

# Trends of Total Factor Productivity in Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareli Districts of Uttar Pradesh Since 1990 To 2008

## Abstract

It is well known fact that productivity is the key factor in agriculture sector. In this Paper, total factor productivity of foodgrain crops of six districts of u.p. was assessed. Six districts were selected for the present study. Findings indicated that all the districts showed the positive total factor productivity growth during the period of the study except kheri.

**Keywords:** Compound Average Growth Rate (CAGR) and Total Factor Productivity.

## Introduction

Achievement of significant increase in agricultural production depends upon the technology used in the farm production and its organization. The scope for increasing agricultural production by using the traditional technology is limited.<sup>1</sup> An increase in the productive capacity of the agriculture can be brought about by the combination of two courses (a) by extending the area under cultivation and (b) by improving the yield per hectare on intensive cultivation.<sup>2</sup> The extensive agriculture's elasticity would not bear much stress. Increase in the agricultural productivity has therefore to be sought for largely on the intensive side and here is obvious scope for improvement. A remarkable illustration of possibilities of intensive cultivation was furnished by pre-war Japan which supported population of nearly 60 million on the cultivated area of barely 17 million acre.<sup>3</sup>

Intensive agriculture can be pursued firstly by increasing area under multiple crops. Secondly by increasing the yield per-acre. In the second one, we have to use new technology such as high yielding varieties of seeds, new methods of irrigation, fertilizer etc. agriculture can be viewed as a chemical processing industry where the seeds, water, plant nutrients and other inputs present in the soil are converted into foodgrains, foods, fibres, fodder and other, needed by the people and animals. To fulfil their requirements, the intensity of cultivation is required.

For increasing the level of cropping intensity and yield of land, orientation to new production technique can be provided through modern input i.e. high yielding varieties of seeds. HYVs are early maturing, highly productive that the yields from the new varieties exceeded 25 to 100 percent compared to the yields from traditional varieties.<sup>4</sup> HYVs are more water responsive than traditional varieties. So increase in agricultural production and productivity depends to a larger extent on the availability of water.<sup>5</sup> The adoption of new high yielding varieties and irrigation entail a high cost of cultivation and hence a cultivator can not afford to lose his crop due to weeds, diseases insects, nematodes, storage pests, rodents and birds.<sup>6</sup>

## Objectives of the Study

1. To measure the district-wise total factor productivity (TFP) for foodgrain crops in six (Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareli) districts of central zone of U.P..
2. To suggest policies and strategies to sustain the growth in TFP by district.

## Review of Literature

### Totals Factor Productivity

The increased use of input, to certain extent, allows the agricultural sector to move up along the production surface by increasing



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the yield per unit area. Their use may also induce an upward shift in production function to the extent that technological change is embodied in them. It has long been recognised that partial productivity measure, such as output per unit of individual inputs, is of limited use as indicator of real productivity change as defined by the shift in a production function. The concept of total factor productivity (TFP), which implies an index of output per unit of total factor input, measures properly this shift or increase in output, holding all inputs constant. The relative sectoral growth rates of productivity are important determinants of structural transformation of economy, and the rate of growth of productivity in the long-run ; productivity being the ' engine of growth '. Since the publication of solow's paper in 1957, voluminous literature dealing with the measurement and analysis of productivity at different levels of aggregation has appeared. Until recently, much of it was concerned mainly with developed countries. Singh and Singh (1973) studied the impact of new technology on agricultural production and resource productivity in Tarwa Block of Azamgarh district of Uttar Pradesh and pointed out that pace of adoption of HYV has been slow in the region. They stressed upon the capital to get the fruits of improved technology. Ahmad (2001) measured agricultural productivity growth differential in Punjab, Pakistan. He analyzed the agricultural productivity growth differentials at three levels in Punjab-district, cropping zones, and the province levels. The results showed that crop output increased at the rate of 2.6 percent per annum, dominated by the share of TFP growth. The mungbean zone emerged as a leader with 3.6 percent per annum growth in TFP, followed by barani (3.2 %), cotton (1.9 %), mixed (1.1 %), and rice (1 %) zones. Rice, mixed, and cotton zones showed a negative trend in TFP growth. Ali (2005) analyzed the impact of Research and Extension (R&E) investment on TFP growth Pakistan during the period 1960-96 within a distributed lag framework. The estimation of the productivity-R&E relationship provided evidence of a strong relationship, explaining 96 percent of the variation in TFP index. The marginal internal rate of return on R&E investment is estimated at 88 percent.

### Methodology

#### The Kendrick Index

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

$$Q = aL + bK.$$

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

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.

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.

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

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 six (Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareli) districts of central zone of U.P. 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 six districts of central zone of U.P.. 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:

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

### 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.

This paper is divided into two sections. Agricultural performance of six (Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareli) districts of central zone of U.P., 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

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six (Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareli) districts of central zone.

## Section I: District-wise Agricultural Performance of Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareli.

The results of estimation of CAGR of area, output and yield in respect of foodgrains of Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareli districts of central zone of 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 Table1.

The results of estimation of CAGR of area, production and yield in respect of foodgrains of six

(Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareli) districts of central zone of U.P. in Table 1.

The district-wise results make clear that CAGR of agricultural output for foodgrain crops in six (Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareli) districts of central 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 except Kheri, Sitapur and Lucknow. It is also observed from these results that all districts 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. All districts have so good experienced over the entire period of study.

Table 1: District-wise CAGR in Area, Production and Yield for Foodgrain (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	Kheri	0.44	1.19	0.03	3.07	0.14	1.75	2.62	-1.04	1.72
2	Sitapur	-0.29	1.81	-0.28	3.34	2.54	1.59	3.65	0.72	1.88
3	Hardoi	0.36	4.13	1.12	3.08	4.03	2.88	2.71	-0.09	1.75
4	Unnao	0.01	4.01	0.45	3.14	4.69	2.75	3.12	0.65	2.29
5	Lucknow	-0.85	0.82	-0.80	1.01	0.24	0.98	1.87	-0.58	1.80
6	Rae Bareli	-0.59	1.63	-0.56	1.85	2.32	1.41	2.45	0.68	1.99

## Section II: Total Factor Productivity: District-wise Analysis of Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareli.

The movements in TFP index of foodgrain in Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareli districts of central Zone (U.P.) over the period

1993-94 to 2007-08 presented in figure (a&b). The level comparisons among these districts over the period of study in figure (a) show that on an average TFP levels have been the highest in Hardoi. In figure (b), an average TFP levels have been the highest in Lucknow.

Figure (a)

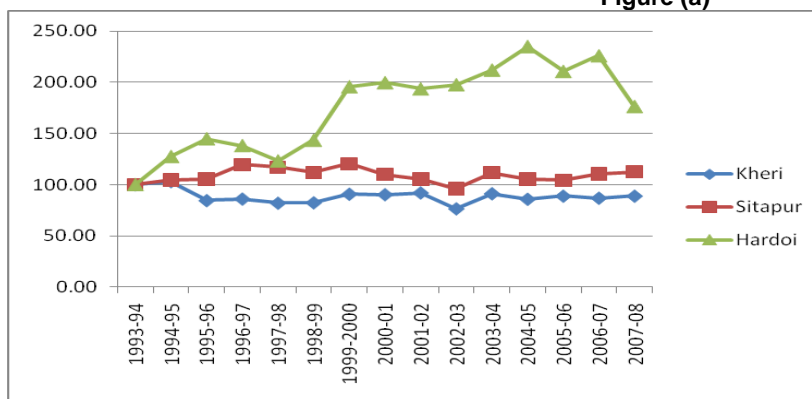
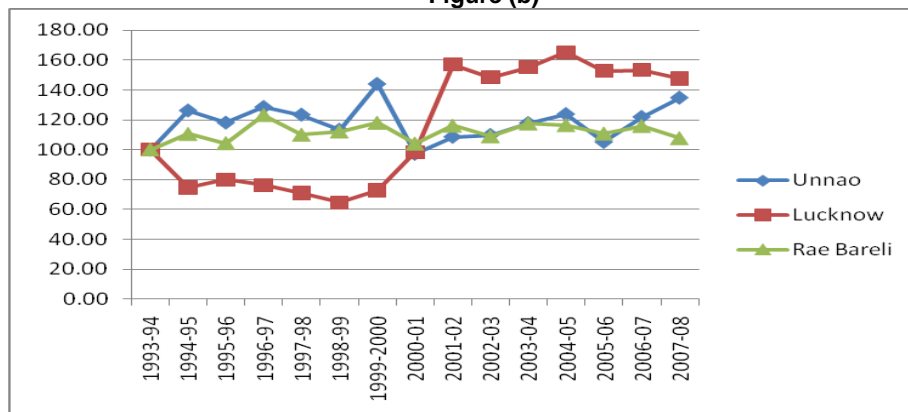


Figure (b)



The compound annual growth rates of total factor productivity (TFP) in Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareilly districts of central Zone (Uttar Pradesh) for foodgrain crop over the two sub-periods of the study as well as for the entire period were at the district level, and the results are presented in table 2.

The comparison between TFP growth rate in Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae

**Table 2: District-wise CAGR in Output, Input and TFP for Foodgrain in Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareilly. (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	Kheri	3.31	-1.04	1.43	6.16	-1.03	1.94	-2.68	-0.01	-0.50
2	Sitapur	4.35	0.72	1.46	1.41	0.02	1.45	2.90	0.70	0.01
3	Hardoi	2.75	-0.09	1.41	-4.63	-0.33	-3.42	7.73	0.24	5.00
4	Unnao	3.70	0.65	2.11	0.35	-2.63	1.86	3.34	3.37	0.24
5	Lucknow	3.42	-0.58	1.92	8.53	-3.93	-4.48	-4.71	3.48	6.70
6	Rae Bareilly	2.69	0.68	1.86	0.58	0.35	1.50	2.10	0.33	0.36

To sum up the result of this study lead to the conclusion that It rises serious doubts about the sustainability of state's agricultural output 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.

#### Suggestions

In view of the foregoing analysis of Agricultural Productivity of foodgrain crops in Uttar Pradesh, it seems proper to evolve a sound strategy to raise the productivity of agriculture in Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareilly districts of central Zone of Uttar Pradesh, especially in low productive regions. For this the following suggestions for raising the productivity may be recommended.

1. First step should be taken to divert the population from agriculture sector to secondary and Service sectors.
2. The measures of land reforms should be strictly observed in all the districts and surplus land should be expeditiously distributed among land less persons.
3. Priority must be given to check the floods & water logging and soil erosion hazards.
4. Ground water development programmes with modern methods in areas of water scarcity.
5. The infra structural facilities i.e. road, electrified villages, banking system, transport etc. are also very poor in the state. But the situation is more distressing in Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareilly districts of central Zone of Uttar Pradesh. Therefore, development of Infra structural facilities should be development at fast pace in these districts.
6. Soil and water conservation programmes is to be needed.
7. Regulated markets may be strengthened so that the farmers are able to obtain remunerative prices for their produce.

Bareilly districts of central zone (U.P.) over the periods from 1993-94 to 1999-2000 and from 2000-01 to 2007-2008 very clearly establishes that a sharp deceleration. All the districts showed the positive total factor productivity growth during the period of the study except Kheri. 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 2: District-wise CAGR in Output, Input and TFP for Foodgrain in Kheri, Sitapur, Hardoi, Unnao, Lucknow and Rae Bareilly. (in Per cent)**

S.No.	District	Output			Input			TFP		
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1	Kheri	3.31	-1.04	1.43	6.16	-1.03	1.94	-2.68	-0.01	-0.50
2	Sitapur	4.35	0.72	1.46	1.41	0.02	1.45	2.90	0.70	0.01
3	Hardoi	2.75	-0.09	1.41	-4.63	-0.33	-3.42	7.73	0.24	5.00
4	Unnao	3.70	0.65	2.11	0.35	-2.63	1.86	3.34	3.37	0.24
5	Lucknow	3.42	-0.58	1.92	8.53	-3.93	-4.48	-4.71	3.48	6.70
6	Rae Bareilly	2.69	0.68	1.86	0.58	0.35	1.50	2.10	0.33	0.36

8. Government should be open soil test center in every block.
9. Government should be give low rate of interest loan to farmers.

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