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Economics of Growth and Instability of Green Cardamom in India: Kerala, Tamil Nadu and Karnataka

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ABSTRACT

Keywords

Compound annual growth rate, Cuddy-Della valle instability index, Coppock's instability index and instability index as deviation

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This study was focus on the growth rate and instability in area, production and productivity in India (Kerala, Tamil Nadu and Karnataka). The growth rate using Compound Annual Growth Rate (CAGR) and instability measured by Cuddy-Della Valle Instability Index (CDVII), Coppock's Instability Index (CII) and Instability Index as Deviation (IID) of the green cardamom were used for the study. The entire study period (1986-87 to 2017-18) is divided on the basis of World Trade Organization (WTO), pre-WTO regime (1986-87 to 1994-95) and post-WTO regime (1995-96 to 2017-18). Several fluctuations in the growth pattern of area, production and productivity of the green cardamom were observed in the study. Also, different pattern of instability were observed in the area, production and productivity of the crops over the period.

Introduction

The term spice is derived from the word 'species' which have taste, aroma, color and flavour and products used for garnishing, flavouring and seasoning of foods and for several industrial and medicinal purposes. Ancient civilizations did not distinguish between those spices and herbs used for flavouring from those used for medicinal purposes. When leaves, seeds, roots, or gums

had a pleasant taste or agreeable odor, it became in demand and gradually became a norm for that culture as a condiment. Cardamom is popularly known as the "Queen of Spices" or "Mother of Spices". The word "cardamom" comes from the same Latin word (cardamom). India had a virtual monopoly of green cardamom until recently. Green cardamom cultivation in India is confined to three states: Kerala, Karnataka and Tamil Nadu (Korikanthimath *et al.*, 2002). However,

now it is cultivated in Guatemala, Sri Lanka, Thailand, Laos, Nepal, Vietnam, Costa Rica, El Salvador, Mexico and Tanzania (Mehra, 2001). The spice board has achieved a massive development of green cardamom however the Kerala has made significant of area or quantities in the field of green cardamom compare to other states i.e. Karnataka and Tamil Nadu. In Kerala, it cultivated mainly in the Cardamom Hill Reserve (CHR) is within the Cardamom Hills, Idukki district. The Cardamom Hill was an administrative area under two revenue officers (Tahasildar) created by the royal proclamation of Kingdom of Travancore in April 1822 to promote cardamom cultivation and to give facilities and protection to cardamom farmers. The above statement is supported by *Manoj Kumar B (2017)*. One reason for the decline that can be identified is that green cardamom from Guatemala, although of an inferior quality, is being sold at a much cheaper price.

Materials and Methods

Growth rate analysis

In the present study, compound growth rate in area, production, and yield of green cardamom in the country as a whole were estimated by using the exponential growth function of the form,

$$Y_t = a * b^t$$

Where, Y_t = dependent variable for which growth rate is estimated,

a= intercept,

b = regression coefficient

t = time variable

The growth rate coefficient (b's) will be computed by transforming the equation in log form

$$\text{Log } Y_t = \text{Log } a + t \text{ Log } b$$

Thus compound growth rate (g) in % will be computed as

$$g = [(\text{antilog of } b - 1) * 100]$$

Significance of growth rate was judged by student's t- test.

Instability analysis

In this study the extent of area, production, and yield instability in green cardamom were examined. The instability in area, production and yield of green cardamom is measured in relative terms by the Cuddy-Della Valle index (CDVI) which is used in recent years by a number of researchers as a measure of variability in time series data. The simple coefficient of variation overestimates the level of instability in time-series data characterized by long term trends whereas the Cuddy-Della Valle index (CDVI) corrects the coefficient of variation. The coefficient of variation (CV) can be calculated by using the formula

$$CV = \frac{\sigma}{\bar{x}} * 100$$

Where,

σ = Standard deviation of variables concerned i.e. area/ production/ productivity and,

\bar{x} = Mean value of the variable.

The formula suggested by Cuddy & Della will be used to compute the index of instability.

$$\text{Index Instability (CV*)} = CV * (1 - R^2)^{0.5}$$

Coefficient of variation will be multiplied by the square root of the difference between the unity and coefficient of multiple determinations (R^2) in the cases where R^2 is significant. The extent of annual instability in prices of green cardamom was also measured using Coppock's Instability Index (CII), which is calculated as the antilog of the

square root of the logarithmic variance using the following formula (Coppock, 1962):

$$CII = (\text{Antilog} \sqrt{V \log - 1}) * 100$$

$$\text{Where, } V \log = \frac{1}{(N-1)} \sum (\log P_{t+1} - \log P_t - M)^2$$

$$M = \frac{1}{(N-1)} \sum (\log P_{t+1} - \log P_t)$$

N = Number of years

P = Price of green cardamom

M = Arithmetic mean of the differences between logs P_t and P_{t+1} , P_{t+2} etc.

V log = Logarithmic variance of the price series CII is a close approximation of the average year to year percentage variation adjusted for trend and the advantage of CII is that it measures the instability in relation to the trend in prices. A higher numerical value for the index represents greater instability.

Instability Index as deviation from exponential trend

The uniqueness of this method is that it assumes an exponential trend for the data and ignores the sign of the deviation of observed variables from the exponential trend. The instability index is estimated as:

$$\text{Instability Index} = \frac{1}{n} \sum_{t=1}^n \left[\frac{(|P_t - p_t|)}{p_t} \right] * 100$$

Where, $P_{(t)}$ is the observed magnitude of the observed variable

$p_{(t)}$ is the magnitude of the estimate obtained by fitting an exponential trend to the observed variable

n is the number of observations

The vertical bar indicates the absolute value (i.e., disregarding signs).

Results and Discussion

The spice board has achieved a massive development of green cardamom however the Kerala has made significant of area or quantities in the field of green cardamom compare to other states i.e. Karnataka and Tamil Nadu.

Compound annual growth rate for state-wise area, production and productivity of green cardamom in India (Table 1). Compound growth rate was used to analyse the percentage of growth in area, production and productivity in the three states of India i.e. Kerala, Tamil Nadu and Karnataka. And the whole period is divided into two sub-periods i.e. Pre-WTO (1986-87 to 1994-95) and Post-WTO (1995-96 to 2017-18).

The table 1 reveals that, during pre-WTO period the All India, compound annual growth rate of area of green cardamom was found to be negative and significant at 5 per cent level of significance. However, production and productivity found to be positive but not significant during 1986-87 to 2017-18. The positive growth in production and productivity of green cardamom can be seen Pre-WTO and Post-WTO periods. During the Pre-WTO (1986-87 to 1994-95) in Kerala, the area of green cardamom show the high negative growth rate i.e. (-) 5.24 per cent, while production and productivity under green cardamom shows positive (9.17 and 15.21 %) growth rate and both found to be insignificant, however the same situation was found in Tamil Nadu as the production and productivity under green cardamom shows positive (14.73 and 21.92 %) growth rate and both found to be significant at 5 per cent level of significance and in the state of Karnataka, a positive growth was analysed in area, production and productivity were observed (1.11, 6.36 and 5.19 per cent) and all found to be in significant.

Table.1 Compound annual growth rates in area, production and productivity in India (Kerala, Karnataka and Tamil Nadu) during 1986-87 to 2017-18

S.N	Particulars		Pre- WTO				Post-WTO				Overall period			
			KL	TN	KA	All-IN	KL	TN	KA	All-IN	KL	TN	KA	All-IN
1.	Area	R ²	0.60	0.68	0.67	0.50	0.52	-0.01	0.27	0.03	0.45	0.44	0.64	0.40
		Coefficient	0.0538	0.0607	0.0110	0.0316	0.0030	0.003	0.0051	0.0011	0.0094	0.0150	0.0095	0.0099
		P- Value	0.0084	0.0038	0.0038	0.0195	5.74E ⁻⁰⁵	0.4337	0.0059	0.6948	1.29E ⁻⁰⁵	1.9E ⁻⁰⁵	1.58E ⁻⁰⁸	5E ⁻⁰⁵
		Growth rate	-5.24 ^{NS}	-5.89 ^{NS}	1.11 ^{NS}	-3.11 ^{NS}	-0.30 ^{NS}	-0.30 ^{NS}	-0.51 ^{NS}	-0.11 ^{NS}	-0.94**	-1.49**	-0.95*	-0.99**
2.	Production	R ²	0.50	0.80	0.03	0.62	0.80	0.04	0.05	0.16	0.89	0.45	0.13	0.20
		Coefficient	0.0877	0.1374	0.0617	0.0848	0.0554	0.0124	0.0111	0.0823	0.0648	0.0312	0.0133	0.0557
		P- Value	0.0185	0.0005	0.0548	0.0070	4.73E ⁻⁰⁹	0.1592	0.1399	0.0302	9.66E ⁻¹⁷	1.2E ⁻⁰⁵	0.0214	0.0053
		Growth rate	9.17 ^{NS}	14.73**	6.36 ^{NS}	8.85 ^{NS}	5.69*	1.25*	-1.11 ^{NS}	8.58 ^{NS}	6.69*	3.17**	1.34 ^{NS}	5.73 ^{NS}
3.	Productivity	R ²	0.77	0.84	0.25	0.80	0.81	0.13	0.01	0.20	0.89	0.57	0.31	0.31
		Coefficient	0.1416	0.1982	0.0506	0.116	0.0584	0.0155	0.0059	0.0835	0.0742	0.0462	0.0228	0.0657
		P- Value	0.0011	0.0002	0.0936	0.0006	2.4E ⁻⁰⁹	0.0450	0.4368	0.0185	1.36E ⁻¹⁶	3.43E ⁻⁰⁷	0.0005	0.0005
		Growth rate	5.21 ^{NS}	21.92**	5.19 ^{NS}	12.35**	6.01*	1.56 ^{NS}	-0.59 ^{NS}	8.70 ^{NS}	7.71*	4.73*	2.31 ^{NS}	6.79 ^{NS}

Source: Author's Calculated

Note: * means significant at one per cent level, ** means significant at five per cent level

(KL = Kerala, TN = Tamil Nadu, KA = Karnataka, All-IN =All India and NS = Not significant)

Table.2 Instability in area, production and productivity of green cardamom in India (Kerala, Karnataka and Tamil Nadu)

S.N	Period	Particulars	Cuddy- Della Valle Index (%)			Coppock's Instability Index (%)			Instability Index as Deviation (%)		
			Are	Prod	Pty	Are	Prod	Pty	Are	Prod	Pty
i.	Pre-WTO	KL	1.06	2.84	5.77	5.38	16.48	15.04	8.58	16.75	15.74
ii.		KA	0.19	2.78	5.07	1.08	7.85	7.78	1.52	14.57	14.15
iii.		TN	1.25	2.96	5.59	5.21	8.88	9.68	8.11	13.57	18.72
i.	Post-WTO	KL	0.18	2.03	3.48	0.94	7.48	7.03	1.47	14.57	14.59
ii.		KA	0.53	3.36	5.79	2.42	14.11	13.84	3.33	15.87	16.03
iii.		TN	1.42	21.80	4.55	6.17	19.00	15.65	8.42	16.39	16.50
i.	All-over	KL	0.88	2.30	4.67	2.99	10.68	9.86	6.93	15.68	15.27
ii.		KA	0.63	3.93	7.77	0.59	12.65	12.40	4.89	23.31	25.18
iii.		TN	1.79	14.36	7.70	5.97	16.89	14.63	11.15	20.96	27.82

Source: Author's Calculated

Note: (Are = Area, Prod = Production and Pty = Productivity)

Fig.1 Show the trend of area, production and productivity of Kerala during the period (1986-87 to 2017-18)

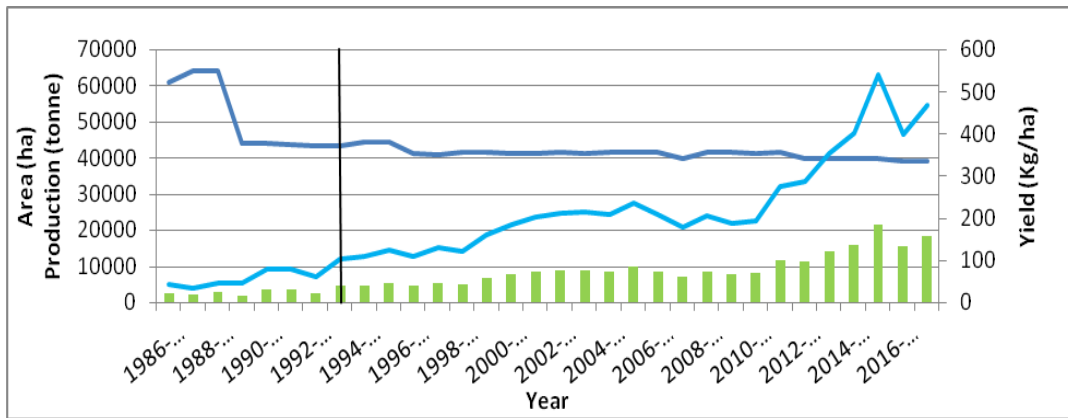


Fig.2 Show the trend of area, production and productivity of Karnataka during the period (1986-87 to 2017-18)

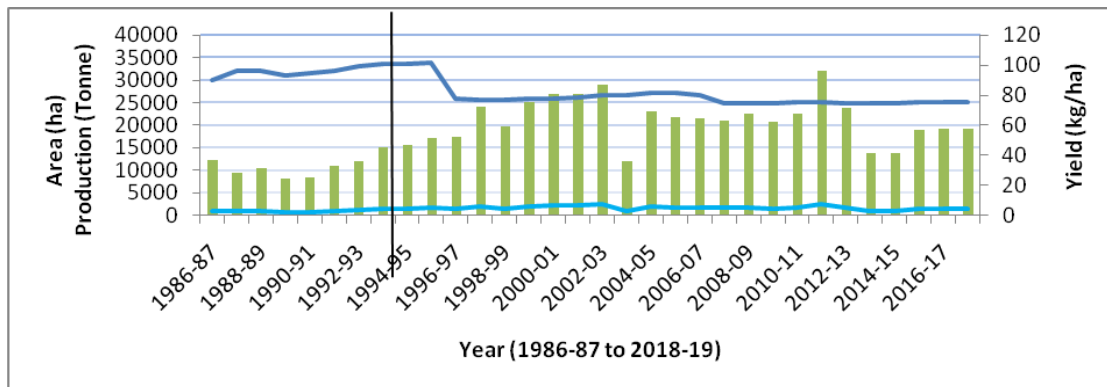
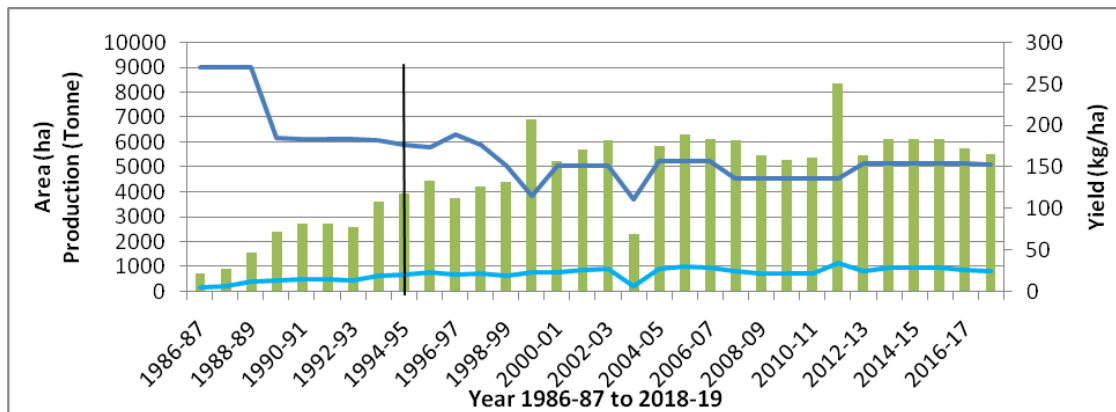


Fig.3 Show the trend of area, production and productivity of Tamil Nadu during the period (1986-87 to 2017-18)



During the Post-WTO (1995-96 to 2017-18), In All-India growth of green cardamom in production and productivity were found to be positive (8.58 and 8.70 per cent) and production is significant at 1 per cent level of significance while productivity was insignificant and area show the negative growth rate i.e. (-) 0.11 per cent. In overall period (1986-87 to 2017-18), the All-India growth of green cardamom in production and productivity were found to be positive (5.73 and 6.79 per cent) and which is considered to be insignificant but there has been a declining trend over the years, while the area also found negative (0.99 per cent) but gradually it is increasing at a positive pace and significant at 5 per cent level of significance. The compound growth analysis of production and productivity shows the highest and the significant growth was observed during pre-WTO followed by post-WTO and overall period and, this result was line with findings Sheikhwaheeda *et al.*, (2015). The statistics clearly indicated the reason for decrease in area under green cardamom in India. After post-WTO or due to existence of surging domestic demand, the green cardamom growers obtained an attractive value which boosts the growers to produce more and more high quality and quantity of green cardamom, similar findings Prakash Mokashi (2014). Figure.1, 2 and 3 shows the trend of area, production and productivity of Kerala, Karnataka and Tamil Nadu during the period (1986-87 to 2017-18).

In order to analyse the instability in area, production and productivity of green cardamom during the overall study period (1986-17 to 2017-18), which is sub-divided into pre-WTO period (1986-87 to 1994-95) and post-WTO period (1995-96 to 2017-18). Cuddy-Della Valle Instability Index (CDVII), Coppock's Instability Index (CII) and Instability Index as Deviation (IID) methods were used; the results are presented in table 2.

Pre-WTO period, CDVII, CII and IID with regards to the area of Kerala (1.06, 5.38 and 8.58 per cent), Karnataka (0.19, 1.08 and 1.52 per cent) and Tamil Nadu (1.25, 5.21 and 8.11 per cent). Karnataka is the lowest among the above three states of India. As regards to production, Kerala (2.78, 16.48 and 16.75 per cent), Karnataka (2.97, 7.85 and 14.57 per cent) and Tamil Nadu (2.96, 8.88 and 13.57 per cent), Karnataka recorded lowest instability indices estimated by CDVII, CII and IID which indicates least consistency in production of Karnataka during the pre-WTO period. The Karnataka (5.07, 7.85 and 14.15) had shown the lowest instability but it shown more stability in productivity in comparison of Kerala (5.77, 15.04 and 15.74) and Tamil Nadu (5.59, 9.68 and 18.72) and likewise they contributed same towards area and production fluctuation. During the post-WTO period the instability was recorded highest in Tamil Nadu in terms of area (1.42, 6.17 and 8.42 per cent for CDVII, CII and IID respectively) in relation to other states of India. Contrary to this, Kerala recorded lowest instability in area *i.e.* for CDVII (0.18 per cent), CII (0.94 per cent) and IID (1.47 per cent). It also recorded similar means lowest instability in post-WTO period variation for production and productivity *i.e.* Cuddy-DellaValle Instability Index (2.03 and 3.48 per cent), Coppock's instability index (7.48 and 7.03 per cent) and Instability Index as Deviation (14.57 and 14.59 per cent), respectively. During the overall study period, green cardamom area registered in Karnataka is (0.63, 0.59 and 4.89 per cent) and in Tamil Nadu (1.79, 5.97 and 11.15 per cent) instability which is higher when compared to the pre-WTO and post-WTO periods. Whereas, lowest instability in green cardamom area registered under Kerala (0.88, 2.99 and 6.93 per cent) during the overall (1986-87 to 2017-18) study period compare to pre-WTO period. It is well known that variability in area and production are interrelated, if other factor remain constant

than the growth in area gives the highest production but variation in productivity may be due to many reasons such as weather conditions, policy changes etc. Some other factor like price also brings the variation in production of green cardamom. In case of variability in area (0.88, 2.99 and 6.93 per cent), production (2.30, 10.68 and 15.68 per cent) and productivity (4.67, 9.86 and 15.27 per cent) of green cardamom in Kerala was found to be lowest compared to pre-WTO. The table 2 shows that, as the instability was found to be low in case of area, production and productivity under Kerala in the pre-WTO period compared to post-WTO period. The instability in production and productivity under Karnataka and Tamil Nadu were found to be highest in post-WTO (1995-96 to 2017-18).

In conclusion this study has analysed the growth rate using Compound Annual Growth Rate (CAGR) and instability measured by Cuddy-Della Valle Instability Index (CDVII), Coppock's Instability Index (CII) and Instability Index as Deviation (IID) of the green cardamom. During the Pre-WTO (1986-87 to 1994-95) the areas in Kerala of green cardamom show the high negative growth rate, while production and productivity under green cardamom shows positive growth. However the Tamil Nadu, the production and productivity under green cardamom shows positive growth rate. In Karnataka, a positive growth was analysed in area, production and productivity were observed. During the Post-WTO (1995-96 to 2017-18), In All-India growth of green cardamom in production and productivity were found to be positive while productivity was insignificant and area show the negative growth rate. In overall period (1986-87 to 2017-18), the All-India growth of green cardamom in production and productivity were found to be positive but there has been a declining trend over the years, while the area

also found negative but gradually it is increasing at a positive pace. During pre-WTO period, instability in area, production and productivity of Karnataka is the lowest among the above three states of India. During the post-WTO period the instability was recorded highest in Tamil Nadu in terms of area in relation to other states. Contrary to this, Kerala recorded lowest instability in area, production and productivity respectively. During the overall study period, green cardamom area registered in Karnataka and Tamil Nadu instability which is higher when compared to the pre-WTO and post-WTO periods. Lowest instability in green cardamom area registered under Kerala during the overall period (1986-87 to 2017-18). It is well known that variability in area and production are interrelated, if other factor remain constant than the growth in area gives the highest production but variation in productivity may be due to many reasons such as weather conditions, policy changes etc. Some other factor like price also brings the variation in production of green cardamom. The instability indices for most the area of green cardamom was found lowest, thereby indicating the low risk for cultivation in the district. Policies need to be focused to increase the yield of green cardamom. Latest or Morden methods of cultivation of green cardamom and Sustainable agriculture need to be carried out to increase the productivity.

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