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## Growth and instability of turmeric in Telangana

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**Abstract**

The study aimed to examine the growth and instability of turmeric in India, Telangana and erstwhile major turmeric growing districts of Telangana for the last 20 years from 2000-01 to 2019-20, in two different sub periods, period I (2000-2010) and period II (2011-2020). The growth rates were worked out by fitting the exponential growth function and instability analysis was carried out by using Cuddy Della Instability Index. The study observed high growth rate in turmeric area for India, Adilabad and Nizamabad districts of Telangana, during period II compared to period I and positive and significant growth rate for India, Telangana Adilabad and Nizamabad for whole period also. Growth rate of turmeric production witnessed high, positive & significant growth rate for India, Telangana, and major producing districts of Telangana during period I, compared to period II except for Adilabad. Productivity of turmeric also exhibited decreasing trends during period II for India, Telangana and Nizamabad district compared to period I except for Karimnagar and Adilabad districts. Adilabad district registered highest positive and significant growth rate of 3.17 percent compared to India, Telangana and other turmeric producing districts of Telangana for whole period. Instability analysis revealed higher level of instability in turmeric area and production during period II compared to period I for India, Telangana and also for major districts of Telangana. While instability in turmeric productivity found increased in Telangana state and Nizamabad district during period II and decreased instability in Adilabad and Karimnagar district during period II. Hazel decomposition analysis revealed that change in mean yield is the major source of variation in average turmeric production for both periods in India and period I in Telangana. Whereas, change in mean area found to be major source of variation in India & Telangana for the whole period. Variations in rainfall, prices, lack of mechanization for harvesting rhizomes, and increased cost of production are some of the factors affecting growth and instability of turmeric in India and Telangana. Growing of location specific varieties, adoption of new technologies can help in improving the growth and stabilising the turmeric area, production and instability in state of Telangana.

**Keywords:** Turmeric growth, Cuddy-Della instability index, compound growth rates

**1. Introduction**

India is popularly known as "Spice Bowl of the World" as wide variety of species with good quality are grown in India since ancient times (Angles *et al.*, 2011) [1]. Turmeric is also called "Indian saffron," as it is one of the most important commercial spice crop grown in India. It is an essential cooking ingredient in every kitchen as flavouring & colouring agent all over the world. Turmeric has been used in the drug and cosmetic industry as it contains anti-cancer, anti-viral, and anti-inflammatory properties. Turmeric powder was widely used during pandemic COVID times, to boost the immune system. Turmeric has a by-product, which is famous among every Indian house wife called as 'Kum-kum'. Oleoresin oil extracted from turmeric is often used as flavouring and colouring agent in a wide range of beverages and food products, and it has got wide acceptance among consumers. India is the largest producer and consumer of turmeric in the world and contributes around 80 percent of total world production. Among the spices, Turmeric ranks third in terms of exports, after chilli and cumin (jeera) from India. India exports 1.53 lakh tons of turmeric with a value of Rs. 31.47 Crores (2021-22) and the major importing countries of Indian turmeric are UAE (47 %) followed by Nepal (24 %), Oman (9 %) and Saudi Arabia (4 %). In India, Turmeric is being grown in 18 states in an area of 3.3 lakh ha with production of 12.21 lakh tonnes and its productivity is 3668kg/ha (2021-22). Among the major turmeric producing states, Telangana ranks second both in area & production with an area of 0.34 lakh ha (10.30%) and production of 2.16 lakh tonnes (17.70%) in 2021-22.

In Telangana, the major turmeric producing districts are Nizamabad, Nirmal and Jagtial It is observed that in India, area of turmeric has increased from 1.02 lakh ha (1980-81) to 3.3 lakh ha (2021-22) and production from 2.17 lakh tonnes (1980-81) to 12.21 lakh tonnes (2021-22). Similarly, in state of Telangana, the area has increased from 0.22 lakh ha (1980-81) to 0.34 lakh ha (2021-22) and production from 0.51 lakh tonnes to 2.16 lakh tonnes. In order to know the growth performance of turmeric, the present study has been undertaken.

With the objective

- 1) To analyze the trends in area, production and productivity of turmeric in India, Telangana and in major producing districts of Telangana.
- 2) To examine the instability in area, production and productivity of Turmeric in India, Telangana and in erstwhile major producing districts of Telangana and
- 3) To know the sources of change in average production of turmeric in India and Telangana.

## 2. Data and Methodology

The present study is based on the secondary data, collected for 20 years period from 2001 to 2020 from Directorate of Economics and Statistics, Telangana, Indiatat.com. The period was further, sub-divided into period I (2001-2010) and period-II (2011-2020) and for whole period i.e.2001-2020. The growth rates were worked out by fitting the exponential growth function. Instability analysis was carried out by generating Cuddy Della instability index.

### 2.1.1. Compound Annual Growth rate

To analyse trends in area, production and productivity of turmeric, exponential function was used as follows:

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

Log transformation of the above function is

$$\ln Y_t = \ln a + t (\ln b) + u$$

$$\ln b = \ln (1+r)$$

$$b = 1+r, r = b - 1 \text{ and } r = [\text{Antilog} (\ln b) - 1]$$

The compound growth rates were calculated by using the formula

$$\text{CGR} (\%) = r \times 100$$

Where,  $Y^t$  = area, production, productivity of turmeric,  $t$ = Time variable,  $a$  = Constant,  $u$  = error term,  $\ln b$  = Regression coefficient of time,  $r$  = CGR

The significance of these compound growth rates was tested at 1 percent, 5 percent and 10 percent level of significance by using student's t-test. If the calculated t-value was greater than table t-value then the growth rate was significant and vice versa.

**Table 2:** Growth rates in area, production and productivity of turmeric crop in India and major producing districts of Telangana.

Periods	Adilabad	Karimnagar	Nizamabad	Telangana	India
<b>Period-I (2000-01 to 2009-10)</b>					
<b>CAGR</b>					
Area (%)	-2.35*	1.99	-0.19	0.91	2.68***
Production (%)	-1.57	5.36	10.26*	5.33*	7.27***
Productivity (%)	0.80	3.31	10.38**	4.35*	4.53***
<b>Period-II (2010-11 to 2019-20)</b>					
Area (%)	4.13**	-1.67	3.69***	0.58	3.79*
Production (%)	6.44**	2.62	3.01	3.72	0.02
Productivity (%)	2.22	4.36**	-0.79	3.01	-3.55***
<b>Whole Period (2000-01 to 2019-20)</b>					
Area (%)	1.88***	-0.49	2.67***	0.59**	2.85***
Production (%)	5.11***	-0.13	1.21	1.08	3.64***
Productivity (%)	3.17***	0.36	-1.49	0.50	0.81

**Note:** \*\*\*Significant at one percent level of probability. \*\* Significant at five percent level of probability, and \*significant at ten percent level of probability.

### 2.1.2. Instability analysis

For calculating instability, Co-efficient of Variation (CV) can be used. 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 corrects the coefficient of variation. The coefficient of variation (CV) can be calculated by using the formula.

$$I_x = CV\sqrt{1 - R^2}$$

$I_x$  = Instability index,  $CV$ = Co-efficient of variation,  $R^2$ = Coefficient of multiple determination obtained from the time series.

### 2.1.3. Hazell's Decomposition analysis

The sources of growth and instability of turmeric production was assessed by Hazell's decomposition model (Hazell, 1982) [5]. The Hazell's decomposition procedure produces the four components of change in average production that indicates the sources of growth of turmeric production (Table 1). The first two terms, change in the mean yield and change in mean area are called as 'pure effects' which arise even if there were no other source of change. The third term is an interaction effect, which arises from the simultaneous occurrence of changes in mean yield and mean area. The fourth term in the equation represents interaction between area and yield covariance.

**Table 1:** Components of change in average production

S. No.	Sources of Change	Symbol	Component of change
1	Change in mean yield	$\Delta \bar{Y}$	$\bar{A} \Delta \bar{Y}$
2	Change in mean area	$\Delta \bar{A}$	$\bar{Y} \Delta \bar{A}$
3	Interaction between change in mean area and mean yield	$\Delta \bar{Y}, \Delta \bar{A}$	$\Delta \bar{Y}, \Delta \bar{A}$
4	Change in area – yield Covariance	$\Delta \text{Cov} (A, Y)$	$\Delta \text{Cov} (A, Y)$

## 3. Results and Discussion

### 3.1 Growth rates in area, production and productivity of turmeric crop

The growth performance of turmeric was assessed by calculating growth rates for area, production, and productivity for India, Telangana and major producing districts of Telangana. The growth rates were computed for two periods viz., period I (2000-01 to 2009-10) and period II (2010-11 to 2019-20) and also for whole period (2000-01 to 2019-20). The results are furnished in the Table 2 and Fig.1.

### 3.1.1. Growth rate in Turmeric area

It is observed that the growth rate of turmeric area in India found to be 2.68 percent during period I, 3.79 percent during period II and 2.85 percent for whole period. The growth rate was positive and significant for all the three periods and it is found higher in period II compared to period I. whereas, in state of Telangana, the annual growth rate of turmeric area found to be high (0.91 percent) during the period I as compared to the period II (0.58 percent) and registered 0.59 percent significant growth rate during whole period. Among major turmeric-producing districts of Telangana, growth rate of turmeric area found positive in Karimnagar district (1.99 percent) while negative in Adilabad (-2.35 percent) and Nizamabad districts (-0.19 percent) during period I while reverse trend was observed during Period II where Adilabad and Nizamabad exhibited positive and significant growth rate of 4.13 and 3.69 percent respectively, while Karimnagar exhibited negative growth rate of 1.67 percent. For whole period also, Adilabad and Nizamabad witnessed positive and significant growth rate of 1.88 and 2.67 percent respectively, while Karimnagar registered negative growth rate of 0.49 percent.

Thus inter period comparison revealed that, the growth rate of turmeric area found to be high during period II both at India level and in major turmeric producing districts of Telangana, namely Adilabad and Nizamabad. For whole period also, the growth rate was found positive and significant except in Karimnagar district, where negative growth rate was observed.

### 3.1.2. Growth rate in Turmeric production

In India, turmeric production witnessed significant positive growth rate of 7.27 percent per annum during period I, 0.02 percent during period II and 3.64 percent for overall period. In state of Telangana, growth rate of turmeric production was 5.33 percent and found positive and significant. While in period II and whole period, growth rate was 3.72 and 1.08 percent respectively and found decreasing compared to period I. Among the major turmeric producing districts, during period I, Nizamabad registered highest, positive and significant growth rate of 10.26 percent per annum followed by Karimnagar (5.36 percent) and Adilabad (-1.57 percent) The finding are in line with Revathi *et al* (2017).During

period II, Adilabad registered highest, positive and significant growth rate of 6.44 percent compared to Nizamabad (3.01 percent) and Karimnagar districts (2.62 percent). Similarly for overall period also Adilabad registered high positive and significant growth rate of 5.11 percent compared to other two districts.

Thus inter period comparison revealed high, positive& significant growth rate of turmeric production for India, Telangana, and Nizamabad district during period I and found decline during period II except for Adilabad where growth rate was found to be high during period II

### 3.1.3. Growth rate in Turmeric productivity

At all India level, the growth rate of turmeric productivity was found to be positive and significant with 4.53 percent during period I and later decreased (-3.55 percent) during period II and registered 0.81 percent for overall period. Similarly for Telangana state also, turmeric productivity which registered positive and significant growth rate of 4.35 percent during period I decreased to 3.01 percent during period II and registered 0.50 percent for overall period. Among the major producing districts of Telangana, Nizamabad exhibited positive and significant growth rate of 10.38 percent during period I and negative growth rate (-0.79 and -1.49 percent) during period II and overall period respectively. Whereas in Karimnagar growth rate was increased from 3.31 percent in period I to 4.36 percent during period II and for overall period it was observed to be 0.36 percent. Similarly in Adilabad, also the productivity has increased from 0.80 percent during period I to 2.22 percent in period II and for overall period positive and significant growth rate of 3.17 percent was observed.

Thus compared to period I, productivity of turmeric exhibited decreasing trends during period II for India, Telangana and Nizamabad district except Karimnagar and Adilabad districts where increasing trend was observed during period II. Moreover, Adilabad district registered highest positive and significant growth rate of 3.17 percent compared to India, Telangana and other turmeric producing districts of Telangana for overall period.

At all India level growth rate of turmeric area, production and productivity was found to be positive and significant during period I. Similar results were obtained by Joshi *et al* (2015)

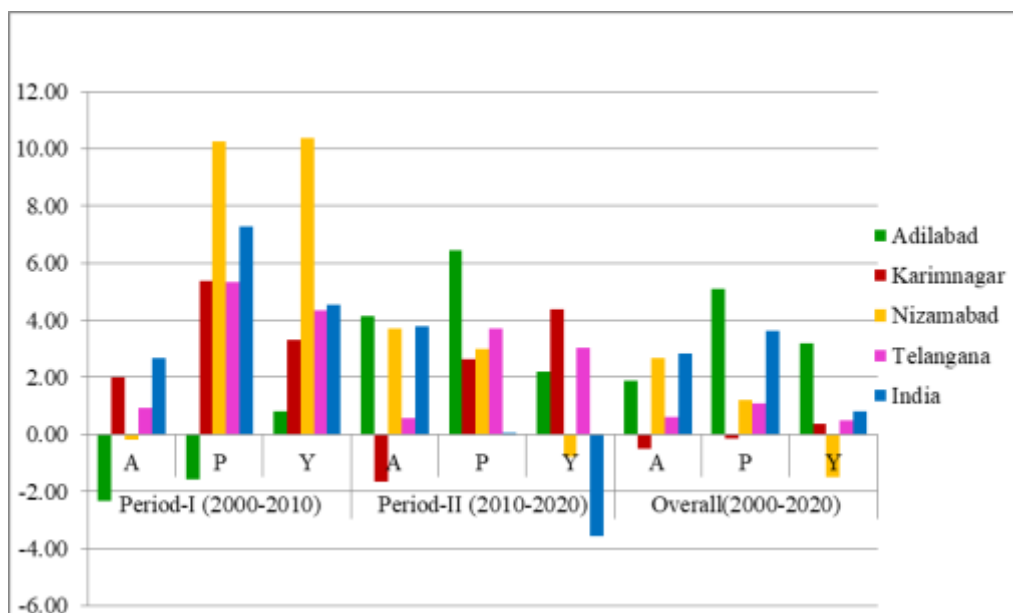


Fig 1: Growth rate in area (A), production (P) and yield (Y) of Turmeric in India & along with major producing districts of Telangana state.

### 3.2 Instability analysis of turmeric area, production and productivity of turmeric crop

The instability in turmeric area, production and productivity was assessed using Cuddy-Della instability index for two

decades viz., period I (2000-01 to 2009-10), period II (2010-11 to 2019-20) and for the whole period (2000-01 to 2019-20). Results are presented in Table 2.

**Table 3:** Instability in area, production and productivity of turmeric crop in India and erstwhile major producing districts of Telangana.

Periods	Adilabad	Karimnagar	Nizamabad	Telangana	India
<b>Period-I (2000-01 to 2009-10)</b>					
Area	7.41	15.14	7.79	8.08	4.37
Production	26.17	33.77	24.00	17.22	8.67
Productivity	25.73	35.63	23.75	14.23	8.21
<b>Period-II (2010-11 to 2019-20)</b>					
Area	12.48	18.86	6.52	8.83	12.10
Production	17.35	24.80	32.02	26.48	13.17
Productivity	16.70	12.97	32.89	20.89	7.48
<b>Overall Period (2000-01 to 2019-20)</b>					
Area	13.45	16.64	8.61	7.82	9.51
Production	22.78	30.59	29.94	23.21	15.06
Productivity	18.69	27.76	33.72	18.86	13.68

#### 3.2.1 Instability in area

Instability analysis in India revealed higher level of instability in turmeric area during period II (12.10 percent) compared to period I (4.37 percent) resulting in overall instability of 9.51 percent. While, in Telangana, instability in area found slightly higher during period-II (8.83 percent) than period-I (8.08 percent) with an overall instability of (7.82 percent) in the whole period. Similarly, among the major districts of Telangana, instability in area found increased during period II in Karimnagar (15.14% - 18.86%) and Adilabad district (7.41% - 12.48%) compared to Period I, while in Nizamabad, it was observed slightly lowered from 7.79 percent (period I) to 6.52 percent (period II).

Thus inter period comparison revealed higher level of instability in turmeric area during period II compared to period I

#### 3.2.2. Instability in production

Instability in turmeric production was high in period II (13.17 percent) compared to period I (8.67 percent) at all India level and for whole period it was observed to be 15.06 percent. Similarly in Telangana also production instability found to high in period II (26.48 percent) compared to period I. (14.23 percent) with 23.21 percent for whole period. Within the Telangana, Nizamabad witnessed highest instability (32.02 percent) in production in period II, while Karimnagar (24.08 percent) and Adilabad (17.35 percent) registered lesser production instability compared to period I. Thus overall

production instability was found to high in Karimnagar (30.59 percent) followed by Nizamabad (29.94 percent) and Adilabad (22.78 percent) respectively.

Thus inter period comparison revealed higher level of turmeric production instability in period II than the period I

#### 3.2.3. Instability in turmeric productivity

Instability in turmeric productivity found high during period II for Telangana (20.89 percent) and Nizamabad district (32.89 percent) while reverse was observed in other districts. For whole period, instability in productivity observed to be 13.68 percent and 18.86 percent for India& Telangana respectively, while among Telangana districts, it was found to be high in Nizamabad (33.72 percent) followed by Karimnagar (27.76 percent) and Adilabad (18.86 percent) districts.

Thus inter period comparison revealed increased turmeric productivity instability in Telangana state and Nizamabad district and decreased instability in Adilabad and Karimnagar districts during period II compared to period I.

### 3.3 Hazell’s Decomposition analysis

The percentage contribution of each components towards the change in average turmeric production during the period-I, period-II and for whole period was analysed by Hazell’s Decomposition for India& Telangana and the results are presented in Table.4.

**Table 4:** Components of change in average turmeric production in India.

Sources of change Description	Symbol	Components of Change (%)		
		Period-I	Period-II	Overall period
Change in mean yield	$\Delta\bar{Y}$	64.02	471.93	27.94
Change in mean area	$\Delta\bar{A}$	29.63	-509.13	67.84
Interaction between change in mean area and mean yield	$\Delta\bar{Y}, \Delta\bar{A}$	6.82	63.64	8.59
Change in yield and area covariance	$\Delta\text{Cov}(A, Y)$	-0.47	73.55	-4.38
Total		100	100	100

From Table.4, it is observed that among the different sources, the change in mean yield accounts for 64.02 percent variation in average turmeric production followed by change in mean area (29.63%), interaction between change in mean area and mean yield (6.82%) during period I. During period II also, variation in average turmeric production is mainly due to change in mean yield (471.93%), followed by change in yield

and covariance (73.55%) and interaction between change in mean area and mean yield (63.64%).whereas for overall period, change in mean area accounts for 67.84 percent variation in average production followed by change in mean yield (27.94%) interaction between change in mean area and mean yield (8.59%).

**Table 5:** Components of change in average turmeric production in Telangana.

Components of Change Description	Symbol	Components of Change (%)		
		Period-I	Period-II	Overall period
Change in mean yield	$\Delta\bar{Y}$	80.75	19.52	21.67
Change in mean area	$\Delta\bar{A}$	13.74	33.05	62.64
Interaction between change in mean area and mean yield	$\Delta\bar{Y}, \Delta\bar{A}$	3.07	0.23	0.90
Change in yield and area covariance	$\Delta\text{Cov}(A, Y)$	2.41	47.17	14.77
Total		100	100	100

The components that contribute for change in average turmeric production in Telangana during the period-I, period-II and for whole period was analysed and the results are presented in Table.5, it is observed that during period I, among the different sources, the change in mean yield accounts for 80.75 percent variation in average turmeric production followed by change in mean area (13.74%), interaction between change in mean area and mean yield (3.07%). While in period II, change in yield and area covariance accounts for 47.17 percent variation in average turmeric production followed by change in mean area (33.05%), change in mean yield (19.52%). whereas for overall period, change in mean area accounts for 62.64 percent variation in average production followed by change in mean yield (21.67%), change in yield and area covariance (14.77%).

Thus, change in mean yield is the major source of variation in turmeric production for India in both periods, while in Telangana change in mean yield in period I and change in yield and covariance in period II are the major sources of variation in turmeric production. For whole period, change in mean area was the major source of variation for both India and Telangana

#### 4. Summary and Conclusion

The analysis of the growth and instability of turmeric revealed high and significant growth rate of turmeric area for India, Adilabad and Nizamabad districts of Telangana, during period II and decline growth rate in production and productivity for India, Telangana, and Nizamabad district during period II compared to period I. Instability analysis revealed increased level of instability in turmeric area, production and productivity for India, Telangana and Nizamabad district during period II. Increased instability in area and decreased instability in production and productivity was observed in Adilabad and Karimnagar district during period II. Hazel decomposition analysis revealed that change in mean yield is the major source of variation in average turmeric production for both periods in India and period I in Telangana whereas change in mean area found to be major source of variation in India & Telangana for the whole period. Variations in rainfall, prices, lack of mechanization for harvesting rhizomes, and increased cost of production are some of the factors affecting growth and instability of turmeric in India and Telangana. Growing of location specific varieties, adoption of new technologies can help in improving the growth and stabilising the turmeric area, production and instability in state of Telangana.

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