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## Decomposition analysis of major cereal crops in different agroclimatic regions of Chhattisgarh

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### Abstract

The present investigation relates to different agro climatic regions of Chhattisgarh, where paddy is the competing crop to other kharif crops. The entire Chhattisgarh state is studied, considering its three agro climatic zones which includes 18 districts of Chhattisgarh (At present 27 districts, have merged and made 18 districts) as units of investigation. Secondary data collected from different sources were used for the research work, for the period 2000-01 to 2014-15. Paddy is the principal crop in Chhattisgarh and along with paddy, maize and wheat are also studied in this investigation, so as to know the position of these crops at present as compared to paddy. For the estimation of the contribution of area and yield with change in production, the decomposition model has been used. The result of the decomposition analysis showed that the yield effect is dominating over area effect in all the agro climatic regions, state and in all the three crops, except in Bastar Plateau where area contributes more in production than yield in case of wheat. Paddy reveals highest yield effect as well as lowest area effect in comparison to maize and wheat in Chhattisgarh state.

**Keywords:** Agro climatic regions, Chhattisgarh, production, contribution, paddy

### Introduction

Chhattisgarh is a state in central India; with a geographical area of 137.90 lakh hectares. It is known for rice cultivation and called "rice bowl of India" and is necessary to examine the contribution of area, production and productivity towards total production and have an estimate of likely supply of this crop as well as other cereal crops such as maize and wheat in the state. In Chhattisgarh rice occupies average of 3.6 million hectare with the productivity of the state ranging between 1.2 to 1.6 tonne per hectare depending upon the rainfall (Status Paper on Rice for Chhattisgarh).

Paddy is an important crop grown in nearly 44 million hectare of land in the country with the productivity of 2.2 tonne per hectare which is less than the productivity of many countries (Status Paper on Rice for Chhattisgarh). The huge demand for cereals in the global market is creating an excellent environment for the export of Indian cereal products. India occupy the major share in India's total cereal export with 64.40 percent during the year 2014-15. Whereas, other cereals including wheat represent 35.60 percent share in total cereals exported from India during this period (APEDA). Rice covers one third of total cultivated area of India. It provides food to more than half of the Indian population. Wheat is the second most important crop of India after paddy.

The growth analysis (area, production and yield) of major crops revealed the general pattern of growth and direction of changes in yield and area. But this analysis does not evaluate the contribution of area and yield towards the production growth. So, it is necessary to examine the sources of contribution to production. Padmanaban *et al.* (1996)<sup>[7]</sup> analyzed components of cotton production in Tamil Nadu. Therefore, future efforts need to be directed towards possible expansion in acreage and at the same time efforts must be taken to increase the productivity of cotton. They observed that the contribution of yield was the major factor that accounted for the growth of cotton output. Lathika *et al.* (2005)<sup>[5]</sup> examine the growth, trends in coconut area, production and productivity for the past five decades. The present study covered the period from overall period (1950-51-2001-02). Area effect continues to assume greater role in output growth by almost all coconut regions of the country, though some states like Kerala and Orissa recently showed signs of a prudence should prevail before displacing other crops. Rahman *et al.* (2011) attempted a decomposition analysis in agriculture production in Pakistan: pre and post reform analysis.

Using decomposition analysis they find that in first period increase in production of wheat, rice and cotton is cause of yield effect and in second periods sources of growth for wheat and cotton was the yield effect and in sugarcane, rice sources of growth was area effect. In overall periods aggregate crop revealed that the area and yield has almost equal contribution to the total changes.

### Research Methodology

The study is carried out in the state of Chhattisgarh. The state comprises of three agro climatic regions, which are Chhattisgarh Plains, Bastar Plateau and Northern Hills, which includes 18 districts of Chhattisgarh (At present 27 districts have merged and made 18 districts covering all 27 districts). A marked variation prevails in soil and climate which divided the state in three distinct agro climatic regions, which have resulted in great variation in farming patterns in area, production and productivity in different parts of the state. Chhattisgarh state was selected purposively for the present study due to some special purpose as to know the decomposition analysis (Sharma model) of major cereal crops. The data used for the study is entirely based on secondary source from different published sources and websites. Time series data of area, production and productivity of major cereal crops viz. Paddy, Maize and Wheat were obtained from various publications and records published by Directorate of Land Records, Chhattisgarh. The general form of formula can be written as:

### Decomposition analysis

$$\text{Area effect} = \frac{(A_n - A_o) Y_o}{(P_n - P_o)} \times 100$$

$$\text{Yield effect} = \frac{(Y_n - Y_o) A_o}{(P_n - P_o)} \times 100$$

$$\text{Interaction effect} = \frac{(A_n - A_o) (Y_n - Y_o)}{(P_n - P_o)} \times 100$$

Where,

$A_o$  = Triennium moving average of area in base year

$P_o$  = Triennium moving average of production in base year

$Y_o$  =  $P_o/A_o$

$A_n$  = Triennium moving average of area in current year

$P_n$  = Triennium moving average of production in current year

$Y_n$  =  $P_n/A_n$

### Results and Discussion

#### Paddy

The contribution of yield was higher than that of area towards change in paddy production in all the agroclimatic regions and in the state too. Relative change and Yield effect is positive in all the agroclimatic regions. The Bastar Plateau showed the highest relative change (80.363%) with lowest interaction (2.087%) effect and lowest relative change is registered in Northern Hills (49.483%) with a declining interaction effect (-0.533%) and area effect (-1.060). Above results showed that total paddy production increase on account of yield as compared to acreage increase.

**Table 1:** Relative contribution of area and yield in production of Paddy (In percentage)

Agro climatic Regions	Relative change	Area effect	Yield effect	Interaction effect
Chhattisgarh Plains	77.811	10.152	83.270	6.578
Bastar Plateau	80.363	2.729	95.184	2.087
Northern hills	49.483	-1.060	101.593	-0.533
Chhattisgarh	74.241	7.686	87.331	4.983

#### Maize

The yield effect dominates over area effect in Chhattisgarh as well as in all the agro climatic regions. In Chhattisgarh Plains and Bastar Plateau, the contribution of yield (46.22 percent and 40.76 percent) in production increase was more, area effect (27.03 percent and 31.24 percent) and interaction effect (26.74 percent and 27.74percent) in the production increase was more or less same. In Northern hills, the increase in production of maize was mainly due to increase in yield which contributed nearly (95.45 percent). The contribution of area and yield effect was more or less same. It is observed that in Chhattisgarh state the positive relative change (171.446%), in maize production was brought about by higher increase in yield as compared to area.

**Table 2:** Relative contribution of area and yield in production of Maize (In percentage)

Agro climatic regions	Relative Change	Area effect	Yield effect	Interaction effect
Chhattisgarh Plains	213.981	27.033	46.227	26.740
Bastar Plateau	219.738	31.245	40.767	27.989
Northern hills	127.042	2.054	95.455	2.491
Chhattisgarh	171.446	17.470	63.509	19.022

#### Wheat

In Chhattisgarh Plains, an increase in output for wheat was mainly due to increase in yield with the respective yield contribution of 58.02 percent. The area effect was the major driving force for contribution in production of wheat in Bastar Plateau. About 100.15 percent growth was due to area effect which more than offset the negative yield effect of -0.32 percent in Bastar Plateau. In Northern hills, the main source of contribution of wheat (77.44 percent) was due to yield effect. The decomposition analysis revealed that growth in production of wheat in Chhattisgarh was mainly due to yield effect 62.46 percent.

**Table 3:** Relative contribution of area and yield in production of Wheat (percentage)

Agro climatic regions	Relative change	Area Effect	Yield Effect	Interaction effect
Chhattisgarh Plains	69.777	29.878	58.025	12.097
Bastar Plateau	-52.052	100.155	-0.323	0.168
Northern hills	39.330	17.293	77.440	5.267
Chhattisgarh	54.097	28.053	62.467	9.480

### Summary and Recommendations

The result of the decomposition analysis showed that the yield effect is dominating over area effect in all the agro climatic regions. The contribution of yield towards increase in the production of paddy and maize crop was found to be higher than area in all the agro climatic regions and in the state. In case of wheat crop, yield effect is dominating over area effect in all the agro climatic regions and in the whole state, except Bastar Plateau in which contribution of area towards increase in the production is more than yield. Yield effect of paddy is

higher than other two crops, and area effect of wheat is higher than paddy and maize.

The results of decomposition analysis have important recommendations because each growth component alone has a limited scope to expand overtime. If the current yield trends continue, the growth in crops production will decline overtime because of the limitations on land growth potential. When a very substantial portion of the population is dependent on agriculture, a situation where nearly 80 % of a state's area is covered only by one crop, immediate attention to turn them into double crop area is needed. All attempts should be required to extend the available improved technology to the farmers and change its adoption. The government policy should focus developing new high yielding varieties suitable to agro climatic conditions of the regions. Intensive need-oriented researches should be done and on that basis planning and designing should be made in such a way which will ideally be fruitful. A comprehensive survey may be undertaken by the competent agencies to identify the problem faced in cultivation of paddy, wheat and especially maize crop whose positive area and interaction effect and relative change show's producers interest in this crop.

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