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Compound growth rate of area, production and productivity of major Chilli growing Districts of Telangana

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Abstract

The present study entitled "estimate the compound growth rate of area, production and productivity of major chilli growing districts of Telangana before and after its creation was undertaken to calculate CGR of area, production and productivity of chilli. The study is based on secondary data with the objective of estimate the compound growth rate of area, production and productivity of chilli and testing the significance of the change in Area, Production, and Productivity of Chilli before and after its creation of Telangana State (2008-09 to 2018-19). The secondary data has collected the particulars of Area, Production and Productivity of chilli district wise. It was found that Before the Creation of Telangana (2008-09 to 2013-14) the Average mean of the area was found to be 81739 ha; average production is 270249.5 tonnes and the productivity is of 3315.83 kg/ha and correspondingly after the creation of Telangana (2014-15 to 2018-19), the Average mean of the area was found to be 87434.4 ha; average production is 330338.0 tonnes; and the productivity is of 3799.2 kg/ha. The testing and significance of the change in overall chilli before and after its formation of Telangana state from 2008-09 to 2018-19 in which the mean of area is 0.631; production is 1.496 and productivity is 1.372 were observed From the study of compound growth rate, it reveals that there was an increase in the area, production, productivity after the bifurcation of Telangana but it was not found to be significant.

Keywords: Area, chilli, compound growth rate, ordinary least squares (OLS) production, productivity

Introduction

Chilli is the prime commercial crop and a general spice cultivated all over the world. It is widely known as hot pepper, cayenne pepper, sweet pepper, bell pepper etc. It is scientifically called *Capsicum annum*, *Capsicum fruitences*. It comes from the "Solanaceae" family. The edible part of chilli is fruit. This fruit size differs in varieties. Few varieties of chillies are popularly recognized for its red colour because of the pigment 'capsanthin'. And few others varieties of chillies are familiar for their biting pungency due to capsaicin. In India, Chilli is one of the important commercial crops, almost all the states of India were cultivating the chillies. India is one among the world's largest producer, most of the consumption takes place within the country and it is the best exporter of chilli throughout the world after India China, Thailand, Ethiopia and Indonesia. The chillies of India are world-"Naga Jolokia" is a variety of chilli which is considered as world's Number one hottest chilli with the high level of pungency which is grown in Tezpur district of Assam state in India. And Indian chilli has a huge demand in aboard, the complete Area under the chilli in 2018-19 was 765330 ha and the production were 1605160 tonnes; productivity was 2097.34 kg/ha. And the present study was confined to Khammam district of Telangana state and the chilli area under Telangana is 82521 ha, production was 369020 tonnes and productivity was 4471 kg/ha. (*Directorate of Economics and Statistics, Government of Telangana; Indian Agristat*) before the bifurcation of Telangana, the Khammam district ranks number one in the production of chilli. And in this particular region maximum, Teja variety of red chilli was been cultivated. This variety is mainly known for the extraction of alkaloids and famous for the colour and sharp hot flavour, most of the produce was been exported and used in the medical industry. This crop was cultivated majorly Rabi and Kharif seasons. Khammam is the leading producer of chilli in the state. The importance of this crop in the state economy the present investigation will be carried out of chilli in Khammam district of Telangana with the following objectives:

Teja chilli is a fine variety of Guntur chilli. It is the one of the popular varieties of chilli in the world and most exported one in the country. It is widely grown in Khammam, Guntur and Warangal districts of India. The fruit skin of crushed Teja chilli is bright red and hot. It is

mainly grown under irrigated as well as rain-fed conditions. In which 90 per cent of the chilli variety grown in this study region is "TEJA". It is one of the hottest chillies in the country with a fiery red colour. It is commonly exported as dried chilli and powdered form. This variety produces massive yields when mature. Khammam district of Telangana state was selected purposively because It ranks 1st in the production of chilli To estimate the Compound growth rate of area, production and productivity of major chilli growing districts of Telangana before and after its creation.

Materials and Methods: Secondary data for this research paper has collected the particulars of Area, Production and Productivity of chilli district wise. The data was available from 2008-13 and due to the unavailability of the appropriate district-wise data from 2013-19 the analysis of compound growth rate was done for the total area, production, and productivity of Telangana. The source of the data was the Directorate of economics and statistics, Government of Telangana; Indian Agristat. The data was been collected for the Agricultural year 2019-2020.

Analysis of data

Compound growth rate: The secondary data about the area, production and productivity of chilli in major districts of Telangana during the period 2008 to 2013 (before the creation of Telangana state) and 2014 to 2019 (after the creation of Telangana state) was been analyzed with the help of statistical tools like percentage analysis, trend values by the method of least squares, compound growth rate, arithmetic mean, range, standard deviation and coefficient of variation.

Trend values: The trend values for the area, production and productivity of chilli was been computed by Ordinary Least Squares (OLS) method by applying the following formula:

$$Y_c = a + bx$$

Where,

Y_c = Trend values.

a = intercept of the trend line.

b = slope of the trend line.

Compound Growth Rate (CGR): By taking time as the independent variable and the area, production and productivity of the Chilli as the dependent variable, the compound growth rates were estimated by using the formula:

$$Y_t = a (1 + r)^t$$

Where,

Y_t = Dependent Variable like area, production and productivity of chilli in the year 't' for which growth rate is estimated.

a = Constant.

r = Rate of annual increment.

t = Time element which takes the value of 1, 2, 3, ..., n.

The above exponential equation can be expressed in terms of log forms as follows:

$$\text{Log } Y_t = \text{Log } a + t \text{Log } (1 + r)$$

$$\log Y_t = \log a + t \log b, \text{ where, } b = 1 + r.$$

By putting $\log Y_t = y$, $\log a = A$ and $\log b = B$, the model becomes linear between y and t , as

$$y = A + Bt,$$

Now, CGR per cent can be expressed as:

$$\text{CGR in per cent} = (\text{Antilog } b - 1) \times 100$$

To test the significance of the compound growth rate t-test has been used as follows:

$$t = r/S.E (r) \text{ with } (n - 2) \text{ degrees of freedom}$$

Where

$$S.E (r) = 100 \times b \times S.E. (\log b) / 0.4343$$

r = CGR per cent; n = number of years

Testing the equality of two means

Let \bar{x} and \bar{y} be the sample means based on sample sizes n_1 (number of years taken before creation of Telangana) and n_2 (number of years taken after creation of Telangana). Let s_1^2 and s_2^2 be the estimates of population variances σ_1^2 and σ_2^2 , respectively. To assess the statistical significance of the change in the area, production, and productivity before and after the creation of Telangana, the following formula was been used:

Case I: When $\sigma_1^2 = \sigma_2^2 = \sigma^2$ (but unknown)

$$t = \frac{|\bar{x} - \bar{y}|}{s \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where s^2 is the pooled mean square variance and is given by

$$s^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

The calculated value of t is compared with the table value of t for $(n_1 + n_2 - 2)$ df at α prescribed level of significance.

Case II: When $\sigma_1^2 \neq \sigma_2^2$ (but unknown)

$$t = \frac{|\bar{x} - \bar{y}|}{s \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

The calculated value of t is compared with the weighted table value of t , say, t' where t' is

$$t' = \frac{t_1 \frac{s_1^2}{n_1} + t_2 \frac{s_2^2}{n_2}}{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

Where, t_1 and t_2 are the tabulated values of t at $(n_1 - 1)$ and $(n_2 - 1)$ df at σ prescribed level of significance, respectively.

Coefficient of variation

$$C.V = \frac{\text{standard deviation}}{\text{mean}} \times 100$$

Results and Discussion

The district wise Area, Production and Productivity of chilli, was available from 2008-13, but due to the unavailability of the appropriate district-wise data from 2013-19 the analysis of compound growth rate was done for the total area, production, and productivity of Telangana state. It is observed in the Table. 1 that the area, production and productivity under chilli of complete Telangana state, year wise from 2008-09 to 2018-19 in which six years before the creation of Telangana (2008-14) and five years after the creation of Telangana (2014-19)

were analyzed. The area under chilli before the creation of Telangana was 74996 ha (2008-14) with production of 259727 tonnes to 84178 ha (2009-10) with production of 300345 tonnes; area under the chilli after the creation of Telangana was 73274 ha (2014-15) with production of 253260 tonnes to 126000 ha (2016-17) with production of 461000.

It indicates that Before the Creation of Telangana (2008-09 to 2013-14) the Compound Growth Rate of the area was -0.945; production was -1.59 and productivity was -0.579 and the

Standard Error of area was 1.608; production was 2.832; productivity was 3.346 and the t_{cal} value of the area was 0.59; production was 0.54 and productivity of 0.17 was found respectively and coming to the data analyzed after the creation of Telangana (2014-15 to 2018-19) the Compound Growth Rate of the area was 1.379; production was 12.261 and productivity of 10.735 and coming to Standard Error area was 8.225; production was 9.041 and productivity was 5.167 and coming to the t_{cal} value of the area was 0.17; production was 1.36; productivity was of 2.08 were found consequently.

Table 1: The compound growth rate of area, production and productivity of chilli before and after the creation of Telangana (2008-09 to 2018-19)

Before the Creation of Telangana (2008-09 to 2013-14)			
Year	Area in ha	Production in Tonnes	Productivity in Kg/ha
2008-09	81670	287435	3519
2009-10	84178	300345	3568
2010-11	77285	239968	3105
2011-12	89634	234088	2612
2012-13	82671	299934	3628
2013-14	74996	259727	3463
Compound Growth Rate (CGR)	-0.945	-1.59	-0.579
Standard Error (S.E)	1.608	2.832	3.346
t_{cal} value	0.59	0.54	0.17
After the Creation of Telangana (2014-15 to 2018-19)			
Year	Area in ha	Production in Tonnes	Productivity in Kg/ha
2014-15	73274	253260	3456
2015-16	81597	227610	2789
2016-17	126000	461000	3660
2017-18	73780	340800	4620
2018-19	82521	369020	4471
Compound Growth Rate (CGR)	1.379	12.261	10.735
Standard Error (S.E)	8.225	9.041	5.167
t_{cal} value	0.17	1.36	2.08

Source: Directorate of Economics and Statistics, Government of Telangana; Indian Agristat.

In this Before the Creation of Telangana (2008-09 to 2013-14), the Average mean of the area was found to be 81739 ha; average production was 270249.5 tonnes and the productivity was of 3315.83 kg/ha. And correspondingly after the creation

of Telangana (2014-15 to 2018-19), the Average mean of the area was found to be 87434.4 ha; average production was 330338 tonnes; and the productivity was of 3799.2 kg/ha was found in Table no.4.1.3 respectively.

Table 2: Average Area, Production productivity of chilli before and after the creation of Telangana State (2008-09 to 2018-19)

Before the Creation of Telangana State (2008-09 to 2013-14)	
Particulars	Mean
Average Area (in ha)	81739
Average production (in Tonnes)	270249.5
Productivity (in kg/ha)	3315.83
After the Creation of Telangana State (2014-15 to 2018-19)	
Particulars	Mean
Average Area (in ha)	87434.4
Average production (in Tonnes)	330338.0
Productivity (in kg/ha)	3799.2

The study examines or analyzes the testing the significance of the change in Area, Production, and Productivity of Chilli before and after its creation of Telangana State during (2008-09 to 2018-19). Table number 4 shows the testing of t_{cal} value. In the testing t_{cal} value for the testing and significance of the

change in overall chilli before and after its formation of Telangana state from 2008-09 to 2018-19 in which the mean of area was 0.631, production was 1.496 and productivity was 1.372 were observed consequently given in Table No: 4.

Table 3: t_{cal} Value for testing the significance of the change in Area, Production and Productivity of Chilli before and after its creation of Telangana State (2008-09 to 2018-19)

Particulars	Mean
Area	0.621
Production	1.496
Productivity	1.372

From the results corresponding area of chilli, it was inferred that compound growth rate of chilli area estimated for Telangana state was increased from -0.549 percent (Before creation of Telangana state) to 1.379 percent (After the creation of Telangana state). Irrespective of the production of chilli, it was observed that compound growth rate of chilli production in Telangana state as a whole was increased considerably after creation of the state as compared to before the creation of the state. Area, Production and Productivity of chilli was also increased after the creation of Telangana state. Compound growth rate of Area, production and productivity of chilli before and after creation of Telangana state, although, non-significant but increase in all these three parameters were seen due to creation of Telangana state. The increase in production of chilli after creation of Telangana state has come mainly from the growth in productivity.

Conclusions

It is concluded that Before the Creation of Telangana (2008-09 to 2013-14) the Average mean of the area was found to be 81739 ha; average production is 270249.5 tonnes and the productivity is of 3315.83 kg/ha and correspondingly after the creation of Telangana (2014-15 to 2018-19), the Average mean of the area was found to be 87434.4 ha; average production is 330338.0 tonnes; and the productivity is of 3799.2 kg/ha. The testing and significance of the change in overall chilli before and after its formation of Telangana state from 2008-09 to 2018-19 in which the mean of area is 0.631; production is 1.496 and productivity is 1.372 were observed from the study of compound growth rate, it reveals that there was an increase in the area, production, productivity after the bifurcation of Telangana but it was not found to be significant.

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