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## **Trend Analysis in Area, Production, Productivity and Price Behaviour of Cardamom in Kerala**

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History reveals that India was known for her exotic spices<sup>1</sup> even 7000 years ago. The aroma and flavour of these spices attracted traders from the far corners of the world to India - the natural house of spices, because of her lush, green rain forests and rich loamy soil. The history of spices is a chequered one of lands discovered or destroyed, kingdoms built or brought down, wars won or lost, treaties made or flouted, favours sought or offered.

Spices may be defined as aromatic vegetable substances used for seasoning of foods. They consist of rhizomes, barks, leaves, fruits, seed and other parts of plants. These plants belong to different species and genera. Most of the spices of the world are produced in tropical Asian countries. India has been from ancient times regarded as the home of spices and the proper cultivation of spices in the country dates back to 500 BC.

They were also mentioned in *Susrutha*<sup>2</sup> writings going back to about this period (Purseglove, 1981). In spite of keen competition and erratic fluctuation in prices, India supplies to the western countries twenty-four spices<sup>3</sup> and enjoys monopoly in the export of cardamom. Thus this spice has a recognised place among the agricultural commodities produced in India since it has a significant role in the economy of the country. Spices are traditional items in the export basket of India. Cardamom is noted for its capacity to fetch larger export earnings with smaller export volumes. It is a foreign exchange earner for India in general and Kerala in particular.<sup>4</sup>

India is a vast country with varying agro-climatic conditions. There are distinct regions bestowed with tropical, sub-tropical, temperate climatic conditions. Soil types are different in different regions of the country. Such diverse conditions have facilitated India to grow almost all spices. During the last ten years, the international trade in spices has grown by nearly 4 per cent per annum in volume and 15 per cent in value. An estimated 50,000 tonnes of spices and herbs valued at 1500 million US dollars are now imported to various countries globally every year from different countries (UNCTAD, 1998). An impressive 20.47 per cent of this supply comes from India (Government of India, 1998-99). But the recent data shows that the share has declined to 7.5 per cent. Indian export of spice extracts has shown spectacular growth attaining over 50 per cent of the global market within a short span of time (UNCTAD, 1998).

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A number of spices grown in India are indigenous. Among them, cardamom is very important. Kerala, Karnataka and Tamil Nadu are the states growing cardamom. Among these states, Kerala shares 60 per cent of the area and production (Government of India, 2002). Cardamom is a traditional and important spice produced and exported from India. The percentage share of cardamom to the spices export during 1980-81 was 31.30. But since 1980-81 the share shows a declining trend, and during 2001-02 it was only 3.74 per cent (CMIE, 2002). From the above data it is clear that this major spice is facing serious threat in the world market from other competing countries. It is often stated that the cost of production of cardamom in India is relatively higher compared to that in other producing countries of the world mainly due to poor yield. Senility and poor genetic trait of the plants, poor crop management practices, pests and attacks of diseases, etc. are often cited as the major reasons for the low yield. In the export scenario, it is reported that cardamom is not price competitive. This situation warrants a thorough analysis of the 'trend growth of area, production, productivity, and price behaviour of cardamom' in Kerala. The present study addresses this task.

The important objectives of the study are: to study the trends in the area, production and productivity of cardamom in Kerala and to analyse the behaviour of prices and the mechanism of price transmission.

#### *Hypothesis*

Auction and wholesale prices of cardamom are determined by the export price.

#### *The Data Base*

Secondary data are used in the study. The available secondary data on area, production, yield, and prices are obtained from different sources such as the Spices Board, Ministry of Commerce, Government of India, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, Directorate of Economics and Statistics, Government of Kerala, Director General of Commercial Intelligence and Statistics, Government of India, F.A.O. Reports on Commodity Review and Outlook, etc. These data are mainly used to analyse the historical trends and to examine the price behaviour and price transmission models.

#### *Trend Analysis*

Cardamom<sup>5</sup> grows wild in the evergreen monsoon forests of the Western Ghats in Southern India. Up to 1800 AD. the world's supply came from these forests. Partial cleaning of the forests found way for some sort of cultivation. Later purposeful planting was done and now it has become one of the most valuable plantation crops of this area (Jos, 1981). The western Ghats are the original home of cardamom, the "Queen of Spices"- a tiny spice that attracts the consumer in the Orient as well as the Occident. Being a shade loving plant the trees are its permanent friends. In contrast to the cultivation of cardamom in forest environments, it is also cultivated under

artificially created shade. Shade conditions are the natural settings of the Western Ghats. This is practised in certain areas of Karnataka and Kerala where cardamom is grown as an inter crop in arecanut gardens where arecanut provides the necessary shade conditions required for the crop.

In India, Kerala has the monopoly of cardamom production. In Kerala, cardamom is mainly cultivated in the districts of Idukki, Wayanad and Palakkad. The detailed analysis of the trends in area, production and productivity of cardamom in Kerala are given in Table 1. The trends in area, production and productivity of cardamom in Kerala during the initial years, from 1970-71 to 1978-79, does not show any

TABLE 1. AREA, PRODUCTION AND PRODUCTIVITY OF CARDAMOM IN KERALA

Year	Area		Production		Productivity	
	Ha	Index of growth	Tonnes	Index of growth	Kg/ha.	Index of growth
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1970-71	55,190	100.00	2,130	100.00	38.59	100.00
1971-72	55,190	100.00	2,720	127.70	49.28	127.70
1972-73	55,190	100.00	1,700	79.81	30.80	79.81
1973-74	55,190	100.00	1,870	87.79	33.88	87.79
1974-75	55,190	100.00	2,050	96.24	37.14	96.24
1975-76	55,190	100.00	2,050	96.24	37.14	96.24
1976-77	55,190	100.00	1,480	69.48	26.82	69.50
1977-78	55,190	100.00	2,900	136.15	52.55	136.18
1978-79	55,190	100.00	2,900	136.15	52.55	136.18
1979-80	56,380	102.16	3,300	154.93	58.53	151.67
1980-81	56,380	102.16	3,100	145.54	54.98	142.47
1981-82	56,380	102.16	2,800	131.46	49.66	128.69
1982-83	56,380	102.16	1,900	89.20	33.70	87.33
1983-84	56,380	102.16	1,100	51.64	19.51	50.56
1984-85	61,000	110.53	2,850	133.80	46.72	121.07
1985-86	61,000	110.53	3,340	156.81	54.75	141.88
1986-87	61,000	110.53	2,500	117.37	40.98	106.19
1987-88	64,000	115.96	2,050	96.24	32.03	83.00
1988-89	64,000	115.96	2,820	132.39	44.06	114.17
1989-90	44,008	79.74	1,900	89.20	43.17	111.87
1990-91	43,826	79.41	3,450	161.97	78.72	203.99
1991-92	43,670	79.13	3,450	161.97	79.00	204.72
1992-93	43,388	78.62	2,570	120.66	59.23	153.49
1993-94	43,459	78.74	4,430	207.98	101.93	264.14
1994-95	44,237	80.15	4,720	221.60	106.69	276.47
1995-96	44,248	80.17	5,380	252.58	121.58	315.06
1996-97	41,268	74.77	4,550	213.62	110.25	285.70
1997-98	40,867	74.05	5,290	248.36	129.44	335.42
1998-99	41,449	75.10	4,990	234.27	120.39	311.97
1999-2000	41,491	75.18	6,585	309.15	158.71	411.27
2000-01	41,288	74.81	7,580	355.87	183.59	475.75
2001-02	41,336	74.90	8,380	393.43	202.72	525.32
2002-03	41,412	75.04	8,680	407.51	209.60	543.15

Source: Area: Up to 1988-89; Estimate based on reports received from State Government on Registration of Cardamom Estates. From 1989-90; Complete enumeration survey and subsequent updating using sample surveys by the Spices Board, Kochi.

Production: Estimate based on sample survey and market sales data.

increment. But from 1979-80 onwards it shows a marginal increase. During 1989-90 area under cardamom in Kerala decreased from 64,000 hectares in 1988-89 to 44,008 hectares. This decrease in area under cardamom poses great concern for the policy makers as well as economists. The “why” of this deceleration really throws light on the felling of trees, deterioration of cardamom hills, crop shifting, etc. The declining trend might have occurred earlier. But it was found out only during 1989-90 when the Spices Board conducted complete enumeration survey.

In order to have a clear picture of the long-term trends in area, production and productivity of cardamom in Kerala, semi-logarithmic growth equations are used and the summary results are presented in Table 2.

TABLE 2. ESTIMATED GROWTH EQUATIONS OF AREA, PRODUCTION AND PRODUCTIVITY OF CARDAMOM IN KERALA FOR THE PERIOD 1970-71 TO 2002-03

Characteristic (1)	Estimated growth equations (2)	R square (3)	Annual trend growth rate (per cent) (4)
Area	$\ln A_t = 4.1284 - 0.01216 * T$ (-6.4246)	0.5710	-1.216
Production	$\ln O_t = 2.7395 + 0.0414 * T$ (7.1854)	0.6248	4.142
Productivity	$\ln Y_t = 3.3295 + 0.05513 * T$ (3.9674)	0.3367	5.513

Note: Figures in parentheses represent ‘t’ values.  
\* Significant at 5 per cent probability level.

Table 2 clearly portrays that the area under cardamom registered a negative percentage annual trend growth rate, i.e., -1.216 that is statistically significant. The output grows at an average annual trend growth rate of 4.14 per cent and yield registered an average annual trend growth rate of 5.51 per cent.

*Test for Acceleration/Deceleration*

When we run Log-Quadratic Regression for area, production and productivity of cardamom in Kerala for the period 1970-71 to 2002-03, we have the following results. We run the function as

$$\ln (y) = A+Bt+Ct^2+e$$

The log quadratic results are presented in Table 3.

The results indicate that the value of  $r_1$  is also negative. It means that the rate of change in the reduction of area is declining over the study period. Since both the values of  $r_0$  and  $r_1$  are negative we can categorically establish that the area under cultivation of cardamom in Kerala shows deceleration. This really poses certain concrete problems, which demands a speedy action plan on the part of the Government as well as the Spices Board. As part of the survey, the researcher met several planters and gathered some valuable information regarding the deceleration in area under cardamom cultivation. This information will be an eye opener to the

TABLE 3. LOG QUADRATIC REGRESSION RESULTS FOR AREA, PRODUCTION AND PRODUCTIVITY OF CARDAMOM

Variable (1)	Coefficient (2)	S.E. (3)	T-statistic (4)
AREA			
Constant	4.12847		
T	-0.01216*	0.001893	-6.42467
T <sup>2</sup>	-0.00038*	0.000047	-7.92632
R square	0.66962		
PRODUCTION			
Constant	2.73951		
T	0.041423*	0.005765	7.18541
T <sup>2</sup>	0.001276*	0.000014	9.11128
R square	0.728107		
PRODUCTIVITY			
Constant	3.329512		
T	0.055125*	0.018941	3.967414
T <sup>2</sup>	0.001582*	0.000395	4.001796
R square	0.340621		

Source: Same as Table 1.

Note: \*Significant at 5 per cent probability level.

concrete solutions for the problems. There is unauthorised felling of trees from the cardamom hills. As we have mentioned earlier cardamom grows wild in the evergreen forests. The greenery and shade trees have been disappearing from the hills. Secondly, the small and marginal farmers have already quit the production scene due to huge losses. Marketing of the product for small farmers is becoming a real problem. Auction centres are a luxury to the small and marginal farmers. They are not getting a profitable price for their product. Thirdly, as a result of the hike in the wage rate and the shortage of labourers at the time of picking, the farmers have to bear huge losses. So they are shifting to coffee, arecanut, pepper and as the last resort to vanilla. And finally, certain big planters complained about the merciless approach of the government regarding sales tax collection. Since large-scale plantations are running at a loss, they are either looking after the plants without much care or earmark a very small fertile area in a selective way.

During the analysis period from 1970 - 71 to 2002 - 03, the area under cardamom shows a negative growth trend since the values of both  $r_0$  and  $r_1$  are negative. In the case of cardamom, the area has been decreasing at a diminishing rate. This means that though the area under cardamom is decreasing over the period, the rate of decrease has declined gradually throughout the period of analysis. And the production of cardamom has been increasing at an increasing rate. It means that the production of cardamom has an accelerating trend. Same as production, the productivity of cardamom has also shown an upward trend. The simultaneous trend movement of these variables collaborates with the actual data. Since the production

accelerates at an increasing rate along with the deceleration in the growth trend of area, the productivity has to accelerate.

It is clear from the above analysis that the average annual trend growth rate for area is negative and the log quadratic regression result is also negative which indicates deceleration in the area under cultivation of cardamom. But there is a possibility for revival since the rate of change in the trend growth rate for area has shown a declining trend. The other two variables, production and productivity show an accelerating trend. These variables are accelerating from a positive growth trend. Since cardamom is an export oriented product, the Spices Board and the Government should introduce target-oriented schemes to renovate the cardamom hills and solve the problems, which emerge at the time of cultivation as well as marketing.

*Price Behaviour*

*Trends in Auction, Wholesale and Export Prices of Cardamom*

It is clear from the Table presented in Appendix that auction, wholesale and export prices have shown an upward trend. The values of annual trend growth rate of auction, wholesale and export prices are 2.98, 2.87 and 2.88 per cent respectively. These three prices are moving almost in the same manner. And it is a clear indication of market efficiency. For detailed data see Appendix. The log linear growth equations are presented in Table 4.

TABLE 4. ESTIMATED GROWTH EQUATIONS OF AUCTION, WHOLESALE & EXPORT PRICES OF CARDAMOM FROM 1970-71 TO 2000-2001

Characteristic	Estimated growth equation	R square	Annual trend growth rate (per cent)
(1)	(2)	(3)	(4)
Auction price	$\ln Pa_t = 1.79535 + 0.029891 * T$ (5.059)	0.4688	2.99
Wholesale price	$\ln Pw_t = 1.85018 + 0.02871 * T$ (10.31988)	0.7859	2.87
Export price	$\ln Pe_t = 1.7992 + 0.028856 * T$ (10.1647)	0.78083	2.88

Source: Figures in parentheses represent 't' values.  
\* Significant at 5 per cent probability level.

*Price Transmission*

The behaviour of commodity prices may be such that either the auction price determines the prices at the wholesale or retail level or the auction price is influenced by the wholesale and retail prices. Cardamom being an export oriented commodity, we hypothesise that auction and wholesale prices of cardamom are determined by the export price. To test this hypothesis linear regression models of the following forms are estimated for the data relating to cardamom price from 1970-71 to 2000-2001.

$$P_a = \alpha_1 + \beta_1 P_e + U_1 \quad \dots (1)$$

$$P_w = \alpha_2 + \beta_2 P_e + U_2 \quad \dots (2)$$

$$P_a = \alpha_3 + \beta_3 P_w + U_3 \quad \dots (3)$$

where,  $P_a$  = auction price,  $P_w$  = wholesale price and  $P_e$  = export price.

$U_1$ ,  $U_2$ , and  $U_3$  are error terms with usual econometric assumptions. The summary results of the regression analysis are presented in Table 5.

TABLE 5. ESTIMATED PRICE TRANSMISSION MODEL

Model No: (1)	Estimated equation (2)	R square (3)
1.	$P_a = -10.2049 + 1.0366 * P_e$ (16.33)	0.9019
2.	$P_w = 17.47165 + 1.085 * P_e$ (8.6937)	0.8936
3.	$P_a = 4.62219 + 0.87147 * P_w$ (9.7083)	0.7647

Note: Figures in parentheses represent 't' values.

\* Significant at 5 per cent probability level.

To test the efficiency of price transmission the null hypotheses formulated are:

$$H_0 : \beta_1 = 1, H_0 : \beta_2 = 1, H_0 : \beta_3 = 1$$

If the null hypotheses are not rejected (i.e., the slope coefficients are not significantly different from unity) the commodity market is relatively efficient in transmitting price change from one market to the other. The summary results presented in Table 5 provide enough evidence to accept all the three null hypotheses. Therefore, cardamom marketing appears to be efficient in transmitting price information from one market level to another. The first model shows that a change by a rupee in export price leads to 1.03 rupee change in the auction price. The second model shows that a change by a rupee in export price is estimated to have given rise to 1.08 rupee change in wholesale price. And the third model explains that a change by a rupee in wholesale price is estimated to have risen 0.8714 rupee change in auction price.

#### CONCLUSION AND POLICY SUGGESTIONS

The analysis employed in this paper clearly portrays the real picture of the growth of cardamom economy in Kerala since 1970. Both log linear and log quadratic functions were tested for acceleration and deceleration of cardamom in terms of area, production and productivity. The summary results exhibit an emerging trend, which demands certain concrete solutions. The percentage annual trend growth rate of area, production and productivity of cardamom are -1.216, 4.14 and 5.512 respectively.

The negative trend growth rate of area under the cultivation of cardamom leads to certain concrete conclusions.

There is massive crop shifting. The small and marginal farmers have already quit the cultivation and opted for more competitive and remunerative crops like vanilla. If the process is continued the cardamom hills will disappear in the near future. The Government and the Spices Board should ensure that the cardamom estates which are formed after registration under CRC (Cardamom Registration Certificate) are growing only cardamom. For this, proper monitoring as well as ample financial support is to be extended. It is observed that the massive shifting of cardamom to other crops is mainly due to recurrent fluctuation in prices. To get a stable price for the product, export and the internal consumption are to be improved significantly. India is facing cut-throat competition in the international market from Guatemala. Hence our product should be price as well as quality competitive.

It is imperative to launch a thorough investigation into the reasons behind the deceleration in area under the cultivation of this spice. Concrete action plan on the part of the Government and the Spices Board is required to save the cardamom hills, the treasure house of the 'queen of spices'. The study suggests the need for a rational price policy, which ensures stable prices to the cardamom growers. Such a price stabilisation can be effected without incurring any heavy cost to the Government exchequer by building a reserve fund through imposing levies on the surplus income when price rises beyond a ceiling level. The fund, thus generated, can be utilised to support the producers when prices fall below a floor level. The fixation of the ceiling and floor prices are to be based on economic considerations such as cost of production, a reasonable return on investment, the prices of competing crops, the general price level, etc.

It is observed that the hidden hand of environmental degradation is a grave danger especially on slopy terrain slowly strangling cardamom yields. The environmental degradation mainly due to deforestation has led to large-scale soil erosion and changes in micro-climates. Soil erosion has resulted in drastic decline in soil fertility and hence crop productivity. Similarly, changes in micro-climate manifested through distortions in the spread of rainfall have adversely affected the yield of cardamom, as rain is essential for the fruit setting. This calls for a watershed management approach for the sustainable development of the crop.

The main thrust of this paper is to explore the economic factors influencing cardamom cultivation in Kerala. Since the prices have played an important role in determining the decision-making of the cultivators/planters, a detailed analysis of the growth of prices and their likely impact on different segments were checked. It is found from the analysis that there are three types of prices prevailing in the cardamom marketing: they are auction, wholesale and export prices.

The results of the log linear growth equations show that auction, wholesale and export prices related to cardamom is positive and exhibit an upward trend. The average annual trend values of auction, wholesale and export prices are 2.94, 2.87



and 2.88 respectively. The results of the price transmission models related to cardamom prove that the markets are very efficient in transmitting even a minute price change. It is understood that the export price has a very significant role to determine the prices at auction and wholesale level. A rupee change in export price leads to 1.03 rupee change in auction price. A rupee change in export price leads to 1.08 rupee change in wholesale price. And a rupee change in wholesale price leads to 0.87 rupee change in auction price. A Spices Policy need to be formulated by the government for the benefit of the small and marginal growers of cardamom. The policy should aim at improving the production and productivity scenario and ease the marketing and export constraints of the vibrant cardamom economy. Measures also must be taken to improve the internal consumption of cardamom.

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#### NOTES

1. Spices are strongly flavoured or aromatic vegetable products usually dried and used for seasoning and preserving foodstuff. In general they consist of volatile and non-volatile oils, protein, fibre, starch, mineral water, tannins etc. The flavouring, preservative and antiseptic properties of certain spices are due to the presence of volatile oils. Spices play a very important part in the human dietary and although they are not classified as food because they contain little of nutritive value, they give an agreeable flavour and aroma to food and add greatly to the pleasure of eating. According to Rosengarton, when the aromatic or fragrant vegetable products used to flavour food or beverages is from plants of tropical origin, which is called a spice.

2. *Susrutha* was the pioneer in the field of *Ayurveda*. *Susrutha Samhitha* is an elaborate discourse on the system of Ayurveda treatment. It is understood that he has written the *Samhitha* even before 500 BC. There are enough references in the *Samhitha* about the queen of spices that was used for Ayurveda treatment in a scientific manner.

3. India was the largest producer and exporter of spices in the world. Our country exports twenty-four spices. They are pepper, cardamom small, cardamom large, chilli, ginger, turmeric, coriander, nutmeg, clove, cumin, celery, fennel, fenugreek, aniseed, bishopsweed (ajwancseed) dillseed, poppyseed, garlic, tamarind, cassia, tejpal, asafoetida, saffron and vanilla.

4. According to the 'Spices Export Review', during 1998-99 India earned a foreign exchange equivalent to 419.68 million US\$ from the export of 242,071 million tonnes of spices. A major chunk of this export is realised from Kerala.

5. There are two types of cardamom, viz., small cardamom and large cardamom. Kerala cultivates only small cardamom. The varieties grown are Malabar, Mysore and Vazhkka and selections, viz., Mudigere - 1 and PV - 1. Harvesting is done from August to February. Oil content varies from 5.5 to 10.5 per cent in the seed depending upon the variety.

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APPENDIX

TRENDS IN AUCTION, WHOLESALE AND EXPORT PRICES OF CARDAMOM

(Rs./kg)

Year (1)	Auction price (2)	Wholesale price (3)	Export price (4)
1970-71	52.23	89.16	65.78
1971-72	30.33	48.41	37.40
1972-73	54.93	47.40	49.47
1973-74	60.54	68.50	63.72
1974-75	76.93	92.90	81.94
1975-76	89.47	94.41	99.86
1976-77	164.20	138.33	157.13
1977-78	142.55	163.66	175.30
1978-79	178.71	194.00	202.90
1979-80	141.98	194.08	184.21
1980-81	108.55	191.66	148.20
1981-82	120.76	145.00	129.88
1982-83	158.29	185.45	158.61
1983-84	379.42	276.81	210.94
1984-85	202.79	397.85	271.95
1985-86	142.44	198.50	163.39
1986-87	116.82	172.91	127.82
1987-88	141.68	158.33	125.94
1988-89	134.19	173.33	131.84
1989-90	266.43	222.50	181.57
1990-91	252.90	357.00	271.65
1991-92	278.96	290.00	286.29
1992-93	500.31	267.25	395.04
1993-94	343.48	546.67	375.93
1994-95	254.45	356.67	296.74
1995-96	207.27	286.66	246.10
1996-97	370.36	389.50	384.81
1997-98	276.44	312.06	342.37
1998-99	567.52	582.28	530.51
1999-2000	487.42	500.50	483.83
2000-01	569.81	580.08	548.09

Source: 1. For auction price and export price; *Spices Statistics*, Government of India (various issues).  
 2. For wholesale price; *Agricultural Prices in India*, Government of India (various issues).