year.

Economic analysis

Economic analysis was carried out as per the methodology suggested by Prafulla Das (1985). The actual price realised per kg of cardamom during each year was used for arriving at total gross return.

Results and Discussion

Pre-bearing period

Labour utilisation

In the first year, 272 labourers ha⁻¹ were required for planting and establishment of cardamom of which, the requirement of men was higher (172 ha⁻¹) when compared to that of women (100 ha⁻¹) due to strenuous operations like land clearing, shade regulation, pitting, planting etc which is in line with Korikanthimath *et al.*, (1989). During the second year, out of total labour requirement of 162 ha⁻¹, men constituted only 35 number (21.6 per cent) as against 127 (78.4 per cent) of women labour. Out of a total of 434 labour days ha⁻¹ required during pre-bearing period (first and second years), the requirement of woman labour was higher i.e., 227 (52.3 per cent) when compared to that of men i.e., 207 (47.7 per cent). This is on par with the requirement of labour for coffee (in arabica and robusta) during the first and second years of establishment (C.C.R.S., 1985).

The total labour cost during the first and second year of establishment period was Rs.3146.50 ha⁻¹. The per cent share of expenditure was highest for pitting and planting (25.5 per cent) followed by weeding (20.73 per cent) and plant protection measures (17.07 per cent) (Table 1).

Input requirement

A total cost of Rs.16,044 ha⁻¹ for various inputs during the first and second year, Rs.6490.85 (40.46 per cent) was incurred towards fertilizers which is followed by labour Rs.5748.19 (35.83 per cent) including the total labour wages and salary of supervisory staff (Table 2). The yield of cardamom depends on the formation of adequate number of tillers and storage of source (Photosynthates) in the rhizomes. Hence, the first 10 months care is very important and it is imperative to follow the appropriate cultural operations methodically as opined by Korikanthimath (1992).

Bearing period

Yield

A maiden satisfactory yield of 290 kg ha⁻¹ (dry) cardamom was obtained during the third year (1983-84). An all time highest yield of 1625 kg ha⁻¹ (dry) was recorded during the fourth year (1984-85) which is one of the world records (Table 3). On an average, for ten crop seasons (1983-84 to 1992-93) 662.72 kg ha⁻¹ (dry) cardamom yield was noticed which is nearly five times more than the India's average yield of 140 kg ha⁻¹ as stated by Korikanthimath *et al* (1989). The general trend in the cardamom yield is that a highest yield would be noticed in the third or fourth year after planting as affirmed by Korikanthimath *et al* (1989). Similarly, a peak

Table 5. Wages paid (per ha/year) for production of cardamom (Bearing period)

Crop/year	No. of labourers	Actual daily wages (Rs.)	Benefits other than actual	Total (Rs.)
1 Crop (1983-84)	471	4,003.50	2,522.20	6,525.70
2 Crop (1984-85)	1398	12,931.50	8,146.85	21,078.35
3 Crop (1985-86)	547	6,509.30	4,100.85	10,610.15
4 Crop (1986-87)	799	10,786.50	6,795.50	17,582.00
5 Crop (1987-88)	847	12,747.35	8,030.33	20,778.18
6 Crop (1988-89)	562	9,554.00	6,019.02	15,573.02
7 Crop (1989-90)	763	12,971.00	8,171.73	21,142.73
8 Crop (1990-91)	578	10,982.00	6,918.66	17,900.66
9 Crop (1991-92)	762	17,388.84	10,954.97	28,343.81
10 Crop (1992-93)	569	14,600.54	9,198.33	23,798.87
Total	7296	1,12,474.53	70,858.94	1,83,333.47
Average	729.6	11,247.45		

Note: Wages paid includes actual wages + other benefits. Other benefits, Bonus 20%, Provident and pension fund 10%, Earned leave 5%, Gratuity 4%, Sickness and Medical expenses 6%, Workmen's compensation (insurance and other welfare schemes) 5%, Housing, fuel and subsidised food grains 13%

Table 6. Partitioning of total input requirement during bearing (yielding) period of cardamom (average of 10 crop season 1983-84 to 1992-93)

Input	Amount (Rs.)	Percentage of expenditure (%)
Fertilizers	4,546.52	12.40
Pesticides	3,472.26	9.47
Fuel (diesel) for irrigation pumpset	856.46	2.34
Labour: Total labour wages (actual daily wages + 63% other benefits)	18,333.35	50.00
Total salary of supervisory staff (Salary + 63% other benefits)	1,937.16	5.28
Maintenance of jeep, trailer, drying kiln, irrigation pump, sprayers etc.	2,010.81	5.48
Depreciation on irrigation pump sets, sprayers and other farm accessories as accepted by AITO	5,514.66	15.03
Total	36,671.22	100.00

yield was recorded during the second crop season (fourth year after planting) which declined drastically by 25 per cent during the following year. One of the reasons for attaining the low yield preceding highest yield may be due to the fact that cardamom is a rhizomatous crop and most of the vegetative buds would have expressed their full potentiality due to conversion of majority (68%) of suckers into bearing suckers in a particular year during

which the highest yield was obtained. Since, the suckers which would have already undergone production decay during the following season by giving rise to sister/daughter suckers and hence the yield drastically comes down subsequently. As there existed a general decline in the yield after 10 crop seasons, it would be worthwhile to resort for regular planting at least in 1/4 th of total area every year so that a better crop

Table 7. Economics of cultivation of cardamom

Expenditure>Returns	Amount/ha (Rs.)
Investment - establishment	16,044.04
Compound interest on investment @ 14%	4,896.39
Total investment	20,940.43
Annuity value @ 14%	3,698.42
Total cost per year	40,369.64
Average production per ha (662.12 kg dry capsules)	1,49,381.77
Net returns	1,09,012.13
Cost of production /kg dry cardamom	60.97

Values are average for 10 crop seasons (1983-84 to 1992-93)

average yield could be obtained over a longer period. Regular replanting after picking 5-6 crops is a common phenomenon in Guatemala whose national average yields are par excellence to India.

Labour utilisation pattern

For carrying out various cultural operations, an average of 729.59 labour days ha⁻¹ was required during ten crop seasons (1983-84 to 1992-93). The requirement of women labour was greater (64.08 per cent) when compared to that of men (35.92 per cent). A similar feature was noticed in coffee based black pepper cropping systems also which was revealed by Korikanthimath and Peter, 1992. A major share of 55.56 per cent of labour utilisation was observed for harvesting followed by trashing (11.01 per cent) and for plant protection (7.84 per cent) (Table 4).

Since harvesting is a skilled and specialised job, it is normally done better by women labourers. It involves picking of mature (ripened), physiologically mature (*karikai*) fruits from panicles. Normally 6-7 rounds of picking is done in a crop season. Delayed harvesting results in splitting up of capsules and damage by rodents and birds. Korikanthimath and Naidu (1986) viewed that the percentage of recovery was 29 when harvested at ripened stage and 24 at physiologically mature stage as against 14 at immature stage. Thus, it is better to pick cardamom capsules at a mature stage at an interval of 10-12 days to minimise splitting of capsules thereby to obtain high crop recovery and returns.

Partitioning of input requirement

Of the various inputs used, the labour cost accounted highest. On an average 729

Table 8. Financial feasibility measures (1984-85 to 1993-94)

Sl. No.	Particulars	Value
1.	Discounted returns @ 14% (Rs.)	7,94,702.90
2.	Discounted costs @ 14% (Rs.)	2,85,406.45
3.	Benefit Cost Ratio (BCR)	2.78
4.	Pay Back Period (Years)	2.15
5.	Internal Rate of Return (IRR)	121 %

labourers per ha. were required during bearing period. The requirement of labour was maximum during highest crop season (1984-85) to an extent of 1398/ha. The average labour wages paid per year for the cropping season was Rs.11,247.45 ha⁻¹. Other benefits paid in the form of bonus, provident fund accounted for 63 per cent of the actual wages paid was Rs.7,085.89 ha⁻¹ (average of 10 crop seasons). (Table 4 and Table 5). Out of Rs.36,711.22 ha⁻¹ per year incurred on an average for ten crop seasons (1983-84 to 1992-93), major expenditure was towards labour i.e. 18,333.35 (50 per cent) which included actual daily wages and other benefits.

Economic analysis

The total investment towards establishment was Rs.22,331.00 ha⁻¹ which includes Rs.16,044 ha⁻¹ in the form of actual investment and Rs.6,295.35 ha⁻¹ made towards compound interest on investment @ 14%. The annual maintenance cost during the bearing period was Rs.36,671.22 ha⁻¹ and total cost per year which includes annuity value of Rs.3698.41 (@ 14% of the maintenance cost to the maximum limit of 12 years of cardamom plantations was Rs.40,369.61/ha.

On an average 662.72 kg dry capsules/ha was obtained for the crop seasons 1983-84 to 1992-93 accounting to Rs.1,49,513.14/ha gross income. The cost of production of cardamom was Rs.60.92/kg. A net return of Rs.1,09,147.53/ha was obtained. The higher yields are known to bring down the cost of production in cardamom (Korikanthimath, *et al.* 1989). It was observed that about Rs.8.78 (BCR) is the profit margin obtained from every rupee invested as per discounting cash flow measures @ 14% with a discounted net returns of (NPW) of Rs.5,09,296.45 and ability

to get back the amount invested within 2.15 years (PBP). It also showed that about 121 per cent more of benefit (Rs.221) could be expected for every Rs.100 investments in the cardamom cultivation in the long term in comparison to the interest which the farmers could likely to get from the deposits in any of the financial institutions is represented by Internal Rate of Return (IRR) in Table 8.

Therefore, the study revealed that the long term cultivation of cardamom is highly remunerative and labour intensive. To obtain higher yields and income the farm operations and input management are to be monitored regularly at appropriate periods since sucker production and bearing period (initiation of panicles and development of capsules) is spread over a period of 8-9 months in a year (Korikanthimath, 1990a). In the recent years, an increased adoption of HPT in cardamom coupled with encouraging prices has not only brought more areas under its cultivation but also made a dent in existing coffee plantations as a mix crop.

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