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A study on growth and instability of Paddy and Wheat crops in Gwalior District (Madhya Pradesh)

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Abstract

A study has been carried out over a period of 20 years from 1998–99 to 2018–19 in the Gwalior District of Madhya Pradesh. This study is primarily based on secondary data which was collected from Department of farmer welfare and agriculture Development Madhya Pradesh and Deputy Director of Agriculture office Gwalior, and then CAGR is calculated by fitting exponential function. It is observed from the study that area, production and productivity in paddy increased at a compound annual growth rate of 2.38 percent, 6.89 percent, and 4.01 percent respectively and 1.11 percent, 4.07 percent, and 2.40 percent, in wheat respectively. And it has also been seen that the productivity effect has a dominant component in increasing the output in both the crop.

Keywords: CAGR, area, production productivity Decomposition, paddy, wheat

Introduction

Paddy and wheat are most of the important cereal crops in India, accounting approximately 83.63 percent of total cereal production (Directorate of Economics and Statistics). These two crops account 30% of total global calories consumed (FAO) and are the primary source of nutrition for billions of people around the world. Paddy is primarily grown in the following countries viz. Asian, African and Latin American while, wheat is mostly grown in the North America, Southern European countries and Australia. At present there is rapidly rising in the population of the worlds thus we need to increase production with advanced technology. India is second largest producer of rice and wheat after China, as the country produces 101.29 million tonnes of wheat and 175.58 million tonnes of rice annually (FAOSTAT, 2018). Approximately 44 million hectares and 29.5 million hectares area are occupied in the production of paddy and wheat crop it symbolizes the importance of both crop in Indian agriculture. Thus rice and wheat production not only makes country food sufficient nation but also strengthen its agrarian economy. Since, agriculture is the major source of income for a large population of the country, and rice and wheat being the majorly grown crops plays key role in enhancing income of the farmers. The analysis of crop growth and instability is more important because it helps us to understand the contemplate food security and income stability (Dey, Anwesha *et al.* 2020) [2].

Material and methods

The Compound annual growth rates (CAGR) of area, production and productivity of paddy and wheat crops were worked out in Gwalior district of Madhya Pradesh during the period of 1998-99 to 2018-19 (20 years). Secondary data were required to estimate Compound annual growth rate which was collected from Department of Farmer welfare and Agriculture Development Madhya Pradesh and Deputy Director of Agriculture office Gwalior then CAGR was worked out by fitting exponential function as given below:

$$Y_t = ab^t$$

Where,

Y_t = Dependent variable on area, production and productivity in the year 't'

a = Constant

b = Regression coefficient;

t = Time element which takes the value 1, 2, 3... 20

After transforming the model into a linear form by taking ln (natural logarithms), we get $\ln Y_t = \ln a + t \ln b$

By putting $\ln Y_t = y$, $\ln a = A$ and $\ln b = B$

The model becomes linear between y and t , as $y = A + Bt$, fit the model by the method of ordinary least squares (OLS) technique. The CAGR (r) in per cent was obtained by the following formula. Similar methodology was also used by Kumari, Neelam, and Bhatia, J.K, (2020) [7], and Das Arghyadeep (2018) [1]

$$r = (b-1) \times 100 = (\text{antilog } B-1) \times 100$$

The significance of growth rate was tested by applying student's t test statistic

$$T = r / S.E(r)$$

Which follows distribution with $(n-2)$ degree of freedom n is number of year considered under study.

Coefficient of variation

The coefficient of variation is an important technique to measure the relative instability in the area, production, and productivity for both crops during the study period (1998–99 to 2018–19) with the help of the following formula.

$$CV = \frac{SD}{\bar{X}} \times 100$$

Where, CV = Co-efficient of variation, SD = Standard deviation of variables and \bar{X} = Mean of the variables

Decomposition analysis

Decomposition analysis was performed to assess the area

effect, productivity effect (yield), and interaction effect in the total production of paddy and wheat. The following additive techniques of decomposition analysis were used. Similar technique was used by De, Anwesha (2020) [2],

$$P = A_0(Y_n - Y_0) + Y_0(A_n - A_0) + \Delta A \Delta Y$$

$$1 = [(Y \Delta A)/P] + [(A \Delta Y)/P] + [(\Delta A \Delta Y)/P]$$

Where, P = Change in production, A_0 = Area in the initial year, A_n = Area in the last year, Y_0 = Yield in the initial year, Y_n = Yield in the last year, ΔA = Change in the area ($A_n - A_0$), ΔY = Change in the yield ($Y_n - Y_0$).

Result and discussion

The CAGR of area, production, and productivity in paddy and wheat cultivation in the Gwalior district of Madhya Pradesh was examined during the period 1998–99 to 2018–2019. The result is shown in the table. 1. The table shows that during 1998-99 to 2018-19, in the paddy crop area, production and productivity increased from 30.4 thousand hectares to 44.5 thousand hectares, with a compound annual growth rate of 2.38 percent, 53.3 thousand metric tons to 160.4 thousand metric tons with a significant compound annual growth rate of 6.89 percent and 1845 kg/ha to 3600 kg/ha during 1998-99 to 2018-19 with a significant growth rate of 4.01 percent respectively. While, in the case of wheat crop from 1998-99 to 2018-19, area, production and productivity increased from 97.2 thousand hectares to 113.2 hectares, with a compound annual growth rate of 1.11 percent, 236.5 thousand metric tons to 492.5 thousand metric tons with a significant growth rate of 4.07 percent, and 2534 kg/ha to 4350 kg/ha with a significant compound annual growth rate 2.40 percent respectively.

Table 1: CAGR of area, production and productivity of Paddy and wheat crops

Year	Period - 1998-99 to 2018-2019					
	Paddy			Wheat		
	Area (000 ha)	Production (000 MT)	Productivity (Kg/ha)	Area (000 ha)	Production (000 MT)	Productivity (Kg/ha)
1998-99	30.4	53.3	1845	97.2	236.5	2534
1999-20	37.5	83.6	2348	99.1	294.7	3098
2000-01	39.0	81.7	2210	78.1	185.1	2468
2001-02	43.4	98.7	2393	84.7	243.0	2988
2002-03	15.8	14.2	947	68.0	174.3	2671
2003-04	14.9	36.7	2592	96.6	274.3	2958
2004-05	14.6	30.9	2221	92.0	236.3	2675
2005-06	17.5	40.6	2434	91.3	230.3	2626
2006-07	15.9	37.4	2471	87.0	187.0	2240
2007-08	11.7	16.8	2471	67.9	111.4	2240
2008-09	31.0	81.8	1503	89.3	229.1	1709
2009-10	21.0	54.1	2710	83.4	189.9	2673
2010-11	24.5	64.0	2751	93.8	254.0	2372
2011-12	31	96.0	3310	113	397	3328
2012-13	49	89.0	1915	115	421	3647
2013-14	57	246.0	4311	118	496	3373
2014-15	49	167.0	3333	104	335	3224
2015-16	53	225	4245	136	515	3785
2016-17	57.4	239.8	4174	103.3	429.4	4167
2017-18	10.2	36.2	3555	63.8	275.2	4310
2018-19	44.5	160.4	3600	113.2	492.5	4350
CGR %	2.38	6.89***	4.01***	1.11	4.07***	2.40***
R ²	0.068	0.258	0.447	0.126	0.377	0.453
P value	0.253	0.018	0.000	0.113	0.003	0.003
t value	1.148	2.573	3.920	1.657	3.394	3.364

Source: <http://mpkrishi.mp.gov.in> and deputy director of Agriculture office Gwalior

Note: The asterisks (*, ** ***) indicate significance at the 10 %, 5% and 1 % levels respectively MT = Metric ton

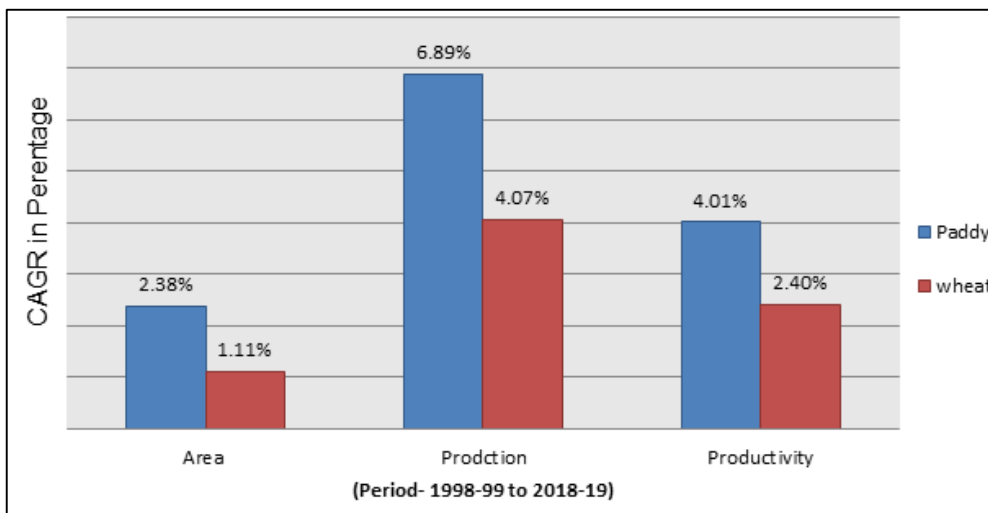


Fig 1: CAGR of Area, Production and Productivity in Paddy and Wheat Crops

Coefficient of variation

The coefficient of Variation in area, production, and productivity in paddy and wheat crop in Gwalior district for the period of 1998-99 to 2018-19 is presented in Table 2. It was depicted in the entire period under both the crop, the highest variation was observed in production, followed by productivity and area (Figure 2). The highest variation in production under both crop were due to improved technology, high yield variety availability of quality inputs and sufficiency

of irrigation facility etc. whereas the lowest variation in the area implies that both crops (paddy and wheat) occupied a major portion in the cropping pattern in the districts. The variation under paddy crop in production, area, and productivity was observed 77.83 percent, 50.03, and 32.9 percent respectively. Whereas variation under wheat in production, productivity and area was observed 39.84 percent, 23.88 percent and 18.98 percent respectively.

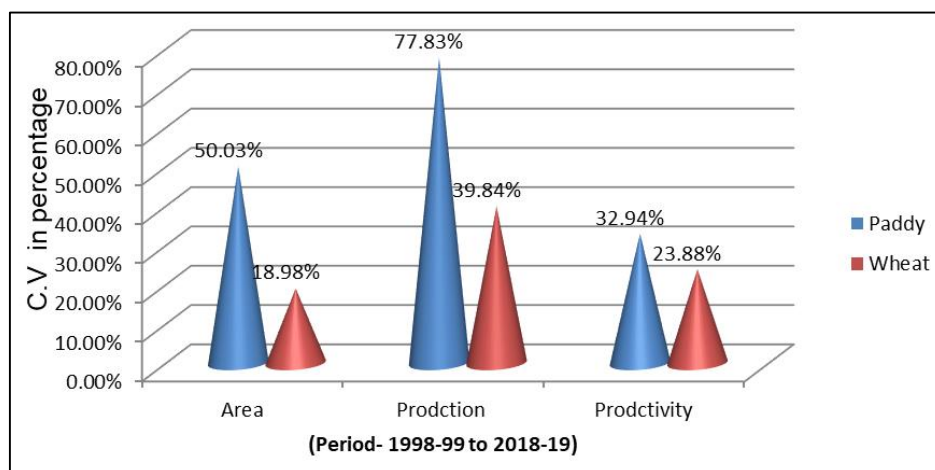


Fig 2: Coefficient of variation in area, production and productivity under Paddy and wheat crop

Table 2: Crop wise coefficient of variation in area, production and productivity

Crop	Variables	Period- 1998-99 to 2018- 2019		
		SD	Mean	CV %
Paddy	Area	15.93	31.83	50.03
	Production	72.44	93.06	77.83
	Productivity	899.44	2730.42	32.94
Wheat	Area	18.32	94.96	18.98
	Production	117.79	295.59	39.84
	Productivity	721.52	3020.78	23.88

Source: Author’s computation based on secondary data

Note – SD, and CV indicates standard deviation and coefficient of variation respectively

Decomposition analysis of growth in production of paddy and Wheat

The CAGR technique helps to know the pattern of growth and direction of changes in the area, production and productivity (yield). But it does not measure contribution of area,

productivity and interaction effect in the production. That’s why it is major need to examine the sources of production growth. Decomposition analysis was carried out to assess the area, productivity, and interaction effect in the growth of paddy and wheat crops in the Gwalior district Madhya

Pradesh for the period of 1998-99 to 2018-19 and result is presented in Table 3. It was noticed from the table 3, productivity was one of the important factor that affect the growth of production under both crops.

The area effect, productivity effect, and interaction effect, under the paddy crop were observed 24.98 percent, 51.24 percent,

and 23.7 percent while in the case of wheat it was observed 16.47 percent, 71.72 percent, and 11.80 percent respectively. Overall it can be concluded that productivity effect was dominated factor in influencing growth of both paddy and wheat crops. Similar finding was observed by Kumar Pawan and Shekhar Himani (2017) ^[6].

Table 3: Crop wise area effect, productivity effect and interaction effect

Crop	Period - 1998-99 to 2018- 2019			
	Area Effect (%)	Productivity Effect (%)	Interaction Effect (%)	Total (%)
Rice	24.98	51.24	23.76	100
Wheat	16.47	71.72	11.80	100

Source: Author's computation based on secondary data

Conclusion

It is concluded from the analysis of CAGR and instability during study period (1998-99 to 2018-19) area, production and productivity observed as an increased trend at a compound annual growth rate of 2.38 percent, 6.89 percent, and 4.01 percent in paddy and 1.11 percent, 4.07 percent, and 2.40 percent, in wheat respectively.

The Coefficient of variation (instability) indicates that maximum variation was observed in the production followed by productivity and area under both the crops. The highest variation in production shows that instability in production due to improved technology, high yield variety, supply of quality inputs and superior facility of irrigation etc.

The decomposition analysis of production suggests that during 1998-1999 to 2018-2019 productivity effect (Yield) was a major source of growth in rice and wheat production compared to area and interaction effect.

References

1. Das, Arghyadeep, Kumar, Sanjay. Growth performance of rice in west Bengal agriculture: a spatio temporal analysis, *Economic affairs* 2018;63(4):897-903.
2. Dey, Anwasha, Dinesh, Rashmi. Rice and wheat production in India: an overtime study on growth and instability, *journal of pharmacognosy and phytochemistry* 2020;9(2):158-161.
3. Edwin Kenamu, Alexander M, Phiri R. Performance of Cotton Production in Malawi. *Scholarly J Agric Sci* 2014;4(3):157-165. <http://www.scholarly-journals.com>
4. Jain, Ankur. Analysis of growth and instability in area, production, yield and price of rice in India. *Social Change and Development* 2018;XV(2).
5. Kakali M, Basu P. Measurement of growth trend: An econometric study of food grains production in west. *Bangladesh Journal of Agricultural Economics* 2006;3(3):44-55.
6. Kumar, Pawan, Shekhar, Himani. Estimation of growth rates and decomposition analysis of rice and wheat production in India. *International Journal of Multidisciplinary Research and Development* 2017;4(6):127-130.
7. Kumari Neelam, Mehta VP, Bhatiya. Food grains production in India: trend and decompositions. *Analysis, economic affairs* 2020;65(3):333-342 doi:10.46852/0424-2513.3.2020.3
8. Sharma, Amod, Kalita DC. Trends of area, production and Productivity of Major Fruit Crops in Jammu & Kashmir. *Agric. Situat. In India* 2008;65:477-488.
9. Sagolsem S, Mitra A, Leivang S. Growth and instability analysis of major crops in North East India. *Journal of*

Crop and Weed 2017;13(1):72-76.

10. Singh A, Srivastava RSL. Growth and instability in sugarcane production in Uttar Pradesh: a regional study. *Indian Journal of Agricultural Economics* 2003;58(2):279-282.