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Growth rate, instability and trend analysis of area, production and productivity of turmeric in India

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Abstract

The present study was conducted to estimate the growth rate, instability and trend in area, production and productivity of turmeric in India from period 1950-51 to 2022-23. Statistical tools like compound annual growth rate and Cuddy-Della Valley Index were used to estimate the growth rates and instability, respectively. The study period 1950-51 to 2022-23 was further sub-divided into three sub-periods, viz., period I (1950-51 to 1989-90), period II (1990-91 to 2022-23) and overall period (1950-51 to 2022-23). The study revealed that the area under turmeric showed the highest positive and significant growth rate per annum during period – II and exhibited less instability in all the periods. Similarly, production and productivity of turmeric in India exhibited the highest positive and significant growth rate per annum during the overall period and exhibited less instability during period -II. The area under turmeric in India showed steady and increasing trend during the study period while production and productivity of turmeric in India exhibited increasing trend with fluctuations throughout the study period.

Keywords: Turmeric, compound annual growth rate, instability, cuddy-della valley index, trend, area, production and productivity

Introduction

India referred to as the “land of spices” owing to its production of different varieties of major spices in the world. The cultivation and trade of these spices have been integral to India's history and continue to be a vital part of its agricultural and economic landscape. Turmeric is one of the keystones of Indian spices widely used for flavouring and medicinal purposes. Turmeric is referred as the "Golden spice of life" and it is grown as a major commercial spice crop of the country since ancient times.

The global production of turmeric is around 11 lakh tonnes per annum with 5.6 lakh hectares area around the world. India dominates the world production scenario contributing 80 per cent followed by China (8%), Myanmar (4%), Nigeria (3%) and Bangladesh (3%). (Turmeric outlook, 2022, PJTSAU).

India is the largest producer, consumer and exporter of turmeric in the world. Indian turmeric is considered to be the best in the world market because of its high curcumin content. Asian countries consume much of their turmeric production. India has 323.00 thousand hectares under turmeric cultivation with a total production of 1161.00 thousand tonnes and productivity of 3.5 t/ha productivity (2022-23) (indiastat.com). The major states producing

turmeric in India are Telangana, Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Madhya Pradesh, West Bengal and Orissa.

Methodology

Growth rate analysis

To analyze the CAGR (Compound Annual Growth Rate), the exponential form of regression analysis was employed. To compute average compound growth rates of area, production and productivity, the following form of regression equation was used.

$$Y_t = ab^t e^u$$

Where,

Y_t = dependent variable (are /production/productivity)

a = intercept term

$b = (1+r)$ and ‘ r ’ is the compound growth rate

t = time trend

u = error term

The above model in the Logarithmic form is expressed as,

$$\log Y = \log a + t \log b + \log u$$

Log a and Log b values were obtained using the ordinary least squares procedures and the R^2 was computed for testing the goodness of fit. Antilog of $(\log(b-1)) \times 100$ give the per cent growth rate. Significance of the growth rate was tested using 't' test.

Co-efficient of variation

The coefficient of variation (CV) also known as relative standard deviation (RSD), is a standardized measure of dispersion of a probability distribution or frequency distribution. It is often expressed as a percentage, and is defined as the ratio of the standard deviation to the mean (average). It is a measure of relative variability.

CV = Co-efficient of variation = (Standard deviation/Mean) * 100

Compound annual growth rates: CAGR will be worked out using the formula

CAGR = [Antilog (log b - 1) * 100

Instability index

Cuddy-Della Valle Instability Index will be used to estimate the instability in export of turmeric data. This index is modification of coefficient of variation (CV) to accommodate for trend which is commonly present in time series economic data. It is superior over other scale dependent measure such as Standard Deviation or Root mean Square of the residuals (RMSE) obtained from the fitted trend lines of raw data and hence suitable for cross comparison. The Cuddy-Della Instability Index calculated as follows:

$$CDVI = C.V \sqrt{(1 - \bar{R})^2}$$

Where,

CV = Coefficient of variation

R^2 = coefficient of determination

Results and Discussion

Annual Compound growth rates and coefficient of variation in area, production and productivity of turmeric in India

Annual Compound growth rates and coefficient of variation in area, production and productivity of turmeric of India in before liberalization period (period-I), after liberalization (period-II) period and overall period were estimated and presented in Table 1.

Area: It is evident from Table 1 that, the annual compound growth rate of area under turmeric for period -I (before liberalization period) was found to be positive and significant at 1 per cent level which was 2.54 per cent, indicating that, the area under turmeric in India before liberalization was increased by 2.54 per cent annually. Similarly, in period- II, that is after liberalization period, the annual compound growth rate of turmeric area in India was positive and significant at 1 per cent level and which was found to be 2.66 per cent, indicating that, the growth rate of area under turmeric in India after liberalization was higher

than the growth rate before liberalization. Consequently, in the overall period, that is from 1950-51 to 2022-23, the area under turmeric in India was increased by 2.64 per cent annually which was positive and significant at 1 per cent level. The coefficient of variations in period – I and period II were 32.58 and 29.45 where as it was found to be higher (56.98) when it was estimated at overall period of study, which indicated that, the area under turmeric in India was observed to be vary during both the periods.

Production: It is observed from Table 1 that, the annual compound growth rate of production of turmeric in India for period-I, that is before liberalization period was found to be positive and significant at 1 per cent level, which was 2.64 per cent, indicating that, the production of turmeric in India before liberalization was increased by 2.64 per cent annually. Similarly, in period- II that is after liberalization period, the annual compound growth rate of turmeric production in India was positive and significant at 1 per cent level, which was 3.47 per cent, indicating that, the growth rate of turmeric production in India after liberalization was higher than the growth rate before liberalization. Consequently, in the overall period, that is from 1950-51 to 2022-23, the turmeric production in India was increased by 4.10 per cent annually which was positive and significant at 1 per cent level. The coefficient of variation in production of turmeric in India during period-I was estimated to be 50.49 and it was comparatively less (33.59) during period – II in India. However, the coefficient of variation in overall period was very much higher (80.97) than period -I and period – II, Indicated variation in turmeric production in India during the study period.

Table 1: Compound annual growth rates of area, production and productivity of turmeric in India

S. No.	Period	Mean	SD	R^2	CV	CAGR
Area						
1.	Period-I	72.85	23.73	0.82	32.58	2.54***
2.	Period-II	191.84	56.50	0.79	29.45	2.66***
3.	Overall period	126.64	72.16	0.95	56.98	2.64***
Production						
4.	Period-I	169.57	85.62	0.51	50.49	2.64***
5.	Period-II	811.81	272.73	0.16	33.59	3.47***
6.	Overall period	459.90	372.41	0.90	80.97	4.10***
Productivity						
7.	Period-I	2.28	0.48	0.004	21.28	0.04NS
8.	Period-II	4.19	0.72	0.81	17.20	0.79**
9.	Overall period	3.14	1.12	0.62	35.57	1.40***

(** 5% level of significance, ***1% level of significance, NS non-significant)

Period – I (1950-51 to 1989-90), Period – II (1990-91 to 2022-23), Overall period (1950-51 to 2022-23)

Productivity: It can be seen from Table 1 that, the annual compound growth rate of productivity of turmeric in India for period-I, that is before liberalization period was found to be positive, but non-significant. However, in period-II that is after liberalization period, the annual compound growth rate of turmeric productivity in India was positive and significant at 5 per cent level and which was 0.79 per cent, indicating that, the growth rate of turmeric productivity in India after liberalization was increased significantly. Consequently, in the overall period, that is from 1950-51 to

2022-23, the productivity of turmeric in India was increased by 1.40 per cent annually which was positive and significant at 1 per cent level. Similarly, the coefficient of variation in productivity in India was comparatively lower than the area and production of turmeric and it was found to be 21.28 during period – I, 17.20 during period – II and 35.57 during overall period, indicated that productivity of turmeric in India was comparatively more stable than area and production during the study period.

Instability indices of Area, production and productivity of turmeric in India

Instability indices were estimated for turmeric area, production and productivity of India for before liberalization period (period-I), after liberalization (period-II) period and overall period and the results are presented in Table 2.

Table 2: Instability indices of Area, production and productivity of turmeric in India

S. No.	Period	Area	Production	Productivity
1.	Period-I	13.63	35.56	21.51
2.	Period -II	13.40	14.73	14.95
3.	Overall period	12.42	25.76	21.81

Period – I (1950-51 to 1989-90), Period – II (1990-91 to 2022-23), Overall period (1950-51 to 2022-23)

Area: It is revealed from the Table 2 that, the instability indices with respect to area of turmeric during the period – I, that is before liberalization period was estimated to 13.63 per cent, indicating that, the area under turmeric in India before liberalization period was less instable. Whereas in period- II that is after liberalization period, Instability indices of turmeric area in India was estimated to 13.40 per cent indicating that, area under turmeric in India after liberalization was also less instable. Consequently, the instability indices of area of turmeric in India at the overall period, that is from 1950-51 to 2022-23, was found to be 12.42 per cent indicated that in all the study periods the area under turmeric in India remained less instable.

Production: The instability indices of turmeric production in India were worked out and it was found that, the instability indices during the period -I, that is before liberalization period was 35.56 per cent, indicating that, the production of turmeric in India during before liberalization was highly instable. Whereas in period- II that is after liberalization period, Instability indices of turmeric production in India was observed to be 14.73 per cent indicating that, production of turmeric in India after liberalization was less instable compared to before liberalization period. Consequently, the Instability indices of the overall period, that is from 1950-51 to 2022-23, for the production of turmeric in India was 25.76 per cent, making it moderately instable, indicating that production of turmeric in India was highly fluctuating during before liberalization period and less fluctuating in after liberalization period, in overall period and it was moderately fluctuating, that was attributed to instability in area under turmeric.

Productivity: From Table 2 it was found that, that, the

Instability of period-I, that is before liberalization period for turmeric productivity was 21.51 per cent, indicating that, the productivity of turmeric in India during before liberalization period was moderately instable. Similarly in period- II that is after liberalization period, the instability of turmeric productivity in India was 14.95 per cent indicating that, productivity of turmeric in India after liberalization was less instable compared to before liberalization period. Consequently, the instability of the overall period, that is from 1950-51 to 2022-23, for the productivity of turmeric in India was 21.89 per cent, indicating that productivity of turmeric in India was moderately fluctuating during before liberalization period and less fluctuating in after liberalization period, in overall period it was moderately fluctuating, which can be due to EXIM policies and government regulations.

Trend in area, production and productivity of turmeric in India

The trend in area, production and productivity of turmeric in India from the period of 1950-51 to 2022-23 were estimated and presented in the form of figures. Fig. 1, 2 and 3 represents the trends in area, production and productivity of turmeric in India, respectively.

Fig. 1 represents the trend in area under turmeric cultivation for the overall study period from 1950-51 to 2022-23. It is clear from the figure that during the initial period of study, area witnessed a steady increasing trend with minimum fluctuations and from 2016-17 the area under turmeric in India has increased steeply and reached the maximum in the year 2021-22. During the overall period, the area under turmeric has shown less fluctuations with a maximum area recorded in the year 2021-22 that was 333 thousand hectares and declined to 323 thousand hectares in 2022-23 (3rd Advanced estimates). The area under turmeric was consistently and steadily increasing over a period of time due to the increase in domestic and international demand. It is evident that the export of turmeric from India is also increasing mostly to Bangladesh, UAE, USA and other Islamic countries.

Fig. 2 represents the trend in the production of turmeric for the overall study period from 1950-51 to 2022-23. It is clear from the figure that during the initial period of study, from 1950-51 to 1976-77 the production of turmeric was constant with any increasing trend. from 1977-78 the turmeric production started increasing with medium fluctuations and reached the maximum in 2010-11. During the overall period, from 1950-51 to 1976-77, the production of turmeric has shown less fluctuations without any increase and after that from 1977-78 to 2022-23, turmeric production was fluctuating with maximum production in 2010-11 with 1237 thousand tonnes of turmeric production. It is evident from the figure that, after 1986-87, the production trend is increasing, but highly fluctuating even the growth trend of area was steadily increasing. The growth trend of production was coincided with area, due to fluctuations in productivity of turmeric. However, the probable reason might be due to climate variations during peak cultivation period of turmeric.

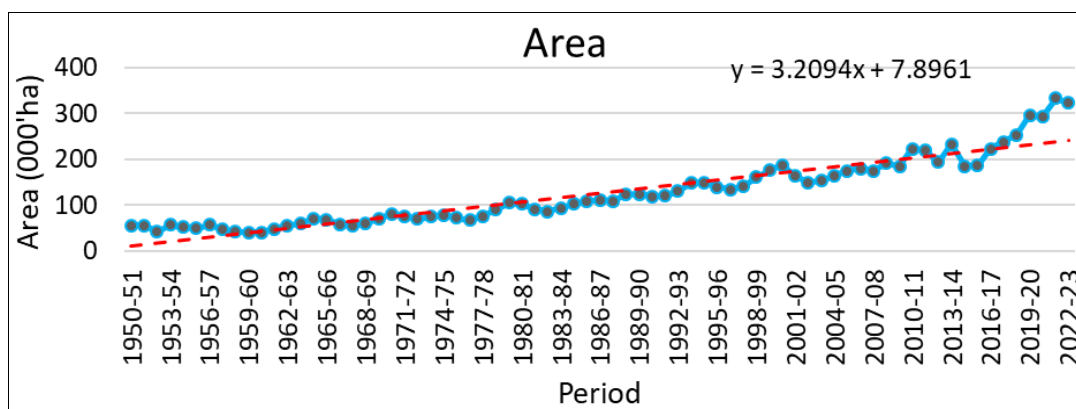


Fig 1: Trend in area under turmeric in India over 70 years (from 1950-51 to 2022-23)

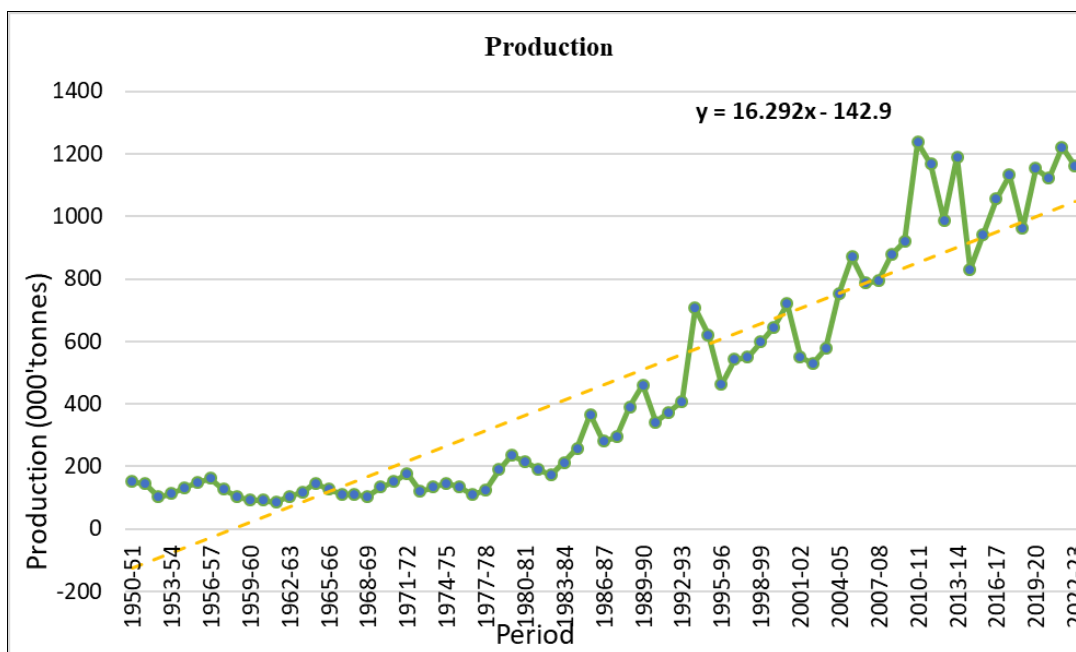


Fig 2: Trend in production of turmeric in India over 70 years (from 1950-51 to 2022-23)

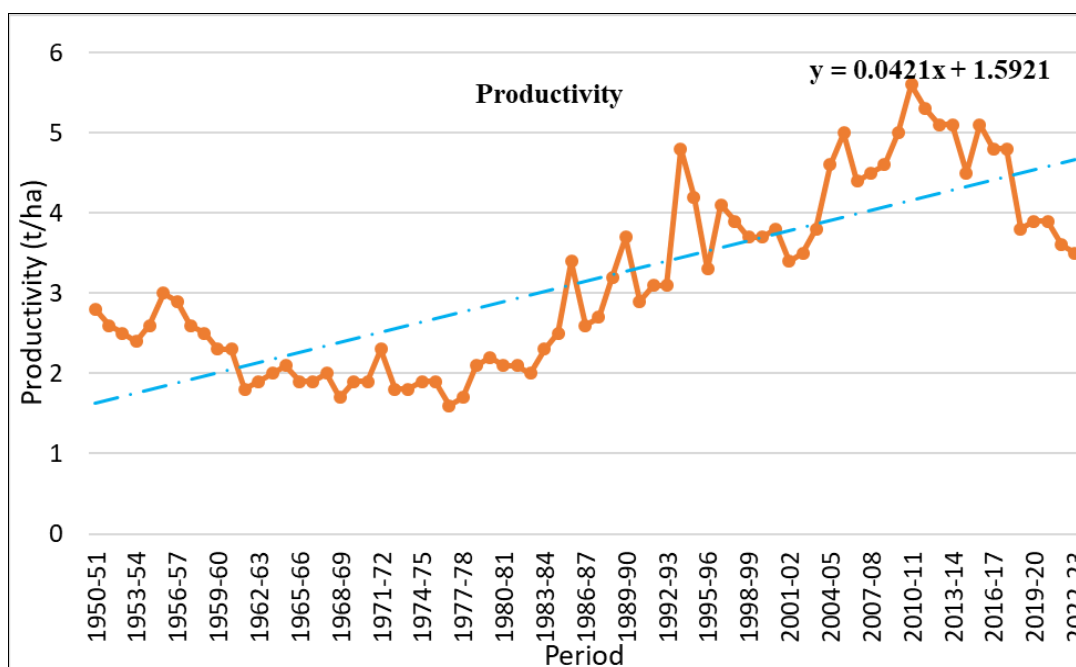


Fig 3: Trend in productivity of turmeric in India over 70 years (from 1950-51 to 2022-23)

Fig. 3 represents the trend in the productivity of turmeric for the overall study period from 1950-51 to 2022-23. It is clear from the figure that during the initial period, from 1950-51 to 1976-77 the productivity was showing a declining trend and from 1977-78 to 2010-11 the productivity was showing an increasing with fluctuation and reached the maximum productivity during 2010-11 with 5.6 tonnes per hectare. After reaching the maximum productivity of turmeric in 2010-11, there was a steep decline in the productivity from 2011-12 to the current year 2022-23. During the overall period, from 1950-51 to 1976-77, the productivity of turmeric has shown heavy fluctuations. Over a period of time, the productivity of turmeric in India was found unstable. There were many reasons for fluctuations in the productivity of turmeric. The major reasons might be climatic variations, varietal segregation, attack of pest and diseases, drought condition in many parts of the country.

Conclusion

Growth rate of area, production and productivity of turmeric in India have shown positive growth rates in period – I, period – II and in overall period. The area under turmeric showed the highest positive and significant growth rate during period – II that is 2.66 per cent per annum. Similarly, production and productivity of turmeric in India exhibited the highest positive and significant growth rates during the overall period that is 4.10 per cent per annum and 1.40 per cent per annum, respectively.

Instability indices of area, production and productivity of turmeric in India revealed that, the area under turmeric was found to be less instable in all the periods, while production of turmeric in India was found to be more instable during the period -I, less instable during period -II and moderately instable during the overall period. Similarly, the productivity of turmeric in India was found to be moderately instable during the period – I and over all period while less instable in the period – II.

The area under turmeric in India showed steady and increasing trend during the study period while production of turmeric in India exhibited increasing trend with moderate fluctuations and productivity of turmeric in India exhibited increasing trend with heavy fluctuations throughout the study period.

References

1. Abid S, Shah NS, Hassan A, Farooq A, Masood MA. Growth and trend in area, production and yield of major crops of Khyber Pakhtunkhwa, Pakistan. *Asian J Agric Rural Dev*. 2014;4(2):149-155.
2. Angles S, Hosamani SB. Instability in area, production and productivity of turmeric in selected South Indian states. *Madras Agric J*. 2005;92(4-6):271-278.
3. Angles S. Production and export of turmeric in South India – An economic analysis. Ph.D. (Agri) Thesis (unpublished). Dharwad: Department of Agricultural Economics, College of Agriculture, Dharwad University of Agricultural Sciences; c2001.
4. Bhowmick BC, Baishya AK, Mathews D. Importance of ginger as a spice crop and its growth performance in Assam. *Agric Situ India*. 2009;66(1):9-12.
5. Darvishi GA, Indira M. An analysis of changing pattern in area, production and productivity of coffee and tea in India. *Int J Mark Finan Serv Manag Res*. 2013;2(9):46-60.
6. Dhage VP. Export performance of turmeric in India. MSc (Agri) Thesis (unpublished). Parbhani: Vasanttrao Naik Marathwada Krishi Vidyapeeth; c2021.
7. Dhakre DS, Sharma A. Growth and instability of ginger production in North-East Region. *Agric Situ India*. 2009;66(8):463-466.
8. Jayesh T. Production and export performance of pepper and cardamom in South India – An economic analysis. MSc (Agri) Thesis. Dharwad: University of Agricultural Sciences; c2001.
9. Joshi D, Singh HP. An empirical analysis of growth and instability in major spices in India. *Int J Agril Sci*. 2015;7(2):440-444.
10. Krishndas M. Production and export performance of major Indian spices - An economic analysis. MSc (Agri) Thesis. Dharwad: University of Agricultural Sciences; c2010.
11. Kumawat RC, Meena PC. Growth and instability in area, production and yield of major spice crops in Rajasthan vis-à-vis India. *J Spices Aromatic Crops*. 2005;14(2):102-111.
12. Madan MS. Changing scenario of turmeric production and marketing. *Agric Situ India*. 2008;66(4):193-210.
13. Sayed YE, Jatinder S, Amit G. Production efficiency and marketing constraints of Basmati rice in Punjab: An economic analysis. *J Agric Dev Policy*. 2021;31(2):153-160.
14. Thumar VM, Gajipara HM, Khunt KA. Growth and instability in production and export marketing of garlic. *Indian J Agric Mark*. 2006;20(2):25-33.