

Trend and Growth Performance of Rice in Central Region of Uttar Pradesh

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ABSTRACT

Present study on the basis of time series data during the 1997 to 2017. In this study conclude that highest area (10,12,425 ha) in 2013-14, highest production (24,98,186 mt) and productivity (24.83 qtl / ha) in 2016-17. It also revealed that minimum area (8,90,377 ha), production (15,96,930 mt) and productivity (17.28 qtl / ha) during the period of 1997-98, 2009-2010 and 2000-01 respectively. In this study also reveal simple growth rate of rice in area, production and productivity is 1.01, 1.94 and 1.03 respectively. The area registered positive combined growth rate of 1.025, per cent annually in the Central region. The production and Productivity registered positive and increasing growth rate of, 1.91 and 0.99 per cent annually during 1997-98 to 2016-17 in the Central region.

Keywords: Trend, Growth performance, Rice, central region of Uttar Pradesh

Agriculture in India has a significant history. Agriculture is the primary source of livelihood for about more than 70.00 per cent of India's population. India ranks second worldwide in farm output. India is the world's largest producer of many fresh fruits, vegetables, milk, major spices, fresh meat, fibrous crops like jute and staple crops such as millets and castor oil seeds. During 2019-20 crop years, food grain production was estimated to reach a record 295.67 million tons (MT). In 2020-21 Government of India is targeting food grain of 298 MT.

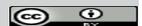
Uttar Pradesh (UP) located in northern part of India is surrounded by Uttara Khand, Himachal Pradesh, Haryana, Delhi in the North and in west Rajasthan, Madhya Pradesh and Chhattisgarh in the South-West and South; and Jharkhand and Bihar in the East. It is the fifth largest state in India in terms of geographical area covering roughly 2,40,928 square kilometers. This is nearly 7.33 per cent of total area of the country. In terms of population, UP is the largest

state of India with a population of about 199.80 million people (Census 2011) accounting for nearly 16.50 per cent of the total population of country. UP had more than 220 million people in 2016, which was comparatively less than (1.38 billion), India, (1.31 billion), U.S.A (321.8 million) and Indonesia (257.60 million) as part UN population projection for 2015 UP's population exceeds that France, Germany, United Kingdom put together.

UP is a large state divided into 75 revenue districts; 312 tehsils, 648 statutory towns, 267 Census towns and 1.06 lakh villages as per Census 2011. It is also among the most densely populated states of India with 829 persons inhabiting every square kilometers.

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Nearly 77.70 per cent of the people in the state live in rural areas making Uttar Pradesh primarily a rural economy. Not just that poverty levels in UP (29.40 per cent) exceed the national average (21.90 per cent) and so does rural poverty -30.40 per cent of the rural people are below the poverty line whereas India as whole, 25.70 per cent of the rural people are classified as poor.

The important crops include rice, wheat, maize, sugarcane, potato, chick pea, pigeon pea, mustard, lentil, urad and moong. Majority of the agriculture land is used to grow major cereal crops: rice & wheat. Rice is the major crop in Uttar Pradesh and is grown in about 5.90 mha which comprises of 13.50 per cent of total rice in India. Uttar Pradesh has favourable and suitable climate, vast areas of fertile soils, sunshine and adequate water resources. The cropping intensity is 153.00 per cent. The state ranks 3rd in the country in production of rice.

MATERIALS AND METHODS

The time series data pertaining to the period from 1997-98 to 2016-17 on area, production and productivity of Rice have been used to study the growth trends. These time series data have been procured from the Bulletins of Directorate of Agricultural Statistics and Crop-Insurance, Krishi Bhawan, Lucknow, Government of Uttar Pradesh and websites like updes.up.in / spatrika and agricoop.nic.in / agristatisticsnew.htm. Time series data of India have been procured from the bulletin of Agricultural Statistics at A Glance, 2018, Directorate of Economics and Statistics, Govt. of India. A lot of efforts are made by the Government of India to improve the scenario of rice crop production in the country in the past.

Statistical Methodologies

The statistical tools used for the analysis of time series data to fulfill the objectives of the of the study are described in the following sub-sections.

1. The regional general profile of rice crop in central region of Uttar Pradesh

(A) Regional Total

Sum of all districts data under particular region in the particular year.

(B) Moving Average

A moving average of order m can be written as,

$$\hat{T}_t = \frac{1}{m} \sum_{j=-k}^k y_{t-j}$$

Where $m = 2k + 1$, that is, the estimate of the trend-cycle at time t is obtained by average values of the time series within k periods of t . Observations that are nearby in time are also likely to be close in value. Therefore, the average eliminates some of the randomness in the data, leaving a smooth trend-cycle component. We call this an m -MA, meaning a moving average of order m .

2. Trend and growth rate

The trend and growth rate in area, production and productivity of major food grain crops have been worked out by fitting the following five different functions:

1. Simple linear function:

$$Y_t = a + b_t + \mu_t$$

2. Compound function:

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

$$Y_t^* = a^* + bt$$

Whereas:

Y_t : Time series data on area/production/productivity of different food grain crops i.e. Rice, Wheat and Gram at time t , a & b are parameters of the function to be estimated.

a : Intercept

b : Coefficient of variables

t : Time index ($t = 1, 2, \dots, n$)

r : Average compound growth rate per annum.

μ_t : error term at t and is assumed to follow independently distributed

However, before the fitting above functions, the time series data on area and production were smoothed by three years moving-average method.

Computation of growth rate

1. For linear function

After fitting the linear trend function by least-square method, we get the estimate of b denoted by \hat{b} (say). Then, annual linear growth rate is computed as follows;

$$r = \frac{\hat{b}}{\bar{Y}} \times 100$$

Where, \bar{Y} is arithmetic mean of Y_t .

2. Compound growth rate

To obtain annual compound growth rate, the third function was first linearised by taking natural log on both side, i.e.

$$\log Y_t = \log a + t \log (1 + r)$$

$$\text{or } Y_t^* = a^* + bt$$

Where, $Y_t^* = \log Y_t$, $a^* = \log a$ and $b = \log (1 + r)$

The above linearized function was fitted by least square method and estimate of b as \hat{b} was obtained.

The annual compound growth rate is then computed as;

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

All growth rates are expressed in percentage. The best fitted function was judged on the basis of R^2 (coefficient of multiple determinations).

RESULTS AND DISCUSSION

Table 1 reveals that area, production and productivity of rice in Central region of Uttar Pradesh during the period of 1997-98 to 2016-17. Table shows that highest area (10,12,425 ha) in 2013-14, highest production (24,98,186 mt) and productivity (24.83 qtl/ha) in 2016-17. It also revealed that minimum area (8,90,377 ha), production (15,96,930 mt) and productivity (17.28 qtl / ha) during the period of 1997-98, 2009-2010 and 2000-01 respectively. Fig. 1 depicted that area, production and productivity of rice in Central region of Uttar Pradesh; the highest area in 2013-14, highest production and productivity during the periods of 2016-17. It also depicted that minimum area, production and productivity during the periods of 1997-98, 2009-10 and 2000-01, respectively.

Table 1: Area, production and productivity of Rice in Central region of Uttar Pradesh

Sl. No.	Year	Area (ha)	3 yearly Moving Average	Production (mt)	3 yearly Moving Average	Productivity (q/ha)	3 yearly Moving Average
1	1997-98	890377		1873482		21.04145	
2	1998-99	908502	905422.3	1724797	1823865	18.98	20.14
3	1999-00	917388	919183.3	1873315	1736153	20.42	18.89
4	2000-01	931660	948637	1610346	1817059	17.28	19.14
5	2001-02	996863	891467.7	1967517	1641900	19.73	18.36
6	2002-03	745880	880484.7	1347837	1720064	18.07	19.44
7	2003-04	898711	866855	1844838	1692691	20.52	19.44
8	2004-05	955974	932969.3	1885398	1869031	19.72	20.04
9	2005-06	944223	943318.3	1876857	1817970	19.87	19.26
10	2006-07	929758	932148.3	1691654	1790595	18.19	19.20
11	2007-08	922464	935420.3	1803274	1812940	19.54	19.37
12	2008-09	954039	922527.3	1943892	1781365	20.37	19.28
13	2009-10	891079	927459.3	1596930	1739670	17.92	18.73
14	2010-11	937260	942605.3	1678188	1847208	17.90	19.50
15	2011-12	999477	981443	2266505	2130574	22.67	21.62
16	2012-13	1007592	1006498	2447029	2401408	24.28	23.85
17	2013-14	1012425	1008707	2490690	2373594	24.60	23.52
18	2014-15	1006105	1008212	2183063	2251489	21.69	22.32
19	2015-16	1006105	1006105	2080714	2253988	20.68	22.40
20	2016-17	1006105		2498186		24.83	

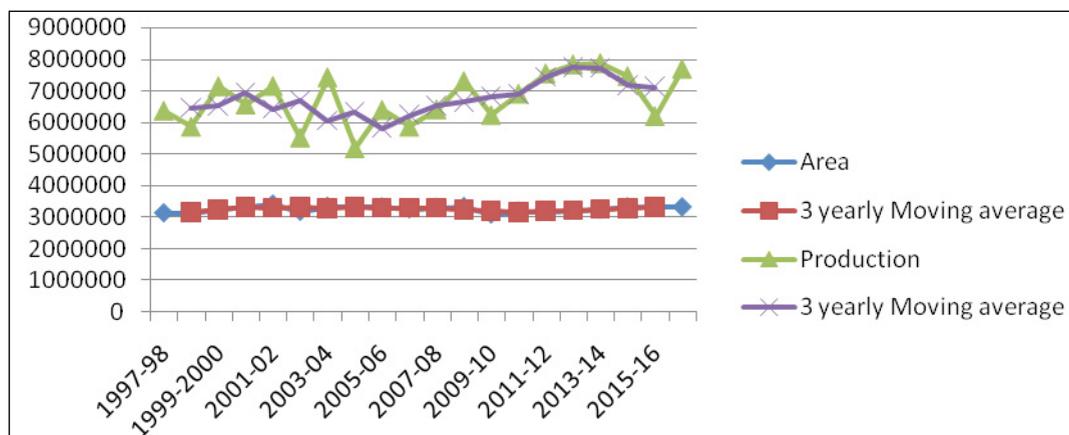


Fig. 1: Area and production of rice in Central region of Uttar Pradesh

Table 2: Annual average simple and compound growth rates of area, production and productivity of rice in different region of Uttar Pradesh and India (1997-98 to 2016-17)

Period		Area	Production	Productivity
Central	S.G.R	1.01	1.94	1.03
	C.G.R	1.02	1.91	0.99

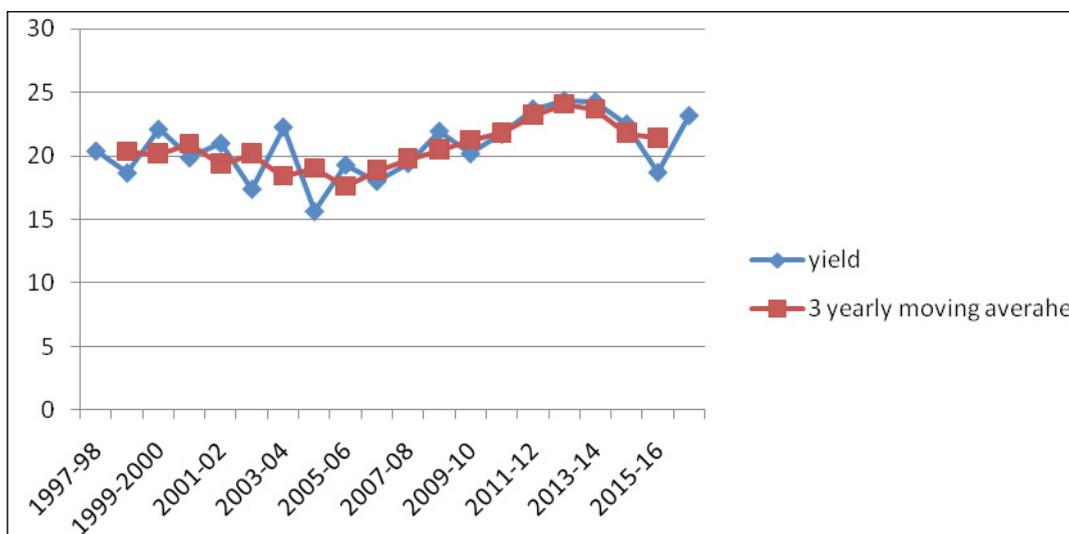


Fig. 2: Yield of rice in Central region of Uttar Pradesh

Table 2 reveals that the annual growth rates of area, production and productivity of rice in central region of U.P. has been computed and presented during the period 1997-98 to 2016-17 and also simple and compound growth function have provided consistent estimates of growth rates. There was an absolute increase in area of central region of U.P. that simple growth rate observed in central region 1.01 per cent, in case of production and productivity,

there was an absolute increase in simple growth rate in Central region with the rate of 1.94 and 1.03, respectively during the period of 1997-98 to 2016-17.

The area registered positive combined growth rate of 1.02476, per cent annually in the Central region. The production and Productivity registered positive and increasing growth rate of, 1.91 and 0.99 per cent annually during 1997-98 to 2016-17 in the Central region.

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