THE PERFORMANCE OF INDIAN AGRICULTURE DURING THE 1990s WITH SPECIAL REFERENCE TO FOODGRAINS PRODUCTION

Dissertation submitted to the Jawaharlal Nehru University in partial fulfilment of the requirements for the award of the degree of

MASTER OF PHILOSOPHY

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CERTIFICATE

This is to certify that this dissertation entitled **THE PERFORMANCE OF INDIAN AGRICULTURE DURING THE 1990s WITH SPECIAL REFERENCE TO FOODGRAINS PRODUCTION** submitted by ***Ajaya Kumar Sahu,*** in partial fulfilment of the requirements for the award of degree of **Master of Philosophy (M.Phil)** of this University, is his original work and has not been submitted for the award of any other degree of this University or of any other University.

We recommend that this dissertation be placed before the examiners for evaluation.

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Dedicated to

.... my beloved parents

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Ajaya Kumar Sahu

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INTRODUCTION

Agriculture in Economic Development

India is one of the countries where agriculture is the predominant sector with more than two-third of the people dependent on it. Agriculture, when the country achieved freedom, accounted for more than half of total GDP. Now its share has got reduced to 33 per cent, whereas the percentage of people being dependent on it remaining more or less the same. It is clear therefore that not only is the growth rate of agricultural output far less than the growth rate of the output of other sectors, but also that, with the progress of the economy, the occupational diversion from agriculture to manufacturing and service sectors, which is a mark of economic development, has not occurred in India.

Apart from this, another feature of Indian agriculture is that agricultural growth has been concentrated in certain limited areas and crops.[1]

Thus any development strategy on agriculture must aim at improving the growth performance of agriculture along with a more even distribution of that growth. The importance of agriculture in the growth process of an economy like India has

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[1] This point has been raised by many economists. Some of them are:

1) Bhalla, G.S. and Alagh, Y.K. (1979) - "Performance of Indian Agriculture: A Districtwise Study", Sterling Publishers, New Delhi.

2) Sawant, S.D. (1997), "Performance of Indian Agriculture with Special Reference to Regional Variations", IJAE, Vol. 52, No. 3, July-Sept.

been underscored by a number of writers. Nicholas Kaldor[2] argued in the context of the world economy that the rate of growth of the manufacturing sector in the world depends essentially on the rate of growth of its exports to the primary producing (mainly agricultural) sector. This argument has special relevance to the case of internal development of a large country like India. Here too it can be argued that the rate of growth of the manufacturing sector, and hence by implication the economy as a whole would depend essentially on the rate of growth of exports from this sector to the agricultural sector; the latter in turn depends on the rate of growth of the agricultural sector itself. It follows therefore that for large economies like India, with substantial scope for making use of the domestic market, Industrialisation can to a significant extent, be agriculture-led. This could in fact, even be the preffered stategy if the alternative, namely export-led industrialisation, becomes problematical because of stagnation in the world economy and world trade as has been happening of late.

Hence it is the income of the agriculture sector which really determines the level and rate of growth of industrial production. According to formula

$$O_I = \frac{1}{m} D_A, \quad (O_I = \text{Industrial output})$$

m = share of expenditure on agriculture products in total industrial income, D_A = Demand for industrial product coming from agriculture sector[3]).

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2 Kalder Nicolas (1975) "What is Wrong with Economic Theory", Quarterly Journal of economics, August 1975, Reprinted in "Further Essays on Economic Theory", Duckworth.

3 Ibid.

Similar arguments have also been made by Bhalla.[4] According to him, India being a labour surplus economy, agricultural growth constitutes the base for overall development of the economy through generation of powerful forward, backward and demand linkages. A dynamic agriculture can lead to rapid accumulation in non-agriculture sectors by ensuring cheap food, the main wage good in the economy.

Dandekar[5] says that the performance of the economy would depend upon the ability of agriculture sector to move ahead which in turn is determined by the pace at which rural people respond and adjust to growing integration of village economies with the larger national interest. This will reduce the urban-rural gap. Quite independent of the overall role of agriculture, there is an additional point of significance. This is that in a country; the size of India, substantial reliance on the world market for the purchase of foodgrains is inadvisable. In other words, India has to produce the bulk of her own food requirement in order to ensure food security. Thus the growth of foodgrains output is crucial on the state of food security in India.

Professor M.L.Dantwala drew attention to the importance of foodgrains production by arguing that reduction in foodgrains price brings in "instant socialism". However, it must be kept in mind that a reduction in foodgrains price through growth of foodgrains output will not bring in instant socialism if adequate purchasing power

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4 Bhalla G.S.(1995)

5 Dandekar V.M.(1994)

is not put into the hands of the rural poor. In other words, if growth occurs on the basis of large diversity in land holding and the concentration of growth performance in some limited areas, then it would not necessarily have the effect of improving the lot of the rural poor in the country as a whole.

In this context it is noteworthy that the growth rate of agricultural output and of foodgrains output in particular is supposed by many to have slowed down in the 1990s. The growth rate of foodgrains production is even supposed to have fallen below the population growth rate of the country. Many have attributed this decline to the Structural Adjustment Programme (SAP), which was formally launched in July 1991.

Structural Adjustment Programme (SAP) and Agriculture:

The SAP, which is primarily based on the tenets of neo-classical economics, emphasises the need for leaving decisions regarding allocation of resources and pricing of products to the operation of the market process. It calls for a significant withdrawal of the state from its role as a producer and investor.

SAP in the agriculture sector calls for an alignment of domestic prices with world prices, which according to it will improve the terms of trade for agriculture and thus will end the era of unfavourable treatment to agriculture (it was argued that excessive protection to manufactured goods through imposition of tariffs and duties along with restricting agricultural prices to be aligned with world prices were all

going against the agriculture sector). It also calls for reduction in subsidies (both input and output) to agriculture.

It may be mentioned here that "liberalisation" process has not been implemented to Indian agriculture in toto. However there is a clear signal that we are moving towards it. This we can know from the continuous rise in issue price/procurement price ever since the New Economic Policy was put into force in 1991, gradual cut in both input subsidies and output subsidies, a retreat of the state from agricultural investment, and the like.

The argument is that decline in public investment and the other adverse developments noted above, which are associated with the SAP, have resulted in a decline of agriculture growth and in particular foodgrains production growth in the 1990s. Of course the decline in public investment in agriculture predates the SAP. Consequently, attributing the performance of agriculture to SAP is problematical. Before we examine the role of the SAP itself, nonetheless, we must first examine the growth performance itself.

Hypotheses:

The specific hypotheses we look at are the following:

i. The growth of agricultural output has deteriorated sharply during the 1990s.

ii. The growth of food grain production has also shown a similar trend for the same period.

iii. Per capita food-grains production growth has stagnated or declined for the country as a whole during the 1990s.

iv. The per capita income of the people dependent on agriculture has remained stagnant or has fallen during the 1990s.

In addition we shall examine state-level performance to throw some light on which states are responsible for pulling down the overall performance of the economy.

Methodology and Coverage:

Since we are concerned with the growth performance (whether accelerating or decelerating) of Indian Agriculture during the 1990s, this we can do only by comparing the growth rate of the 1990s with the growth rates of 1970s and 1980s. For that purpose, we will study the performance of the sector during 1970s and 1980s. Foodgrains output, which is crucial for the state of food security, will be discussed in detail. We will have a better look at the food security in India by studying the per capita foodgrains production.

To have an idea about the regional variation in agricultural performance, we will present state level trends in growth of foodgrains production with special reference to the emerging trends of acceleration or deceleration during 1990s as compared to 1980s.

To make an assessment of the improvement in economic conditions of the people engaged in agriculture, we will find out the per capita income of the people engaged in agriculture for various years.

Time series of crop output do not reveal, normally, a smooth trend. This is not only true for the state level series, but holds equally strongly at the national level also. Hence growth rates based on a selected few observations at the beginning and end of the series or for that matter even those based on their averages too may prove to be misleading.[6] Necessarily, in the analyses that follow, we will estimate growth rates by using all the observations in the series. When the output figures reveal wide fluctuations, we have taken three year moving averages or five-year moving averages, depending upon the intensity of fluctuations.

For the national level data to make a comparative study of various periods, we have divided the time period (1971-72 to 1996-97) into three periods, namely 1971-72 to 1980-81, 1980-81 to 1990-91 and 1990-91 to 1996-97. The periods chosen are such that each represents a peak-to-peak performance. The period 1990-91 to 1996-97, which corresponds to the period of economic reforms, thus, makes it possible for us to study the agricultural performance vis-a-vis the new economic policy.

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6 S.D. Sawant(1997).

In order to see whether agricultural growth has decelerated or accelerated during the nineties, we have in addition to the log-linear function, fitted two alternative trends, namely, a straight line trend and a gompertz trend. These are intended to give more certainty to our findings. Two different levels of probabilities, less than 5 per cent and less than 10 per cent are used for judging the statistical significance of the estimates of parameters. The analysis covers sixteen major states. We study the performance of foodgrains output in those states.

Chapter I and Chapter II are devoted to the study of national level trends.

Chapter I comprises three empirical exercises. The first one is devoted to an analysis of foodgrains production in India since 1971-72. Empirical exercise II studies the trends in per capita foodgrains production over the years. Empirical Exercise III is devoted to agricultural production as a whole. Here due to the differences in units of various agricultural products, to make a combined study of all the products, we have relied on the index of agricultural production, brought about by the Ministry of Agriculture.

Chapter II deals in the analysis of changing per capita income of the people engaged in agriculture, which necessarily shows the changing economic well being of the people engaged in agriculture.

Chapter III is devoted to the statewise anlysis of production of foodgrains output. This makes us know about the regional variation in agricultural performance

since 1980-81. Here we also study the changing trends in the per capita foodgrains production over the period.

Chapter IV is devoted to an analytical study of the agricultural sector in India. There we first look at the SAP adopted by the Government of India, then we study the salient features of Indian Agriculture and evaluate the possible implications of SAP, as also of the WTO, for Indian Agriculture. Chapter IV is followed by the conclusion.

CHAPTER I

TRENDS IN FOODGRAINS PRODUCTION SINCE 1971-72

In this chapter we look at the trend in rate of growth of foodgrains output and agricultural output as a whole, for a longer period encompassing the 1970s, the 1980s and the 1990s to get a clear statistical picture of the performance of the sector.

Growth in Foodgrains Production:

In this section we have looked into the trend in foodgrains production in thousand tonnes (data given in Table 1-1) over the years since 1971-72.[1] The total period is 1971-72 to 1996-97.[2]

We have fitted three alternative curves on the data - a semi-loganthmic fit, a straight line fit and a gompertz fit.

i) Semi-logarithmic Curve:

The semi-logarithmic curve of the form log y = a + bt ('log y' being log of foodgrains production, 'a' being the intercept and 'b' being the slope co-efficient, 't'

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1 Of course it may be argued that since 1970-71 was the peak output year, we should have taken 1970-71 as the initial year. But 1970-71 according to many is an outlier where the output got boosted by an unusually good crop in Rajasthan. 1971-72, which also had a high output was more typical of a peak. In any case, our conclusions are not affected by which of the two years we take as the starting point.

2 Since 1997-98 is a bad year for foodgrains production, showing an impressive decline in that year, we have chosen to take 1996-97 as the end year, which registered the maximum production ever achieved. This makes each sub-period study a peak-to-peak one.

being the time period) is based on the compound growth rate formula of the form $Y_t = Y_o (1 + r)^t$, where 'r' is the compound growth rate of the dependent variable 'Y' and Y_o is the value of Y in the base year. In this way we get a constant growth rate throughout for the period we take.

To examine a deceleration hypothesis, we have to break up the whole period into sub-periods and then fit semi-logarithmic trends to each sub-period. If the growth rates emerging from these fits show a decline, then the deceleration hypothesis is supported.

Accordingly we have fitted regression lines of semi-logarithmic form for the data, both taking all at a time (that is from 1971-72 to 1996-97) and taking various sub-periods from it (here we have analysed three sub-periods, first from 1971-72 to 1980-81, then from 1980-81 to 1990-91 and then from 1990-91 to 1996-97). These sub-periods represent peak-to-peak performances in the agricultural economy.

The results[3] we got for the various observations are as following:

For the period 1971-72 to 1996-97, the results we obtained are:

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[3] Taking 1997-98 as the end point, the regression equations are as follows -

4.991088 + 0.012158 (t) (1971-72 to 1997-98)
4.979321 + 0.013768(t) (1971-72 to 1980-81)
4.996725 + 0.012491(t) (1980-81 to 1990-91)
5.138 + 0.005458 t (1990-91 to 1997-98)
Here also R^2 was quite high ranging between 0.74 and 0.92. Level of significance was blow 5 per cent for all the estimated parameters.

TABLE-1·1

Foodgrains Production (in 000's tonnes) and Index

Year	Production	Index
1971-72	105168	80.98
1972-73	95201	73.31
1973-74	97222	74.86
1974-75	99826	76.87
1975-76	121034	93.20
1976-77	111167	85.60
1977-78	126407	97.34
1978-79	131902	101.57
1979-80	109700	84.47
1980-81	129867	100.00
1981-82	133295	102.64
1982-83	129519	99.73
1983-84	152374	117.33
1984-85	145539	112.07
1985-86	150440	115.84
1986-87	143418	110.43
1987-88	140354	108.08
1988-89	169922	130.84
1989-90	171036	131.70
1990-91	176390	135.82
1991-92	168373	129.65
1992-93	179483	138.21
1993-94	184260	141.88
1994-95	191495	147.45
1995-96	180415	138.92
1996-97	199321	153.48

Source: Economic Survey (Various Issues), Ministry of Finance, Government of India

$$\log Y_t = 4.996007 + 0.012165\ t$$

$R^2 = .92$, D.W. Statistic 2.22

For the period 1971-72 to 1980-81, the results obtained are:

$$\log Y_t = 4.9793 + 0.013768t$$

$R^2 = 0.61275$, Durbin-Watson Statistic = 1.94

For the period 1980-81 to 1990-91, the results obtained are:

$$\log Y_t = 4.996725 + 0.012491\ t$$

$R^2 = .84$, D.W. Statistic = 2.01

For 1990-91 - 1996-97, the results we got are:

$$\log Y_t = 5.067091 + 0.008835\ t$$

$R^2 = .83$, D.W. Statistic = 2.19

Here all the co-efficients were found to be significant at a level of less than 1 per cent. D.W. statistic was in the safe range and did not suggest an auto-correlation problem[4].

We can know the growth rate of foodgrains production over various periods from the slope co-efficient. The growth rate can be derived from the formula r = Antilog b-1.[5]

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[4] Durbin-Watson Statistic (D) lies between 0 and 4. When the estimated D.W. statistic firgure becomes more than the upper limit of the tabulated figure (corresponding to number of observations and number of explanatory variables), we can accept the hypothesis. When the estimated value is more than 2, t hen y minus that value should be more than the tabulated value.

From our econometric findings, the growth rate[6] for the various periods were found as follows:

	Growth rate
1971-72 to 1996-97	2.8 per cent
1971-72 to 1980-81	3.0 per cent
1980-81 to 1990-91	2.9 per cent
1990-91 to 1996-97	2.1 per cent

From this we see a declining trend in growth of foodgrains production during the 1990s.

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5 The logic is as follows:-

We have the compound growth formula -

$Y_t = Y_o(1 + r)^t$ (r = growth rate)

or $\log Y_t = \log Y_o(1 + r)^t$

or $\log Y_t = \log Y_o + t \log (1 + r)$, { $\log (1+r)$ is the 'b' in our equation $\log Y_t = a + bt$}

or $\log Y_t - \log Y_o = t \log (1+r)$

or $\frac{\log Y_t - \log Y_o}{t} = \log (1+r) = b$

or Antilog b = Antilog log (1+r) = 1+r
or r = Antilog b-1.

6 Taking 1997-98 as the end-point, the growth rates for the various periods turned out to be -

Periods	Growth Rate
1971-72 to 1997-98	2.8 per cent
1971-72 to 1980-81	3.2 per cent
1980-81 to 1990-91	2.9 per cent
1990-91 to 1997-98	2.1 per cent

This clearly shows the declining trend in the foodgrains production growth rate over the years.

ii) Straight Line Curve:

The straight line curve is of the form $Y_t = a + bt$, a and b being the intercept and the slope co-efficient respectively. We can find out the point growth rate from the regression line in the following way.

$$\text{Growth rate} = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$$, and this point growth rate would be declining along the straight line.[7]

The results[8] we got for the various time intervals are as follows:

For the period 1971-72 to 1996-97, the results are:

$Y_t = 94600.43 + 3949.28(t)$
$R^2 = .93$, D.W. statistic = 2.2

For the period 1971-72 - 1980-81, the results are:

$Y_t = 97284.13 + 3436.72(t)$
$R^2 = .77$, D.W. Statistic 2.1

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7 For a upward sloping time series straight line curve (where the slope co-efficient is positive), the point rate of growth along the straight line declines as we move towards right. This we can know from the following. We have the growth rate formula for period 't',

$$r_t = \frac{Yt-Y_{t-1}}{Y_{t-1}} = \frac{bt}{Y_{t-1}}$$ (b is the slope coefficient, which is fixed throughout)

Similarly for period t + 1 the point rate of growth is

$$r_{t+1} = \frac{bt}{Y_t}$$, and since $Y_t > Y_{t-1}$ (because $b > O$)

so, $r_{t+1} < r_t$.

8 Taking 1997-98 as the end-point, the regression equations (straight line fit) are:

93520.53 + 3926.72 t (1971-72 - 1997-98)
94689.04 + 3564.3 t (1971-72 - 1980-81)
88370.56 + 4351t (1980-81 - 1990-91)
130837 + 2296.976 t (1990-91 - 1997-98)

For 1980-81 to 1990-91 the results are found out to be

$Y_t = 88370 + 4351.15(t)$

$R^2 = .75$, D.W. statistic = 1.99

For 1990-91 - 1996-97, the results turned to be

$Y_t = 100406.8 + 3746.036(t)$

$R^2 = .77$, D.W. statistic = 2.1

Here it may be mentioned that all the co-efficient are significant at a level less than 1 per cent and the D.W. statistic doesn't suggest an auto-correlation problem.[9]

By applying the point growth rate formula $r = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$ in the above obtained result, we got the growth rate of foodgrains production for the various years in various sub-periods (in this formula we have Y_t for a particular period as the intercept plus the slope co-efficient (t-1).

We could get the estimated growth rates for various years in various sub-periods[10].

Growth rate for the year	Period	Growth rate
1972-73	1971-72 - 1980-81	3.53 per cent
1981-82	1980-81 - 1990-91	4.92 per cent
1991-92	1990-91 - 1996-97	3.73 per cent

[9] This we can know by checking the derived D.W. statistic with the tabulated values given in the D.W. statistic table. We have discussed this in detail previously.

[10] The growth rates for the same years (by including 1997-98) are [illegible] 3.76 per cent, 4.92 per cent and 1.75 per cent respectively.

This shows a declining trend in the growth of foodgrains proportion after 1980-81. During the 1990s the growth rate has declined.

ii)Gompertz Curve:

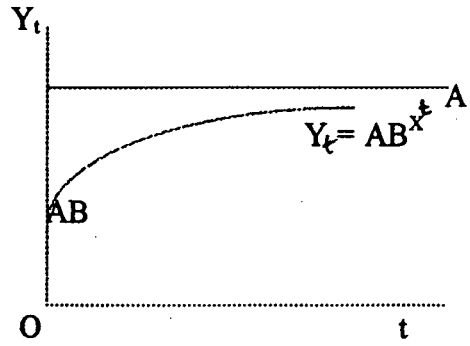
A gompertz refers to a non-linear estimation of parameters. Here we taken gompertz of the form

$Y_t = AB^{X^t}$, where A, B, X are parameters

We can also represent this as -

$\log Y_t = \log A + \log B.\ X^t = a + b.X^t$ ($\log A = a$, $\log B = b$)

In a gompertz of the form $Y_t = AB^{Xt}$ or $\log Y = a + b.X^t$, if $B < 1$ and $X < 1$, the gompertz curve looks like this.[11]



This diagram clearly shows the deceleration in growth of Y. Therefore a deceleration hypothesis requires that a gompertz curve fitted to the data should give B < 1 and X < 1. This means that in the fitted curve $\log Y_t = \log A + \log B.X^t$

[11] When $B < 1, X < 1$

$t \to \infty$, $X^t = 0$, also $B^0 = 1$ so $Y_t = A$ ($t \to \infty$)

When t = o, $Y_t = AB$, so the curve will start from AB.

(or $\log Y_t = a + b.X^t$), $X < 1$ and $b < 0$.

For the data we are considering, we get gompertz of the followint type:

For the period 1971-72 to 1997-98, we get the equation for the gompertz curve as

$$\log Y_t = 5.637765 + (-0.664231)\ (0.9752731)^t$$

$R^2 = 0.9287$, D.W.Statistic = 1.97

For the period 1980-81 to 1996-97, the equation for the gompertz is

$$\log Y_t = 6.022951 + (-0.912436)\ (0.986268)^t$$

$R^2 = 0.882$, D.W. Statistic = 2.21

For the period 1980-81 to 1997-98, the gompertz is

$$\log Y_t = 5.44578 + (-0.338682)\ (0.95672)^t$$

$R^2 = 0.8649$, D.W. Statistic = 2.16.

All the co-efficients were found to be significant at less than 7 per cent level of significance. All the different periods we took gompertz for, we found the exponential parameters (X) to be less than 1 and b less than 0, showing the growth rate of food grains production falling over the years. For 1971-72 to 1997-98, X was 0.975231, for 1980-81 to 1996-97, it was 0.986268 and for 1980-81 to 1997-98, X was 0.95672.

Here also we see that whichever period we took, the exponential parameter was turning to be less than 1, showing a declining growth trend in foodgrains production over the years.

Colclusion:

In our analysis, all the types of curve we fitted, we found that R^2 was quite high in all the cases. It ranged between 0.94 and 0.61. From this we can conclude that the goodness of fit is quite high and hence we can use our results for the data we have taken with reasonable accuracy. Further, considering the significance test, all our estimated co-efficientshave been at reasonable level of significance. Most of them have been significant at less than 1 per cent level and only two have been significant at more than 5 per cent level (at 7 per cent level each). Thus we can use the estimated paramters and the conclusions drawn from them.

Nature of Curves:

We have considered three types of curves in our analysis, namely semi-log, straight line and the gompertz. For the period as a whole both the straight line and the semi-log give high R^2, 0.93 and 0.92 respectively. The fact that the straight line indicating decelerating growth rates, give such a good fit, together with the fact that semi-log trends fited to sub-periods clearly show a declining trend, indicates support for the deceleration hypothesis. The value of b and X in the gompertz curve give added support to this.

From the straight line or the gompertz, however, we cannot say when the deceleration began; however, from the sub-period fits of semi-log curve, it is clear that the 1990s have been the point of deceleration.

Trends in Per Capita Foodgrains Output

Impact of trends in foodgrains output has been crucial on the state of food security in India. However, we can have a better look at the food security in India by studying the per capita foodgrains production.

For the population figure in the years since 1980-81, we rely on the figures given in the various issues of the "Population Census" brought about by the Government of India.

Here in our study, we use the semi-logarithmic equation of the form log Y = a + bt (log Y being log of per capita foodgrains production in kg., a and b are the intercept and slope co-efficients respectively and t is the time).

Using econometric tools we have fitted regression lines of the semi-logarithmic form for the data.

To eliminate the effects of excessive fluctuations we have taken a three year moving average for our data.

The results that we got for the various observations are as follows:

a) For the period 1981-82 to 1995-96,[12] the results we obtained are:

$\log Y_t = 2.279 + 0.00263(t)$
$R^2 = 0.55$, D.W.Statistic = 2.2

b)For the period 1981-82 to 1990-91, the results are:

$\log Y_t = 2.2775 + 0.00295(t)$
$R^2 = .52$, D.W. Statistic = 1.98

c)For the period 1990-91 to 1995-96, the results came to be

$\log Y_t = 2.2997 + 0.00103(t)$
$R^2 = .50$ D.W. Statistic = 2.1

Here all the co-efficient were found to be at levels less than 10 per cent. In all the cases the Durbin-Watson Statistic was within the safe limit.

From our findings, the growth rate[13] of per capita foodgrains for the various periods were found to be

Period	Growth Rate
1981-82 to 1995-96	0.6 per cent
1981-82 to 1990-91	0.7 per cent
1990-91 to 1995-96	0.2 per cent

[12] The period has been 1981-82 to 1995-96, instead of 1980-81 to 1996-97, because we have taken a three year moving average.

[13] The Mathematics of the derivation of growth rate from a semi-log curve has been discussed earlier in this chapter.

Conclusion

i) Even after taking a three year moving average, we could not have got a R^2 of more than 0.55. This shows the wild fluctuations in the per capita foodgrains production over the years.

ii) From the growth rates in the various periods we see a distinct fall in the per capita foodgrains production growth.

Trends in Agricultural Production as a Whole

In the previous two exercises we dealt only with the variations in foodgrains production and per capita foodgrains production. There we saw that both the foodgrains production and per capita foodgrains production had the declining feature of growth rates over the years.

We can have a better look at the performance of the agricultural sector by dealing with the agricultural sector as a whole. Since agricultural sector comprises a number of items and that too with their output in different units, it is impossible to study the various types of agricultural outputs in their own units, since we cannot add them together. For this reason index of agricultural production becomes necessary to analyse the performance of the agriculture sector as a whole. We here use the index of agricultural production brought about by the Directorate of Economics and Statistic, Department of Agriculture and Co-operation. The base has been the triennium ending 1981-82.

We can infer about the performance of the agriculture sector by studying the pattern of change in the index of agricultural production over the years.

Here in our study, we use the semi-logarithmic equation of the form $\log Y_t = a + bt$ ($\log Y_t$ being the log of index of agricultural production, a and b are the intercept and the slope co-efficients respectively and t is the time).

We have fitted regression lines of the semi-logarithmic form for the data.

The results we got for the various observations are as follow:

1) For the period 1971-72 to 1996-97[14] the results we obtained are

$$\log Y_t = 1.8846 + 0.01325(t)$$
$$R^2 = 0.94, \text{ D.W.Statistic} = 1.99$$

2) For the period 1971-72 to 1980-81, the results are

$$\log Y_t = 1.90305 + 0.00976(t)$$
$$R^2 = 0.79, \text{ D.W. Statistic} = 2.25$$

3) For the period 1980-81 to 1990-91, the results are

$$\log Y_t = 1.85698 + 0.014713(t)$$
$$R^2 = 0.88, \text{ D.W. Statistic} = 1.98$$

4) For the period 1990-91 to 1996-97, the results are

$$\log Y_t = 1.941052 + 0.011317(t)$$
$$R^2 = 0.87, \text{ D.W. Statistic} = 2.25$$

In our above estimations, all the parameters estimated were at a level of significance of less than 1 per cent. D.W. Statistic were within the safe limits.

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14 We have taken 1996-97 as the end point simply because as mentioned earlier, this is a peak year. In 1997-98, agriculture has witnessed a negative growth.

From our findings, the growth rate[15] of agricultural output for the various periods were found to be

Periods	Growth rate
1970-71 to 1996-97	3.1 per cent
1970-71 to 1980-81	2.3 per cent
1980-81 to 1990-91	3.5 per cent
1990-91 to 1996-97	2.7 per cent

Conclusion:

In our analysis, for all the time periods we found out estimates, R^2 was found to be quite high. From this we can conclude that the goodness of fit is high and hence we can use our results for the data we have taken with reasonable accuracy. Further, considering the significance test, all our estimated co-efficients have been at a reasonable level of less than 1 per cent. Thus we can use the estimated parameters and the conclusion drawn from them.

From the growth rates calculated for the various periods, we observe that there has been an increase in the growth rate of agricultural production between 1970s and 1980s. However, during the 1990s (here between 1990-91 and 1996-97) the growth rate has shown a declining trend.

[15] Derivation made earlier in this chapter.

CHAPTER II

TRENDS IN STANDARD OF LIVING OF PEOPLE ENGAGED IN AGRICULTURE

In Chapter I we made an assessment of the agricultural performance in India over the years. This we did by looking into the trends in agricultural production in general and foodgrains production in particular. There we studied the behaviour of the agriculture sector during the 1970s, 1980s and 1990s.

Using econometric tools we arrived at the following conclusions:

i. During 1970s and 1980s, growth rate of foodgrains production had remained more or less constant, hovering around 3 per cent point. However during the 1990s, this has shown a major set back with the rate of growth of foodgrains production lowering down to a 2 per cent level, which is even below the population growth rate for that period.

ii. Growth rate of per capita foodgrains production had not been impressive in any of these periods. It was maximum during 1980s (0.7 per cent). However, it got reduced to 0.2 per cent during 1990s. This shows that there was a near stagnation in per capita foodgrains production growth during the 1990s.

iii. There had been an increase in growth of agricultural production during the 1970s and the 1980s, with the rate achieving a peak of 3.5 per cent during the 1980s. It faced a severe set back during the 1990s, with the growth rate declining to a 2.7 per cent level. Thus we saw that the agriculture sector in India had shown a deceleration during the 1990s.

In this chapter we will throw some light on the per capita real income of the people engaged in agriculture. This will give us an idea of the movement in the standard of living of a vast section of society.

For the data on this, we shall rely on the sample survey conducted by the National Sample Survey Organisation (NSSO) across the country. For the year 1991, we get the relevant data from the 1991 census brought about by the Government of India.

The National Sample Survey Organisation (NSSO) conducts surveys of the employment - unemployment situation in India over every five years. The 38th round (1983), 42nd round (1987-88), 50th round (1993-94) and 52nd round (1997) were devoted to the employment - unemployment situation in India.

By the people employed in agriculture, we mean those who are either self employed in agriculture or those who are agricultural labourers. This is in line with the NSSO grouping of people into either self employed or employed labourer in various sectors.

Here we follow the usual status definition of employment[1]. A usual status employed person is one who had worked for a relatively longer period of 365 days preceding the day of survey.

The data we got from various sources are as follows

Table 2.1: Number of persons employed per thousand persons according to usual status by sex and urban-rural residential status.

Year	Rural		Urban	
	Male	Female	Male	Female
1983	547	340	512	151
1993-94	553	328	521	155
1997	550	291	521	131

Source: i) SARVEKSHYANA, July-Sept, 1996

ii) NSS Report No. 442, Household Consumer Expenditure and Employment Situation in India, 1997.

[1] Usual status approach adopted for classification of the population does not take into consideration the changes in activity pattern caused by seasonal fluctuations. However, since we are considering the distribution of employees by groups of industry, we are taking the usual status approach in our analysis

Table 2.2: Per thousand distribution of usually employed persons in agriculture.

Year	Rural		Urban	
	Male	Female	Male	Female
1983	775	875	103	310
1993-94	741	862	90	247
1997	758	885	78	200

Source: i) SARVEKSHYANA, July-Sept, 1996.

ii) NSS Report No. 442.

Since we are given number of employed persons under the headings of males and females, we have to find out the total male and female population for which we need the sex-ratio.

Table 2.3: Sex Ratio

Sex Ratio	Rural	Urban
1983	963	905
1993-94	994	905

Source: SARVEKSHYANA, July-Sept. 1996.

Since the sex ratio figures for 1997 are not available, we will use the 1993-94 figures for 1997.

Table 2.4: Population

Year	Rural		Urban	
	Male	Female	Male	Female
1983	27,65,50972	26,63,44537	8,90,23631	8,05,7,7495
1993	33,38,06654	31,51,17634	12,11,58944	10,96,63964
1997	35,84,97475	3384,26077	13,70,55211	12,40,52068

The population figures for the above three years are estimated population, estimated from the 1981 and 1991 population. We are with us the population figures for 1981 and 1991. Through the compound growth rate formula,

$P_t = P_o (1 + r)^t$, where P_o is the population in the base year, P_t is population in the t^{th} year and r is the rate of growth, we can find out the compound growth rate `r'. Then by extrapolating, we can get the population figure for 1993 and 1997.

Since the population figure for 1993-94 is not estimated we will use the 1993 figure for our calculation in 1993-94.

Using all those above information we can calculate the total number of employed persons in the three mentioned years and also the number of people employed in agriculture.

Table 2.5: Number of employed persons

Year	Rural		Urban	
	Male	Female	Male	Female
1983	15,12,73382	9,05,57143	4,55,80099	1,2167202
1993	18,45,95080	1.0,33,58584	6,3123810	1,69,97914
1997	197173611	9,84,81988	7,14,05765	1,62,50821

Thus the total no. of employed persons in the above three years are -

1983	29,95,77826
1993	36,80,75388
1997	38,33,12185

Table 2.6: Total Number of People Employed in Agriculture

Year	Rural		Urban	
	Male	Female	Male	Female
1983	11,72,36871	7,92,37500	46,94750	37,71833
1993-94	13,67,84954	8,90,95099	56,81143	4198485
1997	14,94,57597	,71,56559	55,69650	3250164

Thus the total number of persons engaged in agriculture in the above three periods are -

Year	Population	%age of total emploed person
1983	20,49,40954	(68.41)
1993	23,57,59681	(64.05)
1997	24,54,33970	(64.03)

(Figures in brackets show agricultural employment as a proportion of total employment)

Thus we see that during the 14 years of our discussion agricultural employment as a proportion of total employment has not declined considerably.

The sub-period which we get from the NSS data are inadequate for our purpose which is to look at the picture during the 1990s. For this we have to know the agricultural workforce for 1991 while the census figures give us an estimate of this, their comparability with the NSS is extremely problematical. However, as the following exercise shows, such a comparison is not as far-fold as is usually believed.

We can have the employment figures for 1991 from the census report 1991.

Census 1991 brought out by the CSO divides the total work force into two categories, namely the main workers and the marginal workers.

A main worker is one who has worked for 183 days or more preceding the day of survey. A marginal worker has worked for less than 183 days during the same time.

According to the 1991 census, the employment figures for 1991 are as follows:

Table 2.7:

Rural		Urban		Total	
Main	Marginal	Main	Marginal	Main	Marginal
222289579	26739365	63642914	1459512	285932493	28198877

Source: Census of India, 1991

Thus total work force in 1991 was 31,41,31370.Total number of people employed in agriculture in 1991 is

18,5300090 (main) + 2,59,46689 (marginal) = 21,12,46779.

Agricultural workforce as a proportion of total work force turned out to be 67.25 per cent.

When we compare the census figure with the NSS figure, we see that they are in line with each other.

According to 1983 NSS figure, 68.41 per cent of total work force were engaged in agriculture. The 1991 census figure says that 67.25 per cent of the total workforce are engaged in agriculture. Total number of people employed in agriculture during 1983 and 1991 were 20,4940954 and 21,12,46779 respectively, which are comparable figures.

So, we can combine the two separate estimates to make our analysis.

Thus the total workforce in agriculture for the four periods were found to be:

Year	Workforce
1983	20,49,40954
1991	21,12,46779
1993-94	23,57,59681
1997	24,54,33,970

We can have an idea about the economic prosperity of the people engaged in agriculture by studying their per capita real income in various periods. This we can know by dividing the constant price value added in agriculture in the various years by the total workforce in agriculture in the respective years.

As we see above the workforce figures for 1983, 1991 and 1997 are for the calendar years, we cannot use the constant price value added (which are calculated for the financial year) for a particular year for an analysis. So, we take average of two adjoining years, like 1982-83 and 1983-84 for 1983 and the like.

Table 2.8: The constant price value added in agriculture for the various years are (in Rupee crores)

Year	Amount
1983 (average of 1982-83 and 1983-84)	50364.5
1991 (average of 1990-91 and 1991-92)	62565
1993-94	66809
1997 (average of 1996-97 and 1997-98)	72130

Source: NAS, 1998.

The per capita income (PCY) of the people engaged in agriculture are as follows

Year	PCY
1983	Rs. 2573
1991	Rs. 2961
1993-94	Rs. 2834
1997	Rs. 2939

Here we see that the PCY of the people engaged in agriculture was maximum during 1991. After that it had declined and it became Rs. 2834 during 1993-94. During 1997 it rose to Rs. 2939, still lower than the 1991 level.

Thus despite the best ever agricultural year during 1996-97, PCY during 1997 could not exceed that of 1991 level. From our above analyses we see that per capita real income of people engaged in agriculture has not increased during the 1990s.

It may be mentioned here that in our analysis we have taken into account the total workforce in agriculture and not the total dependents on agriculture. If we will take into analysis the total dependents on agriculture, the situation will be worse.

As we see the PCY of people engaged in agriculture between 1993-94 and 1997 grew at a rate of 0.9 per cent (the rise was from Rs. 2834 to Rs. 2939). However population has grown at a rate of about 2 per cent. Further we see that

number of persons engaged in agriculture as a proportion of total workforce was same during both 1993-94 and 1997 (it was 64.05 per cent and 64.03 per cent respectively).

Moreover, proportion of workforce to population decreased during the said years (as we see in table 2-1). Therefore a constant growth of per capita income of the agricultural workforce indicates a reduction in PCY of the agriculture-dependent population.

However, we cannot draw from this last fact any firm conclusions about living standards, since the decline in participation rates could have been voluntary. Nonetheless the finding is significant.

Thus we can conclude from our analysis that there has not been any progress in the economic prosperity of the people engaged in agriculture during the 1990s. The same was the case whether we took the total agricultural workforce or the total dependents on agriculture.

CHAPTER III

STATEWISE BEHAVIOUR OF FOODGRAINS OUTPUT

In chapter I, we analysed the trend rate of growth of foodgrains production in India since 1971-72. The total period was 1971-72 to 1996-97. There we saw how the growth of foodgrains production has declined over the years, particularly during the 1990s.

However, by only studying this we cannot have a proper assessment of the agricultural performance, which is synonymous with the economic performance of a majority of people. In country like India where there is a large difference among the states, with regard to infrastructual facilities, rainfall, land condition and the like, accordingly there are differences, both in degree and quality of agriculture in the states. We can know about this by studying the statewise foodgrains production in the major states of India.

In our analysis we have taken 16 major states into consideration and have studied the performance of these states in foodgrains production since 1980-81.

TABLE: 3. 1

INDEX OF FOODGRAIN PRODUCTION

States	ANP	ASM	BHR	GUJ	HAR	J&K	KAR	KER	MP	MAH	ORI	PUN	RAJ	TN	UP	WB
1980-81	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1981-82	113.91	89.39	79.51	114.18	99.93	97.03	124.29	104.12	105.03	108.63	93.00	99.47	110.15	132.59	99.05	79.09
1982-83	111.51	102.48	70.60	98.63	110.03	96.11	102.40	101.53	103.32	94.71	78.05	111.37	127.99	86.60	108.00	70.66
1983-84	118.58	100 11	95.30	128.88	108.95	84.83	123.33	94.05	128.62	112.55	120.01	118.21	154.94	110.80	119.01	110.72
1984-85	95 97	99.00	99.67	117.95	113.14	94.89	116.89	97.71	108.89	100.05	96.12	134.54	121 70	123.54	121.89	111.76
1985-86	103.54	111.97	105.72	61.39	134.70	107.01	99.69	91.76	125.25	90.22	117.74	143.65	121.99	128.53	128.15	110.21
1986-87	91.46	95 64	105.29	69.46	126.32	104.65	129.68	88.32	110.75	73.41	109.27	136.19	104.43	128.22	123.36	116.03
1987-88	98.80	107 13	92.91	30.69	104.27	76.14	108.04	80.99	120.87	113.70	85.89	142.84	73.54	136.36	116.98	124.43
1988-89	128 76	97 12	115.24	119.45	157.21	99.85	116.11	78.63	128.30	113.84	119.06	142.63	163.88	131 70	143.95	139.04
1989-90	127.48	109.05	114.21	107.43	143.13	99.47	120.87	83.82	121.60	136.08	136.38	158.67	131.20	141.39	138.52	143.15
1990-91	123.06	127.20	118.31	108.68	158.19	102.44	108.83	84.81	147.40	125.21	118.75	160.86	168.15	133.27	145.47	136.08
1991-92	116.83	124.87	102.66	76.13	150.45	107.09	134.81	82.67	127.01	85.97	141.52	164.09	122.73	147.73	144.86	155.23
1992-93	116.36	127.38	87.65	121.38	169.61	105.49	144.54	84.73	138.33	144.32	101.08	167.19	176.52	149.76	147.78	149.59
1993-94	122.30	130.64	123.30	84.77	169.66	110.90	147.26	79.69	156.65	139.57	124.70	180.32	108.49	147.95	151.70	158.19
1994-95	117.62	128.94	125.18	117.72	181.88	109.98	137.87	76.34	159.12	118.48	118.01	107.10	180.07	162.84	159.90	160.34
1995-96	116.44	131.60	125.00	92.06	167.72	112.27	147.04	74.27	148.02	119.25	116.35	165.52	147.12	114.76	156.47	155.58
1996-97	126.60	130.52	136.40	116.87	189.53	100.91	157.67	65.50	160.22	149.93	82.69	180.21	189.73	136.98	174.11	165.89

SOURCE Economic Survey. Various Issues, Ministry of Finance, Govt. of India.

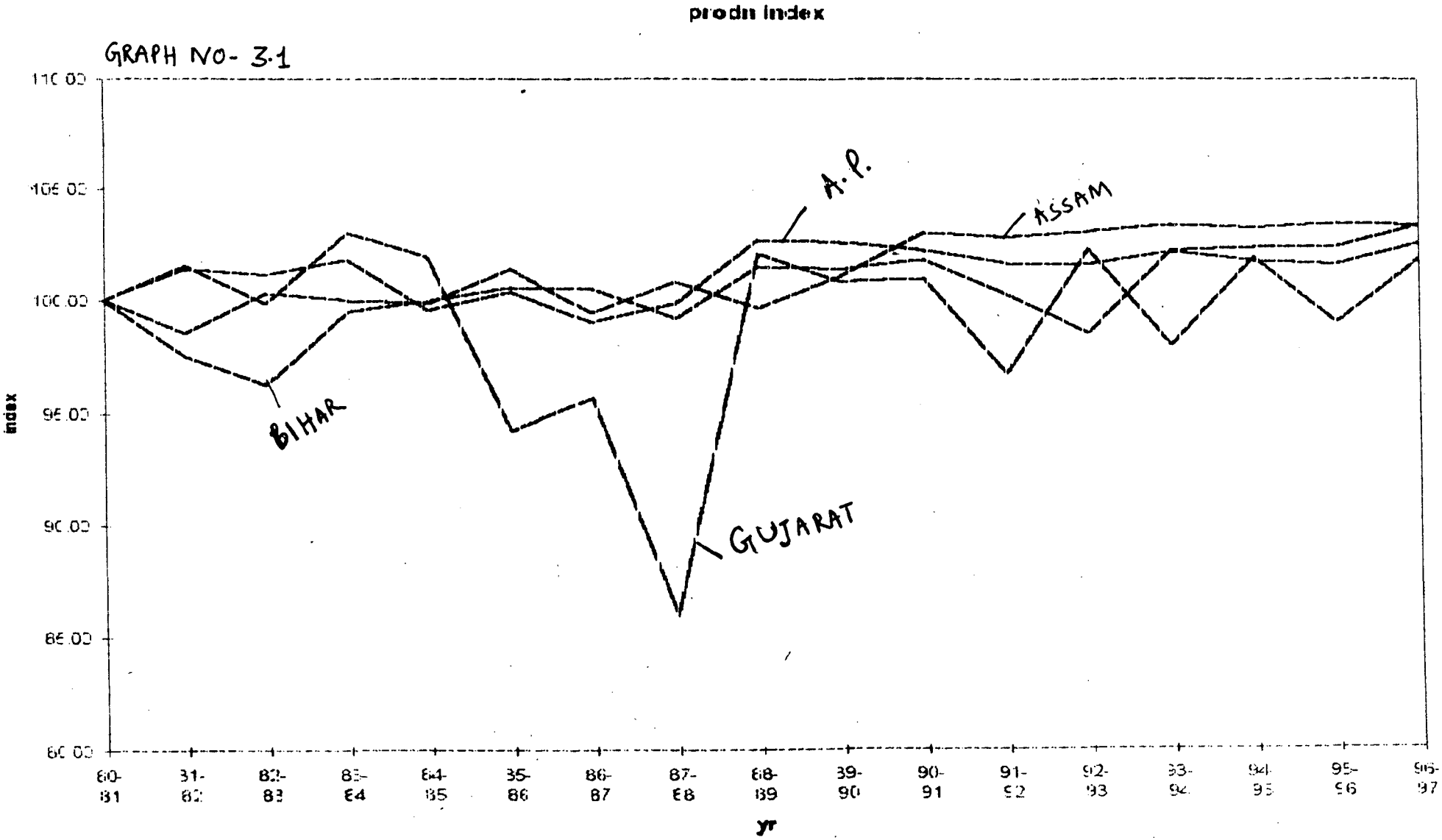
TABLE: 3.2

Production of foodgrains (in 000's tonnes)

States	ANP	ASM	BHR	GUJ	HAR	J & K	KAR	KER	MP	MAH	ORI	PUN	RAJ	TN	UP	WB
1980-81	10019	2706	10362	4457	6044	1312	5880	1310	12210	9731	5846	11966	6503	5581	24521	8282
1981-82	11413	2419	8239	5089	6040	1273	7308	1364	12824	10571	5437	11903	7163	7400	24289	6550
1982-83	11172	2773	7316	4396	6650	1261	6021	1330	12615	9216	4563	13326	8323	4833	26483	5852
1983-84	11881	2709	9875	5744	6585	1113	7252	1232	15704	10952	7016	14145	10076	6184	29182	9170
1984-85	9615	2679	10328	5257	6838	1245	6873	1280	13295	9736	5619	16099	7914	6895	29889	9256
1985-86	10374	3030	10955	2736	8141	1404	5862	1202	15293	8779	6883	17189	7933	7173	31424	9128
1986-87	9163	2588	10910	3096	7635	1373	7625	1157	13522	7144	6388	16296	6791	7156	30249	9610
1987-88	9899	2899	9627	1368	6302	999	6353	1061	14758	11064	5021	17092	4782	7610	28685	10305
1988-89	12900	2628	11941	5324	9502	1310	6827	1030	15665	11078	6960	17067	10657	7350	35298	11515
1989-90	12772	2951	11834	4788	8651	1305	7107	1098	14847	13242	7973	18986	8532	7891	33966	11856
1990-91	12329	3442	12259	4844	9561	1344	6399	1111	17998	12184	6942	19248	10935	7438	35671	11270
1991-92	11705	3379	10638	3393	9093	1405	7927	1083	15508	8366	8273	19635	7981	8245	35522	12856
1992-93	11658	3447	9082	5410	10251	1384	8499	1110	16890	14044	5909	20006	11479	8358	36237	12389
1993-94	12253	3535	12776	3778	10254	1455	8659	1044	19127	13582	7290	21577	7055	8257	37198	13101
1994-95	11784	3489	12971	5247	10993	1443	8107	1000	19428	11529	6899	12816	11710	9088	39208	13279
1995-96	11666	3561	12953	4103	10137	1473	8646	973	18073	11604	6802	19806	9567	6405	38368	12885
1996-97	12684	3532	14134	5209	11455	1324	9271	858	19563	14590	4834	21564	12338	7645	42693	13739

SOURCE: Economic Survey, Various Issues, Ministry of Finance, Govt. of India.

GRAPH NO- 3.1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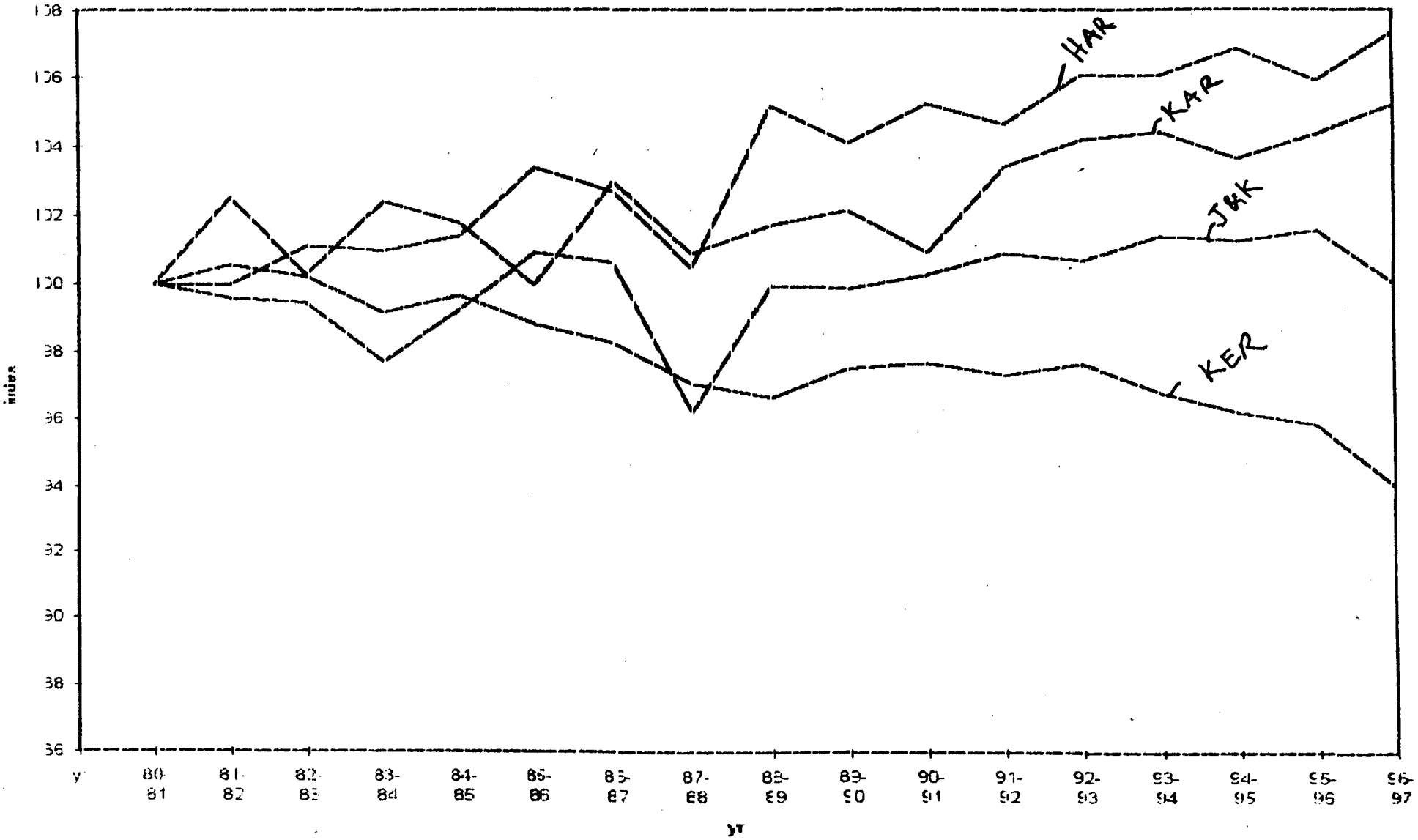
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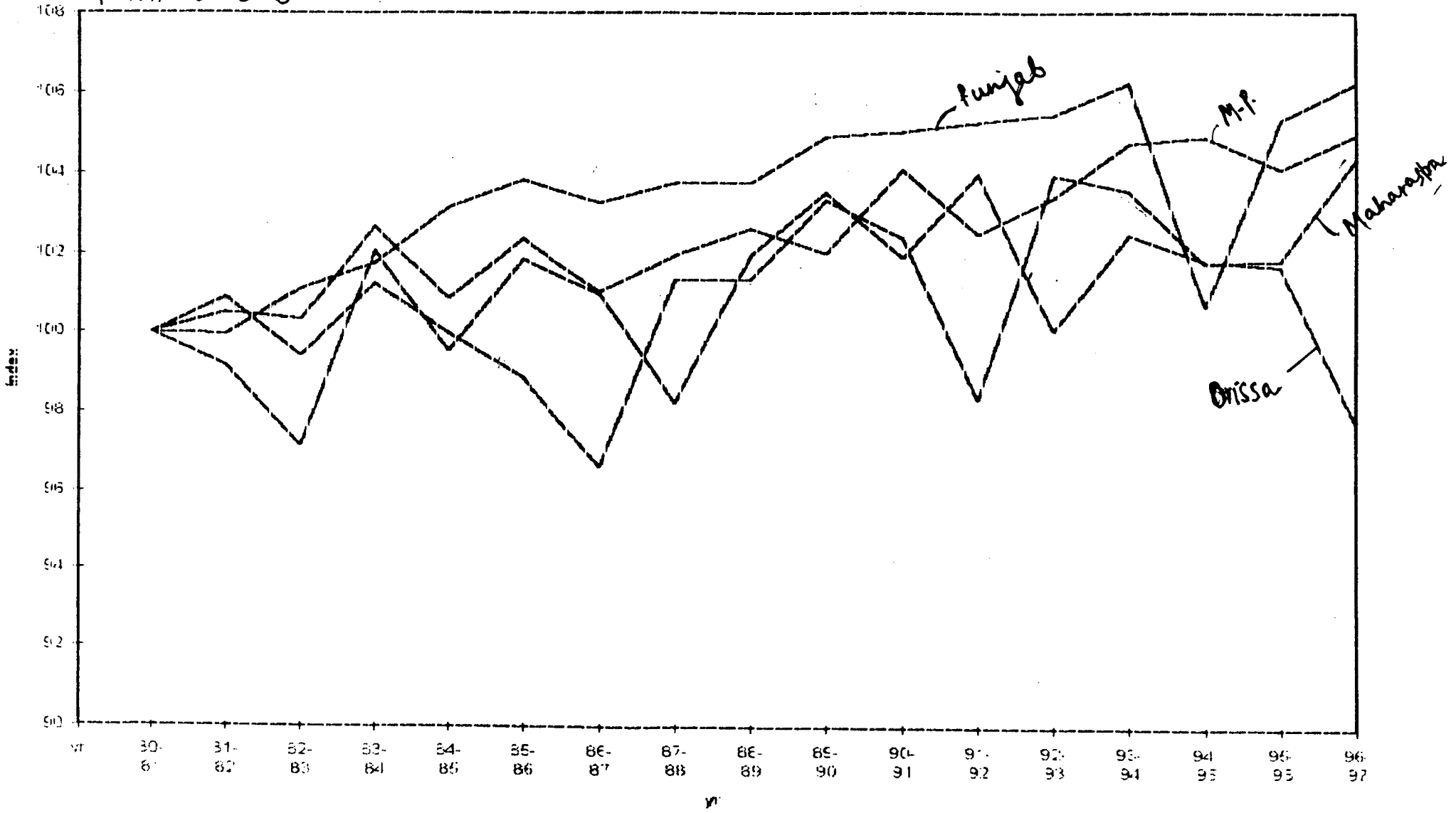
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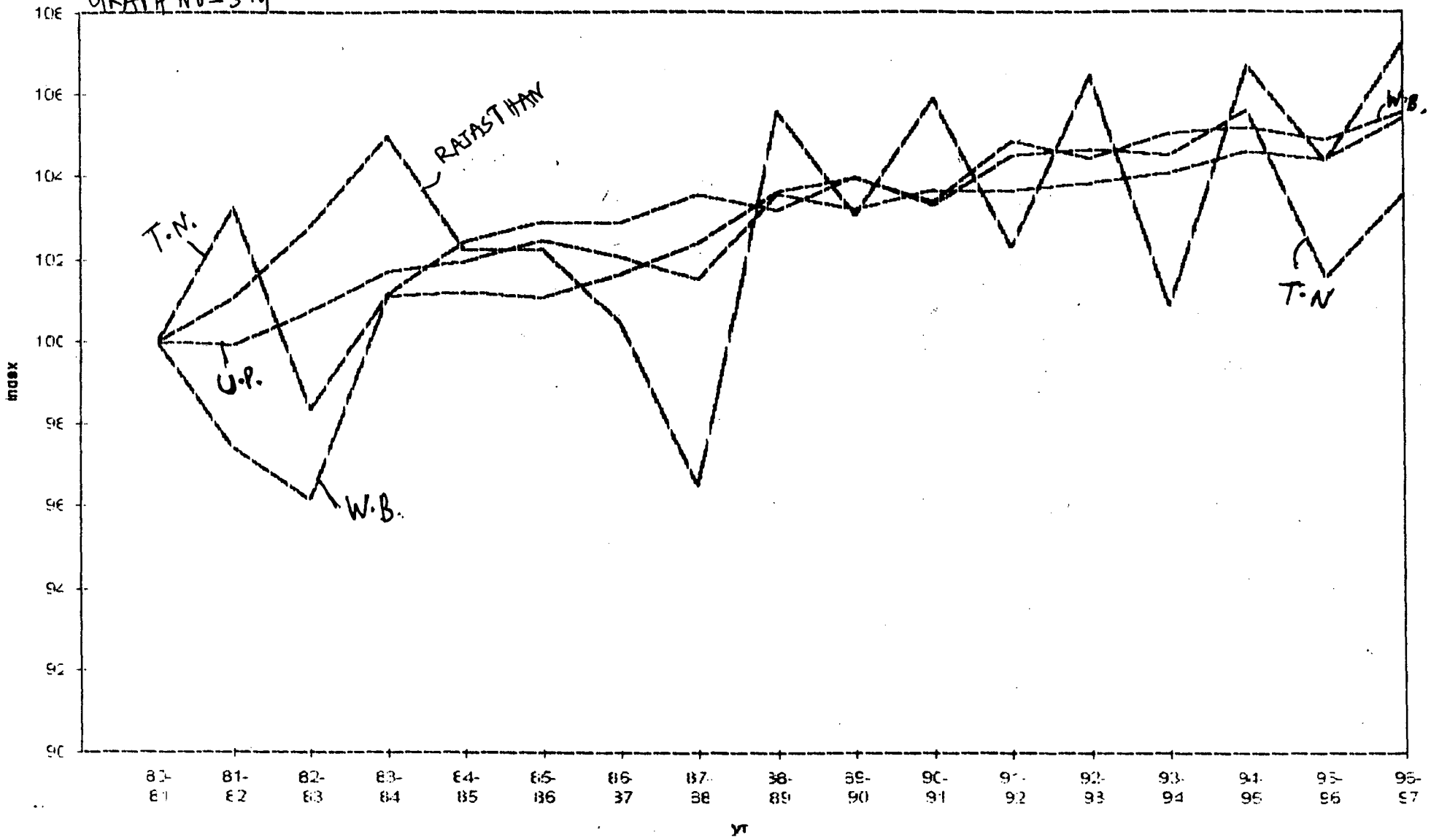
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Trends in Foodgrains Production in Various States

Here we have studied the foodgrains production of the 16 states since 1980-81. We have tried the semi-logarithmic curve on the statewise data of foodgrains production. The equations will be of the form $\log Y_t = a + bt$[1]

(where $\log Y_t$ being log of foodgrains production in the states, a and b are, as usual, the intercept and slope co-efficient respectively, t is time).

The results we got for the various sub-periods in various states are as follows:

Andhra Pradesh

The regression lines for the various observations are as follows:

Here to avoid fluctuations we have taken a three years moving average of the data. That is why the starting points and the end points have also been changed. For 1981-82 to 1995-96, the results are

$$\log Y_t = 4.0198 + 0.004771(t)$$

Here R^2 is 0.41 and the slope co-efficient is significant at a level of less than 1 per cent. D.W. Statistic was 1.9.

For 1981-82 to 1990-91, the results are-

$$\log Y_t = 4.0156 + 0.0058\ (t)$$

(R^2 = 0.46 and slope co-efficient is significant at 5 per cent level of significance, D.W. Statistic was 1.75).

---

[1] We have discussed about the semi-logarithmic curve in detail in our first chapter. Since the semi-logarithmic curve gives a constant growth rate throughout the period and also it shows the period where deceleration or acceleration starts, we have chosen this for our analysis.

For 1990-91 to 1995-96, the results are

$\log Y_t = 4.051 + 0.0022(t)$.

Here R^2 is 0.4 and the slope co-efficient is significant at 7 per cent level. D.W. Statistic was 1.8.

Here we find that due to wild fluctuation in the output of various period (which we can see from the graph 3.1), R^2 is not quite high even after taking a 3-year moving average.

The compound growth rates for the three different periods were -

	Growth rate
1980-81 - 1995-96	1.1 per cent
1980-81 - 1990-91	1.4 per cent
1990-91 - 1995-96	0.5 per cent

This clearly shows a continuous decline in growth rate of foodgrains production. The decline has been stiff during the 1990s.

Bihar

The regression lines for the various observations are as follows:

For 1980-81 to 1996-97, the results are-

$\log Y_t = 3.9466 + 0.01087(t)$

Here R^2 is 0.53 and the slope co-efficient is significant at a level of less than 3 per cent. D.W. Statistic was 1.71.

For 1980-81 to 1990-91, the results are

$\log Y_t = 3.9361 + 0.01454(t)$

(R^2 = 0.46 and slope co-efficient is significant at 3 per cent level of significance,D.W. Statistic was 1.96)

For 1990-91 to 1996-97, the results are

$\log Y_t = 3.8419 + 0.0082(t)$

Here R^2 is 0.66 and the slope co-efficient is significant at 5 per cent level. D.W. Statistic was 1.9.

Here we find that due to fluctuation in the output of various period (which we can see from the graph 3.1), R^2 is not quite high.

The compound growth rates for the three different periods were

	Growth rate
1980-81 - 1995-96	2.5 per cent
1980-81 - 1990-91	3.4 per cent
1990-91 - 1995-96	2.1 per cent

This clearly shows a decline in growth rate of foodgrains production during the 1990s.

Gujarat

In case of Gujarat, as we see in the graph 3.1, the trends in foodgrains production show a very wild fluctuation. To avoid the fluctuations we have taken a second degree (5 year) moving average of the data.

The results we got for the various observations are -

For 1982-83 to 1994-95

$\log Y_t = 3.5733 + 0.005259(t)$

($R^2 = 0.1$, the slope co-efficient is significant at 28 per cent level, D.W. Statistic was 1.9).

For 1982-83 to 1990-91,

$\log Y_t = 3.6673 - 0.03156(t)$

($R^2 = 0.7112$, the slope co-efficient is significant at 1 per cent level, D.W. statistic = 1.7).

For 1990-91 to 1994-95,

$\log Y_t = 3.4680 + 0.017(t)$

($R^2 = 0.6184$, the slope co-efficient was significant at 2 per cent level of significance).

The growth rates for various period were

	Growth rate
1982-83 - 1990-91	-7.5 per cent
1990-91 - 1995-96	4 per cent

From the production index chart 3.1, we see the negative growth in the first half is due to a drastic fall in foodgrains output between 1984-85 and 1987-88. The

high growth rate in the second half is due to a very low output in the beginning year. Thus we can deduct a conclusion from here that though there was no deceleration in the growth rate of foodgrains production in this state, but it was an outlier with a very low base for the 1990s.

Haryana

For 1980-81 to 1996-97, the regression line is

$\log Y_t = 3.7585 + 0.01676(t)$

($R^2 = 0.869$, level of significance is less than 1 per cent, D.W.Statistic = 2.1).

For 1980-81 - 1990-91

$\log Y_t = 3.7569 + 0.01776(t)$

($R^2 = 0.6134$ level of significance being less than 1 per cent, D. W. Statistic = 2.1).

For 1991-92 - 1996-97,

$\log Y_t = 3.8294 + 0.01286(t)$

($R^2 = 0.67298$, level of significance is less than 2 per cent, D. W. Statistic = 1.7).

The growth rates for the various periods were-

	Growth rate
1980-81 - 1996-97	4 per cent
1980-81 - 1990-91	4.2 per cent
1990-91 - 1996-97	3 per cent

In case of Haryana, the variation in the foodgrains production over the years is not much fluctuating, So we get a smooth production index curve. The growth rate

trend clearly shows that the growth rate which was impressive during he 1980s has faced a jolt during the 1990s.

Jammu and Kashmir

The results we got after taking 3 year moving average were as follows:

For 1981-82 - 1995-96,

$\log Y_t = 3.0807 + 0.0051(t)$

(R^2 = 0.6668, level of significance is less than 1 per cent, D. W. Statistic = 1.9).

For 1981-82 - 1990-91,

$\log Y_t = 3.086057 + 0.00634(t)$

(R^2 = 0.27996, level of significance is less than 10 per cent, D. W. Statistic = 1.7).

For 1990-91-1995-96,

$\log Y_t = 3.1019 + 0.003598(t)$

(R^2 = 0.52, level of significance is less than 6 per cent, D. W.Statistic = 2.0)

The growth rates for the various periods were-

	Growth rate
1981-82 - 1995-96	1.2 per cent
1981-82 - 1990-91	1.5 per cent
1990-91 - 1995-96	0.85 per cent

In Jammu and Kashmir also the growth rate of foodgrains production has decelerated during the 1990s.

Karnataka

The results we got after taking a three year moving average are:

The regression line for

1981-81 - 1995-96,

$\log Y_t = 3.791966 + 0.009606(t)$

(R^2 = 0.8293, level of significance is less than 1 per cent, D. W. Statistic = 2.16).

For 1981-82 - 1990-91,

$\log Y_t = 3.815874 + 0.002826(t)$

(R^2 = 0.4414, level of significance is less than 3 per cent, D. W. Statistic = 1.8).

For 1990-91 - 1995-96,

$\log Y_t = 3.7366 + 0.014691(t)$

(R^2 = 0.8434, level of significance is less than 1 per cent, D.W.Statistic = 1.88).

The growth rates for the various periods are:

	Growth rate
1981-81 - 1995-96	2.2 per cent
1981-81 - 1990-91	0.7 per cent
1990-91 - 1995-96	4.3 per cent

The high growth rate in the 1990s is due to the fact that 1990-91 is a slump year in Karnataka. This we can see from the graph 3.2.

Kerala

Kerala is a state which shows a continuous fall in foograins output over the years. This we can see from the continuously falling production index graph 3.2. The regression lines for the three period were found to be -

For 1980-81 - 1996-97,

$\log Y_t = 3.137 - 0.0142(t)$

(R^2 = 0.84, level of significance is less than 1 per cent, D. W.Statistic = 1.8).

For 1980-81 - 1990-91,

$\log Y_t = 3.121071 - 0.01199(t)$

(R^2 = 0.836, level of significance is less than 3 per cent, D.W.Statisic = 1.7).

For 1990-91 - 1996-97,

$\log Y_t = 3.2469 - 0.016966(t)$

($R^2 = 0.836$, level of significance is less than 1 per cent, D.W.Statisic = 2.1).

The growth rates for the various periods were -

	Growth rate
1980-81 - 1996-97	-3.3 per cent
1980-81 - 1990-91	-3 per cent
1990-91 - 1996-97	-4 per cent

This way Kerala registered a declining growth rate, that too negative, over the years. From many a writings we know that in Kerala, there has been an acreage shift from foodgrains production to other cash crops.

Madhya Pradesh

The results of the regression analysis are as follows -

The regression line for

1980-81 - 1996-97,

$\log Y_t = 4.08316 + 0.012057(t)$

($R^2 = 0.8173$, level of significance is less than 1 per cent), D.W.Statisic = 2.2).

The growth rates for the various periods are -

	Growth rate
1980-81 - 1996-97	2.8 per cent
1980-81 - 1990-91	2.2 per cent
1990-91 - 1996-97	2.5 per cent

Madhya Pradesh registered anacceleration in growth rate during the 1990s. Though this is the case, the growth rate of foodgrains production during the 1990s in absolute term was not impressive.

Maharashtra

As we see, the production index chart of Maharashtra shows a continuous ups and downs. To avoid the wild fluctuation in the production behaviour, we have taken a five year moving average. Accordingly the end and starting periods have been changed.

The results we got after taking a five year moving average are-

The regression line for

1982-83 - 1994-95,

$\log Y_t = 3.964058 + 0.010517(t)$

($R^2 = 0.8$, D.W. Statisic = 2.2).

For 1982-83 - 1990-91,

$\log Y_t = 3.970965 + 0.007397(t)$

($R^2 = 0.39$, D.W Statisic= 2.3).

For 1990-91 - 1994-95,

$\log Y_t = 4.003702 + 0.007097(t)$

($R^2 = 0.4966$, D. W. Statisic = 1.9).

Here all the co-efficients are significant at a level less than 7 per cent.

The growth rates for the various periods are -

	Growth rate
1982-83 - 1994-95	2.4 per cent
1982-83 - 1989-90	1.7 per cent
1989-90 - 1994-95	1.6 per cent

This shows a deceleration in foodgrains production growth rate during the 1990s.

Orissa

After taking a five year moving average, the results of the regression processes are (for this we have changed the starting and end year)

The regression line for

1982-83 - 1994-95,

$\log Y_t = 3.774568 + 0.005668(t)$

($R^2 = 0.47$, level of significance is less than 6 per cent, D.W.Statisic = 2.2).

For 1982-83 - 1989 -90[2],

$\log Y_t = 3.7518 + 0.011938(t)$

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[2] Instead of 1990-91 we have taken 1989-90. This we have taken to avoid the continuous downward movement of foodgrains production during the 1990-91, which we can seen from the graph.

(R^2 = 0.957 level of significance is less than 5 per cent, D.W.Statisic = 2.1).

For 1989-90 - 1994-95,

$\log Y_t = 3.917003 - 0.008102(t)$

(R^2 = 0.552, level of significance is less than 5 per cent, D.W.Statisic = 1.8).

The growth rates for the various periods are -

	Growth rate
1982-83 - 1994-95	1.3 per cent
1982-83 - 1989-90	2.8 per cent
1989-90 - 1994-95	-1.9 per cent

The growth rate turned negative during the 1990s, thus showing a clear deceleration.

Punjab

After taking a three year moving average, the results of the regression operations are -

The regression line for

1981-82 - 1995-96,

$\log Y_t = 4.147014 + 0.0112(t)$

(R^2 = 0.6985, level of significance is less than 5 per cent, D.W. Statistic = 2.2).

For 1981-82 - 1990-91,

$\log Y_t = 4.113727 + 0.01998(t)$

(R^2 = 0.9336, level of significance is less than 1 per cent,

D.W. Statistic = 1.9).

For 1990-91 - 1995-96,

$\log Y_t = 4.402039 - 0.011375(t)$

($R^2 = 0.5799$, level of significance is less than 7 per cent, D.W.Statistic = 1.79).

The starting and end-point change are for the moving average operation.

The growth rates for the various periods are -

	Growth rate
1981-82 - 1995-96	2.6 per cent
1981-82 - 1990-91	4.7 per cent
1990-91 - 1995-96	-2.7 per cent

As we see from the graph 3.3, after 1992-93, the foodgrains production in Punjab has shown as much large fluctuations as compared to in the 1980s. The growth rate of foodgrains production during the 1990s has been negative, which was one of the highest in India during the 1980s.

Rajasthan

As we see from the production index chart of Rajasthan, there was no such smooth trend in the output in various years. To avoid those fluctuations to a certain degree, we have taken a five year moving average. Accordingly we have changed the starting and end points.

The results of the regression operations are as follows -

The regression line for

1982-83 - 1994-95,

$\log Y_t = 3.8636 + 0.01101(t)$

($R^2 = 0.69$, level of significance is equal to 0.2 per cent, D.W. Statistic : 2.1

For 1982-83 - 1989-90,

$\log Y_t = 3.876389 + 0.007325(t)$ ($R^2 = 0.306$, level of significance is equal to 9 per cent). D.W. Statistic = 1.9

For 1989-90 - 1994-95

$\log Y_t = 3.7946 + 0.017859(t)$

($R^2 = 0.8633$, level of significance is equal to 2 per cent). D.W. Statistic : 1.8

We have taken 1989-90 instead of 1990-91 to avoid fluctuations.

The growth rates for the various periods are -

	Growth rate
1982-83 - 1994-95	2.6 per cent
1982-83 - 1989-90	1.7 per cent
1989-90 - 1994-95	4.2 per cent

We see that Rajasthan is a state which has done well in foodgrains production during the 1990s. It has moved from a lower growth path to a higher one. This is due to the fact that Rajasthan had shown a higher efficiency of use and management

of water *vis-a-vis* the other states during the post 1980s period, as mentioned by Sawant.[3]

Tamil Nadu

The regression lines for the three periods are (after taking three-year moving average)

For 1981-82 - 1995-96,

$\log Y_t = 3.7794 + 0.0085(t)$

(R^2 = 0.40299, level of significance is less than 5 per cent, D.W. Statisic = 2.1).

For 1981-82 - 1990-91,

$\log Y_t = 3.7443 + 0.0153(t)$

(R^2 = 0.4716, level of significance is equal to 2 per cent, D.W. Statisic = 1.75).

For 1990-91 - 1995-96,

$\log Y_t = 3.970026 + 0.005258(t)$

(R^2 = 0.562, level of significance is equal to 6 per cent, D.W. Statisic = 2.1).

[3] Sawant S.D. (1997), "Performance of Indian agriculture with Special Reference to Regional Variations" Vol. 52, no. 3, July-September 1997, IJAE.

The growth rates for the various periods are -

	Growth rate
1981-82 - 1996-97	2 per cent
1981-82 - 1990-91	3.6 per cent
1990-91 - 1996-97	-1.2 per cent

This clearly shows that there was a deceleration in growth of foodgrains production during the 1990s. It was one of the highest in India during the 1980s.

Uttar Pradesh

The results of the regression operations are as follows -

The regression line for

1980-81 - 1996-97,

$\log Y_t = 4.38834 + 0.013669(t)$

($R^2 = 0.92$, D.W. Statisic = 2.3).

For 1980-81 - 1990-91,

$\log Y_t = 4.376899 + 0.016072(t)$

($R^2 = 0.805513$, D.W. Statisic = 2.1).

For 1990-91 - 1996-97,

$\log Y_t = 4.4095 + 0.011975(t)$

($R^2 = 0.83$, D.W. Statisic = 2.04).

All the parameters estimated are significant at level less than 1 per cent.

The growth rates for the various periods are -

	Growth rate
1980-81 - 1996-97	3.2 per cent
1981-82 - 1990-91	3.8 per cent
1990-91 - 1996-97	2.8 per cent

Here also we find a clear deceleration in foodgrains production during the 1990s. As we see in the graph, U.P. foodgrains production graph shows a relatively smooth line as compared to other states.

West Bengal

The results of the regression operations are as follows -

The regression line for

1980-81 - 1996-97,

$\log Y_t = 3.84179 + 0.0193(t)$

($R^2 = 0.81$, D.W. Statisic = 2.1).

For 1980-81 - 1990-91,

$\log Y_t = 3.805478 + 0.026673(t)$

($R^2 = 0.68$, D.W. Statisic = 2.1).

For 1990-91 - 1996-97,

$\log Y_t = 3.96099 + 0.010364(t)$

($R^2 = 0.6591$, D.W. Statisic = 1.9).

It may be noted that all the parameters estimated are at a level of significance less than 5 per cent level.

The growth rates for the various periods are -

	Growth rate
1980-81 - 1996-97	4.6 per cent
1980-81 - 1990-91	6.3 per cent
1990-91 - 1996-97	2.4 per cent

Conclusion:

(i)As we see from the index graphs of the states and the regression results found out above, many a states have shown a wild variation in the foodgrains production over the years. The prominent among them have been Rajasthan, Gujarat, Orissa and Maharastra.

For this reason the goodness of fit has not been that much good for many a states. However, we have tried to get a good fit by taking 3 years and 5 years moving averages as required. We have tried to make the regression results to be good estimates of the production data, and we have reached a level, where we can use these results with not doing a big mistake. Further the estimated parameters have been in a level of significance quite acceptable. Most of them have been significant at levels less than 5 per cent, baring a few which have been significant at less than 10 per cent level. Also the Durbin Watson

Statistic in all the estimated equations did not suggest auto-correlation problem.

(ii)In many a states we find that the growth rate in foograins production has been decelerating during the 1990s. It is noticed that the states which are doing more than average in foodgrains production during the 1980s have done badly in the 1990s. For example Harayana which registered a growth rate of 4.2 per cent during the 1980s, registered a decelerating growth rate of 3 per cent during the 1990s. Punjab, which registered a growth rate of 4.7 per cent during 1980s, registered a decelerating growth rate of -2.7 per cent during the 1990s.

West Bengal which registered a growth rate of 6.3 per cent during the 1990s, registered a decelerating rate of 2.4 per cent during the 1990s.

Tamil Nadu's rate of growth got reduced to -1.2 per cent in the 1990s from 3.6 per cent in the 1980s. Similarly in Uttar Pradesh, the decline was from 3.8 per cent to 2.8 per cent.

This shows that the traditional growth centres of foodgrains production are losing out during the 1990s.

Per Capita Foodgrains Production Variation in the States

As mentioned earlier we can have a better look at the food security in India by studying the per capita foodgrains production. We can intensify our assessment of the food security in India by analysing the per capita foodgrains production in various states.

As the variation in growth rate of foodgrains production in various states was substantial, the same trend has also been seen in case of per capita foodgrains production.

For finding the population of the states we have used the compound growth formula.

We have the formula $P_t = P_o (1+r)^t$

Where P_o is the population in the base year, P_t is the population in year 't', r is the rate of growth of population.[4]

[4] We have the population figure for 1981 and 1991, using these two figures and the formula $P_t = P_o(1+r)^t$, we get the value of 'r'. Then we get the population of subsequent years by extrapolation.

Trends in Per capita Foodgrains Production in States

We have fitted semi-logarithmic regression lines for each states and have analysed the growth rate of foodgrains production in the states. The equation will be, as discussed earlier, of the form $\log Y_t = a + bt$ ($\log Y_t$ being the log of per capita foodgrains production, a and b are the intercept and slope co-efficients respectively).

The results of the econometric analysis for the states were as follows -

Andhra Pradesh

The results of the regression operations after taking a three years moving average are as follows

The regression line for

1981-82 - 1995-96,

$\log Y_t = 2.2863 - 0.004641(t)$

($R^2 = 0.55$, level of significance is equal to .8 per cent, D.W. Statisic = 2.1).

For 1981-82 - 1990-91,

$\log Y_t = 2.3054 - 0.0067(t)$

($R^2 = 0.55$, level of significance is equal to 7 per cent, D.W. Statisic = 1.9).

For 1990-91 - 1995-96,

$\log Y_t = 2.3747 - 0.011(t)$

($R^2 = 0.89$, level of significance is equal to 7 per cent, D.W. Statisic = 1.8).

The compound growth rates for the three periods are -

	Growth rate
1981-82 - 1996-97	-1 per cent
1981-82 - 1990-91	-1.2 per cent
1990-91 - 1996-97	-2.6 per cent

Thus we see that for all the periods the growth rate of per capita foodgrains production is negative. It is becoming worse during the 1990s.

Assam

The results of the regression operations after taking a 5 years moving average are as follows(we have changed the starting point and end points accordingly):

The regression line for

1982-83 - 1994-95,

$\log Y_t = 2.13198 + 0.0018(t)$

($R^2 = 0.37$, level of significance is equal to 6 per cent, D.W. Statisic = 2.1).

For 1982-83 - 1989-90,

$\log Y_t = 2.160098 - .0043(t)$

(R^2 = 0.87, level of significance is equal to 2 per cent, D.W. Statisic = 2).

For 1989-90 - 1994-95

$\log Y_t = 2.0948 + 0.0053(t)$

(R^2 = 0.63, level of significance is equal to 3 per cent, D.W. Statisic = 2.

The compound growth rates for the three different periods are -

	Growth rate
1982-83 - 1995-96	0.4 per cent
1982-83 - 1989-90	-1 per cent
1989-90 - 1995-96	1.3 per cent

Assam shows an increase in growth of per capita foodgrains production during the 1990s. This we achieved over a negative growth rate during the 1980s.

Bihar

The results of the regression operations after taking three years moving average are as follows - (Accordingly we have changed the starting and end point).

The regression line for

1981-82 - 1996-97,

$\log Y_t = 2.095 + 0.0021(t)$

(R^2 = 0.42, level of significance is equal to 9 per cent).

For 1981-82 - 1990-91,

$\log Y_t = 2.07 + 0.0047(t)$

($R^2 = 0.57$, level of significance is equal to 8 per cent).

For 1990-91 - 1996-97,

$\log Y_t = 2.015 - 0.00174(t)$

($R^2 = 0.42$, level of significance is equal to 8 per cent).

The compound growth rates for the three periods are -

	Growth rate
1981-82 - 1995-96	0.5 per cent
1981-82 - 1990-91	1.1 per cent
1990-91 - 1995-96	0.4 per cent

Thus we see that Bihar registered a deceleration in the growth of per capita foodgrains production during the 1990s.

Gujarat

The results of the regression operations after taking a 5 years moving average are (we have changed the starting and end points accordingly).

The regression line for

1982-83 - 1990-91,

$\log Y_t = 2.1627 - 0.0311(t)$

($R^2 = 0.69$, level of significance is equal to 1 per cent, D.W. Statisic = 1.7).

For 1990-91 - 1995-96,

$\log Y_t = 1.9 + 0.0087(t)$

($R^2 = 0.39$, level of significance is equal to 10 per cent, D.W. Statisic = 1.9).

The compound growth rates for the two periods are -

	Growth rate
1982-83 - 1990-91	-7.4 per cent
1990-91 - 1995-96	2.1 per cent

Gujarat registered a positive rate of growth of per capita foodgrains production during the 1990s. However, this is an out-lier as it has been established over a huge negative rate of growth during the 1980s.

Haryana

The results of the regression operations are as follows-

The regression line for

1980-81 - 1996-97,

$\log Y_t = 2.66 + 0.0072(t)$

($R^2 = 0.52$, level of significance is equal to 1 per cent, D.W. Statistic= 2.1).

For 1980-81 - 1990-91,

$\log Y_t = 2.66 + 0.0074(t)$

(R^2 = 0.43, level of significance is equal to 7 per cent, D.W. Statistic = 2).

For 1990-91 - 1996-97,

$\log Y_t = 2.706 + 0.0041(t)$

(R^2 = 0.72, level of significance is equal to 4 per cent, D.W. Statistic = 1.72).

The compound growth rates for the three periods are -

	Growth rate
1980-81 - 1996-97	1.6 per cent
1980-81 - 1990-91	1.7 per cent
1990-91 - 1996-97	0.9 per cent

This clearly shows a deceleration in rate of growth of per capita foodgrains production during the 1990s.

Karnataka

The results of the regression operations after taking a three years moving average are(we have changed the starting year and end year accordingly):

The regression line for

1981-82 - 1990-91,

$\log Y_t = 2.237 - 0.00549(t)$

(R^2 = 0.75, level of significance is equal to1 per cent, D.W. Statistic = 2.2).

For 1990-91 - 1995-96,

$\log Y_t = 2.1158 + 0.0063(t)$

($R^2 = 0.5$, level of significance is equal to per cent, D.W. Statistic = 2).

The compound growth rates for the two periods are

	Growth rate
1981-82 - 1990-91	1.3 per cent
1990-91 - 1996-97	1.5 per cent

Here we do not find any deceleration in per capita foodgrains production growth rate. There has been a small increase during 1990s as compared to 1980s. This is due to the good performance of foodgrains production during the 1990s.

Kerala

The results of the regression operations after taking a 3 years moving average and thus changing the end points here found as follows -

The regression line for

1980-82 - 1995-96,

$\log Y_t = 1.7261 - 0.0149(t)$

($R^2 = 0.95$, D. W. Statistic = 2.1).

For 1980-81 - 1990-91,

$\log Y_t = 1.7369 - 0.0177(t)$

(R^2 = 0.95, level of significance being 2 per cent, D.W. Statistic = 1.8).

For 1990-91 - 1995-96,

$\log Y_t = 1.7782 - 0.0190(t)$

(R^2 = 0.93, level of significance being 1 per cent, D.W. Statistic = 1.9).

The compound growth rates for the three periods are -

	Growth rate
1981-82 - 1995-96	- 3.5 per cent
1980-81 - 1990-91	- 4.1 per cent
1990-91 - 1995-96	- 4.5 per cent

Here we find a clear deceleration in growth rate of per capita foodgrains production during the 1990s. The growth rate was -4.5 per cent during the 1990s.

Maharashtra

The regression operations results after taking a 5 years moving average are found. (We have changed the end points accordingly).

The regression line for the various periods are -

For 1982-83 - 1990-91,

$\log Y_t = 2.126 + 0.0035(t)$

(R^2 = 0.58, level of significance is equal to 8 per cent, D.W. Statistic = 1.88).

For 1990-91 - 1994-95

$\log Y_t = 2.208 + 0.0047(t)$

($R^2 = 0.64$, level of significance is equal to 7 per cent, D. W. Statistic = 1.47).

The compound growth rates for the two periods are -

	Growth rate
1982-83 - 19990-91	0.8 per cent
1990-91 - 1994-95	-1.1 per cent

Here also we find a deceleration in the growth of per capita foodgrains production.

Orissa

The results of the regression operation after taking a 5 years moving average (and thus changing the end points) are as follows -

The regression line for

1982-83 - 1990-91,

$\log Y_t = 2.315 + 0.0039(t)$

($R^2 = 0.71$, level of significance is equal to 6 per cent, D.W. Statistic = 1.49).

For 1990-91 - 1994-95,

$\log Y_t = 2.48 - 0.0160(t)$

($R^2 = 0.82$, level of significance is equal to 5 per cent, D.W. Statistic = 1.79).

The compound growth rates for the two periods are -

	Growth rate
1982-83 - 1990-91	0.9 per cent
1990-91 - 1994-5	-3.8 per cent

Thus we find a clear decline in the growth of per capita foodgrains production.

Punjab

The results of the regression operations after taking a 3 years moving average are - (end years have been changed accordingly).

The regression line for

1981-82 - 1995-96,

$\log Y_t = 2.906 + 0.0047(t)$

($R^2 = 0.47$, level of significance is equal to 5 per cent, D.W. Statistic = 1.97).

For 1981-82 - 1990-91,

$\log Y_t = 2.87 + 0.0133(t)$

($R^2 = 0.79$, level of significance is equal to 0.2 per cent, D.W. Statistic = 1.59).

For 1990-91 - 1995-96,

$\log Y_t = 3.059 - 0.0106(t)$

($R^2 = 0.53$, level of significance is equal to 4 per cent, D.W Statistic = 2.1).

The compound growth rates for the three periods are -

	Growth rate
1981-82 - 1995-96	1.1 per cent
1981-82 - 1990-91	3.2 per cent
1990-91 - 1995-96	-2.4 per cent

The growth rate of per capita foodgrains production which was at an impressive level of 3.2 per cent during 1980s got reduced to -2.4 per cent during the 1990s. This is clearly due to the negative foodgrains production growth rate during the 1990s.

Rajasthan

The regression lines after taking a 5 years moving average are (end years being changed accordingly).

The regression line for

1982-83 - 1990-91

$\log Y_t = 2.3386 - 0.0114(t)$

($R^2 = 0.62$, level of significance is equal to 2 per cent, D.W. Statistic = 1.89).

For 1990-91 - 1994-95,

$\log Y_t = 2.26 + 0.0047(t)$

($R^2 = 0.47$, level of significance is equal to 7 per cent, D.W. Statistic = 1.47).

The compound growth rates for the two periods are -

	Growth rate
1982-83 - 1990-91	-2.7 per cent
1990-91 - 1994-95	1.1 per cent

Here the impressive growth in per capita foograins production during 1990s which is much more than the growth figure during 1980s is due to the impressive performance of foodgrains output during 1990s.

Tamil Nadu

The results of the regression operations after taking a 3 years moving average are - (the end points are changed accordingly).

The regression line for

1981-82 - 1995-96,

$\log Y_t = 2.097 + 0.004(t)$

($R^2 = 0.45$, level of significance is equal to 5 per cent, D.W. Statistic = 2.2).

For 1981-82 - 1990-91,

$\log Y_t = 2.0713 + 0.012(t)$

($R^2 = 0.82$, level of significance is equal to 1 per cent, D.W. Statistic = 1.9).

For 1990-91 - 1995-96,

$\log Y_t = 2.1862 - 0.0036(t)$

(R^2 = 0.49, level of significance is equal to 5 per cent, D.W. Statistic = 1.89).

The compound growth rates for the three periods are -

	Growth rate
1981-82 - 1995-96	0.9 per cent
1981-82 - 1990-91	2.8 per cent
1990-91 - 1995-96	-0.8 per cent

This clearly shows a deceleration in growth of per capita foodgrains production during the 1990s.

Uttar Pradesh

The results of the regression process after taking a 3 years moving averages (and thus changing the end years) are -

The regression line for

1981-82 - 1995-96,

$\log Y_t = 2.3659 + 0.00329(t)$

(R^2 = 0.64, level of significance is equal to 3 per cent, D. W. Statistic = 2.14).

For 1981-82 - 1991-92,

$\log Y_t = 2.3585 + 0.00549(t)$

(R^2 = 0.6, level of significance is equal to 1 per cent, D.W. Statistic = 1.96).

For 1990-91 - 1995-96,

$\log Y_t = 2.389 + 0.0011(t)$

($R^2 = 0.75$, level of significance is equal to 6 per cent, D.W. Statistic = 1.49).

The compound growth rates for the three periods are -

	Growth rate
1981-82 - 1995-96	.8 per cent
1981-82 - 1991-92	1.3 per cent
1990-91 - 1995-96	0.2 per cent

Thus we find a clear downswing in the trend growth of per capita foodgrains production during the 1990s.

West Bengal

The regression lines after taking a 3 years moving average are (we have changed the end years accordingly).

The regression line for

1981-82 - 1995-96,

$\log Y_t = 2.1239 + 0.01129(t)$

($R^2 = 0.79$, D. W. Statistic = 2.21).

For 1981-82 - 1990-91,

$\log Y_t = 2.0936 + .02(t)$

($R^2 = 0.92$, D.W. Statistic = 1.96).

For 1990-91 - 1995-96,

$\log Y_t = 2.2288 + .0016(t)$

($R^2 = 0.69$, level of significance is equal to 5 per cent, D.W. Statistic = 1.49).

The compound growth rates for the three periods are -

	Growth rate
1981-82 - 1995-96	2.7 per cent
1981-82 - 1990-91	4.7 per cent
1990-91 - 1995-96	0.3 per cent

The rate of growth of per capita foodgrains production which registered an impressive level of 4.7 per cent got reduced to 0.3 per cent, thus noticing a clear downswing.

Conclusion

(i)Just like the situation in case of foodgrains production in the states, here also most of the states show a wild variation in their per capita foodgrains production. To get a better fit for the data, we have taken 3 years and 5 years moving averages as when required. This has helped cross our minimum R^2, throughout the operation, the 0.5 level. This we can call a good fit, given the wild variation found. Further, the estimated parameters have been significant at levels less than 5 per cent, being a few which have been significant at less than 10 per

cent level. Also, the Durbin Watson Statistic which shows the auto-correlation problem is found to be within safe limits in all our estimations.

(ii)As found in the case of total foodgrains production, here also in most of the cases the trend growth in per capita foodgrains production has been found to be decelerating during the 1990s. States having quite well growth rate of per capita foodgrains production during the 1980s have done badly during 1990s in this front. For example, West Bengal had a per capita foodgrains production growth of 4.7 per cent during the 1980s, it declined to 0.3 per cent during the 1990s. For Punjab the two figures are 3.2 per cent and -2.4 per cent respectively. For Tamil Nadu the figures are 2.8 per cent and -0.8 per cent respectively during the 1980s and 1990s.

Other states like Orissa, Maharastra, Kerala and Andhra Pradesh have registered negative rate of growth of foodgrains production during the 1990s.

The state Gujarat which had a per capita foodgrains production growth rate of -7.4 per cent during the 1980s has registered a growth rate of 2.1 per cent during the 1990s. This is an outlier since for the growth rate derivation during the 1990s, the base was a very low base.

Other states having done better during the 1990s as compared to the 1980s are Assam, Karnataka and Rajasthan. For the state Assam the per capita

growth rate for the period 1982-83 to 1989-90 was -1.0 percent. So the calculation for the 1990s was estimated on a low base. Perhaps for this reason the performance looks good during the 1990s. For the other two states, Karnataka and Rajasthan agriculture sector has performed well(the reasons being discussed in Chapter IV).

Thus, our hypothesis that the growth of per capita foodgrains production has faced a declining trend during the 1990s has been invariably proved.

CHAPTER IV

TOWARDS AN ANALYSIS OF AGRICULTURAL PERFORMANCE

In the previous three chapters we made a detailed analysis of the performance of the agriculture sector in general and of foodgrains production in particular. We highlighted the growth performance of Indian agriculture for a longer period encompassing the 1970s, the 1980s and the 1990s. To know the state-wise variation in the growth performance of foodgrains production we made a state-wise analysis of foodgrains production since 1980-81. Chapter II was devoted to a study of changing economic well being of the people engaged in agriculture during the 1980s and the 1990s.

Our findings show a deceleration in the growth of agricultural production and of foodgrains production during the 1990s. The per capita income of the agriculture dependent population in 1997 could not even have reached the 1991 level per capita income of the same population.

In the present chapter we will analyse the agricultural performance of the economy, causes of the deceleration and the effects of the policy prescriptions in some detail.

Summary of Production:

As we saw in chapter I the trend growth rates of agricultural and foodgrains production for the period 1980-81 to 1990-91 was better than the same trend growth rates for 1990-91 to 1996-97. The growth rate of agricultural production was 3.8 per cent during 1980-81 to 1990-91, but it fell down to 2.7 per cent during 1990-91 to 1996-97. The rate of growth of foodgrains production for the period 1980-81 to 1990-91 was 2.9 per cent, but it fell down to 2.1 per cent during 1990-91 to 1996-97.

As we saw, agricultural output growth was at its peak during the 1980s. This was achieved by an innovation (fertilizer-seed-irrigation package) triggered off in particular areas by public investment in irrigation and other infrastructural activities. As we see during the 5th Five Year Plan period (1974-79), the share of plan expenditure under the head "Agriculture and Allied" sector had been 12.3 per cent[1], maximum ever in any plan period. This might have conditioned an innovation during the 1980s, favouring a healthy agricultural growth.

As we saw, during the 1980s (we have taken the period 1980-81 to 1990-91), five states, namely Haryana, Punjab, Uttar Pradesh, Tamil Nadu and West Bengal had registered trend growth rate of foodgrains production which are quite above the national rate of 2.9 per cent for the same period. The respective growth rates for the

[1] Plan document, Fifth Five Year Plan.

above five states were 4.2 per cent, 4.7 per cent, 3.8 per cent, 3.6 per cent and 6.3 per cent.

Various authors have analysed the causes of the relatively better performance in these states as compared to other states.

Bhalla and Singh[2] took four states, namely West Bengal, Harayana, Punjab and Tamil Nadu into consideration. They took the period 1980-83 to 1990-92. They found that these states had recorded high rates of growth due to the use of modern inputs in general and use of fertilizers in particular.

As they observed, during the years, area under irrigation showed a phenomenal growth in West Bengal. The fertilizer consumption in West Bengal rose by three times between 1982-83 and 1992-93. As they saw, in all the four states, the level of fertilizer consumption and gross area under irrigation was much above the national level. We can know this from the table 4.1.

[2] Bhall G.S. and Singh (1997)

Table 4.1

States	Consumption of fertilizer (Kgs/hectare) (2)		Percentage of gross cropped area under irrigation (1)	
	1980-82	1992-95	1980-82	1992-95
Harayana	68.99	191.19	62.21	77.14
Punjab	192.07	296.68	86.84	94.58
Uttar Pradesh	75.36	134.27	47.42	62.29
West Bengal	48.02	139.36	24.57	54.27
Tamil Nadu	92.17	140.78	48.7	47.9
All India	42.62	89.09	29.29	35.66

Source : (1) Government of India, Indian Agricultural Statistics (various issues).
(2) Fertilizer Association of India, Fertilizer Statistics (various issues).
Calculations were made by Bhalla & Singh.[3]

A similar analysis was made by Sawant.[4] He took into account five states namely, West Bengal, Harayana, Tamil Nadu, Maharastra and Rajasthan.

Sawant highlighted the characteristics of their input use, the state of rainfall conditions and conditions like average shift from one crop to another behind their above average performance in the period ranging from 1980-81 to 1994-95.

The best rainfall was in West Bengal and Tamil Nadu, which recorded normal rainfall for fourteen consecutive years. The frequency of rainfall deficient years was the highest for Rajasthan. However, this state had shown a higher efficiency of use and management of water *vis-a-vis* the other states. Sawant found that the role of

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3 Ibid.

4 Sawant, S.D. (1997)

irrigation appeared to be quite critical and decisive in respect of Harayana, where almost all the cultivated area received low rainfall.

He also found that changes in crop pattern in favour of high yielding crops, expansion in use of fertilizers and High Yielding Variety seeds together had a significant importance on output growth in Rajasthan and Maharastra[5].

In Tamil Nadu, apart from the crucial role of increase in fertilizer use, changes in crop pattern in favour of many commercial crops such as groundnut, coconut, sugarcane and the like, along with substantial flow of institutional credit must have helped according to him, in inducing high growth in agriculture.

With regard to West Bengal, his finding was that the successful implementation of land reforms which protected the interests of small and marginal farmers in the post 1981 period has been the significant factors popularising the new seed-fertilizer technology (as is indicated by the expansion in the use of fertilizers and HYV seeds) on the small and marginal firms which dominate overwhelmingly the agricultural sector of West Bengal.

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5 ibid.

Slow Down of Public Investment

As we saw in our previous section, growth in public investment in agriculture conditioned innovations which led the agricultural sector to a high-growth path during the 1980s.

However, we witness a stiff decline in public investment in the 1990s, which basically started during the later part of 1980s. As we see, the share of plan expenditure under the head "agriculture and allied sectors" dropped from 12.3% in the fifth plan (1974-79) to 6.1% in the 6th plan (1980-85) and to 5.8% in the 7th plan (1985-90).[6] Plan expenditure on "Irrigation and Flood Control" also fell as share of total plan outlay from 9.8% in the Fifth Plan to 10% in the 6th plan and to 7.6% in the 7th plan. We can know the decline in public investment during the 1990s from the table 4.2.

Table 4.2: Gross Public Capital formation in agriculture (1980-81 price)
(in Rupees Crores)

Year	GPCF
1980-81	1776
1990-91	1154
1991-92	1002
1992-93	1061
1993-94	1153
1994-95	1316
1995-96	1268
1996-97	1132

[6] Various Plan documents.

Source: Economic Survey (1998-99), Ministry of Finance, Government of India.

Thus we see a continuous decline in public capital formation in agriculture. The figure in 1996-97 is far below the figure for 1980-81.

This slowing down in public investment in the agriculture sector can have three consequences:

(a) Spread to new areas gets checked: As we had seen in our state-wise analysis of foodgrains production, those states which had been performing below normal in terms of foodgrains production during the 1980s had performed similarly during the 1990s. We can give examples like Assam, Jammu and Kashmir, Kerala, Orissa and Maharastra.

In four states, the foodgrains production growth had improved during the 1990s over the 1980s. Those states were Karnataka, Gujarat, Rajasthan and Madhya Pradesh. It may be seen here that these states had registered below normal (lower than the national average rate of growth) growth rate during the 1980s. The growth rates in Karnataka, Gujarat, Rajasthan and Maharastra during the 1980s were 0.7%, -7.5%, 1.7% and 2.2% respectively, which was quite below the national average of 2.9%. Thus for these states, the growth rate for the 1990s was calculated over a below normal base and this seems to have given them increased growth rates of foodgrains production during the 1990s.

b) Old growth centres are lost: As it has been experienced any innovation in any sector cannot have ever-ending effect and it cannot put the sectoral economy on a continuously higher growth path. It becomes an obsolete method after sometime and then a new innovation is to be adopted. Since public investment is the pre condition for innovation in agriculture, or at least for the spatial spread of any existing superior technology, with the decline in public investment in agriculture, a new innovation or a spatial spread of high growth is not possible and this retards overall growth. This seems to have happened in Indian agriculture during the 1990s. The states which had done well in foodgrains production growth have started decelerating during the 1990s. For Harayana, the growth rate of foodgrains production declined from 4.2% during the 1980s to 3% during the 1990s. For Punjab, Uttar Pradesh, Tamil Nadu and West Bengal the growth rates decline from 4.7% to -2.7%, 3.8% to 2.8%, 3.6% to -1.2% and 6.3% to 2.4% respectively.

Shift of Acreage to Non-foodgrains:

Another noticeable development during the 1990s, is that there has been an acreage shift to the non-foodgrains cultivation. This we can see from the table 4.3.

Table 4.3: Percentage share of different crops in Gross Cropped Area

States	Foodgrains		Non-foodgrains		Oil seeds		Sugarcane	
	1980-83	1992-95	1980-83	1992-95	1980-83	1992-95	1980-83	1992-95
West Bengal	83.37	80.65	16.63	19.35	4.79	6.86	-	-
Rajasthan	77.49	66.59	22.51	33.41	7.57	19.61	-	-
Madhya Pradesh	86.17	75.43	13.83	24.57	9.94	21.1	-	-
Karnataka	68.98	61.36	31.02	38.64	12.98	25.33	-	-
Kerala	32.49	21.28	67.51	78.72	-	-	0.22	0.41
Tamil Nadu	67.51	61.6	32.49	38.4	16.93	20.82	2.95	3.62
All India	76.63	72.21	23.37	27.79	10.92	15.31	1.85	2.13

Source: Govt. of India Agricultural Statistics (various issues), calculated by Bhalla & Singh (1997).[7]

From this we see that for almost all the states the acreage shift have been towards the non-foodgrains cultivation. This may have been a possible case for the decline in foodgrains production growth rate witnessed during the 1990s.

In this way we realised that the period of 1990s has been a period quite unfavourable to agriculture in general and foodgrains production in particular. A clear deceleration in the 1990s has been noticed.

We cannot study the agriculture sector during the 1990s without linking it with the Structural Adjustment Programme (SAP), which was formally introduced in 1991. SAP has not been fully implemented in the agriculture sector and so we cannot make

7. op. cit

the SAP fully responsible for the down showing agriculture sector during the 1990s. However, the agriculture sector is bound to be affected by the SAP and this we can know by throwing some light on the SAP and the government's policies in line with this. There we can see that the theoretical underpinnings of the previous experiment we conducted is different from the theory underlying neo-classical economies which is also the basis of Structural Adjustment Programme of the government.

In the liberalising world view, most economic problems can be resolved by a greater recourse to markets and allowing the price mechanism free play. Presumably, a similar position governs the attitude to agricultural growth, it is supposed that relative price movements and profitability ratios will be sufficient to ensure that supply responsiveness in agriculture will lead to higher rates of growth. Not only is the price factor seen as dominant, but it is assumed that deregulation and withdrawal of subsidies, exchange rate flexibility and redemption of government intervention in the agricultural economy are the best way to achieve the desired price movements.

The Structural Adjustment Programme adopted formally by the government of India in July 1991 is primarily based on the neo-classical logic of liberalisation-privatisation-globalisation. The neo-classical logic is that, given perfect competition in all forms of market (both product market and factor markets), if allocation of resources and pricing of products will be left for the market to decide, the economy

will achieve pareto optimality (a situation where no one can be made better off without making at least one other person worse off).

The exponents of the economic reform have the following arguments in favour of liberalisation of agriculture.

The overall liberalisation of the economy would result in higher investment and growth in agriculture induced by favourable terms of trade (we assume here that domestic terms of trade in the developing countries like India is unfavourable to agriculture as compared to the international terms of trade. In fact this is accepted as an established fact.).

India, like several Asian countries, has a comparative advantage in agriculture, so there has been a considerable scope for raising farm income and employment by stepping up agro based exports without jeopardising and indeed by consolidating the food security already achieved.[8]

SAP as a factor providing a boost to agricultural development in the developing countries has been emphasised by the world bank in 1986 and again in 1991.[9]

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8 Rao, C.H.H. (1995) Liberalisation Agriculture in India: Some Major Issues. Indian Journal of Agricultural Economics, Vol 50, No. 3, July-September.

9 i) World Development Report, 1986.
ii) Country Economic Memorandum for India, Subtitle "Agriculture", Vol 2, World Bank, 1991.

According to World Development Report (WDR) (1986), world agricultural output has grown rapidly during 1970-85, and that the growth in food grains production was higher in the developing countries than in the developed countries. The reason for the above in India was the availability of green revolution technology raising agricultural productivity. However, the report adds, the general economic polices followed by the developing countries limited the growth of agricultural production and hampered efforts to reduce rural poverty.

The WDR further adds, that restrictions on international trade, quota and tax subsidy regimes resulted in a bias against agriculture, caused by a divergence of domestic prices from international prices.

Government intervention at all stages of production, consumption and marketing of agricultural products and inputs have frequently resulted in greater inefficiencies and loss of output and income of the rural people.

The Bank disapproves, as being inimical to agricultural growth, any industrilisation process which involves an attempt to accelerate industrial growth by turning the internal terms of trade between agriculture and industry against agriculture, so that agriculture gets worsen off than it would have been if domestic prices were aligned with world prices.

It argues further that government programs for price stabilisation, consumer subsidies and product input subsidies are for less effective than they were thought to be in promoting either a more efficient allocation of resources or a more even distribution of income.

Moreover, the bank report adds, the discrimination against agriculture is strengthened by the ways in which countries attempt to cope with changing economic circumstances, failing to adjust exchange rates sufficiently in periods of inflation and relying instead on excessive foreign borrowings and adhoc exchange rate trade control. All these factors which act to restrict free trade come in the way of the countries gaining from the comparative advantage they enjoy in agriculture.

The report is silent on the role of the government in providing agricultural infrastructure or initiating reforms in tenancy or ownership structure.

The economists sharing the SAP view hold that rise in relative prices of agricultural goods and thus the profitability, will encourage more and more private investment in agriculture, which will act as a substitute for reduced public investment in agriculture. This will raise agricultural exports without reducing availability of food in the domestic economy.

In the Bank's view domestic intersectoral terms-of-trade were more unfavourable for agriculture vis-a-vis industry than the terms-of-trade prevailing in the

world market, so that removing trade restrictions and thereby preventing state sponsored industrilisation would benefit the agricultural sector which is the repository of mass poverty.

Also, since inequalities in urban income distribution was larger than that in rural income distribution, a shift in income distribution from urban to rural sector, which means in effect from industry to agriculture, world have the effect of lowering overall income inequalities.

Thus the SAP gives exclusive importance to price factor as an incentive for private investment and this is to raise productivity and hence output. Giving importance to this, the Economic Survey 1998-99 says that recent changes in trend in allowing an increase in minimum support price (MSP) as a part of agricultural policy changes have created conditions to bring about more favourable trade regime for agriculture.[10]

However, the idea that giving more emphasis to prices and granting rise in administered prices of major foodgrains with a view to giving adequate incentive and profitability to the producers would promote agricultural growth is contrary to empirical findings. Empirical research shows that growth in agriculture is not a matter of price alone, but requires substantial government investment in irrigation and

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10 Economic Survey (1998-99), Ministry of Finance, Govt. of India.

the like, to which private investment responds. This was explained by Raj Krishna[11] and later by Sawant.[12]

We can have an impression about the rising prices of foodgrains from the table 4.4.

Table 4.4: Index no. of wholesale prices of agricultural commodities relative to manufacturing products (base 1981-82)

Year	Price index of agri. prodt.	Price index of manufacturing prodt.	Agri price index as percent of manufacturing prices
1982-83	107.3	103.5	103.7
1983-84	121.4	109.8	110.6
1984-85	129.2	117.5	109.9
1985-86	129.1	124.4	103.8
1986-87	142.8	129.2	110.5
1987-88	161.8	138.5	116.8
1988-89	170.9	151.6	112.7
1989-90	174.4	168.6	103.5
1990-91	198.3	182.8	108.5
1991-92	236.8	203.4	116.4
1992-93	255.5	225.6	113.2
1993-94	271.4	243.2	111.6
1994-95	307.6	208.8	114.4
1995-96	330.5	293.1	112.8
1996-97	358.4	305.0	117.5
1997-98	370.5	317.5	116.7
1998-99	417.4	331.0	126.1

Source: Economic Survey (1998-99).

[11] Krishna, Raj (1963), Firm Supply and Response in India-Pakistan; A Case Study of Punjab", The Economic Journal, Vol. 73, No. 291, September.

[12] Sawant S.D, (1997).

Table 4.5: Minimum Support Price of Wheat & Paddy

Year	Wheat		Paddy
	MSP	Per cent Change	MSP
1980-81	117	-	-
1990-91	225	-	215
1991-92	275	22.2	240
1992-93	330	32	280
1993-94	350	6.1	330
1994-95	360	2.9	360
1995-96	380	5.6	375
1996-97	475	25	395
1997-98	510	7.4	-
1998-99	550	7.8	-

Source: Economic Survey (1998-99).

From these tables 4.4 and 4.5 we observe that after 1991, the minimum support price of wheat and paddy has been grown by large amount every year. This is in line with the SAP, which calls for alignment of domestic prices with world prices.

Due to this rise in MSP (it is natural that the change in MSP is reflected in the market price) agricultural price index as percentage of manufacturing price index has been consistently more during the 1990s than during the 1980s.

Despite the price rise, agricultural output growth rate has remained stagnant during the 1990s.[13] Thus, studies on short and long term price elasticity of agricultural output growth have proved that the response of output to infrastructure is significantly higher than that of prices.

Again, studies show that price-centric agrarian development has been under the aegis of rich farmers and its effect on employment would be minimal. The elasticity of employment with respect to output in the new green revolution areas is very low and for the country as a whole has sharply declined.[14]

Structural Adjustment measures are designed basically to improve allocative efficiency through the operation of incentives in market economy. Emergence of surpluses and the incentives for greater investment and technological change (mainly the incentives are price borne) are a corollary to improvements in the allocative efficiency. For the above purpose the SAP calls for phasing out of agricultural subsidies (both input and output). SAP in order to reduce inflation calls for a reduction in fiscal deficit. But such a reduction usually entails further curtailments in public investment in agriculture which have only a dampening effect on growth.

The cut in subsidies is going to hurt the marginal and small farmers households, majority of whom are the net buyers of foodgrains. So price rise is

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13 This we have dealt in detail in Chapter 1.

14 Bhalla, Sheila (1987), Trends in Employment in Indian Agriculture and Asset distribution - IJAE, October-December.

going to affect them adversely. Firstly their input prices will rise and secondly they will have to pay more to purchase foodgrains.

A similar argument was offered by Patnaik and Chandrasekhar.[15] They argue that reduction in subsidy and rise in foodgrains will affect 60% of agriculture dependent population in India, who are the net buyers of foodgrains. They write, "if foodgrains prices have to be raised for the surplus food producers (who happen to be the rural rich) while food subsidies are cut, if all talk on land reform is kept away from, if financial reforms do away with any system of earmarking of credit, and if even infrastructural development, like power, becomes the responsibility of the private sector, with profitability being the main consideration, then there is no scope left for improvement in the conditions of the rural poor, or for rural development."[16]

Thus we see that foodgrains price rise, as a move towards the SAP has been adversely affecting the rural poor and at this cost no gain in production-efficiency-employment has been seen.

A theoretical argument calling for a non-alignment of domestic price with international price was given by Prabhat Patnaik.[17]

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15 Patnaik, Prabhat and Chandrasekhar, C.P. (1996) "Indian Economy Under Structural Adjustment". Economic and Political Weekly, November 25.

16 ibid.

17 Patnaik, Prabhat (1996), Should Domestic Prices be aligned with World Prices? EPW special number, September.

Should domestic prices be aligned with world prices?

An argument in this regard has been given by Patnaik. He has given an argument, which is relevant in the context of an underdeveloped agrarian economy like India, and which turns on the fact that agriculture has very specific characteristics different from industrial activities to show why alignment with world prices is likely to be a patently in-optimal policy for such an economy.

Through a two sector macro economic model (food sector and manufacture good sector) with assumptions like the economy imports manufacture goods and exports food articles, exports of food being excess of production over domestic absorption, trade deficit being the excess of total domestic absorption over total domestic output and only wages being spent on food, he came to the following conclusions.

(i)Equilibrium corresponding to a positive level of import tariff would give both a larger level of per capita domestic food availability than an equilibrium corresponding to a low level of import tariff. This follows from the point that an equilibrium with a higher import tariff entails a higher domestic price of manufacture and hence a higher domestic output of manufacture. This will entail smaller import, and hence for balanced trade smaller export.

The conclusions drawn were different from the neo-classical conclusions due to the difference between agriculture and industry.

Agricultural output, unlike that of industrial output is unaffected by demand, and hence price in the short run, the author argues.

The author further argues, not only is the output of the agricultural sector not demand determined in the short run, but its productive capacity cannot be easily augmented in the short run through the shift of resources from else where.

Another factor which caused the difference in conclusion is the fixed money wage assumption or more precisely the existence of unemployment in the economy. This makes possible large output in one sector (manufacture) even for a given output in the other sector (food). This is in contrast to the commonly made assumption in neo-classical models that the money wage is flexible and its equilibrium value is that which clears the labour market. If the economy always experiences full employment then the movement can only be along a production possibility frontier and the question of any policy giving rise to larger employment simply does not arise.

Rural Poverty during the 1990s

Many have suggested that due to the initiation of Structural Adjustment Programmes (SAP) during the 1990s, poverty in the agriculture sector (which is synonymous with rural poverty) has increased. We can have a better analysis of that by studying the pattern of land holding in India.

In Indian Agriculture more than 90% of the household population dependent on agriculture are small and marginal farmers. This is clear from the table give below -

Table 4.6: Distribution of Operational Holdings in India

	1985-86		1990-91	
Holding site	**numbers (in thousand)**	**Percent**	**numbers (in thousand)**	**Percent**
less than 4 hectares	88,669	89.8%	95450	91.2%

Source: CSO report (1995)

When input subsidies are cut, prices of fertilizers go up, thus small and marginal farmers are forced to restrict their use of fertilizer, which has an adverse impact on output. Also cut in output subsidies raise the prices of agricultural

commodities which they purchase, thus adversely affecting them. These two tendencies have pushed many of these farmers below the poverty line.[18]

In this line, Parikh[19] argues that if the savings from the removal of input subsidies are used for stepping up investment in inputs like irrigation and for increasing expenditures on poverty alleviation programmes, there would be a rise in growth as well as welfare.However, this has not been undertaken in India.

As we notice, food and fertilizer subsidies began to be cut from the very first budget (1991-92) after SAP was implemented. The strategy was to raise domestic fertilizer prices to cover the higher cost of domestic fertilizer production. To compensate this rise in the in production cost the government raised the procurement prices. This was termed as faulty by many like Sen.[20] He argues that simply allowing procurement prices to rise along with the price of fertilizer was no real solution because fertilizers were widely used for the cultivation of crops which were not covered by government procurement as also by groups of farmers whose output was marketed only to limited extent.[21] Thus a cut in fertilizer subsidy will first hit the small and marginal farmers whose output is marketed to a much smaller extent.

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18 Gupta, S.P. (1995), "Recent Economic Reforms & Their Impact on Poor and Vulnerable Sections of Society". Indian Council for Research on International Economic Relations." Mimeo, New Delhi.

19 Parikh, K.S., Panda, Manoj, Narayana, N.S.S., Kumar, A Ganesh (1995) "Strategies for Agricultural Liberalisation, consequences for growth, Welfare and Distribution" Economic & Political Weekly, September 30.

20 Sen, Abhijit (1992), "Economic Liberalisation and Agriculture in India", 'Social Scientist', Vol. 20, No. 11, November 1992.

21 ibid.

Further, since food subsidies are also being cut, the burden will fall mainly on consumers, particularly the poor.

Along with this, as we have discussed earlier, public investment an agriculture was also cut during the 1990s. All these factors put together have increased the rural poverty level.

We can know about this from the table 4.7.

Table 4.7: Rural Poverty estimates (Proportion of people below poverty line)

NSS round	H	PG	SIG
45 (July 89-June 90)	34.3	7.8	2.58
46 (July 90-June 91)	36.43	8.64	2.93
47 (July 91-Dec 91)	37.42	8.24	2.68
48 (Jan 92-Dec 92)	43.47	10.88	3.81
50 (July 93-June 94)	38.74	9.41	3.27

H - Head count ratio of poverty
PG - Poverty gap ratio
SPG - Squared poverty gap

Source :

(1) B. Ozler, G. Dutt & M. Rasakim, 'A Data base on Poverty & growth in India, The WB, January 96 (for estimates upto 48th round).
(2) For 50th round NSS data has been used to calculate the estimates using exactly the same methodology in the rest of the series.

Another noticeable feature was that rural non-agricultural employment declined fairly sharply as soon as the stabilisation and SA policies were put into place in 1991. This we know from the table 4.8.

Table 4.8: Composition of Rural employment (NSS usual status data)

	Males			Females		
	Primary	**Secondary**	**Tertiary**	**Primary**	**Secondary**	**Tertiary**
1990-91 (July-June)	71	12.1	16.9	84.9	8.1	7
1991 (July-Dec)	74.9	11.2	13.9	86.3	7.9	5.8
1992 (Jan-Dec)	75.7	10.4	13.9	86.2	7.8	6
1997 (Jan-Dec)	75.8	10.3	13.9	88.5	7.8	4.8

Source : Various reports of NSS.

The self employed and the casual workers displaced from non-agriculture appears to have reverted back to agriculture and thus increasing the burden on agriculture.

Thus we see that the policies of procurement price increase, cut in agricultural subsidy and cut in public investment in agriculture which were all taken on being motivated by the neo-classical logic have not given the result they had kept in mind (high agricultural growth rate and an increase in employment generation) on the

contrary they have quite adversely affected the living condition of the poor. This has been witnessed by an increase in poverty ratio during the 1990s.

Indian Agriculture and International trade

The economists who share the views with the SAP are of opinion that with the agriculture sector being opened up for international trade, with a free flow of agricultural products across the countries as envisaged by the WTO, the sector will be benefited a lot. This will be brought about by a relative increase in prices of agricultural products *vis-a-vis* manufactured goods, given that relative prices of agricultural products in the domestic market is less than their relative prices in the global market.

However, many economists are critical of this; they base their argument, on the relative stability of domestic and international markets.

Nayyar and Sen[22] in their paper warns that because of larger fluctuations in international prices of agricultural commodities, the variability in the domestic market prices is likely to get accentuated as a result of trade liberalisation, and this fluctuations would adversely affect food security of the poor. They have found in

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22 Nayyar, Deepak and Sen, Abhijit (1994): "International Trade and Agriculture sector in India", published in Globalisation and Agricultural Policy in India, edited by G.S. Bhalla.

their analysis that the world market was less stable than the domestic market through a detailed comparison of domestic and international prices of eighteen countries.

A similar argument was given by Singh.[23]

In view of the move towards the retreat of the state from the agricultural scenario and its internationalisation, many economists concern themselves with the domestic market situation in India.

S.S. Johl[24] argues, under the dispensation and compulsions of the new economic policy the agriculture sector has to drop the crutches of support/procurement/administered prices form subsidies. Also, in response to WTO challenges and opportunities that will emerge in the international market, agricultural market is bound to get progressively integrated with the global market, and thus domestic market prices cannot remain uninfluenced by the world prices. This will put India in a position, on the one hand, to enjoy the opportunities available under the WTO provisions to export goods and services in which it has comparative advantage. On the other hand, the Indian farmers have to face the onslaught of international suppliers in the domestic market.[25]

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23 Singh, Sukhpal (1995), "SAP and Indian Agriculture: Towards an assessment of implications." Economic and political, Weekly, December 23.

24 Johl, S.S. (1995): "Agricultural Sector and NEP", Indian Journal of Agricultural Economics, Vol. 150, No. 3, July-September.

25 ibid.

The agriculture sector cannot be expected to perform well under the liberalised policy regime in the national and international market until domestic market distortion are removed, Johl argues. Even today small and marginal farmers, due to inadequate availability of credit to them, have to enter into pre-harvest contract with indigenous money lenders. This does not permit them to sell their produce at market rates. This necessitates that the government should continue to provide for a reasonable level of support price for all commodities of economic importance to the farmers.

From this analysis we see that the domestic agricultural market situation in India is not well enough to make the agricultural sector face international challenges.

Thus from our above analysis we came to the following conclusions.

i. (i)The administered price rise to give a boost to the farmers by correcting the terms-of-trade in favour of them has not paid good result. The agricultural growth rate, which has been found to be more correlated with investment in agriculture, particularly infrastructural, has not improved during the 1990s. The negative effect of this price rise has adversely affected the 60% of the agriculture-dependent population, who are either net buyers of foodgrains or sell early in the season and purchase later, and are thus squeezed by rising prices of foodgrains. This has raised the poverty ratio in rural areas.

ii. Agriculture sector if opened up for international trade will adversely affect the sector due to the larger fluctuations in the international market than the domestic market. Moreover, with the agriculture sector growth rate decelerating, if exports of agricultural products increase, this will affect the food security of the country.

iii. The domestic agricultural market situation in India is not well enough to make the sector face international challenges. This will adversely affect the small and marginal farmers.

CONCLUSION

In the previous chapters we studied the agriculture sector in India in some detail. We studied the changing behaviour of the sector during the 1990s. We also made a comparative analysis of the performance of the sector during the 1970s, 1980s and 1990s. In our analysis we gave additional importance to the foodgrains production for its performance is the decisive element underlying food security of the country.

In our analysis we found that the percentage of population dependent on agriculture had remained roughly the same. However, the share of agriculture in national GDP had been falling, showing that the growth rates of other sectors, namely the manufacturing and service sectors, had been more than the agriculture sector. So, according to common belief and as experienced in many other countries, agricultural dependence should have declined through an occupational shift from the agriculture sector to the secondary and tertiary sectors. But in India, the case has been contrary to this. This has come in the way of the economic well being of the people engaged in agriculture.

In chapter I, we studied the behaviour of foodgrains production in India since the 1970s, encompassing the 1980s and 1990s. In line with our hypothesis we noticed that the trend rate of growth of foodgrains production has shown a clear deceleration

during the 1990s. This was sought to be established by fitting three alternate trends, namely a semi-logarithmic fit, a straight line fit and a gompertz fit.

In that chapter we studied the behaviour of per capita foodgrains production, which gives a better idea of food security in the country. There we found that during the two sub-periods we took, namely the 1980s and the 1990s, the growth rate of per capita foodgrains production was quite marginal in both the periods, but worse during the 1990s. During this period per capita foodgrains production had remained almost stagnant with just 0.2 per cent trend growth rate.

In the same chapter we also studied the behaviour of agricultural output as a whole. There also we found the same decelerating trend in the performance of the sector during the 1990s.

Thus in chapter I it was clear that the performance of the agriculture sector in general and foodgrains production in particular was deteriorating during the 1990s.

We can know the change in well being of the people engaged in agriculture by studying their change in per capita real income over the years. This was the subject matter of chapter II. There we found that the real per capita income of the people engaged in agriculture during 1997 was less than the same for the year 1991. Thus

during the 1990s, there was a stagnation in the economic condition of the people, and possibly a decline in their economic condition.

Another noticeable feature we found there was that, in the rural areas, during the 1990s, the number of people engaged in agriculture as a proportion of the total workforce had increased. This clearly shows that share of non-agricultural employment in rural areas during the 1990s had declined. Many have suggested that this reverting back to agriculture (it may be mentioned that during 1980s non-agricultural employment in rural areas had increased substantially) has increased the size of disguised unemployment in agriculture, which might have been a cause of the slight decline in per capita income of people in agriculture sector during the 1990s. Nevertheless, it is clear that due to the decline in per capita real income of the agriculture-dependent population, the rural-urban gap has increased and poverty has increased in the rural areas. The head count ratio of poverty in rural areas had increased from 32.3 per cent in 1989-90 to 43.47 per cent in 1992 and then 38.74 per cent in 1993-94.

Just by studying the changing behaviour of the agricultural production or foodgrains production of the country as a whole we cannot make inferences about the agriculture sector in India and the people engaged in the sector. This was owing to the wide variation found in agricultural performance over the regions. This is the

subject matter of chapter III, where we discussed the changing behaviour of foodgrains production in 16 major states.

In that chapter we found that the states which had done very well during the 1980s have done badly during the 1990s. For example the growth rate of foodgrains production in three states, namely West Bengal, Punjab and Tamil Nadu fell from 6.3 per cent , 4.7 per cent and 3.6 per cent respectively during 1980s to 2.4 per cent, -2.7 per cent and -1.2 per cent respectively during 1990s.

The states showing an improvement in the growth rate during the 1990s over the 1980s had not done well during the 1980s. So the bases for the growth rate calculation during 1990s were relatively low. We may take the example of Gujarat whose growth rate for foodgrains production was -7.5 per cent and 4 per cent respectively during the 1980s and 1990s.

Thus our hypothesis that there are underlying factors working towards a deceleration in foodgrains production during the 1990s appears very plausible.

Many have suggested that, the decline in the performance of the agricultural sector has been due to the negative impact of the Structural Adjustment Programme (SAP) on agriculture, which was formally launched in July 1991.

Nevertheless, the SAP has not been implemented fully in the agriculture sector and we cannot make the SAP fully responsible for the relatively poor performance of the agriculture sector during the 1990s. However many aspects of macroeconomic stabilisation and the SAP have had a profound effect on the agriculture sector.

i. Fiscal compression resulted in partial withdrawal of subsidies to fertilisers.

ii. Fiscal compression resulted in decline of public investment in irrigation, power and other rural infrastructure.

iii. Giving more emphasis to prices and granting excessive increase in administered prices of major foodgrains with a view to giving adequate incentive and profitability to the producers has been in line with the general emphasis on price incentives given by the SAP.

The SAP is based on the view that relative prices and profitability ratios, which can be raised by allowing the determination of prices to be left to the market forces(given that relative prices of agricultural products are less in the domestic market than in the international market), will be sufficient to ensure that supply responsiveness in agriculture will lead to higher rate of growth. The comparative advantage enjoyed by countries like India can be reaped through globalisation of trade

and this can give a considerable scope for raising agricultural income and employment by stepping up agro based exports without jeopardizing the domestic food security.

As a move towards the SAP, government of India had taken many steps during the 1990s. In order to equate domestic prices with world prices, prices of foodgrains were raised, public expenditure on agriculture particularly infrastructure were cut, subsidies, both input and output, to the agricultural sector were cut (this and the previous measure were undertaken with a view to reducing the fiscal deficit). All these have been discussed in chapter IV.

We found in that chapter that these measures were not favourable to the agriculture sector in India. Some of the findings can be summarised as follows.

i. Research findings have shown that in India infrastructure elasticity of output is more than the price elasticity of output, as found by Sawant. Increased investment for technology upgradation, improvements in the input use efficiencies and development of infrastructure for agriculture play a crucial role for agricultural development.

ii. In India more than 90 per cent people who are engaged in agriculture are small and marginal farmers. It is a paradox that a large proportion among them constitute net buyers of foodgrains.

So subsidy cut and price rise will both affect them adversely.

In this way, the conclusion is inescapable that instead of more increases in the prevailing rate of profit through opening agriculture to world trade, direct intervention by the government in the form of investment in infrastructure, ensuring credit to small and marginal farmers, keeping down price fluctuations and undertaking a modicum of land reforms is essential for promoting agricultural growth and food security.

Agricultural growth also contributes the basis for industrialisation in our case. For a large economy like India with substantial scope for making use of the domestic market, industrialisation can to a significant extent be agriculture-led. This could be a preferred strategy to the export-led industrialisation strategy when there has been a stagnation in the world economy. Thus, by boosting the agriculture sector through appropriate policies, keeping in view the socio-economic condition of the Indian economy will boost the other sectors as well. A minimal set of immediate land reforms providing security to the tenants including the hitherto unregistered ones and distributing surplus land already with government, as well as more investment in rural infrastructure are two measures which have to be urgently undertaken for achieving a higher production growth. These will be both pro-agriculture and pro-poor.

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