



RESEARCH ARTICLE

TRENDS IN CEREAL CROP PRODUCTION IN JAMMU AND KASHMIR INDIA

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ABSTRACT

Within the spectrum of agricultural geography trends are being studied to find out the changes taking place in a particular period. The present study has been undertaken to study the trends in cereal crops of Jammu and Kashmir state for a period of 2000-2011 and accordingly assessments can be formulated for better agriculture growth and development. Coupled with this possible factors have been taken into consideration for finding out the causes for fluctuating trends in cereal crops.

Significance: The study is useful to agronomists, planners, administrators, and social scientists in viewing out priority regions for planning purposes and that way future plans can be designed and implemented accordingly. In so doing balanced growth in agriculture sector can take place which is of course one of the major objectives of going for a research in the field of agricultural geography.

Data Base and Methodology: The present study has been carried out in a systematic order. Both primary and secondary data was utilized to find out the results. Data was collected, tabulated and analyzed. To Study trends in cereal crops various statistical methods were applied viz Time series analysis, correlation, Kendal's method, etc .To find out the future trends regression analysis was applied.

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INTRODUCTION

The state of Jammu and Kashmir is the Northern most state of India which lies between 32^o.17 and 36^o. 58 North latitude and 73^o.26 and 80^o.3 longitude with marked relief variations, antecedent drainage, complex geological structure and rich temperate flora and fauna. The state is known for its agriculture potential. Agriculture plays a pivotal role in the economy of Jammu And Kashmir State. Even those who are involved in other industrial activities are one way or the other way associated with the agriculture. Nearly 70% of the population of the state is involved with agriculture and its allied activities. As per the estimates the share of agriculture and allied sectors in the gross domestic product for the year 2010-11 was nearly 20.59%.

Analysis and Discussion

In the above context the present research paper is analyzing the trends in the major cereal crops of the state which include rice, wheat and maize for a period of 11 years from 2000-2011. Yield trends of cereal crops has been predicted for the year 2020 and 2050. It has been observed that cereal crops have recorded minor fluctuations and most of the years have shown a stable growth. However, increasing growth trend has been observed in the year 2006-07 in terms of rice. While as the highest yield for wheat was recorded in the year 2004-05 and lowest wheat yield was recorded in the year 2000-01 .In terms of maize the yield was highest in the year 2008-09 and lowest in the year 2002-03.

Let the linear trend equation be

$$Y_t = a + bx \dots\dots\dots(I)$$

Subjected to the given normal equation

$$y = Na + b \sum X$$
$$\sum XY = a \sum X + b \sum X^2$$

Sub. All the above calculated values in

$$217.12 = 11a + b.0 \dots\dots\dots(II)$$

$$158.95 = a.0 + b.2750 \dots\dots\dots(III)$$

From Eqn. II we get

$$217.12 = 11a$$
$$a = 217.12/11 \text{ or } a = 19.73$$

From Eqn. III

$$158.95 = a.0 + b.2750$$
$$158.95 = 0 + b.2750 \text{ or } b = 158.95/2750 \text{ Or } b = 0.05$$

Sub. the value of (a) and (b) in eqn. (I) we get

$$Y_t = 19.73 + 0.05x$$

Now from the trend values

$$Y_{2020} = 19.73 + 0.05(75)$$

$$Y_{2020} = 19.73 + 3.75 \text{ or } Y_{2020} = 23.48$$

$$Y_{2050} = 19.73 + 0.05(225) \text{ or } Y_{2050} = 19.73 + 11.25 = 30.98$$

Let the linear equation be

$$Y_t = a + bx \dots\dots\dots(I)$$

Subjected to the given normal equation

$$Y = Na + b \sum x$$
$$165.40 = 11a + b(0)$$

$$165.40 = 11a \text{ Or } a = 165.40/11 = 15.03$$

$$\sum xy = a \sum x + b \sum X^2$$

$$-213.90 = a(0) + b.2750$$

$$-213.90 = b.2750 \text{ or } b = -213.90/2750 = -0.07$$

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Table 1 RICE: Area, Production and Yield

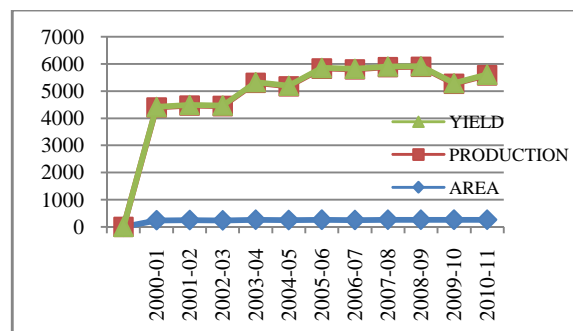
YEAR	Area(000 ha)	Production 000 qtls)	YIELD (qtls./ ha)	% AREA	% PRODUCTION	%YIELD
1999-00	244.05	3915	16.65
2000-01	244.05	4153	17.61	-2.62	6.07	12.52
2001-02	249.80	4223	16.90	2.35	1.68	-4.03
2002-03	236.20	4214	17.84	-5.44	-0.21	5.56
2003-04	259.82	5048	19.42	10.00	19.79	8.85
2004-05	250.04	4928	18.96	-3.45	-2.37	-2.36
2005-06	259.01	5574	21.52	3.58	13.30	13.50
2006-07	252.52	5546	22.00	-2.50	0.50	2.23
2007-08	263.25	5620	21.34	4.24	1.33	-3.00
2008-09	257.63	5637	21.88	-2.13	0.30	2.53
2009-10	259.89	5011	19.28	0.87	-11.10	-11.88
2010-11	261.35	5324	20.37	0.56	6.24	5.65

Source: Digest of statistics, Directorate of Economics and Statistics, Govt. of Jammu and Kashmir (2010-11)

Table 2 Trend Analysis of Rice Yield/Hact, in Jammu and Kashmir

YEAR (X)	YIELD (Y)	X= (X-2005)	X ²	XY
2000-01	17.61	-5	25	-88.05
2001-02	16.90	-10	100	-169.00
2002-03	17.84	-15	225	-267.60
2003-04	19.42	-20	400	-388.40
2004-05	18.96	-25	625	-474.00
2005-06	21.52	0	0	00
2006-07	22.00	5	25	110.00
2007-08	21.34	10	100	213.40
2008-09	21.88	15	225	328.20
2009-10	19.28	20	400	385.60
2010-11	20.37	25	625	509.25
TOTAL	Y=217.12	X=0	X²=2750	XY=158.95

YEAR	x	Yt =19.73 + 0.05x	Yt (Trend Value)
2000-01	-5	19.73 + 0.05 (-5)	19.48
2001-02	-10	19.73 + 0.05 (-10)	19.23
2002-03	-15	19.73 + 0.05(-15)	18.98
2003-04	-20	19.73 + 0.05(-20)	18.73
2004-05	-25	19.73 + 0.05(-25)	18.48
2005-06	0	19.73 + 0.05(0)	19.73
2006-07	5	19.73 + 0.05(5)	19.98
2007-08	10	19.73 + 0.05(10)	20.23
2008-09	15	19.73 + 0.05(15)	20.48
2009-10	20	19.73 + 0.05(20)	20.73
2010-11	25	19.73 + 0.05(25)	20.98

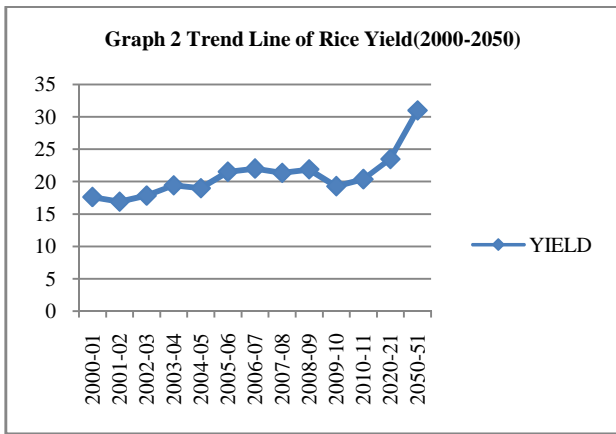


Graph 1 Rice: Trend in Area, Production and yield

Table 3 WHEAT: Area, Production and Yield

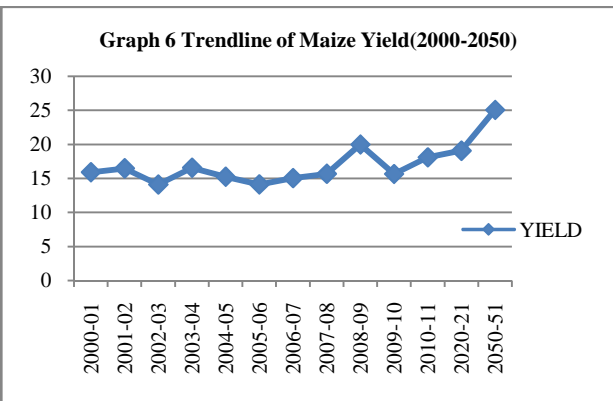
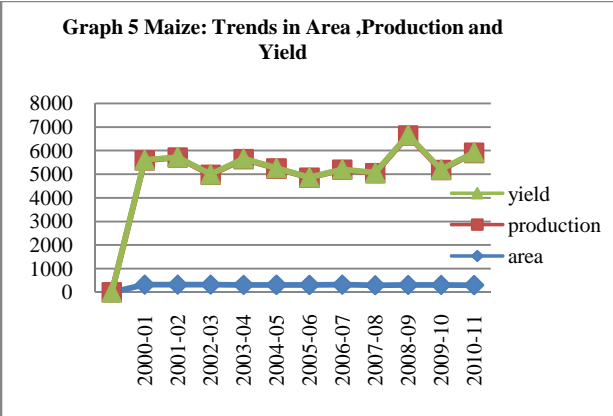
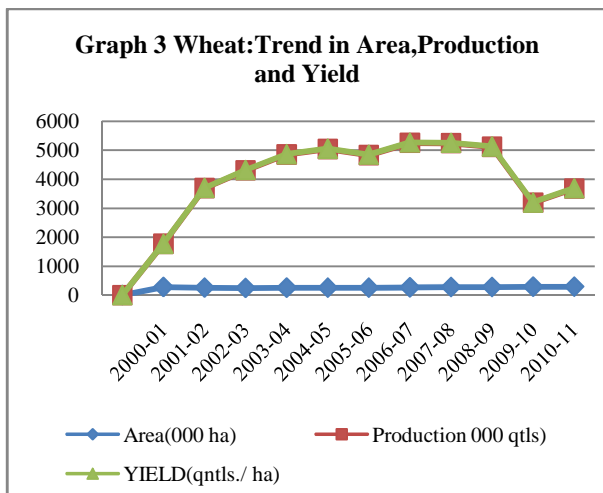
YEAR	Area(000 ha)	Production 000 qtls)	YIELD(qtls./ ha)	% AREA	% PRODUCTION	%YIELD
1999-00	245.75	4343	17.67
2000-01	280.96	1487	5.29	14.32	-65.76	-70.05
2001-02	259.60	3430	13.21	-7.60	130.66	149.71
2002-03	248.30	4055	16.33	-4.35	18.22	23.61
2003-04	254.66	4595	18.04	2.56	13.31	10.47
2004-05	252.78	4782	18.91	-0.07	4.06	4.82
2005-06	252.83	4575	18.09	0.01	-4.32	-4.33
2006-07	266.11	4983	18.72	5.25	8.91	3.48
2007-08	278.30	4959	17.81	4.58	-0.48	-4.86
2008-09	278.72	4835	17.34	0.15	-2.50	-2.63
2009-10	288.94	2899	10.03	3.66	-40.04	-42.15
2010-11	290.72	3383	11.63	0.61	16.69	15.95

Source: Digest of statistics, Directorate of Economics and Statistics, Govt. of Jammu and Kashmir (2010-11)



Source: Calculated and Computed by Researchers

YEAR	X	Yt = 15.03 + (-0.07) X	Yt = Trend values
2000-01	-5	15.03 + (-0.07) -5	15.38
2001-02	-10	15.03 + (-0.07) -10	15.73
2002-03	-15	15.03 + (-0.07) -15	16.08
2003-04	-20	15.03 + (-0.07) -20	16.43
2004-05	-25	15.03 + (-0.07) -25	16.78
2005-06	0	15.03 + (-0.07) 0	15.03
2006-07	5	15.03 + (-0.07) 5	14.68
2007-08	10	15.03 + (-0.07) 10	14.33
2008-09	15	15.03 + (-0.07) 15	13.98
2009-10	20	15.03 + (-0.07) 20	13.63
2010-11	25	15.03 + (-0.07) 25	13.28

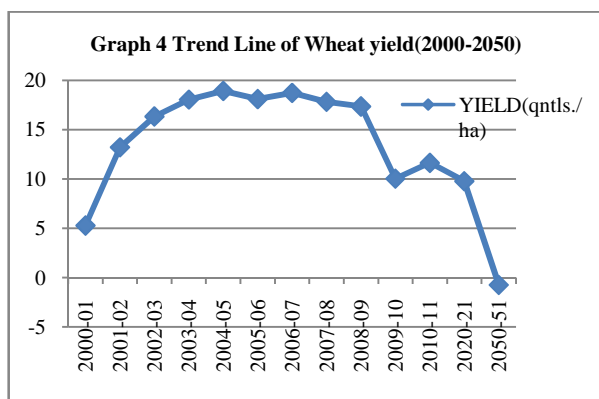


Source: Calculated and Computed by Researchers

Table 4 Trend Analysis of Wheat

YEAR(x)	YIELD(Y)	X= X-2005	X ²	XY
2000-01	5.29	-5	25	-26.45
2001-02	13.21	-10	100	-132.10
2002-03	16.33	-15	225	-244.95
2003-04	18.04	-20	400	-360.80
2004-05	18.91	-25	625	-472.75
2005-06	18.09	0	0	0
2006-07	18.72	5	25	93.60
2007-08	17.81	10	100	178.10
2008-09	17.34	15	225	260.10
2009-10	10.03	20	400	200.60
2010-11	11.63	25	625	290.75
	y=	X= 0	X² =	XY = -
	165.40		2750	213.90

Year	(x)	Yt=16.08 +0.04(x)	Yt = Trend value
2000-01	-5	16.08 +0.04(-5)	15.88
2001-02	-10	16.08 +0.04(-10)	15.68
2002-03	-15	16.08 +0.04(-15)	15.48
2003-04	-20	16.08 +0.04(-20)	15.28
2004-05	-25	16.08 +0.04(-25)	15.08
2005-06	0	16.08 +0.04(0)	16.08
2006-07	5	16.08 +0.04(5)	16.28
2007-08	10	16.08 +0.04(10)	16.48
2008-09	15	16.08 +0.04(15)	16.68
2009-10	20	16.08 +0.04(20)	16.88
2010-11	25	16.08 +0.04(25)	17.08



Source: Calculated and Computed by Researchers

Substituting the value of (a) and (b) in equation (I), we get

$$Y_t = a + bx$$

$$Y_t = 15.03 + (-0.07) x$$

Now for the year 2020 will be

$$Y_{2020} = a + bX$$

$$Y_{2020} = 15.03 + (-0.07) 75$$

$$Y_{2020} = 15.03 - 5.25$$

$$Y_{2020} = 9.78$$

Now for year 2050 the value of Yt will be $Y_{2050} = 15.03 +$

$$(-0.07) 225$$

$$Y_{2050} = 15.03 -15.75 \quad \text{or } Y_{2050} = -0.72$$

Let the linear trend equation be

$$Y_t = a + bx \dots\dots\dots (I)$$

Subjected to the normal equation

$$Y = Na + b \sum x \dots\dots\dots (II)$$

$$176.94 = 11a + b.0$$

$$176.94 = 11a \text{ or } a = 176.94/11 = 16.08$$

$$\sum xy = a \sum x + b \sum x^2 \dots\dots\dots (III)$$

$$126.10 = a.0 + b.2750$$

$$126.10 = 2750.b \text{ or } b = 126.10/2750 = 0.04$$

Substituting the value of a and b in Eqn. (I)

$$Y_t = a + bx$$

$$\text{Therefore } Y_t = 16.08 + 0.04 (x)$$

Now from the given equation $Y_t = a + bx$

$$Y_{2020} = 16.08 + b(75)$$

$$Y_{2020} = 16.08 + 0.04 (75) \text{ or } Y_{2020} = 16.08 + 3 = 19.08$$

$$\text{And for } Y_{2050} = 16.08 + 0.04(225) \text{ or } Y_{2050} = 16.08 + 9 =$$

$$25.08$$

The fluctuating trends are mainly contributed to the changing land use /land cover, environmental, irrigational and technological factors. Conversion of agriculture land into built up area which is the main cause of low agricultural production in the state of Jammu and Kashmir .Climatic factors especially variations in temperature, precipitation and humidity trends have also contributed to fluctuating nature of crop production. Assured irrigation facility, high yield variety (HYV) crops and modern agriculture technologies are to be implemented in order to increase yield per hectare of crops. Besides that there is a need to curb the conversion of agriculture land into built up area so that the state of Jammu and Kashmir will be self sufficient in food grains and the state will remain on the track of prosperity.

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Table 5 MAIZE: Area, Production and Yield

YEAR	Area(000 ha)	Production 000 qtls)	YIELD(qtls./ha)	% AREA	% PRODUCTION	%YIELD
1999-00	317.30	4712	14.85	-----	-----	-----
2000-01	330.21	5258	15.92	4.06	11.58	7.20
2001-02	326.48	5381	16.48	-1.12	2.33	3.51
2002-03	329.46	4651	14.11	0.91	-13.56	-14.38
2003-04	321.19	5326	16.58	-2.51	14.51	17.50
2004-05	322.70	4922	15.25	0.47	-7.58	-8.02
2005-06	320.92	4535	14.13	-0.55	-7.86	-7.34
2006-07	323.60	4869	15.04	-0.83	7.36	6.44
2007-08	302.44	4745	15.68	-6.53	-2.54	4.25
2008-09	315.81	6331	20.00	4.42	33.42	27.74
2009-10	311.02	4870	15.65	-1.51	-23.07	-21.75
2010-11	308.22	5600	18.10	-0.90	14.98	15.65

Source: Digest of statistics, Directorate of Economics and Statistics, Govt. of Jammu and Kashmir (2010-11)

Table 6 Trend Analysis of Maize

YEAR X	YIELD Y	X= X-2005	X ²	XY
2000-01	15.92	-5	25	-79.60
2001-02	16.48	-10	100	-164.80
2002-03	14.11	-15	225	-211.65
2003-04	16.58	-20	400	-331.60
2004-05	15.25	-25	625	-381.25
2005-06	14.13	0	0	0
2006-07	15.04	5	25	75.20
2007-08	15.68	10	100	156.80
2008-09	20.00	15	225	300.00
2009-10	15.65	20	400	313.00
2010-11	18.10	25	625	450.00
	Y = 176.94	X = 0	X ²	XY = 126.10

CONCLUSION AND SUGGESTIONS

Although it is evident from the tables 1.1, 1.3 and 1.5 that the yield has shown minor fluctuations. But trend values calculated by regression analysis for the cereal crops for year 2020 and 2050 has shown a positive growth except wheat which has negative growth which is evident from the graph 1.2,1.4 and 1.6.The calculated rice yield for the year 2020 and 2050 is 23.48 and 30.90 respectively. Trend value of the wheat yield for year 2020 and 2050 is 9.78 and -0.72 respectively. While as the maize yield for the year 2020 and 2050 will be 19.08 and 25.08 respectively.

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