



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2019; 7(6): 2484-2487

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Received: 16-09-2019

Accepted: 20-10-2019

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## Growth in rice crop in Kymore plateau and satpura hill agro-climatic zone of Madhya Pradesh

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### Abstract

The present investigation is related to Kymore Plateau & Satpura Hills agro climatic zone of Madhya Pradesh, where rice is the competing crop to other kharif and *rabi* crops respectively. Kymore plateau and satpura hill zone consists of Jabalpur+Katni, Rewa, Panna Satna, Seoni, Sidhi + Singroli districts as units of Investigation. Secondary data collected from different sources for the period of 1980-81 to 2015-16, and divided into Period I (1980-81 to 1991-92), Period II (1992-93 to 2003-04) and Period III (2004-05 to 2015-16). For the pooled period of study rice crop recorded a growth in area. The growth in production and productivity of rice crop was visible in third period (2004-05 to 2015-16) of study of recorded remarkable increasing. There has been growth in the use of crucial input like irrigation, chemical fertilizer and high yielding variety seeds. The productivity growth and trend were major factors that accounted for the growth of crop output in the state. The future strategy of agricultural development of the state will have to be centered on increasing productivity through the expansion of area under irrigation and HYVs. This study examines the trend using compound growth rate and assess area, production and productivity variability.

**Keywords:** Agro-climatic zone, Madhya Pradesh, trend, growth, rice

### Introduction

Agriculture plays an important role in economic development, such as provision of food to the nation, enlarging export, transfer of manpower to non-agricultural sectors, contribution to capital formation, and securing markets for industrialization. The sector provides employment to 56.7 percent of country workforce and it is the single largest private sector occupation. Agriculture accounts for about 13.2 percent of total export Earning and provides raw material to several industries (GOI, 2017). Madhya Pradesh is the fifth largest state in India in terms of population and second with respect to area. Agriculture continues to be the major source of income for most of the population (Census 2011) since 61.5 per cent of population is dependent on agriculture for livelihood. However, contribution of agriculture sector in the state income is declining over the period.

Rice 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. 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. Rice covers one third of total cultivated area of India. It provides food to more than half of the Indian population.

Thus diagnoses of trend necessitate the prescriptive measure and needed technological development for higher level of productivity in these two crops. An attempt was made to find the trends in area, yield and production of rice in Kymore Plateau and Satpura Hill of Madhya Pradesh. The results of the present study indicated that the output of rice during the post-green revolution period grew at an annual rate of 1.43 percent and this was contributed solely by per hectare yield. Area under rice experienced deceleration due to diversion of area to oilseeds and pulses (Tripathy (1996) <sup>[10]</sup>, Shankar *et al.* (2010).

The agriculture of Madhya Pradesh is divided into eleven agro-climatic zones based on the Agri-climatic and soil conditions. The classification mainly concentrates on the range of rainfall received, type and topography of the soils. The 52 districts covered by the different zones. Eleventh agro-climatic zones are: Chhattisgarh plain, Northern hill region of Chhattisgarh, Kymore Plateau and Satpura hills, Central Narmada valley, Vindhya plateau, Grid region, Bundelkhand, Satpura plateau, Malwa plateau, Nimar plains and Jhabua hills.

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Kymore Plateau and Satpura Hill is one of the agro-climatic Zone of Madhya Pradesh comprises of Seoni, Jabalpur, Katni, Satna, Rewa, Panna, Sidhi and Singrouli districts. The crops grown in kharif season are soybean, rice, maize, Bajara and tur etc. and in *rabi* season wheat, gram, mustered and vegetables. Along with banana also grown in some districts. Madhya Pradesh is highest producer of pulses, gram and soybean contributing 21.38%, 40.33% and 59.92%, respectively and is second in oil seed production; Jowar, Masoor contribution 22.10, 14.11 and 22.30% respectively to the total production of India (GOI, 2018) [3].

### Research Methodology

The study is carried out in the state of Madhya Pradesh. The state comprises of eleventh agro climatic zone, Kymore plateau and Satpura hills zone, which includes 6 districts of zone (At present 8 districts) is selected for this study. The data used for the study is entirely secondary in nature and collected from different published sources and websites. Time series data of area, production and productivity of Rice was obtained from various publications and records published by Directorate of Land Records, Madhya Pradesh. The study covers 36 years from 1980-81 to 2015-16. The entire period is divided as Period I (1980 -81 to 1991-92), Period II (1992-93 to 2003-04) and Period III (2004-05 to 2015-16). The analysis was also carried out for pooled data (1980-81 to 2015-16).

### Estimation of Growth in area, production and yield

Compound growth rates are estimated using following exponential model.

$$Y = a b^t$$

### Where

Y = trend value (Area, Production, Yield)

a = constant

b = Trend coefficient

t = Independent variable (Time in years)

$$\text{C.G.R. (Compound Growth Rate \%)} = [\text{Antilog of } b-1] \times 100$$

### Results and Discussion

#### Growth Rate of Area, Production and Productivity of Rice

The trend and compound growth rates of area of rice crop in Madhya Pradesh and for agro-climatic zone over three periods are presented in table 1. Result of analysis revealed a mixed trend with respect to growth in area of rice crop in Madhya Pradesh for period 1980-81 to 2015-16. Trend in area of rice was higher for second period than first and third period. Moreover this period was green revaluation period i.e. spectacular trend in rice production due to use of high yielding varieties supported by increased use of fertilizer and irrigation. This table reveals increasing rate (5.27%) in area in Kymore plateau and Satpura hills zone and state as a whole also it is increasing (9.66%) trend in area during pooled period. The growth rate of area of rice crop was highly significant for second period compare to first and third period with higher growth rate. The growth rate of rice area has increasing significant for all districts of Kymore plateau and Satpura hill zone at one per cent level of significant except Rewa district has five per cent level of significant during pooled period. The growth of area of rice crop in Madhya Pradesh was also positive significant 0.51 per cent at one per cent level of significant per annum during pooled period.

**Table 1:** Districts wise Trend and Growth rate in area of rice crop for Kymore Plateau & Satpura Hills agro-climatic Zone (Per cent)

Districts	Period t1 (1980-81 to 1991-92)		Period t2 (1992-93 to 2003-04)		Period t3 (2004-05 to 2015-16)		Pooled (1980-81 to 2015-16)	
	b	CGR	b	CGR	b	CGR	b	CGR
Jabalpur + Katni	-2.57	-1.63	2.84	1.77***	1.08	1.61	1.59	1.04***
Rewa	1.1	0.75	2.8	2.14***	-1.79	-1.37	0.43	0.35**
Panna	-0.49	-0.61	0.16	0.26	-0.18	-0.28	0.17	0.29***
Satna	1.28	0.71*	2.41	2.57***	0.31	0.26	0.45	0.48***
Seoni	0	0.57*	2.14	1.99***	3.71	2.75***	1.47	1.31***
Sidhi + Singrouli	0.38	0.83*	2.55	2.33***	-1.15	-0.98	1.16	1.13***
Zone	0.18	0.02	12.91	1.97***	1.98	0.27	5.27	0.83***
Madhya Pradesh	25.69	0.73	14.97	0.91***	36	1.94**	9.66	0.51***

**Note:** \*\*\*Significant at probability level 0.01, \*\*Significant at probability level 0.05, \*Significant at probability level 0.10

Growth and trend in rice production over a period of time gives an idea of pace of agricultural development in the state. Result obtained are presented in table 2, it could be seen from this table that the production of all the districts of zone was increased sustainability over the entire study period in the state. The growth and trend of rice was visible in the second period and it remained so in the third also. This growth and trend in production was obviously due to spread of HYV's of rice during these periods. The table inferred the all districts of kymore Plateau & Satpura Hills agro-climatic Zone showed positive trend barring panna district (-0.78) for production of rice during second period. This table reveals increasing rate

(29.16) in production in Kymore plateau and Satpura hills zone and state as a whole also it is increasing (72.43) trend in area during pooled period. Thus, there is an increase of 72.3 thousand tones-of production in Madhya Pradesh every year. The growth rate of rice production of all districts of Kymore plateau and Satpura hill zone has showed positive growth in all periods except second period of rice production, in second period of rice production has Panna (-2.78%) and Seoni district (-0.66%) has declining growth. The production of rice registered positive significant of all districts under this zone at one per cent except Panna district has also positive significant but it was five per cent level of significant.

**Table 2:** Districts wise Trend and Growth rate in production of rice crop for Kymore Plateau & Satpura Hills agro-climatic Zone. (Per cent)

Districts	Period t1 (1980-81 to 1991-92)		Period t2 (1992-93 to 2003-04)		Period t3 (2004-05 to 2015-16)		Pooled (1980-81 to 2015-16)	
	b	CGR	b	CGR	b	CGR	b	CGR
Jabalpur + Katni	1.32	1.48	3.99	2.82	39.54	14.84***	8.25	4.84***
Rewa	2.57	1.91	3.89	3.89*	19.33	10.96**	4.63	3.83***
Panna	0.73	1.04	-0.78	-2.78	5.29	9.37**	0.63	1.27*
Satna	3.2	1.94*	5.47	9.01**	27.47	16.23	5.87	5.71***
Seoni	1.79	1.07	0.39	-0.66	25.14	12.19***	4.98	2.97***
Sidhi + Singroli	2.09	5.98***	6.3	8.52***	19.72	12.31***	4.8	4.88***
Zone	10.45	1.86	19.26	3.64*	136.49	14.08***	29.16	4.11***
Madhya Pradesh	175.33	4.22***	18.48	0.98***	408.77	14.31***	72.43	2.83***

Note: Same as in Table 1.

The new production technology had its impact on per hectare yield of crop also. Table 3 represents the trend and growth rates of productivity of rice in the state. Trend and growth rate of yield of rice was higher during third period. Except for the second period, there is increase yield of rice in zone over the entire period of study in the state. It shows positive regression co-efficient of yield for all the districts of Kymore plateau and Satpura hill zone and the state in all districts and the state during pooled period. The increase in average yield of rice at the Kymore plateau and Satpura hills zone 36.11 and state level is 35.47 kg/ ha although it varies substantially across the

districts of zone and is highest for Satna (57.38) followed by Jabalpur + Katni (40.02), Sidhi + Singroli (36.92), Rewa (33.47), Seoni (26.59) with lowest of 9.25 in Panna district during pooled period. Table 3 inferred that highest growth rate has Sidhi+ Singroli district (3.77%) and lowest growth rate was observed in Panna district (0.97%) under this zone and Madhya Pradesh was also positive significant 2.52 per cent at one per cent level of significant per annum during pooled period. Although overall period, yield of rice recorded higher rate of increase and significant in productivity.

**Table 3:** Districts wise Trend and Growth rate in yield of rice crop for Kymore Plateau & Satpura Hills agro-climatic Zone (Per cent).

Districts	Period t1 (1980-81 to 1991-92)		Period t2 (1992-93 to 2003-04)		Period t3 (2004-05 to 2015-16)		Pooled (1980-81 to 2015-16)	
	b	CGR	b	CGR	b	CGR	b	CGR
Jabalpur + Katni	23.57	3.11*	11.31	1.05	215.43	14.22***	40.02	3.55***
Rewa	10.57	1.16	3.78	0.51	161.35	12.01***	33.47	3.31***
Panna	14.93	1.66	-15.49	-3.01	94.9	9.72**	9.25	0.97***
Satna	13.45	1.44	44.1	6.43**	261.44	15.13***	57.38	5.09***
Seoni	10.87	0.49	-18.69	-2.65	144.36	9.44***	26.59	1.82***
Sidhi + Singroli	39.77	5.14***	35.95	5.24**	177.95	13.31***	36.92	3.77***
Zone	15.21	1.85	14.16	1.65	184.57	13.77***	36.11	3.25***
Madhya Pradesh	41.48	3.48***	8.61	0.68	188.17	12.36***	35.47	2.52***

Note: Same as in Table 1.

## Conclusions

After a long period of stagnation Madhya Pradesh registered a significant improvement in the rice production during 1980-81 to 2015-16. The growth rates of other two factors, viz., area and production also increased during 1980-81 to 2015-16 but in percentage terms their contributions were only around 2.52 per cent and 3.92 per cent respectively. This high yield growth of rice and wheat in Kymore plateau and Satpura hills agro-climatic zone during 1980s is partly because of institutional reforms and partly due to technological factors (Saha, 1996). During 1980s under the Left Front Government some institution and technology advancements took place in Madhya Pradesh, which seem to be the root cause of significant improvement in the eighties though still it is debatable. However, this remarkable growth rate sustained for a long time.

In a Kymore plateau and Satpura hills agro-climatic zone of Madhya Pradesh where the output growth of rice is explained at a maximum level by the growth of its yield, this type of fall in its growth is not desirable rather alarming. There is a limit to any reform practices and it is not possible to sustain the steady growth of yield unless further technological breakthrough takes place. New thinking, new reforms, etc. are very much necessary to give a new dimension to the yield growth in Kymore plateau and Satpura hills zone of Madhya Pradesh in the present decade. Overall Growth rates and trend estimated for changes in area, production and yield under rice

crop showed a significant positive change. During pooled period of rice crop has shown also significant positive growth.

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