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TRENDS OF AREA, PRODUCTION AND YIELD IN WESTERN UTTAR PRADESH 'A DISTRICT-WISE ANALYSIS OF FOODGRAINS'

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Introduction

The term 'agriculture' literally means the science and practices of the cultivation of the soil including the raising of live stock. In economic jargon, the word includes the production and distribution of goods of agriculture origin for consumption by the population at large, domestic or foreign. In this respect it is a complex sector encompassing many products. The understanding of the contribution of agriculture to economy and of their relationship with the growth process of economy is of special significance for setting goals of agriculture development for a region and for designing a strategy for agriculture development.

Agricultural development in Western Uttar Pradesh has been characterized by wide disparities. One the one hand there are districts which have experienced a very high level of per capita agricultural output caused by a sustained rise in per hectare agricultural output. In view of this it becomes necessary to study the extent of the inequalities in agricultural productivity and to identify the factors underlying this state affairs.

Objectives:

1. To measure the district-wise total factor productivity (TFP) for foodgrain crops in Western U.P.
2. To suggest policies and strategies to sustain the growth in TFP by district.

METHODOLOGY:

The Kendrick Index:-

This index is based on the assumption of a linear production function of the following from assumed by Kendrick (1961)

$$Q = aL + bK.$$

Where a and b are positive constants, and Q, L and K convey the usual meanings.

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This index is the ratio of output to weighted average of the two factors of production, where base year rates of reward are taken as weights.

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Kendrick index of TFP is given by:

$$A_t^K(t) = \frac{Q_t}{W_0L_t+r_0K_t}$$

W_0 and r_0 are the base year rates of reward for labour and capital respectively.

Each of the above three methods has its own merits and demerits.

In the present study due to limitation of data, we have used kendrick index for measuring the Total Factor Productivity (TFP) in agricultural sector. In this study we have taken yield as output and fertilizer, pesticides, Seeds, working capital used as inputs. Then this formula is convert as:

$$A_t = \frac{Y_t}{WC+F+S+P}$$

where Y_t= yield in ‘t’ year

WC= Working Capital per hectare in ‘t’ year

F= Fertilizer consumption per hectare in ‘t’ year

S= Seed Consumption per hectare in ‘t’ year

P= Pesticide consumption per hectare in ‘t’ year

A_t= Index of Total factor productivity in ‘t’ year

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In the above formula, we take equal weightage of all inputs (Non availability of price data at district level) and we make indexing of inputs and outputs.

In this study, TFP is measured for foodgrain crop sector in Western Uttar Pradesh during the period from 1993/94 to 2007/08. For analytical convenience this period has been divided into two sub periods, namely, 1993/94 to 1999/2000 (first sub-period) and 2000/01 to 2007/08

(second sub-period). The study covers 26 districts of Western Uttar Pradesh. We have taken rice, wheat, jowar, bajara, maize, barley and gram crops as foodgrains.

A widely accepted exponential model, $y = a\, b^t\, e^u$, has been fitted to the time series data for estimating growth rates. The logarithmic form of this function is given by;

$$\ln (y) = \ln(a) + t \ln(b) + u$$

where,

y is the dependent variable whose growth rate is to be estimated.

t is the independent variable (Time)

u is the disturbance or error term.

a and b are the parameters to be estimated from sample observations. The regression coefficient b is estimated by ordinary least squares (OLS) technique.

The Compound Average Growth Rate (CAGR) in % term is estimated as:

$$CAGR = \{\text{antilog } (b) - 1\} * 100$$

RESULTS AND DISCUSSION:

Productivity as a source of growth has been an important theme of analytical enquiry in economics all along. Analysis of total factor productivity, attempts to measure the amount of increase in total output which is not accounted for by increase in total inputs. There is a large residual which is the contribution of the knowledge sector; this is called technological change or total factor productivity. The total factor productivity index is computed as the ratio of an index of aggregate output to an index of aggregate inputs.

There are two sections. Agricultural performance of India at the state level, i.e, trend analysis of Area, Production and Yield, has been discussed in Section I. Section II appraises the district-wise trends and growth of total factor productivity in foodgrain crops at district level in Western Uttar Pradesh.

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SECTION I: District-wise Agricultural Performance of Western U.P.

The results of estimation of CAGR of area, output and yield in respect of foodgrains of the western zone of U.P. for the two sub-periods i.e. 1990-91to 1999-2000, 2000-01 to 2007-08 and as also for the complete period i.e., 1990-91 to 2007-08 are presented in Table 1.

The district-wise results make clear that CAGR of agricultural output for foodgrain crops in western zone of U.P. in the later period i.e. 2000-01 to 2007-08 has significantly increased as compared to first period i.e. 1990-91 to 1999-2000 in case of nine districts (Moradabad, Meerut, Ghaziabad, Bulandshahr, Aligarh, Etah, Mainpuri, Farrukhabad and Etawah). It is also observed from these results that most of district, except Bijnore, Moradabad, Saharanpur, Muzaffar Nagar, Meerut, Ghaziabad, Farrukhabad and Etawah, experienced a rise in output growth rate of foodgrains over the study period 1990-91 to 2007-08. But the CAGR of output of foodgrain crops varied across the state. In case of foodgrain crops, it has been estimated between 1 to 3 % per annum for Rampur, Mathura, Agra, Firozabad, Etah, Mainpuri, Bareilly, Pillibhit and Shahajahanpur during the study period. In case of 7 districts (Bijnore, Moradabad, Saharanpur, Muzaffar Nagar, Ghaziabad, Farrukhabad and Etawah) experienced a fall in output growth rate of foodgrain over the study period 1990-91 to 2007-08 because area whose contributions have decreased over a period of time in most of district.

During this period , the Aurriya district of western zone of U.P. recorded the highest growth performance of the order of 38.38% per annum followed by Kannuj, Gautam Budh Nagar and Baghpat in that order.

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	District	Area			Production			Yield		
		1990-2000	2000-2008	1990-2008	1990-2000	2000-2008	1990-2008	1990-2000	2000-2008	1990-2008
	Bijnor	-1.54	-2.25	-1.73	0.95	-2.06	-0.30	2.53	0.19	1.45
	moradabad	-4.18	1.22	-1.59	-2.70	-0.31	-1.05	1.55	-1.51	0.55
	Rampur	1.36	0.95	1.21	3.60	-0.21	1.85	2.22	-1.15	0.63
	Saharanpur	-0.27	-1.62	-1.47	1.57	-2.83	-1.04	1.85	-1.23	0.43
	Muzaffarnagar	-1.14	-1.88	-1.87	0.52	-3.00	-0.81	1.68	-1.14	1.08
	Meerut	-6.30	-1.99	-4.80	-5.10	-1.62	-4.05	1.27	0.37	0.78
	Ghaziabad	-4.18	0.45	-2.08	-2.62	0.50	-1.26	1.62	0.04	0.83
	Bulandshahr	-2.98	6.50	0.25	-0.93	2.57	0.64	2.11	-3.69	0.39
	Aligarh	-2.95	2.89	-1.14	0.06	1.39	0.45	3.10	-1.46	1.61
	Mathura	1.08	-1.34	0.51	3.27	-0.04	2.02	2.16	1.32	1.51
	Agra	2.09	-2.23	0.09	6.32	-1.91	1.59	4.15	0.32	1.50
	Firozabad	1.24	-0.98	0.72	3.07	1.66	2.17	1.80	2.67	1.45
	Etah	-0.85	3.91	0.03	2.00	2.43	1.73	2.88	-1.42	1.70
	Mainpuri	1.02	5.81	1.33	3.13	5.58	2.83	2.09	-0.22	1.48
	Budaun	-0.57	-0.44	-0.62	2.12	-1.65	0.81	2.70	-1.21	1.44
	Bareilly	0.69	0.53	0.25	3.90	0.24	1.60	3.19	-0.29	1.34
	Pilibhit	0.07	1.04	0.55	2.09	2.08	2.08	2.01	1.03	1.51
	Shahjahanpur	1.12	0.78	0.82	3.38	1.62	2.39	2.23	0.84	1.56
	Farrukhabad	-9.39	6.56	-5.06	-5.77	2.91	-3.72	3.99	-3.43	1.41

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	Etawah	-7.97	1.36	-5.06	-5.97	2.39	-3.78	2.18	1.01	1.35
	Jyotiba Phule Nagar		-6.10			-5.58			0.55	
	Baghpat	1.11	-15.60	-4.18	10.49	-8.21	5.14	9.28	8.75	9.72
	Gautam Buddha Nagar	18.39	-1.68	10.98	27.30	-3.36	16.38	7.53	-1.71	4.87
	Hathras		-0.05			-1.11			-1.06	
	Kannauj	21.74	4.32	13.49	31.14	4.08	18.04	7.73	-0.24	4.01
	Auraiya	45.32	1.66	26.72	75.68	2.50	38.39	20.89	0.82	9.21
	W.Zone	-0.80	0.61	-0.48	1.63	0.31	0.85	2.45	-0.31	1.33

Table 1 : District-wise CAGR in Area, Production and Yield for Foodgrain in Western Zone(in per cent)

The results of estimation of CAGR of area, output and yield in respect of foodgrains of the U.P. for the two sub-periods i.e.1990-91 to 1999-2000, 2000-01 to 2007-08 and as also for the complete period i.e., 1990-91 to 2007-08 are presented in Table 2.

The Western zone results make clear that CAGR of agricultural output for food grain crops in Uttar Pradesh in the later period i.e. 2000-01 to 2007-08 has significantly decreased as compared to first period i.e. 1990-91 to 1990-2000 in case of Western U.P. Yield for food grain crops in U.P. has significantly decreased during the entire period.

Table 2 : CAGR in Area,Production and Yield for Foodgrain in Western Uttar Pradesh and India (in per cent)

S. No.	Districts	area			Production			Yield		
		1990-2000	2000-2008	1990-2008	1990-2000	2000-2008	1990-2008	1990-2000	2000-2008	1990-2008
1	**W.Zone**	-0.80	0.61	-0.48	1.63	0.31	0.85	2.45	-0.31	1.33
2	**U.P.**	-1.49	0.89	-1.04	1.22	0.25	0.47	2.76	-0.64	1.52
3	**India**	-0.08	0.48	-0.13	2.09	2.01	1.28	2.17	1.52	1.41

SECTION II: Total Factor Productivity: District-wise Analysis of Western UP

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The movements in TFP Index of foodgrain in western zone (Uttar Pradesh) over the period 1993-94 to 2007-08 are presented in Figure (a) to Figure (h) shows that the level Comparisons among these districts over the period of study show that on an average TFP levels have been the highest in Bijnore. In Figure (b), an average TFP levels have been the highest in Moradabad. In figure (c), an average TFP levels have been the highest in Aligarh in figure (d), average TFP levels have been the highest in Baghpat. In figure (e) an average TFP levels have been the highest in Agra.

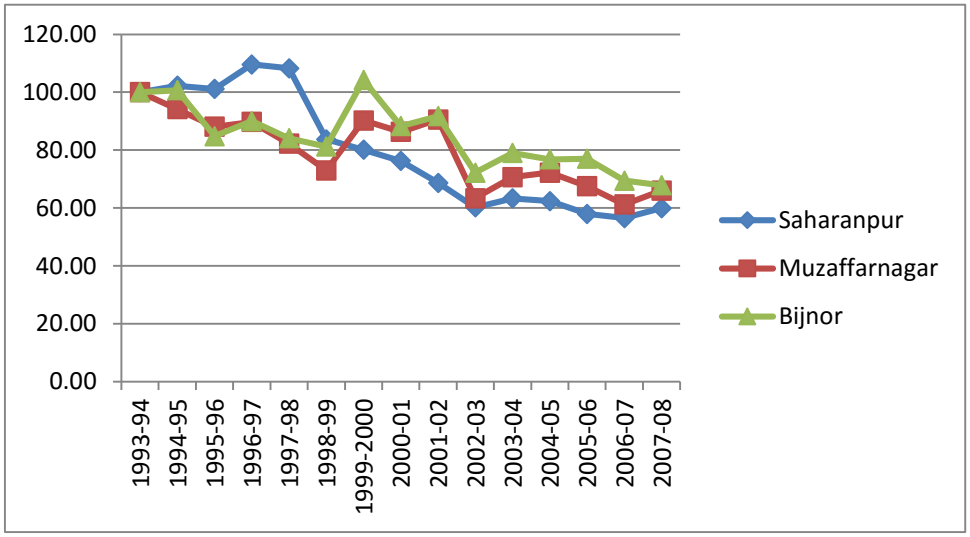

Figure (a)

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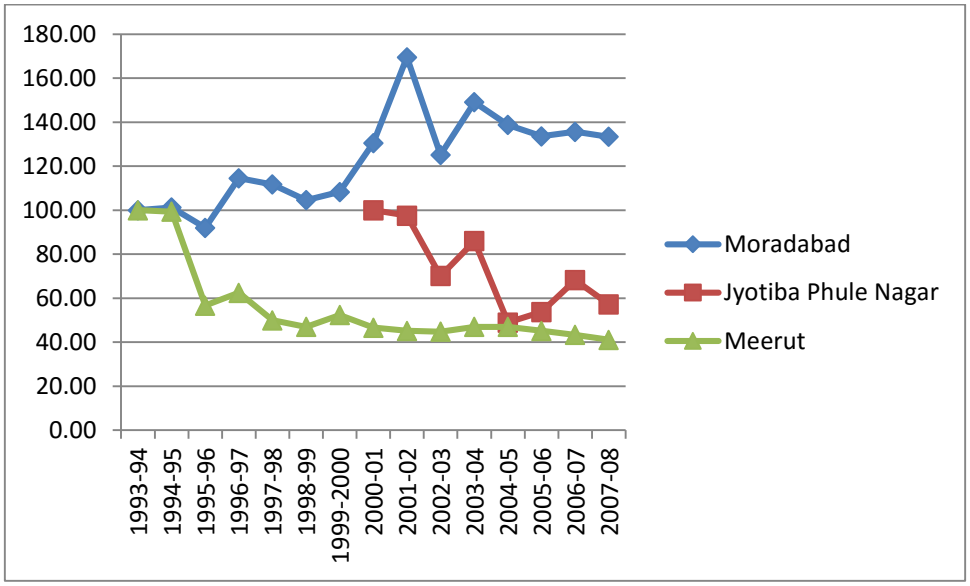

Figure (b)

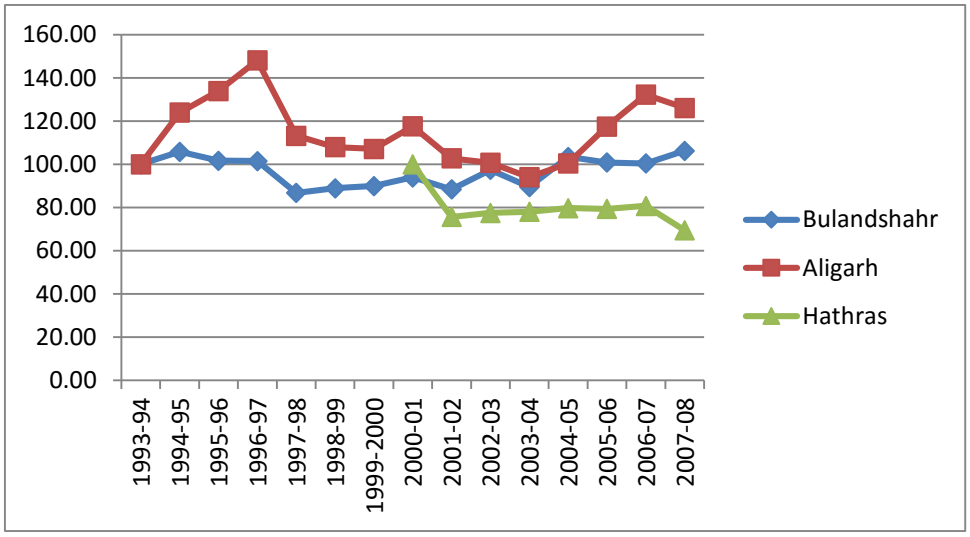

Figure (c)

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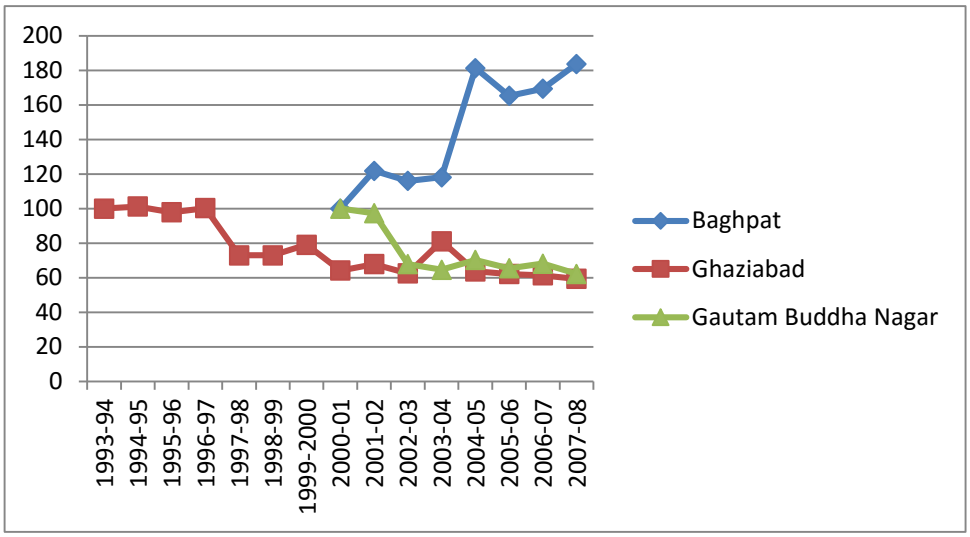

Figure (d)

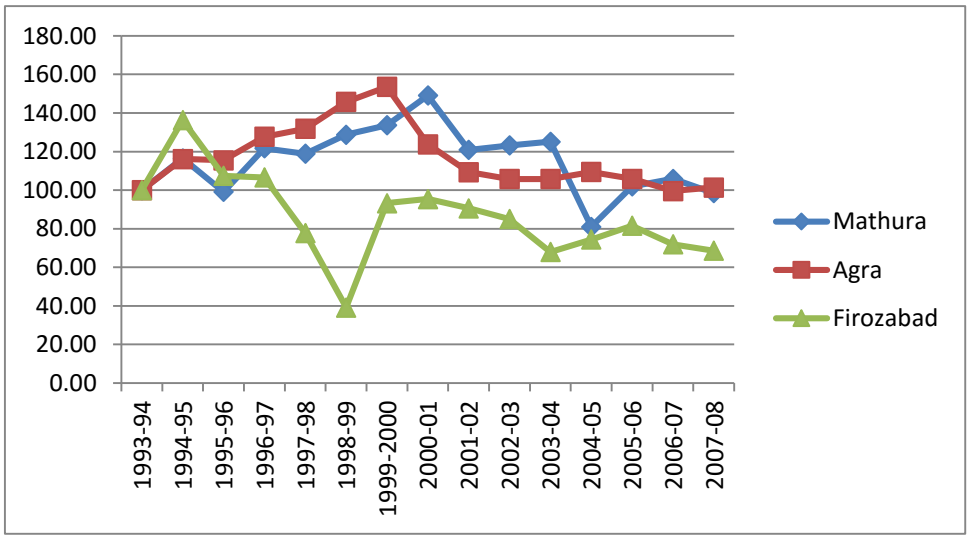

Figure (e)

The level Comparisons among these districts over the period of study in figure (f), an average TFP levels have been the highest in Eath. In figure (g), an average TFP levels have been the highest in Auraiya.

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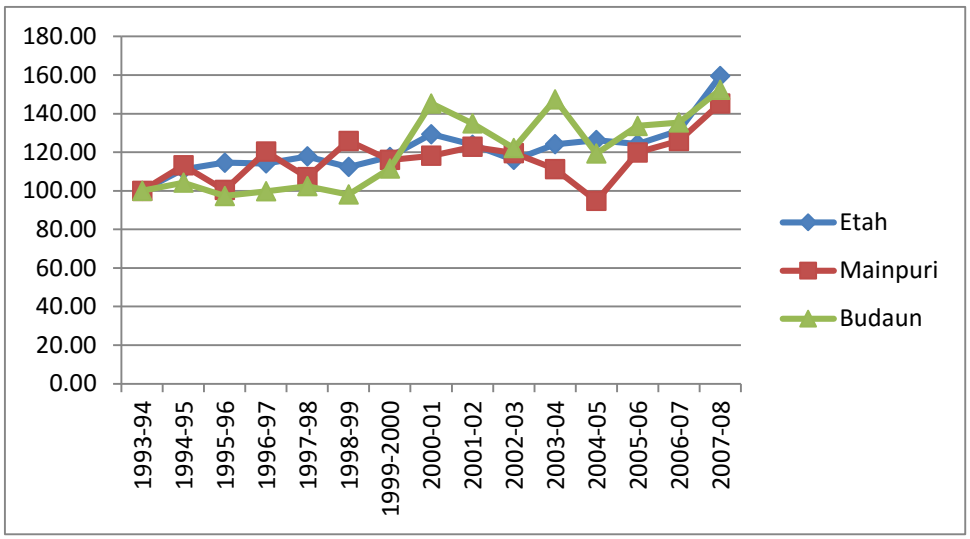

Figure (f)

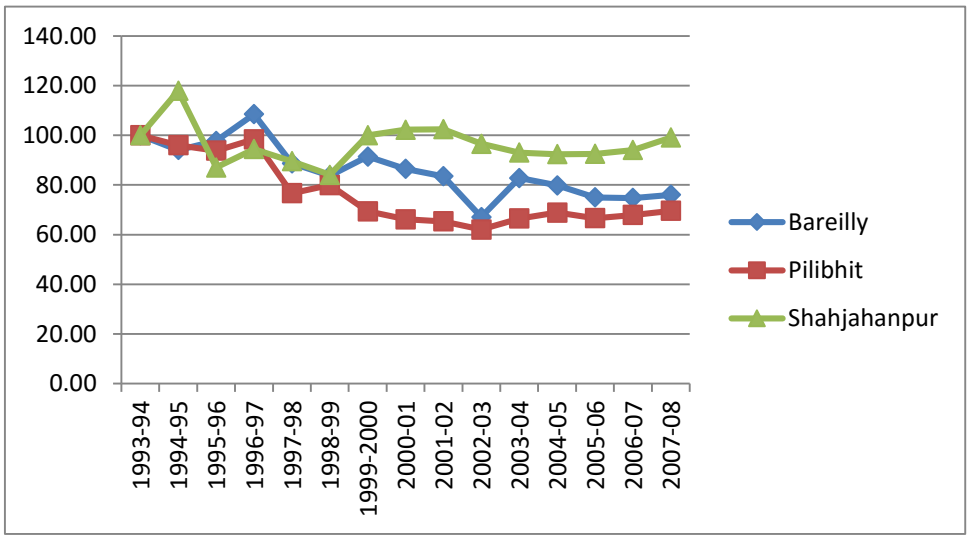

Figure (g)

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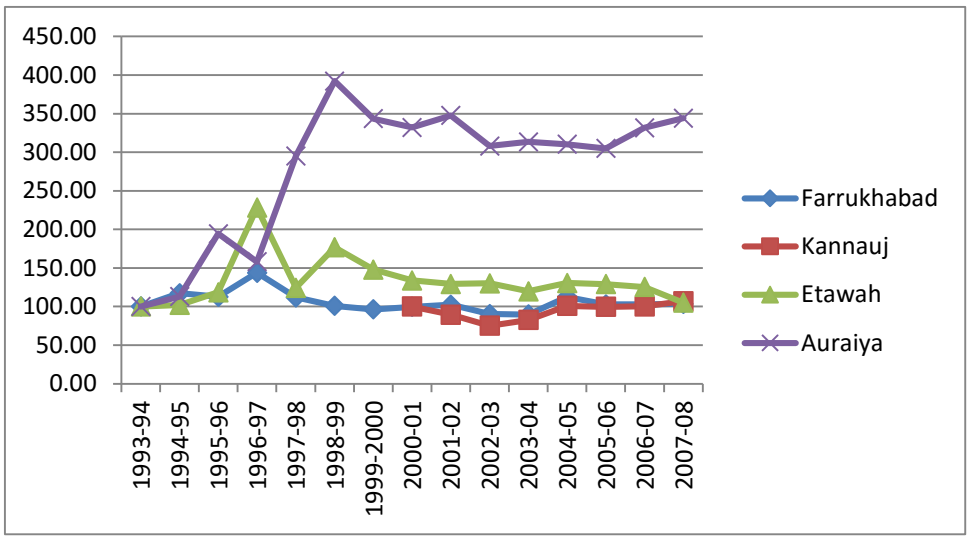

Figure (h)

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Table 3: District-wise CAGR in Output, Input and TFP for Foodgrain in Western Zone (in Per Cent)

S.No.	District	Output			Input			TFP		
		1993-2000	2000-2008	1993-2008	1993-2000	2000-2008	1993-2008	1993-2000	2000-2008	1993-2008
1	Bijnor	3.12	0.19	1.24	4.28	3.92	3.66	-1.12	-3.59	-2.33
2	moradabad	0.88	-1.51	0.09	-0.90	-0.52	-2.75	1.79	-1.00	2.93
3	Rampur									
4	Saharanpur	2.55	-1.23	0.14	6.26	2.10	5.50	-3.49	-3.26	-5.08
5	Muzaffarnagar	1.94	-1.14	0.87	5.23	3.22	3.95	-3.12	-4.23	-2.96
6	Meerut	1.00	0.37	0.57	14.73	1.65	5.69	-11.96	-1.27	-4.84
7	Ghaziabad	0.31	0.04	0.36	6.40	1.61	4.34	-5.73	-1.54	-3.81
8	Bulandshahr	2.63	-3.69	-0.11	5.69	-5.67	-0.26	-2.90	2.10	0.14
9	Aligarh	4.21	-1.46	1.28	5.09	-4.10	1.62	-0.84	2.75	-0.33
10	Mathura	2.43	1.32	1.40	-2.05	6.98	2.20	4.57	-5.29	-0.78
11	Agra	5.92	0.32	1.11	-0.93	2.53	2.39	6.92	-2.16	-1.25
12	Firozabad	2.47	2.67	1.55	14.17	7.03	4.56	-10.25	-4.08	-2.88
13	Etah	3.75	-1.42	1.40	1.79	-3.72	-0.52	1.93	2.39	1.93
14	Mainpuri	1.54	-0.35	1.42	-1.04	-2.01	0.24	2.61	1.70	1.17
15	Budaun	3.45	-1.21	1.11	2.50	-1.69	-1.93	0.92	0.49	3.10
16	Bareilly	3.33	-0.29	0.77	5.56	1.10	3.17	-2.11	-1.37	-2.33
17	Pilibhit	2.61	1.03	1.45	8.90	0.09	4.67	-5.77	0.95	-3.08
18	Shahjahanpur	1.27	0.84	1.17	3.64	1.78	1.45	-2.29	-0.93	-0.28
19	Farrukhabad	5.11	-3.43	0.72	6.69	-4.46	1.74	-1.48	1.09	-1.00
20	Etawah	3.19	1.01	1.32	-5.02	3.19	1.71	8.65	-2.11	-0.39
21	Jyotiba Phule Nagar		0.55			9.36			-8.06	
22	Baghpat		8.75			-0.41			9.20	
23	Gautam Buddha Nagar		-1.71			4.48			-5.93	
24	Hathras		-1.06			1.48			-2.51	
25	Kannauj		-0.24			-2.67			2.50	
26	Auraiya	17.19	0.82	5.68	-7.45	0.86	-1.52	26.62	-0.04	7.31
	W.Zone	3.75	0.02	0.95	4.38	1.29	2.13	1.74	-0.51	-0.31

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Table 4 shows that the comparison between TFP growth rate in U.P. over the periods from 1993-94 to 1999-2000 and from 2000-01 to2007-08 very clearly establishes that a sharp deceleration has taken place from 4.72% per annum in the first period to -1.30% per annum at the significance level. The results also indicate that the CAGR of TFP in the later period in comparison to the first period for food grain crops shows a sharp deceleration.

Table 10: District-wise CAGR in Output, Input and TFP for Foodgrain in Uttar Pradesh (in Per cent)

S.No.	District	Output			Input			TFP		
		1993-2000	2000-2008	1993-2008	1993-2000	2000-2008	1993-2008	1993-2000	2000-2008	1993-2008
1	**W.Zone**	3.75	0.02	0.95	4.38	1.29	2.13	1.74	-0.51	-0.31
2	**C.Zone**	3.30	-0.30	1.53	2.95	-0.55	0.09	4.65	-2.89	1.96
3	**B.Zone**	3.08	-4.55	0.15	1.61	-0.50	3.34	7.33	-3.82	-1.73
4	**E.Zone**	3.60	-0.30	1.36	0.76	0.80	1.42	6.34	-0.78	0.59
5	**U.P.**	4.09	-0.57	1.13	2.51	0.66	1.72	4.72	-1.30	0.26

To sum up the result of this study lead to the conclusion that It raises serious doubts about the sustainability of state's agricultural performance and food security programmes in the face of no significant reduction being achieved in the population growth during the last two decade. It implies that the post higher growth rates of output and TFP observed in foodgrain crops may not be sustained without substantial technological improvements in future.

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Suggestions

In view of the foregoing analysis of Agricultural Productivity of foodgrain crops in Western Uttar Pradesh, it seems proper to evolve a sound strategy to raise the productivity of agriculture in different districts of Western Uttar Pradesh, especially in low productive regions. For this the following suggestions for raising the productivity may be recommended.

- The density of population is very high leading to low land man ratio. For this, step should be taken to divert the population from agriculture sector to secondary and Service sectors.
- The measures of land reforms should be strictly observed in all the districts and surplus land should be expeditiously distributed among land less persons.
- Priority must be given to check the floods & water logging and soil erosion hazards.
- Ground water development programmes with modern methods in areas of water scarcity.
- Arrangements must be made to ensure the regular water by canals.
- The highest priority in the Saharanpur, Meerut,Firojabad and Pillibhit Should be given to the promotion of cropping Intensity.
- The infra structural facilities i.e. road, electrified villages, banking system, transport etc. are also very poor in the Western U.P. Therefore, development of Infra structural facilities should be development at fast pace in these districts.
- The rural credit facilities at more liberal rates and in great amount should be made available to the farmers.
- Soil and water conservation programmes is to be needed.
- Regulated markets may be strengthened so that the farmers are able to obtain remmunerative prices for their produce .
- Cooperative societies should be strengthened so that they are better to supply credit & other agricultural inputs to the farmers to market their produce.

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