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Trends in area, production and productivity of rice crop of Barabanki district of Uttar Pradesh, India

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Abstract

The present study is based on secondary data collected from Sankhiki Patrika published by Uttar Pradesh Government and available on web-site <http://updes.up.nic.in/spatrika/spatrika.htm>. The data collected from 1994-1995 to 2014-15 and used the moving 3-yearly average, 5-yearly moving average and percent change with graphical presentations of Area, Production, and Productivity of Barabanki district of Uttar Pradesh. The graphical presented in the graph equations along with R^2 for 3 Models of each variable such as Linear, Exponential and Coefficient of Variation declined from 21.27% to 15.54% due to smoothing by Moving Average.

Keywords: Secondary data, moving average, linear model, exponential model, CV

Introduction

Rice (*Oryza sativa*), is a most important food grains crops in world, forms the staple diet of 2.7 billion people. It is grown in all continents except Antarctica, occupying 150 million ha, producing 573 million tones paddy with an average productivity of 3.83 tones / ha. Its cultivation is of immense importance to food security of Asia, where more than 90% of the global rice is produced and consumed. Belongs Rice to the genus *Oryza*, sub tribe oryzineae of the family Gramineae. It is one of the few crop species endowed with richest genetic diversity. There are 21 recognized species in genus *Oryza*.

Rice is most important food grains of India. Moreover, this country has the biggest area under rice cultivation, as it is the principal food crop Rice is the major crop of Uttar Pradesh which covers about 36.5 per cent area of total gross-cropped area in Uttar Pradesh.

Uttar Pradesh is one of the major states of rice growing in the country. It accounts about 13.53 and 13.54 per cent towards the total acreage and production of the rice in the country (2011-12). It has first rank in area as well as production among all the states of India. The productivity of rice has increased 2358kg/ha in 2011-12 from 519kg/ha in 1950-51 i.e. four and half times during the last 60 years. However, productivity of rice in Uttar Pradesh has been a little low (2358kg/ha, 2011-12) as compared to leading states of rice growing. For example, the maximum productivity of rice has been 3741kg/ha in Punjab followed by Tamil Nadu (3423kg/ha), Andhra Pradesh (3146kg/ha), Haryana (3044kg/ha), Karnataka (2897kg/ha), West Bengal (2715kg/ha) etc. during the year 2011-12. Thus, the Uttar Pradesh has still scope of vertical production.

Various research workers in the trends several crops based on time series data on crop yield with other variables. Notably among them are Annu and Nitin Tanwar (2018) [1], Naidu, *et al.* (1994) [2], Pant (2004) [3], Singh, and Sisodia (1989) [4, 5], Verma, *et al.* (2004) [5] Singh, and Chandra, (2001) [6].

Various efforts are being made by farm scientists, farmers and policy makers to increase the productivity of rice through sustainable agricultural development programmes by harnessing rain fed rice area in Uttar Pradesh.

Materials and statistical methodologies**Materials**

The present study is related to Barabanki district (Eastern Uttar Pradesh, India) which is situated between Latitudes 26° 30' North and 27° 19' North and Longitudes 80° 58' East and 81° 55' East. District Barabanki is surrounded by district Ayodhya in the East, districts Gonda and Bahraich in the North East, district Sitapur in the North West, district Lucknow in the West, district Rae Bareli in the South and district Amethi in the South East.

The river Ghaghra forms the North Eastern Boundary separating Barabanki from Bahraich and Gonda. The annual normal rainfall data of Nawabganj, Ramsanehi Ghat, Fatehpur and Haidergarh rain gauge station is 1173.4 mm, 1058.4 mm, 982.4 mm & 1011.6 mm respectively. The annual normal rainfall of the district is 1056 mm. It lies in the Eastern plain zone of Uttar Pradesh. It has an annual rainfall of about mm. the secondary data collected from Sankhiki Patrika published by Uttar Pradesh Government and available on web-site <http://updes.up.nic.in/spatrika/spatrika.htm>. The investigation was carried out during 1994-1995 to 2014-15 related to Paddy. The time series data of 21 years on Area, Production and Productivity.

Statistical methodologies

Moving average of extent (or period) m is a series of successive average (arithmetic mean) of m terms at a time, starting with 1st, 2nd and 3rd term etc. Thus, the first average is the mean of the 1st, m terms, the 2nd is the mean of the m terms from 2nd to $(m+1)$ th term, the third is the mean of the m terms from 3rd to $(m+2)$ th term, and so on.

If m is odd= $(2k+1)$ say, moving average is placed against the mid-value of the time interval it covers, i.e. against $t=k+1$ and if m is even= $2k$ (say), it is placed between the two middle value of the time interval it covers; i.e. between $t=k$ and $t=k+1$. In latter case the moving average does not coincide with an original time period and an attempt was made to synchronize the moving average and the original data by centering the moving average which consists in taking a moving average extent two, of these moving average and putting the first of these values against $t=k+1$. The graph obtained on plotting the moving average values against the corresponding time value given trend curve.

Result

Status of the area under rice crop

Table No. 1 shown the area of rice crop of Barabanki district with the 3-yearly and 5-yearly moving averages with percent changes and coefficient of variation. Coefficient of Variation declined from 9.12% to 7.10% due to smoothing by Moving Average. Area in year 2007-08 declined by 35.24 % in comparison to 2006-07

Table 1: Area under rice

Year	Area	3-Year moving average	5-Year moving average	% Change
1994-1995	176882			
1995-1996	170414	165243.67		-3.66
1996-1997	148435	152780.00	156927.00	-12.90
1997-1998	139491	145779.67	152352.20	-6.03
1998-1999	149413	147637.33	150098.00	7.11
1999-2000	154008	154188.00	152174.40	3.08
2000-2001	159143	157322.67	153512.00	3.33
2001-2002	158817	154713.00	158957.80	-0.20
2002-2003	146179	160546.00	165553.60	-7.96
2003-2004	176642	169936.00	171837.20	20.84
2004-2005	186987	184730.00	177812.80	5.86
2005-2006	190561	188747.67	182135.00	1.91
2006-2007	188695	182348.67	180873.20	-0.98
2007-2008	167790	175606.00	178847.80	-11.08
2008-2009	170333	171661.00	176423.00	1.52
2009-2010	176860	175210.00	174277.80	3.83
2010-2011	178437	177755.33	176908.20	0.90
2011-2012	177969	179116.00	180836.40	-0.26
2012-2013	180942	182961.67	184777.40	1.67
2013-2014	189974	189160.33		4.99
2014-2015	196565			3.47
C.V.	9.12	7.89	7.10	

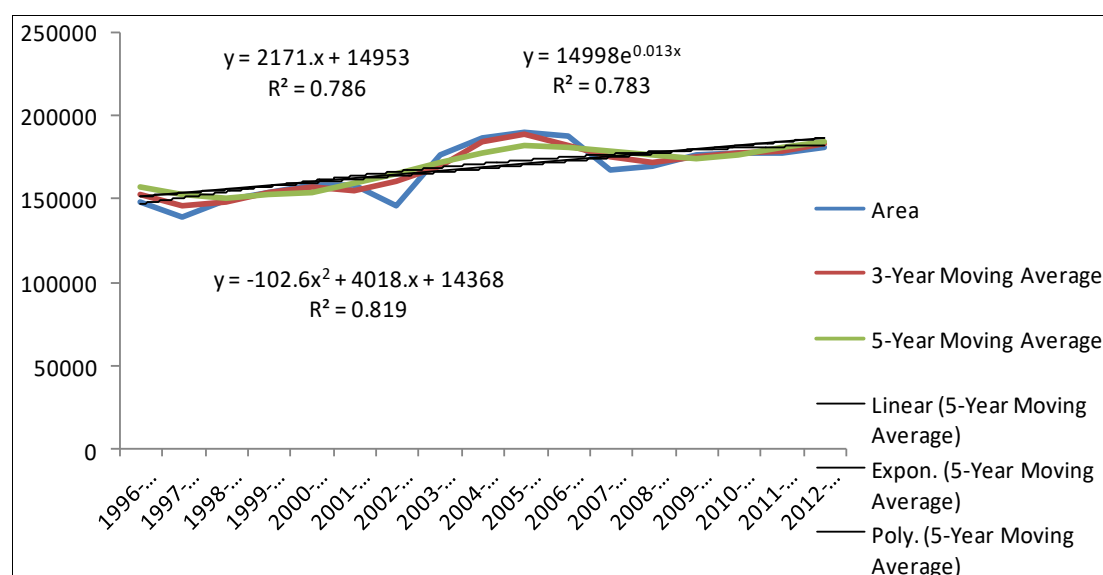


Fig 1(A): Year to year area under rice

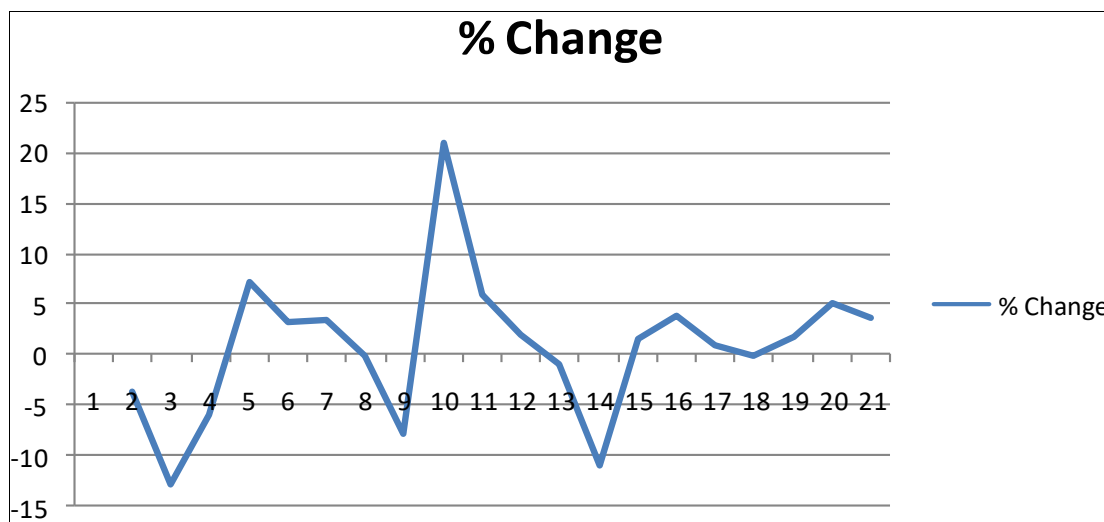


Fig 1(B): Year to year percent change in area under rice

Table 2 shows Coefficient of Variation declined from 21.27% to 15.54% due to smoothing by Moving Average. Production in year 2007-08 declined by 35.24 % in comparison to 2006-

07 which is not desirable and need to be reduced by developing adequate infrastructure for Irrigation which depends on Electricity, Diesel etc.

Table 2: Production of rice

Year	Production	3-Year moving average	5-Year moving average	% Change
1994-1995	352518			
1995-1996	327140	330506.67		-7.20
1996-1997	311862	305314.00	317989.2	-4.67
1997-1998	276940	303429.33	313581.8	-11.20
1998-1999	321486	309635.67	304737.6	16.09
1999-2000	330481	311628.67	309742.4	2.80
2000-2001	282919	316762.00	316421	-14.39
2001-2002	336886	310046.00	335167.8	19.08
2002-2003	310333	354146.33	361424	-7.88
2003-2004	415220	395771.67	393452.2	33.80
2004-2005	461762	440014.00	404146.8	11.21
2005-2006	443060	431727.00	392637.4	-4.05
2006-2007	390359	362068.33	379498	-11.89
2007-2008	252786	330889.33	368602.6	-35.24
2008-2009	349523	336531.33	364455.4	38.27
2009-2010	407285	393044.00	384695.2	16.53
2010-2011	422324	440389.00	444473.8	3.69
2011-2012	491558	488520.33	483283.6	16.39
2012-2013	551679	528936.33	509805.8	12.23
2013-2014	543572	545049.00		-1.47
2014-2015	539896			-0.68
C.V.	21.27	18.02	15.54	

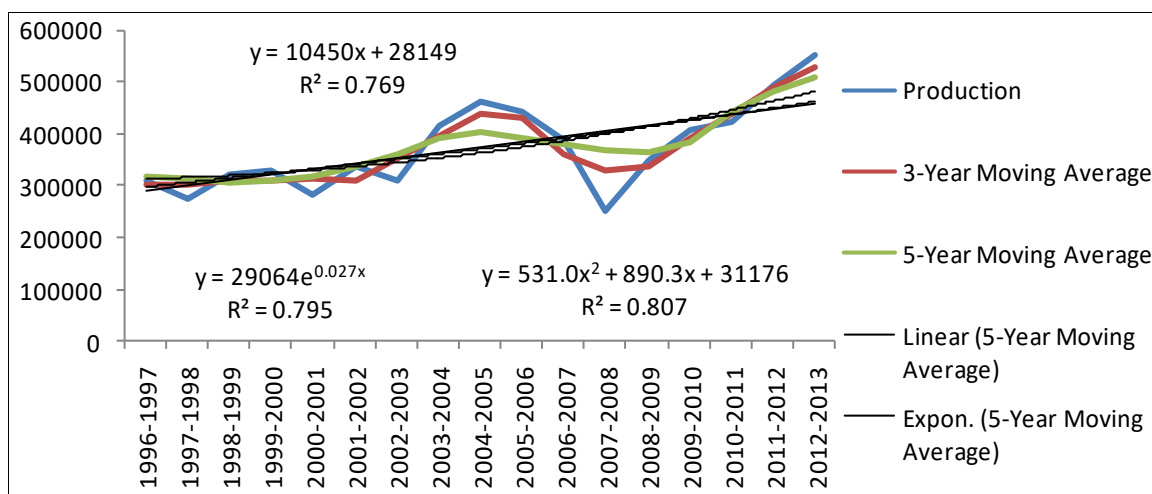


Fig 2(A): Year to year production for rice

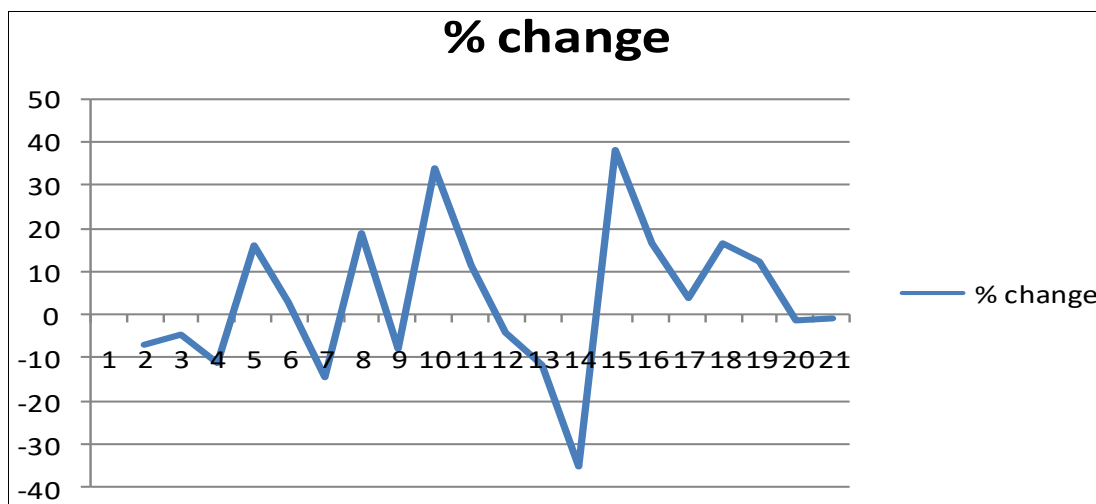


Fig 2(B): Year to year percent change in rice production

Table 3 shows Coefficient of Variation declined from 15.3% in year 2006-07 declined by 27.17 % in comparison to 2006-07 to 9.98% due to smoothing by Moving Average. Productivity

Table 3: Productivity of rice

Year	Productivity	3-Year moving average	5-Year moving average	% Change
1994-1995	199.30			
1995-1996	191.97	200.45		-3.68
1996-1997	210.10	200.20	203.01	9.45
1997-1998	198.54	207.93	206.07	-5.50
1998-1999	215.17	209.43	203.23	8.38
1999-2000	214.59	202.51	203.64	-0.27
2000-2001	177.78	201.50	206.39	-17.15
2001-2002	212.12	200.73	210.37	19.32
2002-2003	212.30	219.83	216.84	0.08
2003-2004	235.06	231.44	227.79	10.72
2004-2005	246.95	238.17	226.74	5.056
2005-2006	232.50	228.77	214.41	-5.85
2006-2007	206.87	196.68	208.44	-11.02
2007-2008	150.66	187.58	205.10	-27.17
2008-2009	205.20	195.38	205.94	36.20
2009-2010	230.29	224.06	219.81	12.23
2010-2011	236.68	247.72	250.65	2.78
2011-2012	276.20	272.59	266.84	16.70
2012-2013	304.89	289.08	275.71	10.39
2013-2014	286.13	288.56		-6.15
2014-2015	274.67			
C.V.	15.30	12.29	9.98	

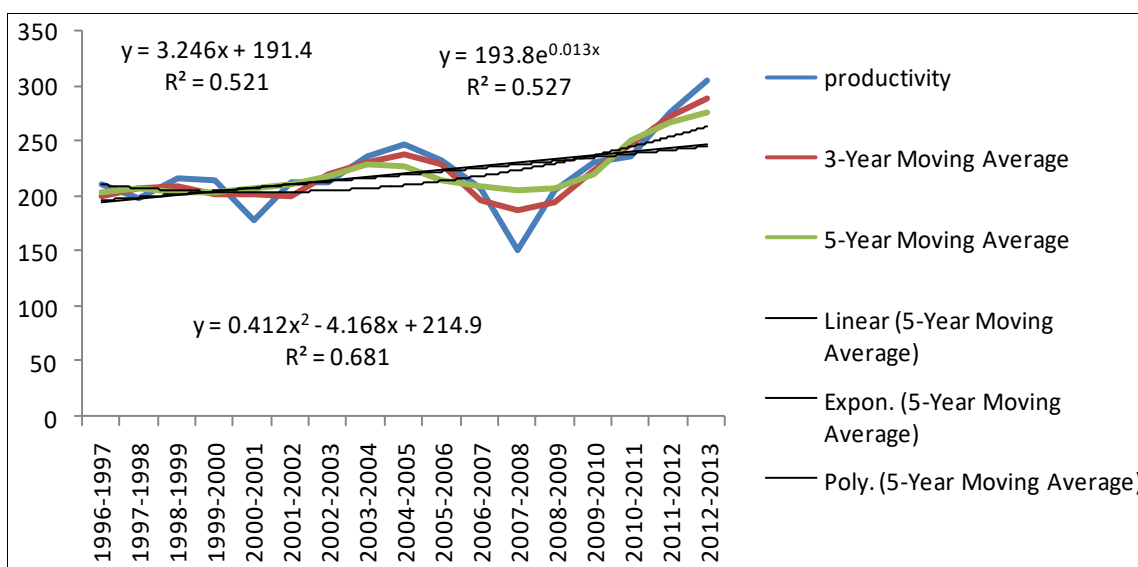


Fig 3(A): Productivity for rice

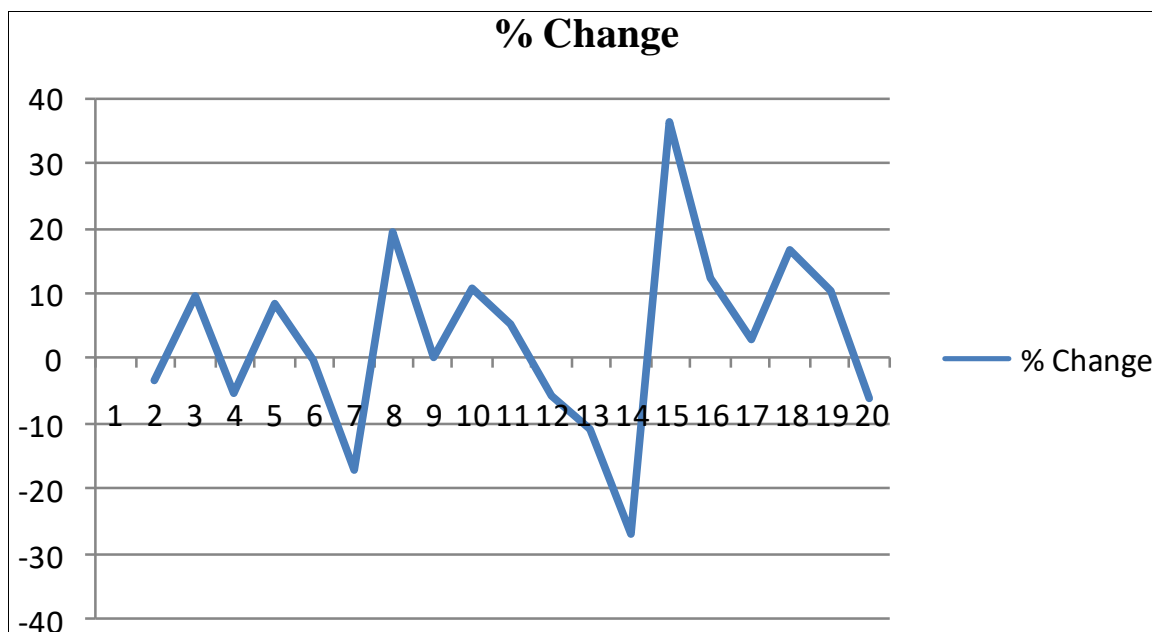


Fig 3(B): Year to year percent change in productivity for rice

Above fluctuations in Productivity is not desirable and needs to be made sustainable by augmenting Infrastructure and Technology.

Per-cent change, every year, in Production, Area, Productivity is very erratic and random. 3 years and 5 years moving average confirms this trend which indicate that production is still heavily based on weather parameters in particular rainfall. This trend suggested for strengthening of Irrigation infrastructure.

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