PERFORMANCE AND PROSPECTS OF RICE PRODUCTION IN ORISSA

DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE AWARD OF THE DEGREE OF
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I hereby affirm that the research for this dissertation titled ***"Performance and Prospects of Rice Production in Orissa"*** *being submitted to the Jawaharlal Nehru University for the award of the Degree of Master of Philosophy, was carried out entirely by me at the Centre for Development Studies, Trivandrum.*

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Certified that this dissertation is the bonafide work of Sudip Kumar Mohapatra. This has not been considered for the award of any other degree by any other University.

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CHAPTER 1

Introduction

1.1 The Problem

The crucial importance of a dependable growth rate in agriculture sector in general and that of foodgrains production in particular, for a predominantly agrarian economy attempting State-led industrialisation, has been amply emphasised in Development Theory. For, on the performance of foodgrains production could depend the supply of wage goods for the industrial labour, the survival of the rural poor, the level of prices, and ultimately the possibilities of economic growth as a whole. Erratic performance on the foodgrains front leading to serious macro economic problems in many of the developing economies during the last few decades has upheld the important connection between foodgrains production, price stability, and sustained economic growth.

The Indian Planner seems to have recognised this truth fairly early, though in the light of frequent Monsoon failures and realising certain technological and institutional constraints holding back growth in agriculture, he has had to revise his strategies over the years, towards his efforts to make growth in foodgrains production more consistent and to achieve some reasonable measure of price stability.

The first three five year plans had enough faith in the capacity of traditional agriculture to deliver the goods, which it did too to a certain extent. But in the early sixties, faced by droughts and uncomfortable balance of payments situation, the government had to reexamine its strategy for agricultural development, and go for measures like PL 480 to keep the prices stable. Technological modernisation was then given utmost importance to accelerate agricultural growth. Institutional reforms, especially land reforms, though were not favoured much. The Green Revolution took place in this background. There is enough literature that has documented the impact of new technology on production and productivity of agricultural produce including foodgrains. To recall a few facts, the Green Revolution, having been confined to Wheat and to the North-Western region in its earlier years, spread in the subsequent years to some other crops, mainly coarse cereals, and to the better irrigated conventionally rice growing regions. As a result, and partly helped by favourable weather conditions in recent years foodgrains production has managed to increase at a rate faster than the rate of growth of population.

Some of the more recent and notable trends in India's foodgrain economy include the growing importance of rice in the composition of foodgrain production and the locational shifts in foodgrains production.

While wheat accounted for the bulk of the incremental increase in foodgrains production in the earlier years of the green revolution, the contribution of rice has grown in the later years. In the early seventies, the share of wheat in the total foodgrains output in the country was 13.4 per cent while that of rice was 40 percent[1]. By the early nineties, the share of rice had gone up to 42.2 percent.

Three things are important as regards locational shift. One, it is more marked in the case of rice production. Two, North-Western states, notably Punjab and Haryana, have emerged as major rice producing areas. Three, rice production has revived to an extent in the Eastern states.

Rice has become a major complementary crop to wheat in Punjab and Haryana. Thanks to assured irrigation, coupled with efficient application of modern inputs like fertilisers these states have succeeded in realising the potential of the new high yielding varieties of rice to a very impressive extent in the process achieving levels of productivity far higher than most of the other regions in the country excepting a few pockets of Andhra Pradesh and Tamil Nadu. Subsequently, the share of the north western region in the total rice production of the country increased from 2.7 percent in the early seventies to 11.3 per cent by the early 1990's.

Taken as a whole, the foodgrains scene in the country still leaves a lot to be desired. To put the domestic foodgrains economy on a self-sustaining path, the breakthroughs have to be taken to regions that continue to show signs of sluggishness whether due to technical or institutional constraints. Rice being a major staple food of the country's population deserves special attention. And given that the productivity level of rice in the North-Western states has almost reached a technical plateau, an analysis of the factors holding back production of rice in other rice producing states becomes all the more important.

In this context, Eastern states have been the focus of attention for some time now. According to a Planning Commission study, 1985, there is a huge potential to be realised in rice production in these states. The performance of these states has been far too low than the potential. According to another study, much of the projected increase in the demand of rice will come from the Eastern states in the coming years. The availability of rice being so closely related to rural poverty in these states, the importance of increasing rice production within these states cannot be exaggerated.

Rice has always been the staple food in these states and until not long back, a major contribution to the total rice production in the country used to come from the Eastern states where rice has traditionally been the staple food. Their contribution, however has come down quite a bit of late, from 50 percent of the rice output in the country in the early fifties to about 29 per cent in early eighties,to be specific. However, since the mid-eighties there has been a recovery in the production of rice in these states. The available evidence suggests that there has been faster rate of adoption of high yielding varieties and some improvement in yield rates in the eighties.

Looking at the Eastern states individually, what strikes is that not all are doing equally bad. Orissa is lagging behind its neighbouring states. Orissa's contribution in the total rice production in the country was about 11 percent in the early seventies; which came down to 9 per cent by 1991-92, a year of bumper harvest in the state. Though, the absolute production in Orissa has been showing an upward trend in recent years, it has failed to catch up with the rest of the states in India in general and the neighbouring eastern Indian states in particular.

Rice is the most important crop in Orissa accounting slightly more than 50 per cent of the gross cropped area[2]. It seems that substantial improvements in its productivity and production will help to reduce significantly the incidence of rural poverty[3].

An indepth analysis of the factors shaping the past performance of rice production in the state may be useful for designing effective policy interventions for improving the performance of this crop. The present study is a preliminary attempt in this direction.

1.2 Objectives and scope of the study

In the present study we will examine the following aspects of rice production in Orissa.

(a) It will examine the trends in rice production during the last three decades with the specific objective of finding out whether there is a break in the trend in the growth of output in recent years. It will also attempt to isolate the relative importance of area and yield in influencing the fluctuations in output. Following the above line of analysis, the study attempts to bring out the extent to which fluctuations in rainfall and irrigated area has influenced the fluctuations in rice output through fluctuations in yield. The analysis at this level will be carried out by making use of the relevant data for the state as a whole.

(b) Analysis at the state level may conceal the situation faced by individual districts. Therefore the study intends to go a step ahead to examine at disaggregated level to see whether some districts show different pattern of rice production as against the pattern observed at the state level. Since there is a high degree of regional concentration of irrigated area in the state an attempt has been made to bring out the extent to which irrigation has brought about stability in rice output across districts.

(c) It has been pointed out in some of the official reports (RBI, 1984 and Planning Commission, 1985) that the state has a very high potential to increase rice production. While the role of irrigation in helping to realise this is well appreciated, there is hardly any explanation for the slow diffusion of high yielding variety in the state. This matter assumes importance, since there has been considerable research on rice in

Orissa, especially in the Central Rice Research Institute. Given this background, the present study will also examine the types of rice varieties bred in the in rice research station, the extent of diffusion of these varieties, levels of productivity realised, the yield gap and the scope for realising higher levels of production through faster diffusion of the high yielding varieties.

1.3 Organisation of the Study

This study is organised into four chapters including this introduction. In Chapter Two, the trends and fluctuations in rice production and the reasons for output fluctuations will be examined. Further, the association between output fluctuations and the fluctuations in rainfall and the extent to which irrigation has helped in moderating the fluctuations in rice production will also be examined in this chapter.

The fluctuations in rice output at the district level will be analysed in Chapter Theree. It will also examine the differential impact of coverage of irrigation and the share in the total rice output of the districts in shaping the output fluctuations of the state.

Then again, in Chapter Four the diffusion of high yielding varieties in the state and the role of the rice research institute in the breeding and diffusion of the high yielding varieties will be looked into. Here, the study will also be highlighting some of the constraints for the adoption of high yielding varieties and the lack of realisation of its potential productivity.

Finally, Chapter Five will bring together the major findings of the study and highlight its policy implications for increasing rice production in the state.

CHAPTER 2

Trends and Fluctuations in Rice Output in Orissa

2.1 Introduction

The purpose of this chapter is to examine the trend and fluctuations in rice output in Orissa during the last three decades. The analysis is based on the data available from the Directorate of Economics and Statistics (DES) of the Government of Orissa. Data on area production and yield of rice are also available from the Directorate of Agriculture and Food Production (DAFP). Between the two sources of data the former source is considered more reliable since it provides estimates of area, production and yield obtained through crop cutting surveys based on systematic sampling. Since the data provided by the DES is not exhaustive with respect to the major variables influencing rice production, we have also used the data from DAFP, wherever it is necessary. The major limitations of the two sources of data used in this study are provided in **Appendix I**.

The organisation of this chapter is as follows. Section

2.2 examines the trend in rice output in Orissa. This is done especially with the objective of testing out whether there is a trend break in output in recent years. Section 2.3 decomposes the growth in output into its component elements and shows that from the mid seventies, the output fluctuations are largely contributed by the fluctuations in yield. In Sections 2.4 and 2.5, we have attempted to examine the extent to which the yield fluctuations are influenced by the fluctuations in rainfall and irrigated area under rice.

2.2 Trend in rice output:

While analyzing the performance of agricultural production, there is a general tendency to divide the entire time series into pre and post green revolution period in the Indian context. Even if the time series data is periodised the survey of literature gives an impression that there has not been any consensus in estimating growth performance with statistical accuracy. Although the literature on the issue of estimating growth rates of crop output is wide and vast, it fails to agree on the functional form that will fit the best (Dandekar, 1980; Reddy, 1978; Rao, 1980; Dey, 1975; Rao et al., 1980; Krishnaji, 1980; Sagar, 1980; Rath, 1980; Alagh et al., 1980; Srinivasan, 1979; Mukherjee et al., 1980 and Boyce, 1987). While one is advised to go through all the parametric and non-parametric tests and to correct for auto or serial correlation, there has been an obvious tendency to look for certain functional form that satisfies the need of the problems or objectives at hand.

The approach becomes much more subjective when one tries to evaluate performance of agricultural production for a state. While it is sound to accept a break point at the mid sixties for the nation as a whole, the same may not be the case with individual state, as the spread of green revolution was uneven among the states. Therefore, it is necessary to decipher from the data, the break point for individual states. This is obtained in most cases from the plotted graph which might be depicting a particular trend since the break point.

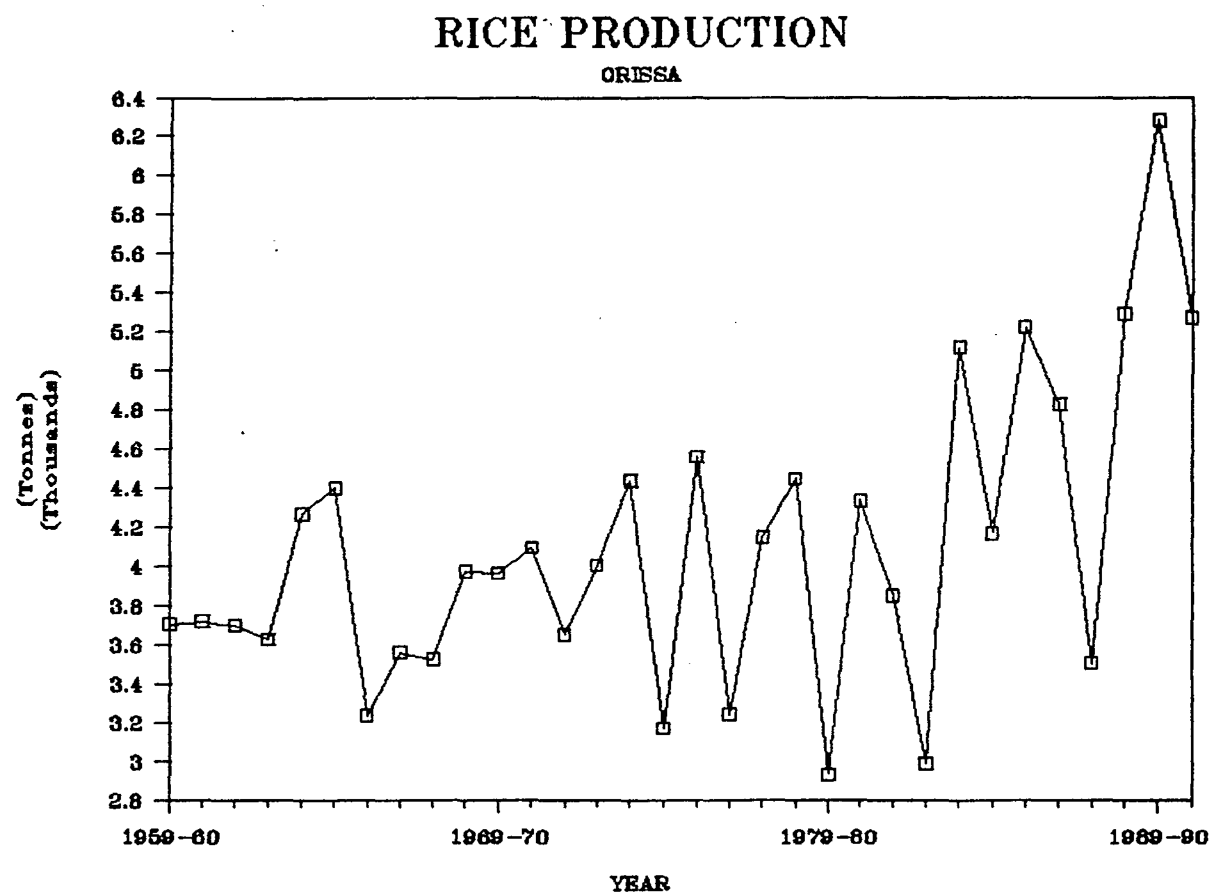
One such interesting approach to evaluate agricultural performance is provided by Das (1978) for Eastern India. He begins his analysis step by step in evaluating growth of crop output. He moves from the simple annual average to compound growth rate and then to the area of inferential statistics by fitting straight line, exponential and Gompertz curve taking care for auto correlation and looking at `T' and `F' statistic and rejecting one function against another on the basis of higher adjusted R^2. But Das ends by pointing out that all these methods are "text book methods" and goes on to suggest "search technique" which is supposed to be superior and capable of taking care of probable loopholes in the so called "text-book" methods but he himself avoids the laborious task.

We begin with the time series of rice production for the period 1959-60 to 1990-91, presented in **graph 2.1**. There is no clear rising trend in the plot till 1983-84. There are five occasions in the last eight years, ie., 1983-84 to 1990-91 when production reached levels higher than any of the previous years. What is most conspicuous in the plot is fluctuations. In order to examine this fluctuation we consider the first difference of logarithm (ie., $\ln P_t - \ln P_{t-1}$) presented in **Graph 2.2** which depicts the year to year change. The plot moves up and down around the zero line without any trend[4]. This obviously implies that the production series has no trend but fluctuations all along the period around a certain level. Further, the fluctuation has definitely increased after 1974-75. The factors underlying this output fluctuations will become evident from the decomposition of output in terms of its component elements attempted in the following section.

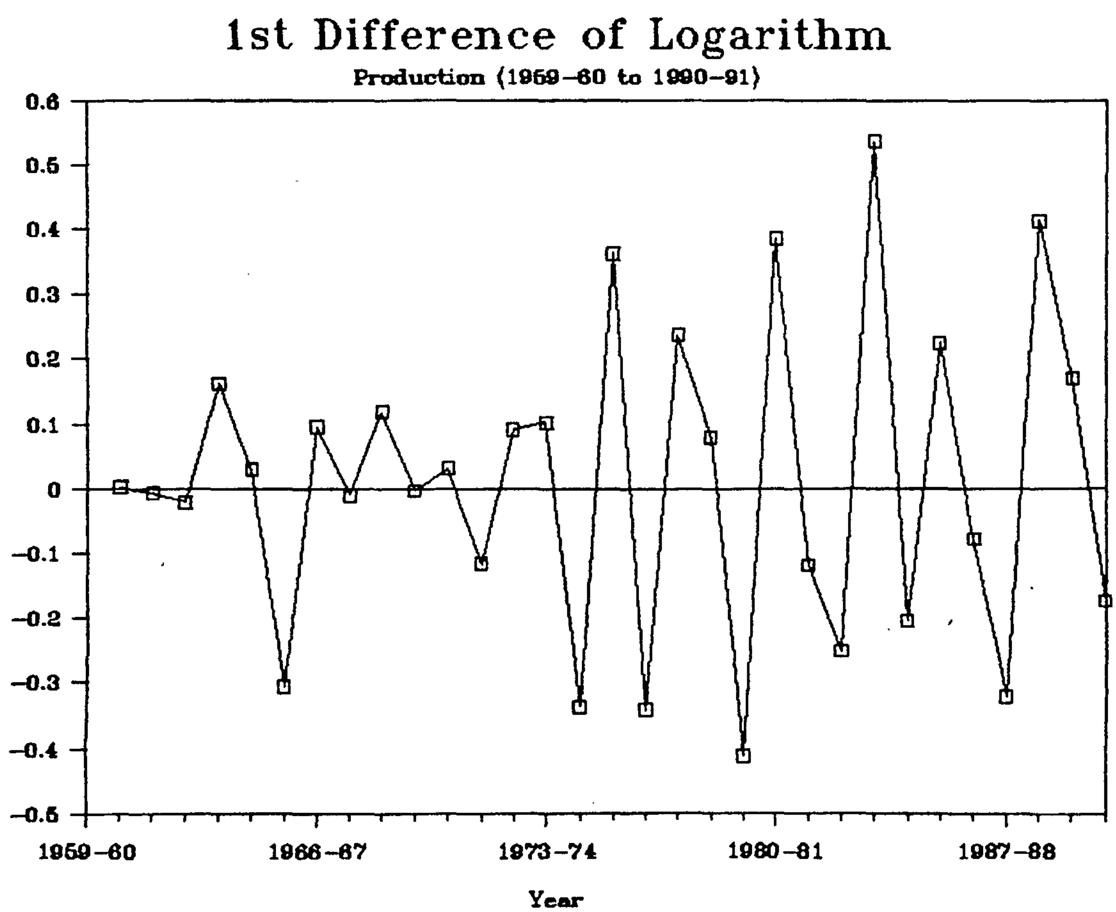
2.3 Sources of fluctuation:

The fluctuation in output can take place either due to fluctuation in area under rice or due to fluctuation in yield rate. In order to bring out the relative importance of these two sources of growth in shaping the fluctuations in output we

Graph 2.1



Graph 2.2



have carried out an analysis using the following well known decomposition.

$$[(P_{t+1}-P_t)/P_t] = [(A_{t+1}-A_t)/A_t] + [(Y_{t+1}-Y_t)/Y_t] + [((A_{t+1}-A_t)(Y_{t+1}-Y_t))/(A_tY_t)]$$

where P_t denotes Production at time t.

A_t denotes Area at time t.

Y_t denotes Yield at time t.

$[(P_{t+1}-P_t)/P_t]$ denotes Annual Growth Rate.

$[(A_{t+1}-A_t)/A_t]$ denotes Area effect.

$[(Y_{t+1}-Y_t)/Y_t]$ denotes Yield effect.

$[((A_{t+1}-A_t)(Y_{t+1}-Y_t))/A_tY_t]$ denotes Interaction effect.

The results can be seen in (**Table 2.1**). We have normalised the table to see the percentage contribution of the component elements to the growth rate. It is evident from the result that yield effect has been the main explanatory variable for the growing fluctuation observed in the production of rice, during the second period. During the first period, both area effect and yield effect contributed to fluctuations in yield, with its relative importance showing marked variations across different years.

The fluctuations in rice yield may be due to the interaction among agro-climatic, technological, institutional

TABLE 2.1

Decomposition of Annual Growth Rate of Rice Production.

Year	Annual Growth Rate	Area Effect	Yield Effect	Inter-action Effect	Col 3 as % of Col 2	Col 4 as % of Col 2	Col 5 as % of Col 2	Total (6+7+8)
1	2	3	4	5	6	7	8	9
1960-61	0.32	-11.76	13.70	-1.61	-3635.42	4233.35	-497.92	100
1961-62	-0.56	7.30	-7.33	-0.54	-1293.88	1299.02	94.86	100
1962-63	-1.89	8.24	-9.36	-0.77	-435.57	494.80	40.77	100
1963-64	17.60	-1.49	19.38	-0.29	-8.44	110.08	-1.64	100
1964-65	3.05	0.19	2.85	0.01	6.10	93.73	0.17	100
1965-66	-26.42	-1.95	-24.95	0.49	7.37	94.47	-1.84	100
1966-67	10.04	-0.28	10.35	-0.03	-2.82	103.12	-0.29	100
1967-68	-0.95	1.85	-2.75	-0.05	-193.60	288.27	5.33	100
1968-69	12.67	-0.79	13.57	-0.11	-6.24	107.09	-0.85	100
1969-70	-0.20	1.78	-1.95	-0.03	-885.40	968.15	17.25	100
1970-71	3.33	2.79	0.53	0.01	83.77	15.79	0.44	100
1971-72	-10.83	3.90	-14.18	-0.55	-36.00	130.90	5.10	100
1972-73	9.69	-7.94	19.14	-1.52	-81.96	197.65	-15.69	100
1973-74	10.78	10.90	-0.11	-0.01	101.11	-1.00	-0.11	100
1974-75	-28.53	-6.34	-23.69	1.50	22.22	83.05	-5.26	100
1975-76	43.70	5.66	36.00	2.04	12.96	82.38	4.66	100
1976-77	-28.85	-6.47	-23.93	1.55	22.42	82.95	-5.37	100
1977-78	27.83	0.57	27.10	0.15	2.05	97.39	0.56	100
1978-79	7.30	-0.77	8.14	-0.06	-10.56	111.42	-0.86	100
1979-80	-34.06	-5.86	-29.96	1.75	17.19	87.96	-5.15	100
1980-81	47.77	1.77	45.19	0.80	3.71	94.61	1.68	100
1981-82	-11.16	-0.74	-10.50	0.08	6.63	94.06	-0.70	100
1982-83	-22.32	-2.45	-20.37	0.50	10.99	91.25	-2.24	100
1983-84	71.10	7.40	59.32	4.39	10.40	83.43	6.17	100
1984-85	-18.53	-1.19	-17.55	0.21	6.44	94.69	-1.13	100
1985-86	25.26	2.30	22.45	0.52	9.10	88.85	2.04	100
1986-87	-7.48	-0.20	-7.29	0.01	2.73	97.47	-0.20	100
1987-88	-27.49	-7.72	-21.42	1.65	28.07	77.95	-6.01	100
1988-89	51.11	6.07	42.47	2.58	11.87	83.09	5.04	100
1989-90	18.63	2.09	16.20	0.34	11.23	86.95	1.82	100
1990-91	-16.07	0.30	-16.32	-0.05	-1.84	101.54	0.30	100

Source: Estimated.

and other factors. It is well known that rainfall plays an important role in shaping yield, area, and hence, output fluctuations. Further, as yield rate fluctuations have a larger influence in the output fluctuations of Orissa it becomes significant to examine the influence of rainfall on the yield rate fluctuations.

2.4 Rainfall, Output and Yield

The data on annual rainfall in Orissa during the period 1959-89 is given in **table 2.2**. In order to bring out the annual fluctuations in rainfall we have computed the differences in the annual rainfall from the normal rainfall. The normal rainfall which is taken as the average rainfall during the period 1901 to 1961 is about 1482.2 millimetres. The deviation of the annual rainfall from the normal shows considerable fluctuations over the last 30 year period. It may be noted that the rainfall was above normal only in four years and the rest of the years it was below normal. What is more striking from the data is that there is no correspondence between fluctuations in rainfall and the incidence of floods and drought in the state. In several years when the rainfall was below normal there were floods and in some years when it was closer to normal, there was a drought. It is obvious that this had happened because of the seasonal intensity of rainfall. Apart from these features of the rainfall, Orissa

TABLE 2.2

Rain Fall, Yield Rate and Production of Rice

Year	Actual Rainfall	Deviation from Normal	Yield	Production	Remark
1	2	3	4	5	6
1959	1352.8	-129.4	0.87	3709	
1960	1395.4	-86.8	0.99	3721	
1961	1262.8	-219.4	0.92	3700	
1962	1169.6	-312.6	0.83	3630	
1963	1467	-15.2	0.99	4269	
1964	1414.1	-68.1	1.02	4399	
1965	997.1	-485.1	0.76	3237	Drought
1966	1134.9	-347.3	0.84	3562	Drought
1967	1326.7	-155.5	0.82	3528	Cyclone and Flood
1968	1296.1	-186.1	0.93	3975	Cyclone and Flood
1969	1302.1	-180.1	0.91	3967	Flood
1970	1660.2	178	0.92	4099	Flood
1971	1791.5	309.3	0.79	3655	Cyclone and Flood
1972	1177.1	-305.1	0.94	4009	Flood and Drought in part
1973	1360.1	-122.1	0.94	4441	Flood
1974	951.2	-531	0.72	3174	Flood and Drought in part
1975	1325.6	-156.6	0.97	4561	Flood
1976	1012.9	-469.3	0.74	3245	Drought
1977	1326.9	-155.3	0.94	4148	Flood
1978	1261.3	-220.9	1.02	4451	Hail storm, Whirlwind and Tornodo
1979	950.7	-531.5	0.71	2935	Drought
1980	1321.7	-160.5	1.04	4337	Flood and Drought in part
1981	1187.4	-294.8	0.93	3853	Tornodo, Whirlwind, Flood and Drough
1982	1179.9	-302.3	0.74	2993	Flood,Drought and Cyclone
1983	1374.1	-108.1	1.18	5121	
1984	1302.8	-179.4	0.97	4172	Drought
1985	1606.8	124.6	1.19	5226	Flood
1986	1548.9	66.7	1.1	4835	Drought and Cyclone
1987	1040.4	-441.8	0.86	3506	Drought and Cyclone
1988	1274.4	-207.8	1.23	5298	Drought
1989	1272.2	-210	1.43	6285	Drought
1990	N.A.	—	1.2	5275	Flood

Note: Column 2 and 3 is in millimeter; Column 4 is tons per hectare; and, Column 5 in '000 tonnes

Source:1) For Cloumn 2, 6 and normal rainfall (1482.2 mm) the source is A K Dalua (1991) Irrigation in Orissa, WALMI (Water and Land Management Institute), Cuttack, Orissa. pp.2.

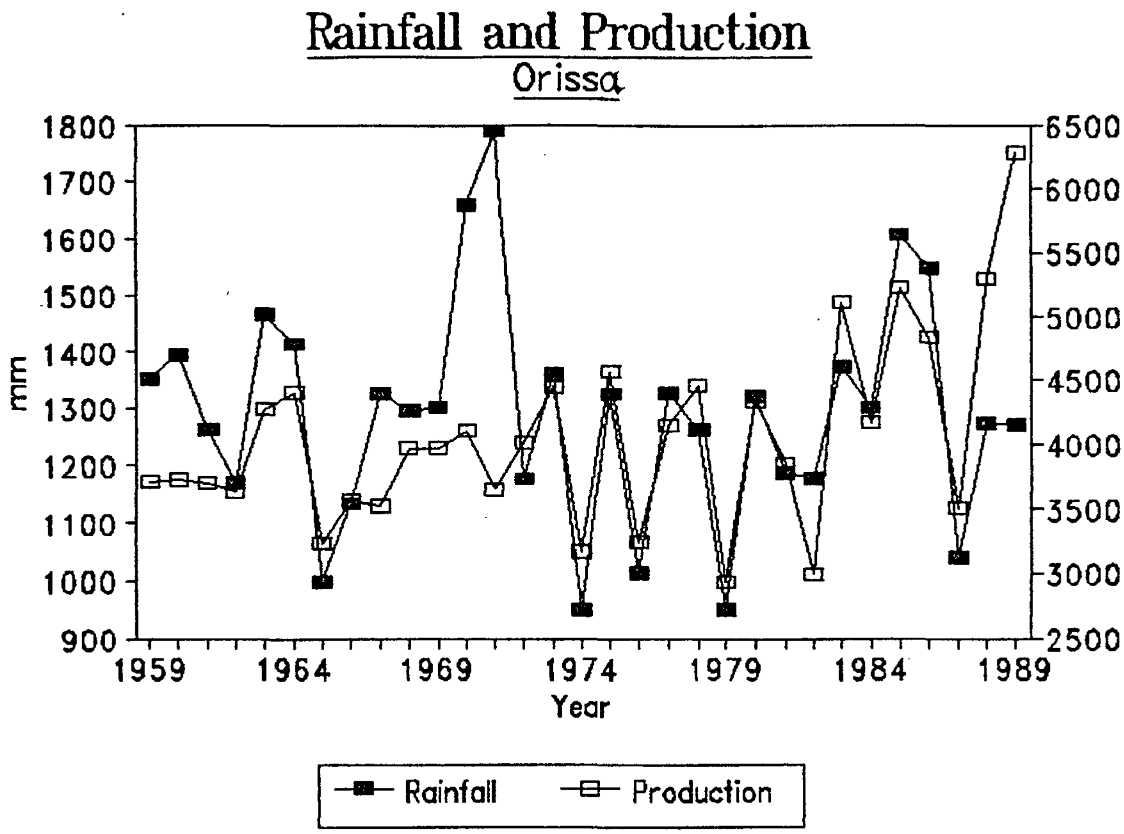
2) For Yield rate and Production of Rice the source is Combimed Technical Report on Sample Survey through establishment of an agency for reporting Agricultural Statistics in Orissa, Directorate of Economics and Statistics, Government of Orissa.

is one state in the country where there has been frequent incidence of cyclone and other natural calamities[5].

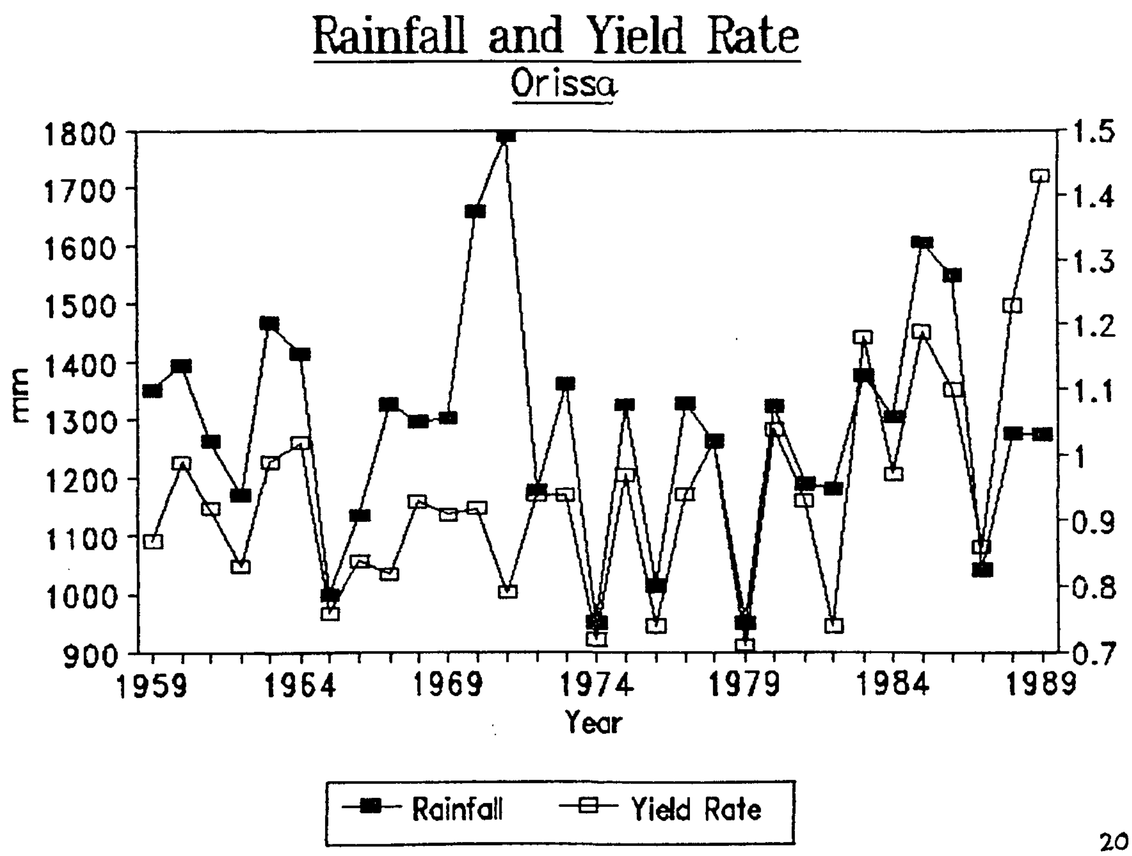
Given the above features of the rainfall in the State, it may be interesting to examine the association between the fluctuations in rainfall and its likely impact on the fluctuations in output and yield. A cursory look at the data shows that in a number of years when the rainfall is closer to normal or above normal, the output is higher. On the other hand, in years when the rainfall is far below normal, it has resulted in lower levels of output. This association between output and rainfall is more visible from **graph 2.3**. However, the association is not that straight forward, since there is no one to one correspondence with rainfall and output levels. For instance, in the year 1988/89, the level of output was very high despite the fact that there was significant deficiency in rainfall. The correlation between the level of rainfall and level of output was 0.46, which to some extent indicate that output and rainfall moves almost in similar direction.

Since output fluctuations are caused more by yield fluctuations and not by area fluctuations, it is interesting to examine the association between annual variations in rainfall and yield. This is depicted in **graph 2.4**. The pattern of association is almost the same as that between

Graph 2.3



Graph 2.4



rainfall and output. In fact the correlation between annual rainfall and annual yield rate is 0.41, which is very close to what we noted for rainfall and output.

Rainfall fluctuations could influence the yield fluctuations both directly and indirectly. The direct effects may operate through the rainfed segment and indirect influence in the irrigated segment of the area under rice cultivation. In a situation where there is an upward trend in the irrigated area under rice, and the irrigation source is predominantly surface irrigation, the fluctuations in rainfall would certainly affect the availability of irrigation water and thus the crop growth and its productivity. In the next section, we shall look at the extent to which the growth of irrigation has helped to stabilise the yield rate for the state as a whole.

2.5 Irrigation and Yield Rate

The trend in irrigated area under rice is given in **Table 2.3** and the same is depicted in **graph 2.5**. There was a steady increase in the gross irrigated area under rice cultivation till the year 1971-72 and it showed a sharply falling trend in 1972-73, 1973-74 and 1974-75[6]. In the subsequent years it has shown an upward trend and in the second half of the eighties it has shown a fairly rapid increase than in the earlier years. In percentage terms also the irrigated area has gained

TABLE 2.3

Irrigated Rice Area ('000 Hectares)

Year	Total Rice Area	Rice Area Irrigated	Share of Irrigated Rice Area to Total Rice Area
1	2	3	4
1959-60	4268	NA	NA
1960-61	3766	981	26.05
1961-62	4041	NA	NA
1962-63	4374	NA	NA
1963-64	4290	NA	NA
1964-65	4317	NA	NA
1965-66	4233	931	21.99
1966-67	4129	981	23.76
1967-68	4298	866	20.15
1968-69	4266	1138	26.68
1969-70	4406	1224	27.78
1970-71	4471	1397	31.25
1971-72	4646	1397	30.07
1972-73	4475	1100	24.58
1973-74	4733	1041	21.99
1974-75	4432	1080	24.37
1975-76	4684	1195	25.51
1976-77	4380	1127	25.73
1977-78	4405	1165	26.45
1978-79	4377	1161	26.53
1979-80	4117	1155	28.05
1980-81	4191	1192	28.44
1981-82	4159	1192	28.66
1982-83	4058	1192	29.37
1983-84	4356	1192	27.36
1984-85	4304	1347	31.30
1985-86	4402	1434	32.58
1986-87	4393	1460	33.23
1987-88	4053	1396	34.44
1988-89	4282	1556	36.34
1989-90	4391	1498	34.12

Note: NA is not available

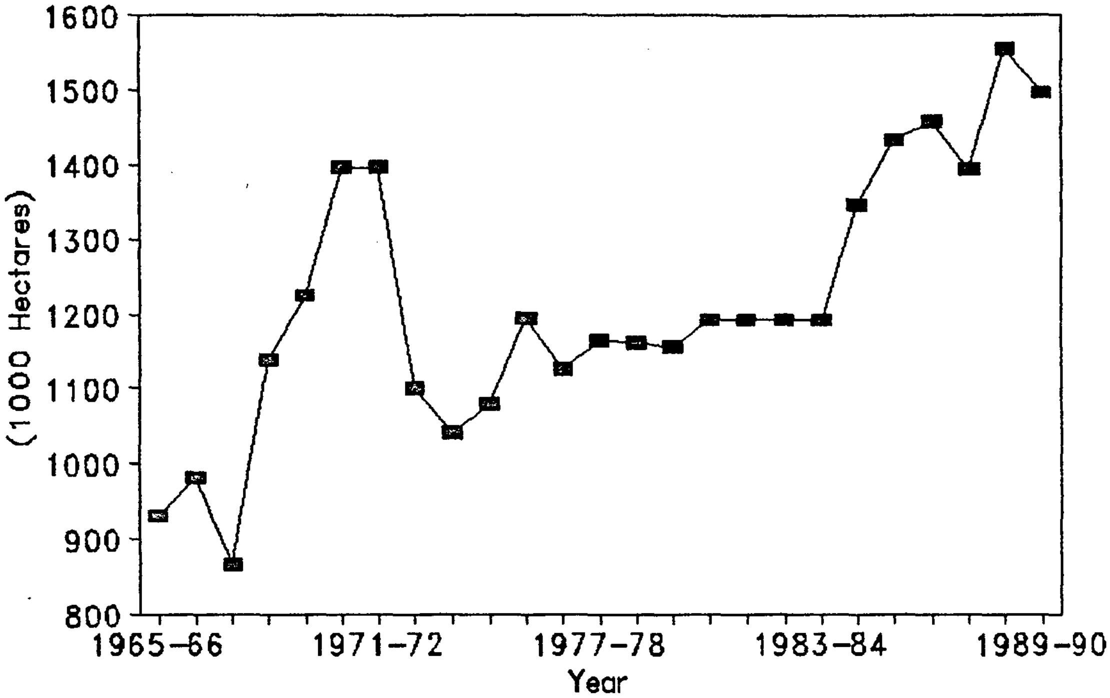
Source: 1) Various Issues of Orissa Agricultural Statistics, Directorate of Agriculture and Food Production, Orissa and

2) Bansil P C (1990): Agricultural Statistical Compendium, Volume-1, Foodgrains, Part-1

Graph 2.5

Irrigated Area Under Rice

Orissa



more in recent years.

To what extent the irrigated segment of the area under rice cultivation in the state has helped to reduce fluctuations in rice yields? One way to gain insight in to this is to look at the yield fluctuation in irrigated and rainfed segments. (**See Table 2.4**). It clearly shows that the yield rate of irrigated land in general is much higher than the unirrigated land. However, it has also shown significant variations across seasons. The yield rates in the irrigated area during the first two seasons has shown an upward trend overtime and has shown a fair degree of stability. Though, the summer area under irrigated rice cultivation is very small (about 5%), the yield rates obtained during this season is much higher and more stable. Compared to the irrigated segment, in the rainfed segment, in both autumn and winter seasons, the yield has shown more fluctuations with very slow increase in its growth rate. Given such disparities in the yield growth and fluctuations between irrigated and rainfed segments, one would expect the development of irrigation in the state to result in some degree of stability in rice yields. However, at the state level, irrigation hardly appears to have played this role. Since, there is considerable regional concentration of irrigated area in Orissa, it is possible that the analysis at the state level conceals the role of irrigation in stabilising the yield

TABLE 2.4

Yield Rates of Rice from Irrigated and Unirrigated Plots (Qt/Hec)

	Irrigated Yield Rates			Unirrigated Yield Rates		
Year	Autumn	Winter	Summer	Autumn	Winter	Summer
1	2	3	4	6	7	8
1976-77	8.63	10.48	15.40	5.15	7.26	---
1977-78	10.51	11.25	14.09	7.29	9.87	---
1978-79	8.84	12.66	12.95	7.52	10.78	---
1979-80	9.16	12.30	12.93	4.21	7.15	---
1980-81	9.13	13.13	15.77	6.46	10.88	---
1981-82	9.16	12.72	13.90	6.66	9.19	---
1982-83	9.62	11.24	12.81	4.39	6.51	---
1983-84	12.09	15.91	17.27	9.01	12.89	---
1984-85	11.66	13.89	18.61	8.21	10.21	---
1985-86	12.75	15.85	16,85	9.37	13.28	---
1986-87	12.36	15.72	19.92	8.05	12.43	---
1987-88	11.48	12.90	18.64	5.45	8.39	---
1988-89	13.35	17.78	20.69	8.63	13.17	---
1989-90	15.59	19.92	21.78	10.88	14.86	---
1990-91	16.09	15.86	20.26	10.88	12.89	---

Source: Technical Report on Sample Surveys Through Establshment of an Agency for Reporting Agricultural Statistics in Orissa; Directorate of Econmics and Statistics, Orissa; variuos issues.

levels due to the dominance of the rainfed regions in the total area and output in the State. An analysis at the district level, may provide more insight into this question, which we have attempted in the following chapter.

CHAPTER 3

Fluctuations of Rice Output: A Disaggregate Analysis

3.1 Introduction

The purpose of this chapter is to analyse the extent to which the growth of irrigation has influenced the fluctuations in rice output at the district level. The need for such an analysis arises out of the fact that at the state level fluctuations in output and yield are largely conditioned by the fluctuations in rainfall and that the growth of irrigation hardly succeeded in reducing instability. Since there is considerable inter regional variations in irrigated area across regions in Orissa, the absence of systematic interrelationship between growth of irrigation on the one hand rice output and yield on the other could be due to the fact that the higher degree of fluctuations in the rainfed areas may be vitiating the stability in the irrigated areas resulting in the overall instability of output at the state level. In order to gain more insight in to this it is important to carry out a disaggregated analysis of the fluctuation in the output. Ideally such an analysis would have been carried out by the agro-climatic zones. However, the available data hardly permits such an analysis. Since the data is available only at the district level we have no choice but to work with districts as the unit of study[7].

The organisation of this chapter is as follows. Section 3.2, makes an attempt to classify the districts according to level of irrigation and their share in the total rice output in the state. Based on this classification section 3.3 attempts an analysis of the output fluctuations observed in the different groups of districts. The last section will briefly comment on the nature of irrigation development in shaping the fluctuations observed across different groups of districts.

3.2 Classification of Districts:

Historically the development of irrigation was uneven across regions in Orissa (Satpathy, 1984). This is reflected in the fact that in the early years of our study period, the percentage of irrigated area under rice was relatively high in districts like Ganjam, Cuttack, and Puri. However, what is more interesting to note is that there has been expansion of irrigated area in a number of districts during the last three decades (See **Table 3.1**). The districts where the level of irrigation is low and its growth has been very slow are districts of Koraput, Dhenkanal, Kalahandi, Keonjahar,

TABLE 3.1

Percentage of Irrigated Rice Area to Total Rice Area

Districts	1976-77	1977-78	1978-79	1979-80	1980-81	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90
1	2	3	4	5	6	7	8	9	10	11	12
Balasore	19.7	18.4	19.1	19.5	21.3	26.5	26.9	41.3	40.1	37.7	38.5
	(16.3)	(16.0)	(16.7)	(17.3)	(21.0)	(23.0)	(22.1)	(37.8)	(36.5)	(34.4)	(34.0)
Bolangir	23.4	25.7	27.5	27.0	27.0	30.2	34.3	34.4	30.7	35.9	34.5
	(19.3)	(20.2)	(20.0)	(21.0)	(20.0)	(23.9)	(28.5)	(30.9)	(25.2)	(30.3)	(29.0)
Cuttack	41.8	41.7	41.0	46.0	40.9	43.3	42.5	37.7	43.6	43.4	42.3
	(36.6)	(37.1)	(39.1)	(44.6)	(39.0)	(41.1)	(40.6)	(35.9)	(41.3)	(40.9)	(40.0)
Dhenkanal	11.7	12.2	14.0	11.8	13.7	20.0	22.9	26.1	23.4	26.8	29.2
	(11.4)	(12.2)	(13.3)	(11.3)	(13.0)	(19.0)	(21.9)	(24.8)	(21.8)	(25.1)	(28.0)
Ganjam	54.9	55.9	55.5	67.8	62.9	64.5	64.4	61.6	65.0	66.5	61.2
	(54.5)	(55.7)	(55.1)	(68.0)	(63.0)	(64.2)	(64.3)	(61.5)	(64.6)	(66.5)	(61.0)
Kalhandi	10.0	10.9	10.4	11.7	11.6	10.6	10.0	12.2	16.6	17.2	14.7
	(9.5)	(10.6)	(9.9)	(11.0)	(11.0)	(10.3)	(9.3)	(11.6)	(16.3)	(17.0)	(14.0)
Keonjhar	3.4	4.5	4.0	8.3	8.7	14.0	13.6	24.8	19.3	26.6	18.3
	(3.3)	(3.9)	(3.8)	(8.2)	(8.0)	(13.6)	(13.2)	(24.5)	(18.7)	(24.0)	(18.0)
Koraput	6.6	7.4	7.9	6.7	5.4	12.3	13.8	9.7	10.4	13.4	14.8
	(5.7)	(6.0)	(6.5)	(5.2)	(4.0)	(11.5)	(13.0)	(9.1)	(9.5)	(12.2)	(13.6)
Mayurbhanj	10.6	11.0	10.7	9.6	10.3	15.6	16.0	16.9	23.0	19.2	18.4
	(10.4)	(9.9)	(10.5)	(9.3)	(10.0)	(14.5)	(15.1)	(15.5)	(22.1)	(18.6)	(17.8)
Phulbani	30.0	36.0	34.8	34.5	30.5	33.0	40.8	38.5	21.8	37.6	31.8
	(29.6)	(35.3)	(34.1)	(34.8)	(28.0)	(32.4)	(39.6)	(37.5)	(21.0)	(36.7)	(31.0)
Puri	44.4	46.2	44.3	47.6	53.2	56.5	57.3	54.0	55.9	52.2	42.8
	(41.3)	(41.7)	(41.8)	(44.8)	(49.0)	(53.3)	(52.4)	(49.4)	(50.7)	(50.5)	(36.0)
Sambalpur	35.7	36.3	37.1	39.1	19.2	42.6	23.4	42.4	46.5	48.6	48.8
	(27.0)	(27.6)	(27.4)	(29.9)	(28.0)	(33.6)	(31.9)	(31.9)	(38.7)	(40.4)	(41.0)
Sundergarh	7.9	8.4	8.9	6.6	7.8	11.2	17.4	12.2	16.9	19.7	17.8
	(7.3)	(7.7)	(8.3)	(6.4)	(7.0)	(10.0)	(17.1)	(11.4)	(16.3)	(8.3)	(16.8)

Note:-1) Figures in the brackets are percentage shares of irrigated kharif rice area to total rice area.
2) As more than 90 per cent of area under rice is cultivated in Kharif season, it is important to note the share of irrigated rice area under Kharif.

Source: Various issues of Orissa Agricultural Statistics, Directorate of Agriculture and Food Production, Orissa.

Mayurbhanj and Sundergarh.

What is the extent to which the differential pattern of irrigation across districts has influenced the fluctuations in output and yield observed at state level? To gain insight in to this question, we have classified the districts by taking the share of rice productions of individual districts to the state total and the coverage of rice area. Based on this classification, we have ranked the districts and clubbed 13 districts of the state into four groups.

The first group is characterised by high share in the rice output and high coverage in the irrigated rice area (HH). There are five such districts in the group which together contributed to more than 55 per cent of the total rice output. The second group is characterised by low share in rice output as well as low irrigation coverage (LL). The third group is characterised by high share in rice output but low irrigation coverage (HL). The fourth group is characterised by low share in the rice output but interestingly better placed in terms of irrigation coverage (LH). This is shown in table 3.2.

Since the first and the second group have five districts each and combined together they contribute nearly 80 per cent to the total output, we decided to focus on these two broader groups whose performance is expected to reflect significantly to the pattern of output fluctuation at the state level.

Table 3.2:
Percentage of Area Irrigated and Share in the Total Rice Outuput of Individual Districts, Groupwise.

Districts (Group Wise)	Seventies		Eighties	
	Percentage rice area irrigated	Percentage share in the total rice output	Percentage of rice area irrigated	Percentage of share in the total rice output
HH				
Balasore	18.5	9.1	31.9	9.4
Cuttack	45.4	14.5	44.3	15.1
Ganjam	55.1	7.7	64.1	10.0
Puri	44.8	9.4	41.5	11.0
Sambalpur	35.9	13.1	37.0	13.1
Group Total	38.0	54.3	45.0	58.6
LL				
Dhenkanal	12.2	5.5	21.2	5.01
Kalahandi	10.2	5.3	12.3	4.4
Keonjhar	3.7	5.3	15.7	3.6
Mayurbhanj	10.6	7.8	17.0	7.1
Sundergarh	8.2	4.0	14.4	3.4
Group Total	9.0	23.9	20.0	23.6
HL				
Koraput	6.9	9.4	10.2	7.8
LH				
Bolangir	25.0	5.57	28.7	5.1
Phulban	3.4	1.9	25.2	2.1
Group Total	27.0	7.4	32.0	7.2

Note: Estimated figures of three yearly averages of 1976-77, 1977-78 and 1978-79 for the Seventies and 1987-88, 1988-89 and 1989-90 for Eighties.

Source: Estimated from various issues of Orissa Agricultural Statistics, Published by Directorate of Agricultural and Food Production.

3.3 Comparative analysis of output fluctuation:

In order to measure the fluctuations in the time series of production, yield and area, we have used standard deviation of first difference of logarithm[8]. Since the first differences do exhibit any time trend in any of the cases considered, standard deviation seems to be a reasonable measure of year to year fluctuations.

Table 3.3:
Standard Deviation of
First Difference of Logarithm

	1959/60 to 1973/74	1974/75 to 1990/91
i. Production		
HH	0.1012	0.2930
LL	0.1825	0.3687
ii. Yield		
HH	0.1116	0.2442
LL	0.1886	0.3472
iii. Area		
HH	0.0654	0.0532
LL	0.1171	0.0500

Note: 1) HH is first group with high share in rice output and higher coverage of irrigation.

2) LL is the second group with low share in rice output and relatively lower share in coverage of irrigation.

Source: Estimated.

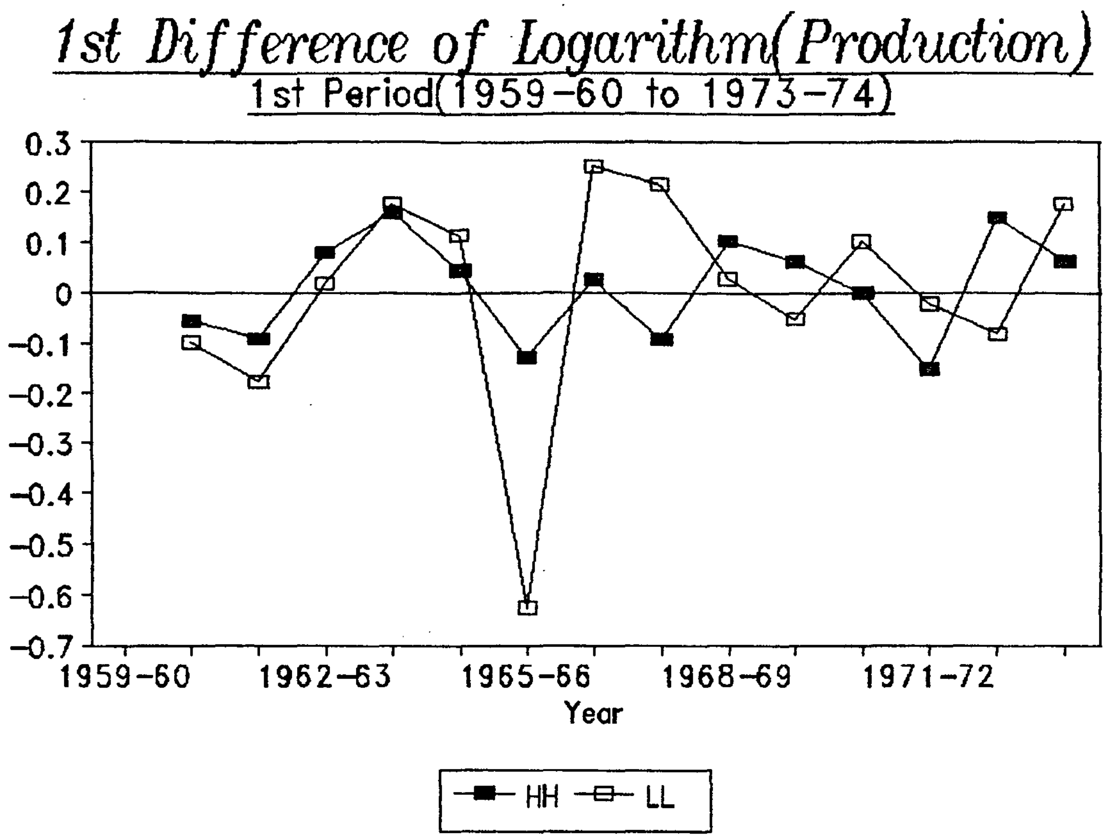
The results for the two groups of districts are given in table 3.3. As far as output fluctuation is concerned the results broadly conform to the pattern at the state level.

Both in HH and LL groups the output fluctuation is substantially higher in the second period, i.e., from 1974-75 to 1990-91 (**Graph 3.1 and 3.2**). The yield fluctuations is substantially higher in the second period in the HH and LL group. Although the yield fluctuations in the high irrigated group of districts (HH) is lower than that in the low irrigated districs (LL), what is significant is that the difference is not impressive. This point is very clear in the **graph 3.3 and 3.4**. But for one or two time points the extent of yield fluctuations is very similar between the two groups of districts at considerably different levels of irrigation (45 per cent in contrast to 20 percent).

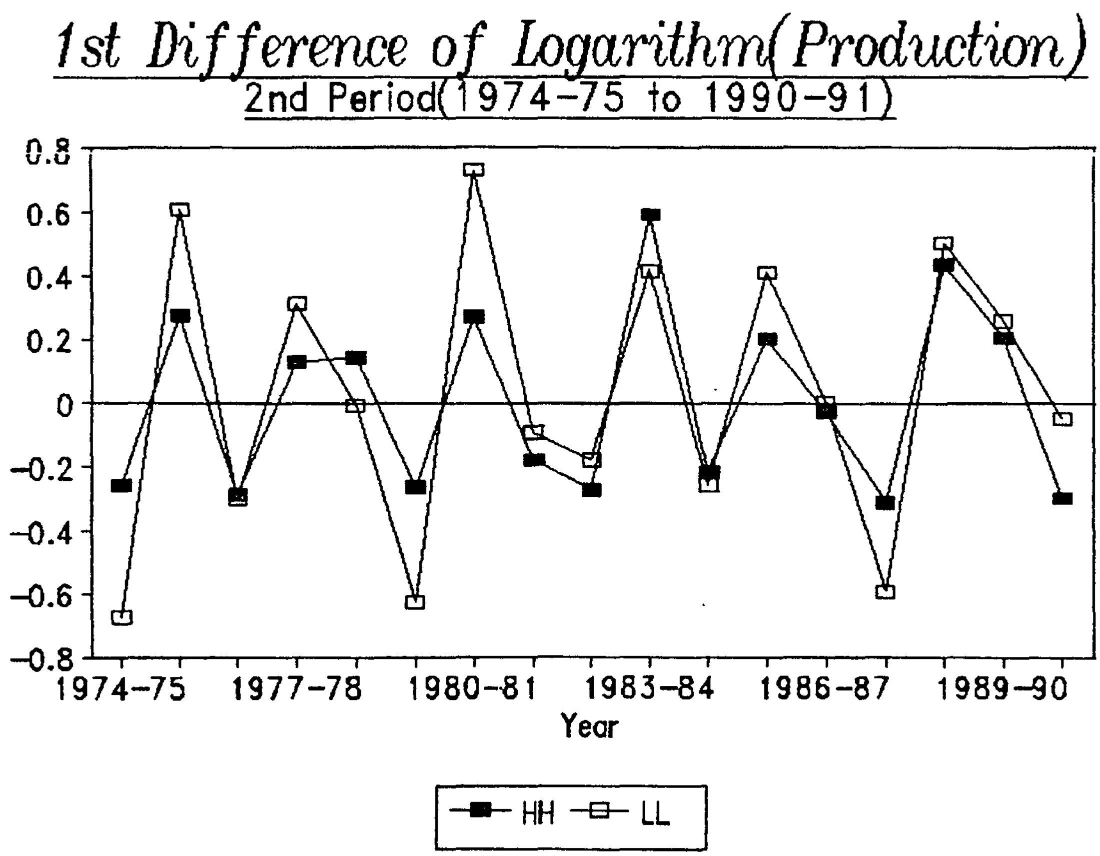
As far as fluctuation in the area is concerned, both the group seems to remain at similar level in both the period. The high standard deviation for the 1st period for LL group is mainly due to extreme value of one year (**Graph 3.5 and 3.6**).

We have also examined the pattern of yield fluctuations in HL group of one district and LH group of two districts. The findings from HL group and LH are similar to that in HH Group and LL group. It is evident from these findings that the increasing rice output fluctuations during the post mid seventies in Orissa was due to increased fluctuations in yield in both the high and low irrigated districts. Irrigation seems to have had a marginal moderating effect on yield

Graph 3.1

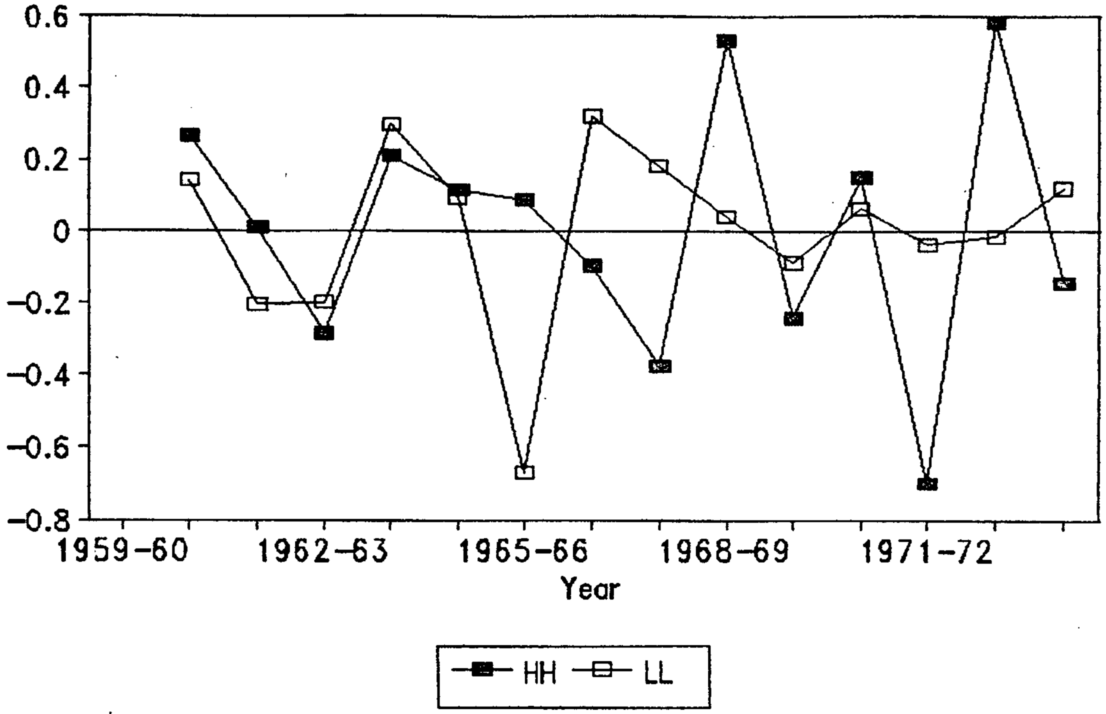


Graph 3.2



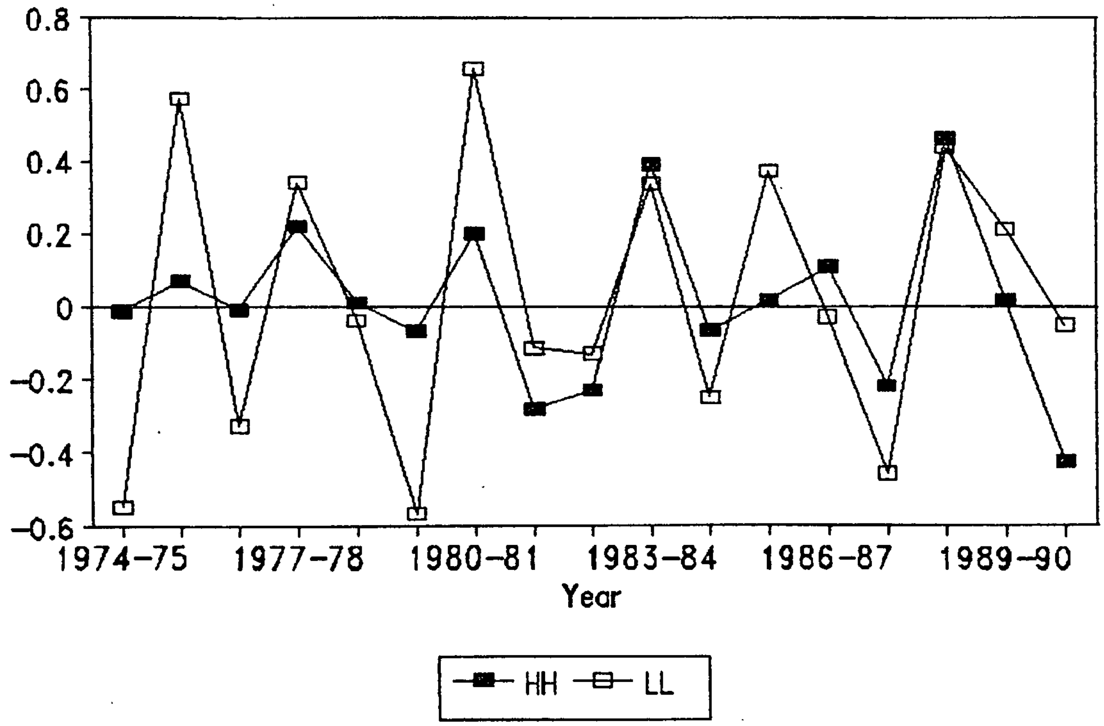
Graph 3.3

1st Difference of Logarithm(Yield)
1st Period(1959-60 to 1973-74)

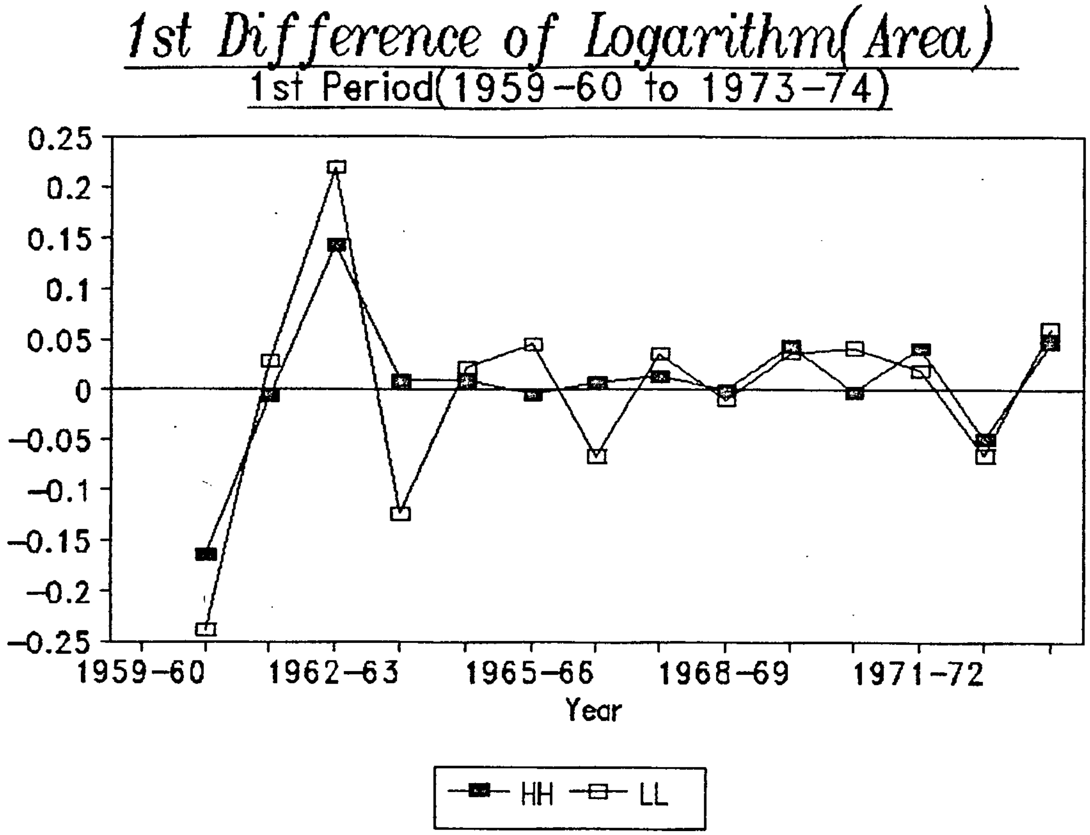


Graph 3.4

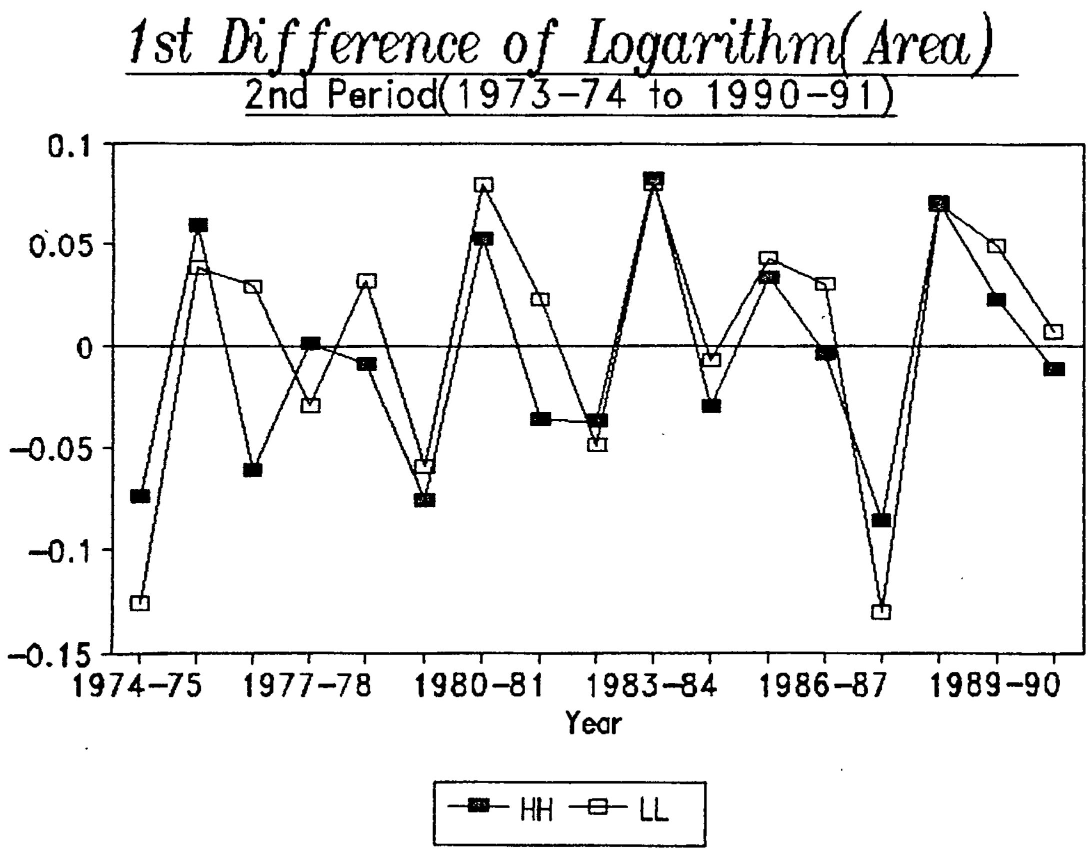
1st Difference of Logarithm(Yield)
2nd Period(1974-75 to 1990-91)



Graph 3.5



Graph 3.6



fluctuations.

The above findings raises an important question regarding irrigation and instability in rice production and yield. Why is that in the first group of districts irrigation has not contributed to reduction in output and yield fluctuations? To answer this question it is important to examine the nature and sources of irrigation in the first group of districts.

3.4 Nature and Sources of Irrigation in the First (HH) Group:

In this group of districts major part (90%) of the rice is cultivated in kharif season. The rabi cultivation is carried under assured irrigation. Since bulk of the irrigated rice is under the kharif season, we have examined the data on the source wise irrigation in the kharif season (See **Table 3.4**). The data shows that in the four out of the five districts surface irrigation contributed to more than 90 per cent of the area irrigated in the early seventies. The only exemption was Ganjam where surface irrigation contributed to only about 80 per cent of the area irrigated. While the surface irrigation continues to remain important in these districts, it is interesting to note that percentage of area irrigated through ground water source has been increasing. By the late eighties in the districts of Sambalpur, Puri, Ganjam and Cuttack about 25 to 30 per cent of the kharif rice was

TABLE 3.4

Sources of Kharif Irrigation ('000 Hectares)

District	1976-77	1977-78	1978-79	1979-80	1980-81	1982-83	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90
1	2	3	4	5	6	7	8	9	10	11	12	14
Balasore												
Total Irrigation	83	88	96	99	180	143	139	183	244	230	209	254
Kharif (i+ii)	67	66	69	72	82	106	103	135	166	160	136	166
(i)Surface	62	62	64	64	76	87	91	92	92	95	94	94
% of i to Kharif	93	94	93	89	93	82	88	68	55	59	69	57
(ii)Groundwater	5	4	5	8	6	19	12	43	74	65	42	72
% of ii to Kharif	7	6	7	11	7	18	12	32	45	41	31	43
Cuttack												
Total Irrigation	311	333	369	375	358	364	399	509	511	462	485	527
Kharif (i+ii)	219	226	236	240	225	232	233	319	321	303	307	321
(i)Surface	207	214	223	223	209	211	211	212	212	212	214	223
% of i to Kharif	95	95	94	93	93	91	91	66	66	70	70	69
(ii)Groundwater	12	12	13	17	16	21	22	107	109	91	93	98
% of ii to Kharif	5	5	6	7	7	9	9	34	34	30	30	31
Ganjam												
Total Irrigation	144	441	238	263	270	268	280	276	264	285	191	314
Kharif (i+ii)	129	213	223	239	242	246	255	247	234	243	145	250
(i)Surface	100	184	184	195	197	199	207	207	207	208	102	194
% of i to Kharif	78	86	83	82	81	81	81	84	88	86	70	78
(ii)Groundwater	29	29	39	44	45	47	48	40	27	35	43	56
% of ii to Kharif	22	14	17	18	19	19	19	16	12	14	30	22
Puri												
Total Irrigation	218	222	258	280	167.5	231.5	255	359	361	380	407	354
Kharif (i+ii)	161	156	169	180	54.1	205.5	210	222	222	240	246	213
(i)Surface	154	155	156	164	36	187	191	193	193	193	199	160
% of i to Kharif	96	99	92	91	67	91	91	87	87	80	81	75
(ii)Groundwater	7	1	13	16	18.1	18.5	19	29	29	47	47	53
% of ii to Kharif	4	1	8	9	33	9	9	13	13	20	19	25
Sambalpur												
Total Irrigation	214	213	222	228	231	248	302	328	306	315	343	354
Kharif (i+ii)	133	134	139	144	144	160	174	199	194	203	209	213
(i)Surface	127	128	130	133	132	147	152	154	154	157	160	160
% of i to Kharif	95	96	94	92	92	92	87	77	79	77	77	75
(ii)Groundwater	6	6	9	11	12	13	22	45	40	46	49	53
% of ii to Kharif	5	4	6	8	8	8	13	23	21	23	23	25

Source: Various issues of Orissa Agricultural Statistics, Direcorate of Agriculture and Food Production, Government of Orissa.

under ground water irrigation. In Balasore district, the area irrigated through ground water was higher (about 40%) than in the other districts. Since, there has been some degree of shift in the sources of irrigation from surface to ground water, one would expect this also to contribute to reduction in output and yield fluctuations.

The weak influence of irrigation development on fluctuations in output and yield could have been taken place due to the following factors.

a). The surface irrigation in the state depends on rainfall in the catchment area for storage. Therefore the fluctuations in rainfall might have influenced the fluctuations in the irrigated area and thus in the fluctuations in output.

b). The ground water sources in orissa are mostly shallow dug wells which depend on the rainfall for recharge. The growth of tube wells has been a very recent phenomenon in the state and the area irrigated by this sources constitutes even less than 5 per cent. Thus the fluctuations in rainfall seems to be getting reflected in the fluctuations in irrigated area. Thus unstable nature of irrigation has implications for the absorptions of modern technology in the production consisting of high yielding varieties, fertilizers, pesticides etc. If the irrigation is unstable it would not result in the realisation of the higher levels of productivity of the high yielding varieties and it might slow down the rate of adoption of high yielding varieties. In the chapter that follows we shall examine the extent to which high yielding varieties has contributed to increase in the production in the state and the prospects for increasing rice production through spread of modern technology.

CHAPTER 4

Prospects of Rice Production in Orissa

4.1 Introduction:

In the proceeding analysis we have mapped out some of the major features of rice production in Orissa. In particular we have seen that in the period after mid seventies output has moved to higher levels with increasing fluctuations. The movement of yield also has shown almost the same pattern as that of output. This in turn indicates that the potential for increasing output through improvements in yield is considerable in Orissa. However irrespective of the levels of irrigation, the output and yield fluctuations in the past appears to be influenced largely by the intensity and spread of rainfall. As we have noted in the previous chapter the instability in rainfall has influenced the instability in irrigated area, since the state has a predominantly surface irrigation system. Even in the phase of the unstable nature of irrigation the higher potential output and yield observed in years with reasonable weather conditions has also to do with the spread of high yielding varieties. In this chapter we will examine the extent of diffusion of high yielding varieties in Orissa, the problems associated with its diffusion and the prospects for increasing productivity and output based on the modern Bio-physical technology.

The organisation of this chapter is as follows. Section 4.2 looks at the diffusion of high yielding varieties in the State and the extent to which it has brought in growth and stability in yields. Section 4.3 looks at the past experience of the generation of high yielding varieties and bottlenecks in the agricultural extension. In the light of the analysis of the last two sections, we will broadly indicate the prospects for increasing rice production based on the modern high yielding varieties.

4.2 Diffusion of High Yielding Varieties:

There are two different sources of data available to judge the diffusion of high yielding varieties of rice in Orissa. The first source is the estimates made by the Directorate of Agriculture and Food Production (DAFP). This data is based on eye-estimation collected from their field agencies and is available from the mid sixties. The second source of data is from the Directorate of Economics and Statistics(DES). Though DES has been estimating data on area, production and yield of high yielding varieties on a scientific basis since 1975-76(see **Appendix 1**), the data available with us is from 1979-80. The data available from the two sources are given in table **4.1**. The estimates provided by the DAFP is several times higher than that provided by the DES. In the year 1979-80, the estimated area under HYV provided by DES was only 179 thousand hectares (about 4.34 per cent of the total area under rice) against an estimate of 942 thousand hectares (24.1 per cent of the total area under rice) by DAFP. If the spread of high yielding varieties has taken place at the level and rate of expansion reflected in the DAFP data, then it would have made tremendous increase in rice production in the state. Since this has not taken place, one gets a feeling that the DAFP has been inflating the area under HYV. Such a tendency to exaggerate the area under HYV is not only confined to Orissa, but also to other regions of the country. According to Boyce (1987) the official agencies have been doing this to boost their image by claiming greater spread of HYV. It is difficult to reconcile the differences in the two sources of estimates since one is based on Sample Survey, and the other is based on eye-estimate. However, a striking feature common to both sources of data is that in the eighties there has been rapid spread of HYV(See **Table 4.1**).

District wise area under HYV (estimated by DES) shows that the level of adoption of HYV was higher in districts with greater coverage of irrigated rice excepting the district of

TABLE 4.1

Comparative Estimate of HYV Rice Area

('000 Hect)

Year	Total Area Under Rice	DAFP		DES	
		HYV Rice Area	% of 3 to 2	HYV Rice Area	% of 5 to 2
1	2	3	4	5	6
1966-67	4253	46	1.1	-	-
1967-68	4336	121	2.8	-	-
1968-69	4299	146	3.4	-	-
1969-70	4506	173	3.8	-	-
1970-71	4511	182	4.0	-	-
1971-72	4646	197	4.2	-	-
1972-73	4476	301	6.7	-	-
1973-74	4734	359	7.6	-	-
1974-75	4432	313	7.1	-	-
1975-76	4684	483	10.3	-	-
1976-77	4380	557	12.7	-	-
1977-78	4405	647	14.7	-	-
1978-79	4372	867	19.8	-	-
1979-80	4117	942	22.9	179	4.34
1980-81	4191	1207	28.8	234	5.60
1981-82	4159	1168	28.1	217	5.21
1982-83	4058	1363	33.6	297	7.31
1983-84	4356	1427	32.8	393	9.02
1984-85	4304	1429	33.2	541	12.56
1985-86	4402	1647	37.4	729	16.56
1986-87	4394	1845	42.0	737	16.77
1987-88	4046	1697	41.9	682	16.83
1988-89	4283	2031	47.4	865	20.00
1989-90	4391	2259	51.4	1027	23.00
1990-91	4403	-	-	1136	26.00

Source: 1) Various issues of Orissa Agricultural Statistics, Directorate of Agriculture and Food Production, Orissa.

2) Combined Technical Report on Sample Surveys Through Establishment of an Agency for Reporting Agricultur Statistics in Orissa, Various Issues, Directorate of Economics and Statistics, Orissa.

Phulbhani(HH and LH based on our classification in chapter. 3). However one can notice that the HYV coverage in some of the districts with lower coverage of irrigated rice (HL and LL based on our classification in chapter.3) is also showing an increasing spread in the districts, namely Koraput, Kalhandi and Dhenkanal (see **Table 4.2**).

It is interesting to examine the yield rates obtained by High Yielding Varieties compared to the traditional varieties. This data for the winter crop (the main cropping season) for a few years is given in **table 4.3**. As is to be expected the HYV yield rates are in general higher than the traditional varieties.

What is the extent to which the spread of HYV might have brought stability in rice yields? We have attempted to examine this question by estimating the standard deviation of the first difference of logarithm for all the districts. The results(see **Table 4.4**) shows that in the first group of districts the fluctuation in HYV yield are lower than that of traditional varieties. This is particularly so in the districts of Sambalpur, Cuttack and Balasore. In the LH group of districts the pattern is mixed. In the district of Bolangir the HYV yield fluctuations is higher than the traditional varieties whereas in the other districts it is not striking. In the HL group, the HYV yield variability is

TABLE 4.2

Area Under HYV Rice, District Wise. ('000 Hec.)

Districts	1979 to 1980	1980 to 1981	1981 to 1982	1982 to 1983	1983 to 1984	1984 to 1985	1985 to 1986	1986 to 1987	1987 to 1988	1988 to 1989	1989 to 1990	1990 to 1991
1	2	3	4	5	6	7	8	9	10	11	12	13
Balasore	10	6	8	16	30	25	34	36	33	36	40	59
Bolangir	24	30	27	36	44	49	59	56	69	75	82	103
Cuttack	20	29	21	54	40	39	41	47	51	58	74	81
Dhenkanal	2	3	2	5	9	10	14	13	11	18	23	27
Ganjam	9	17	25	30	50	149	198	199	148	245	292	288
Kalhandi	3	3	3	2	4	5	9	8	8	14	21	35
Keonjhar	1	1	1	2	3	4	4	5	5	7	8	8
Koraput	5	12	12	6	10	28	78	80	68	84	78	115
Mayurbhanj	2	5	4	7	12	17	16	16	11	12	10	15
Phulbani	1	1	3	1	4	3	5	7	3	5	7	9
Puri	23	33	9	44	46	70	95	97	103	84	128	99
Sambalpur	76	88	99	91	137	133	171	169	166	219	54	286
Sundergarh	3	3	3	3	4	9	5	5	6	9	9	12
State	179	234	217	297	393	541	729	737	682	865	1027	1136

Source: Combined Technical Report on Sample Surveys through Establishment of an Agency for reporting Agricultural Statistics in Orissa, Various Issues, Directorate of Economics and Statistics, Orissa.

TABLE 4.3

Yield Rates of Winter Rice (Qt/Hec.)

Year	Balasore	Blangir	Cuttack	Dhenkanal	Ganjam	Kalahandi	Keonjhar	Koraput	Mayurbhan	Phulbani	Puri	Sambalpur	Sundergarh
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Traditional													
1978-79	9.61	9.11	11.42	11.13	11.19	9.42	5.77	11.19	10.69	13.50	10.26	10.96	9.49
1979-80	8.61	4.11	8.47	4.51	9.83	6.74	6.58	9.11	6.91	9.93	9.85	4.57	5.84
1980-81	11.08	11.34	10.97	10.90	11.95	9.68	9.42	10.87	11.91	12.50	9.43	10.76	10.67
1981-82	7.83	9.46	9.51	10.81	8.89	9.17	8.99	10.78	9.93	9.92	7.97	11.37	9.55
1982-83	6.22	8.19	5.74	6.27	9.65	8.77	5.85	10.79	7.25	8.94	6.51	8.41	7.33
1983-84	9.51	10.98	12.27	15.25	15.55	10.03	12.36	12.72	12.43	14.43	12.48	12.79	11.41
1984-85	10.09	9.31	10.42	9.28	5.99	9.43	8.91	11.24	10.89	10.06	11.83	11.01	9.53
1985-86	8.63	13.60	11.61	12.21	13.29	11.91	10.12	15.00	11.67	15.83	11.96	12.60	10.91
1986-87	9.74	13.15	11.75	11.08	12.11	8.07	10.59	12.80	11.74	14.14	10.46	11.69	10.05
1987-88	7.68	7.73	10.75	7.11	7.32	7.42	6.25	9.88	11.21	6.02	7.97	8.16	8.37
1988-89	12.78	12.25	13.87	13.79	12.97	8.58	11.43	11.39	13.11	11.85	12.18	10.57	10.97
1989-90	12.67	15.89	16.43	14.03	14.75	11.13	12.21	12.87	11.82	15.23	16.20	13.06	10.31
1990-91	7.39	14.39	10.00	10.51	11.65	10.45	10.99	12.75	11.19	12.25	8.99	14.51	11.15
High Yielding Varieties													
1978-79	11.73	13.04	15.50	9.20	15.49	10.61	13.67	13.60	13.18	14.29	12.73	14.29	10.02
1979-80	12.41	12.63	14.69	13.92	15.87	11.25	8.63	13.37	8.93	18.27	15.76	11.04	13.49
1980-81	13.90	13.79	17.16	18.71	16.20	11.90	11.11	14.67	15.88	14.96	15.58	15.03	14.55
1981-82	11.14	12.82	18.11	15.54	16.28	12.86	15.49	13.90	18.17	15.67	16.91	19.49	11.85
1982-83	11.06	19.00	15.27	15.23	17.91	10.93	8.21	15.72	10.91	14.85	12.71	16.32	7.51
1983-84	12.91	20.46	21.87	24.99	23.80	14.82	17.03	19.25	16.13	17.64	24.63	21.43	12.79
1984-85	15.54	8.02	21.61	16.51	12.61	13.55	15.56	17.61	17.39	11.82	19.76	17.93	11.57
1985-86	14.61	16.89	21.11	18.41	19.70	17.78	11.47	19.86	16.03	21.21	20.15	15.19	17.11
1986-87	16.84	20.98	20.01	16.15	17.66	13.09	11.29	19.71	17.93	19.40	19.62	18.29	17.12
1987-88	13.63	17.11	19.79	11.59	9.23	10.31	10.58	11.73	15.93	9.34	15.94	14.94	10.34
1988-89	20.61	21.13	24.40	20.38	20.72	12.61	22.98	15.08	20.37	18.84	19.88	17.93	20.29
1989-90	22.07	63.73	26.41	20.93	23.99	15.89	20.50	16.27	18.15	19.63	28.81	17.93	18.37
1990-91	16.43	20.57	20.31	16.18	15.83	14.86	20.22	17.56	14.40	18.14	19.24	27.01	16.73

Source: Combined Technical Report on Sample Surveys through Establishment of an Agency for Reporting Agricultural Statistic Variuos Issues, Directorate of Economics and Statistics, Orissa.

TABLE 4.4

Standard Deviation of 1st Difference of Logarithm.

	HYV	TRADITIONAL
HH		
Balasore	0.192	0.299
Cuttack	0.152	0.340
Ganjam	0.405	0.460
Puri	0.264	0.310
Sambalpur	0.239	0.414
LH	0.590	0.450
Bolangir	0.373	0.417
Phulbani		
HL		
Koraput	0.188	0.160
LL		
Dhenkanel	0.317	0.558
Kalahandi	0.194	0.218
Keonjahar	0.411	0.370
Mayurbhanj	0.290	0.280
Sundergarh	0.351	0.295

Note: HH - High share in rice output and higher coverage of irrigation
LH - Lower share in rice output and higher coverage of irrigation
HL - High share in rice output and Lower coverage of irrigation
LL - Lower share in rice output and Low coverage of irrigation

Source: Estimated.

slightly higher than that of traditional variety. Coming to the LL group in Dhenkanal the yield fluctuations of HYV varieties is much less than in the case of traditional varieties. In Kalhandi and Mayurbhanj, there is not much difference between the two. However, in the remaining two districts the yield fluctuations of HYV yield varieties is higher than the traditional varieties. Thus, except in the first group of districts, the yield variability between the two varieties, has not shown a clear pattern in the other groups of districts. However, it appears from the results, for the first group of districts, that the high yielding varieties could bring about some degree of stability in yield.

Looking at the yield achieved and the stability attained in at least some of the irrigated districts, it is evident that the diffusion of HYV could substantially increase the productivity of rice in Orissa. However, given the fact that there is considerable variations in the agro-climatic conditions, within Orissa, the HYV varieties diffused should be suitable to these conditions. This is especially important since the state has a substantial proportion of the rice area under rainfed conditions and even in the irrigated areas, the irrigation is not stable. In this context, a look at the state of research on rice in the state will be of interest.

4.3 The Role of Rice Research Institute:

Orissa is privileged to have the premier rice research institute in India at Cuttack established in 1948. The breeding of rice varieties with high yielding capacity has been one of the major tasks of this institute. From the year 1950-51 to 1972-73, this institute had released 38 varieties of seeds. But whether these seeds were accepted by the farmers or not, is difficult to Judge (George et al, 1973). Breeding of varieties of seeds suitable to various agro-climatic eco-system has been continuing and over the last two decades 62 high yielding varieties were released to the farmers. The year of release of 47 major varieties with their main features are given in **Appendix-II**. This information clearly indicates that scientists have been trying to breed varieties which are suitable to various agro-climatic conditions. This has gained more momentum in the second half of the eighties, with the release of a large number of varieties with different characteristics.

Even though the number of seed varieties released from Central Rice Research Institute kept on increasing (to which joined the Orissa Agricultural University, stationed at state's capital) the spread of HYV has been at a slow rate until very recent years. The rate of adoption noted in the second half of the eighties could be partly due to the release of better varieties by the research stations and partly due to the impact of the special rice production programme launched by the central government for the Eastern Indian States. However, this is an aspect which needs closer investigation.

There are two major problems associated with the HYV rice varieties released from the research centres.

One is the environmental (biological) constraints and the other is the risk involved. This could be a serious factor if the information gap is too wide between the actual cultivators and the scientists and if the extension services are inadequate from the cultivator's point of view. These issues deserve a detailed treatment for an understanding of the slow spread of HYV rice.

As regards the environmental constraints, the usual argument is that the imported IR varieties are not acceptable in different paddy-rice ecosystems. Being dwarf varieties they are susceptible to floods in coastal districts (ie. low lying area)[9] and being water dependant they are not acceptable to upland districts which have limited irrigation facility. But as far as Orissa is concerned, scientists in the research institutes have released different varieties of seeds suitable to different ecosystems, that take care of all the problems that IR varieties faced. But the slow spread of HYV rice in the state leads us to examine what hinders the diffusion process.

It is possible that it happened because of a wide gap between the result achieved in the controlled experimental situation and the result obtained on the fermer's field in actual conditions. The actual performance has a significant bearing on the farmer`s decision to adopt or reject the seeds made available by the various government agencies. The feedback that is very essential for the scientists might not have come because of lack of commitment or incompetency on the part of the extension wing of the Agriculture Department. Of late, a realisation by the scientists on this front has made these research institutes go for field level experiments to bridge the gap between biological potential and field level results.

In **table 4.5** we have brought out such a picture. All the 37 varieties of the seed released for farm level testing in the villages under the strong vigil of scientists of the research institutes were having potential of 5 tonnes per hectare; but only 6 varieties could achieve the yield rate above 3 tonnes per hectare, the highest being 3.53 tonnes.

It clearly reflects that in the earlier years, in a hurry to gain dramatic output growth, the scientist might have

TABLE 4.5

Performance of Different Seed Varieties of Rice at Village Level Experiments.

Sl.No	Variety/ Culture	Grain yield (tones/hectare)
1	RR 203-16	3.53
2	RR 167-982	3.46
3	Bala	3.41
4	RR 151-3	3.18
5	RR 174-1	3.06
6	CR 666-100	3.03
7	Banaprabha	2.98
8	JD 10	2.98
9	JD 5	2.88
10	CR 219-1	2.9
11	CR 750-42	2.83
12	Shneha	2.75
13	RR 203-10	2.82
14	M. G. Green	2.75
15	Brown Gora	2.62
16	Dhala Heera	2.58
17	RR 203-2	2.56
18	RR 36-141	2.48
19	RR 50-5	2.46
20	CR 749-34	2.36
21	JD 6	2.33
22	IR 42(S)	2.16
23	Heera	2.11
24	Birsadhan-101	2.2
25	Mutant-7	2.1
26	CRM 58-177	1.96
27	M. Gora Purple	1.93
28	OR 705-2	1.76
29	IR 50	1.75
30	CR 750-41	1.7
31	Kalinga-III	1.7
32	BAU 151-51	1.7
33	CR 693-575	1.31
34	Local (Kalakeri)	1.05
35	CR 749-32	0.99
36	JD 3	0.85
37	CR 693-42	0.53

Note: In ideal experimental level all of these varieties were showing around 5 tonnes per hectare.

Source: Extension Divission, Central Rice Research Institute, Cuttack.

prescribed the wrong seed without proper field testing. Hence, the resulted yield rate must have been below expectations which might have forced the farmers to reject these varieties in later years. This might have happened especially with the small and marginal farmers whose ability to take risk is very low. The essential point is that there can be loopholes in the prescribed seed if they are not properly field tested.

What one can infer from extension experiments is that the imported and modified High Yielding Varieties addressed to the local conditions have failed to deliver the goods.

The vulnerability of HYV rice to unknown types of diseases and pest attacks and vagaries of weather is well documented in the literature(Shakuntala Mehra, 1981). Scientists have been attempting to provide solutions to this kind of problems by extending village level experiments. This in turn raises the gestation period for the release of the new breed to farmers and delays the process of HYV rice diffusion. Here one should also note that the link between the farmer and the scientist is very crucial for proper feedback.

4.4 Potential for Rice Production:

We have seen in the preceding section that there has been some degree of spread of high yielding varieties. Though yield rates of HYV are higher than the traditional varieties, the level of exploitation of the potential of the HYV is low in the state. However, it has significantly contributed to overall up trend movement in rice yield in the late eighties. Therefore, the extent to which the rice production in the state can be increased depends on the potential for expanding the area under HYV and on updating its potentiality.

In this context it may be noted that the higher production level can be realised not only through development of HYV but also by creating varieties with shorter maturity period in order to increase the cropping intensity. The degree to which the potential of the new varieties is realised will depend, of course, on a wide range of complementary research activities and other socio-economic factors (Barker et al,1985). As mentioned earlier, some of the official committees on agricultural development in Eastern India have recognised the importance of these factors and highlighted their importance for exploiting the potentiality of rice production.

The Report of the Study Group on Agricultural Strategies for Eastern Region of India (Planning Commission, Govt.of India; July 1985) has highlighted the scope for increasing production of rice in eastern region. For estimating the potential in rice production two alternative approaches were used. In the first approach, based on the results of experiments conducted on cultivators' fields by the Indian Agricultural Statistics Research Institute, the additional production had been estimated by taking the differences in the economically optimum yields under experimental conditions on cultivators fields and average yield as actually observed. In the second approach, the states of the region had been divided according to agro-climatic zones, and in each zone, the average yield was then compared with highest yield obtained in a district falling in that zone. The first approach seeks to realise the expected additional production by proper extension effort taking the technology to the farms while the second approach aims at achieving the potential by providing infrastructure and inputs at par with the best districts in each agro-climatic zone. On the basis of the first approach, the potential of rice yields in the eastern region was estimated at 400 per cent higher than the potential while with the second approach it corresponded to 244 per cent. In years of optimum potential yield too Orissa ranked first in terms of the gap between optimum and the actual yield followed by Bihar. This in turn indicates that among the eastern Indian states, Orissa has the highest potential for rice output expansion.

The data on the yield rate based on the crop cutting experiment carried out by Directorate of Economics and Statistics in different seasons under irrigated and unirrigated land, with fertilizer and without fertilizer application clearly indicates the potential for increasing rice production under improved management conditions (See **Table 4.6**). Given proper infrastructural facilities it is possible to realise higher production potential in the state.

Water seems to be one among the two crucial variables that can make a significant difference in rice output. It has been assessed (according to the master plan, 1981, Govt. of Orissa) that the total potential use of surface water of 7000 thousand hectare metres can irrigate 4919 thousand hectares (75%) of total cultivable land and the total potential of the ground water of 1900 thousand hectare meter can irrigate 887 thousand hectare of land (13.5%) of the total cultivable area. Till the end of Seventh five year plan only 230 thousand hectares could be irrigated by surface irrigation. As regards the ground water, hardly 4 per cent of the potential has been used (Dalwa, 1991).

Coming to the other crucial variables namely fertilizer consumption, the position of Orissa is not that encouraging. Infact fertilizer consumption per hectare is very low in Orissa compared to other states in the country. And it has

TABLE 4.6

Estimates of Yield Rate of Rice from Fertiliser Applied and Fertiliser not Applied Season-Wise, both for Irrigated and Un-Irrigated plots.

(Qt/Hec.)

	Autumn				Winter				Summer	
	Irrigation		Unirrigated		Irrigation		Unirrigated		Irrigation	
Year	Fertiliser applied	Fertiliser not applied	Fertiliser applied	Fertiliser not applied	Fertiliser applied	Fertiliser not applied	Fertiliser applied	Fertiliser not applied	Fertiliser Applied	Fertiliser not applied
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1982-83	10.58	7.87	7.82	5.46	12.96	9.99	7.74	7.50	11.73	6.53
1983-84	13.17	10.04	11.66	8.16	18.60	14.02	15.58	12.26	13.83	7.21
1984-85	13.02	8.91	11.20	7.03	15.49	12.15	12.35	9.69	16.67	8.21
1985-86	13.72	10.00	11.55	8.42	17.28	13.93	15.21	12.72	16.91	9.98

Source: Combined Technical Report on Sample Surveys Through Establishment of an Agency for Reporting Agricultural Statistics in Orissa(1981-82 to 1985-86), Directorate of Economics and Statistics, Government of Orissa.

shown hardly any improvement over time (See **Table 4.7**). In

TABLE 4.7

Consumption of Fertilizers

Year	Kg/Hec.
1	2
1960-61	0.90
1970-71	3.80
1976-77	8.00
1977-78	9.00
1978-79	9.90
1979-80	8.30
1980-81	8.70
1981-82	9.50
1982-83	10.20
1983-84	11.70
1984-85	12.99
1985-86	15.74
1986-87	16.40
1987-88	16.70
1988-89	22.00
1989-90	21.70
1990-91	20.70

Source: Various issues of Agricultural Statistics, Directorate of Agriculture and Food Production and Economic Survey, 1992-93, Government of Orissa.

the absence of proper water control, it is not possible to realise the full productivity of this input. The lack of adequate distribution network for fertilizer may also be contributing to this low level of fertilizer use.

CHAPTER 5

Summary and Conclusions

The purpose of this study, as we noted in the introduction, was to bring out the performance of rice production in Orissa and to assess its prospects of growth in the near future. In the process we have analyzed the trends and fluctuations of rice output, and the factors contributing to it at the state level. We have also attempted to examine the extent to which the fluctuations observed at the state level are contributed by the fluctuations in output observed across different districts. The study has also examined the diffusion of high yielding varieties in the state, its pattern of spread across districts, and its probable impact in achieving higher level of output alongwith better degree of stability in the yield rates. An attempt is also made to explain the recent spurt in the spread of high yielding varieties partly in terms of the modern rice varieties released from the rice research institutes. The major conclusions from the study are briefly summarised below.

Analysis of the trends in rice output over the last three decades have shown that the output has moved to higher levels from the mid seventies, especially in very recent years. However this movement to higher levels has also been accompanied by yield fluctuations. Decomposition of the annual rate of growth of output clearly indicates that output fluctuation has been largely contributed by fluctuations in yield. This fluctuation in output and yield appears to be shaped to a large extent by the fluctuations in rainfall. In fact the relationship between rainfall and yield and rainfall and output has shown almost a similar pattern, thereby revealing the dominant role played by yield factor in shaping the output fluctuations. It was also noted that, irrespective of the expansion of irrigated area, it has not succeeded in bringing out much stability in output.

The lack of growth and fluctuations in rice output was subjected to further analysis in Chapter 3. The analysis shows that the four groups of districts has shown almost similar pattern in the behaviour of output and yield fluctuations as noted for the state as a whole. While drawing this conclusion at a general level it may be noted that in the group of districts with higher coverage of irrigated rice yield rates fluctuations were marginally lower than the other three groups, thereby indicating that the high irrigation coverage has only played insignificant role in reducing the fluctuations in output. It was argued in this context that the relatively insignificant impact of irrigation in stabilising output and yield was due to the predominance of surface irrigation, which depended on rainfall for storage. Though there has been some degree of development of groundwater, this too has also failed to bring in stability, since, recharging of wells has also been influenced by the intensity and fluctuations in rainfall.

Though, the state has a relatively unstable irrigation and a very high percentage of area under rice is rainfed, there has been fairly rapid growth in the spread of high yielding varieties in the recent past. The movement of output and yield to a higher level in years with reasonable weather conditions appears to have been contributed to a large extent by the diffusion of high yielding varieties. Though the spread of high yielding varieties was more in the irrigated districts to begin with, some of the rainfed districts are also catching up since the late eighties. It was also marked from our analysis that in most of the districts with high coverage of irrigated rice, the stability in HYV yield was more than that in traditional varieties. On the other hand the districts with low coverage of irrigated rice showed a mixed pattern.

The recent spread of high yielding varieties in the state also seems to be influenced, to some extent, by the release of varieties which are more suitable to the various agro-climatic zones. In this context an appraisal of the varieties of rice released from the research stations and the extent of HYV spread in different districts gave an immpression that the existing agricultural extension sources seems to have failed in providing the necessary feedback from the farmer's to the research stations for undertaking the modifications of the seed varieties by the research scientists for its improved performance and better acceptance. Available evidence on the performance of high yielding varieties at the field conditions shows that the yield rate obtained at the farm level is far below the same what is realised at the research station.

The state has immense potential for expanding rice production. This fact has been highlighted by a number of official committees. And the present study envisages that the realisation of this potential greatly depends on the rate of adoption of high yielding varieties and better realisation of its potential productivity at the farm level. This, in turn, requires expansion of the irrigation coverage, especially in the rainfed regions and to make it more reliable. In fact the state has not exploited a better part of its surface and ground water potential, which needs emphasis in future programes towards rapid increase in the rice production in the state. However, given the fact that investment in surface irrigation is likely to be more expensive and less cost effective, it may be more suitable in the immediate future to give priority to the exploration of ground water. Simultaneously, the rice research stations in the state have to pay more attention in developing high yielding varieties which are highly suitable to the rainfed regions of the state. It is also important to popularise the use of inputs like fertilizers which are essential for realising the potential productivity of the high yielding varieties. In order to facilitate higher levels of fertilizer consumption, there is a need to expand its distribution network.

The present study restricts to address a number of issues relating to rice economy of the state which need further investigation. Some of these issues are briefly outlined below.

In recent years there has been some decline in the area under rice cultivation, especially in the rainfed segment. This could happen because of the replacement of rice by other crops, which merit further attention. Another issue which is closely linked with crop shift is the profitability of rice production in the State. And there fore, a few more questions deserve a deeper study on its impact and implications on the rice economy of the state. What has been the increase in the cost of production of rice in Orissa and to what extent the availability of cheap rice from other regions of the country have affected the profitability of rice production in the state? And further, what are the advantages or disadvantages which it has over the competing crops? To what extent technological change could make rice production more profitable? How far the existing argrarian relation would be able to absorb and be conducive to the spread of HYV rice and the agro-mechanical technology in various agricultural operations? These are issuses which demand attention for understanding the dynamics of rice economy in particular and the rural economy in general.

END NOTES

1. Estimated from Economic Survey, Government of India, 1992-93.

2. Foodgrains accounts for about 84 per cent of the total gross area and rice has a share of more than 50 per cent in the gross cropped area in recent years (Economic Survey 1992-93, Government of Orissa.).

3. Orissa recorded the highest incidence of rural poverty, (44.7 per cent) when compared to other states in India in the year 1987-88 (Economic Survey, 1992-93, Government of Orissa.).

4. Tested statistically for the line slope by means of a regression of these difference on time and found it insignificant.

5. RBI's Report (1984) on Agricultural Productivity in Eastern India points out that flood, drought or cyclone occurred in almost every alternative year. While flood occurs almost every year with varying intensity, drought conditions are experienced once in every three years. These have contributed to considerable instability in agricultural production.

6. Data regarding area under irrigation provided by the state government sources, mainly, the various issues of agricultural statistics of Orissa, Directorate of Agriculture and Food Production, is highly unreliable. The sudden fall in irrigated rice area in the years 1972-73, 1973-74 and 1974-75 may be due to change in definition of irrigated area. The directorate of Economics and Statistics has not published crop specific time series data necessary for the present study. Dhawan (1991) has pointed out that there is some degree of stickiness observed in the time series data provided for both gross and net sown irrigated area. The gross irrigated area of the state of Orissa has expanded between 1950/51 and 1987/88 at the annual rate of about 2.2 per cent, doubling from a level of about one million hectares in 1950/51 to about 2 million hectare by 1987/88.

7. Since 1992, the state has undergone reorganisation of districts into further division, that is, to 27 districts by 1993. As the scope of the present study is limited to the period up to 1990/91, we have stuck to the original 13 districts for which systematic data is available.

8. First difference = $Ln(P_t) - Ln(P_{t-1})$; Where t is any given year (See Note 4)

9. Experiments have shown that modern semi dwarf photo period insensitive rice varieties of 120-130 days duration do not perform so well in the rainfed lowland ecosystem because of the following reasons: (a) they easily get submerged in the low lands because of their short stature, (b) there is high sterility, caused due to low light intensity during August-September, coinciding with the pinnacle inflation stage of the crop, (c) wild rice menace associated with the prolonged practice of broadcast seeding.

APPENDIX—1

There are two sources of information on agricultural statistics in the state of Orissa: (1) Directorate of Agriculture and Food policy and (2) Directorate of Economics and Statistics. Despite the fact that there has been a substantial difference between the two sources, the former source is accepted by the government of Orissa. Even though it has been realised that there should be some reconciliation between the two sources and to come out with one set of data acceptable to the general researchers.

Sample survey for estimating the area, yield rate and the production of the principal crop, i.e., paddy was first undertaken in the state by the Directorate of Economics and Statistics, Orissa during the year 1959-60. Since then such sample surveys are being conducted on paddy crop regularly during the three crop seasons every year. Subsequently, sample surveys for estimation of yield rate of Jute crop and area, yield rate and production of potato crop were also taken up by the Directorate since 1964-65 and 1968-69 respectively. For the rest of the crops, the Directorate of Agriculture and Food Production, Orissa is compiling information on the basis of the reports received from the field agencies, who are collecting information from the field through eye-estimation.

The scope of the sample survey conducted by the Directorate of Economics and Statistics, Orissa was limited at the beginning stage since the estimation of production of the principal crops i.e., Paddy at the lower administrative levels like sub-division and Community Development blocks and that for the minor crops at the State and the District levels were not brought under its scope at that time.

In view of the above limitations, a scheme entitled "Establishment of an Agency for Reporting Agricultural Statistics" popularly known as EARAS, was implemented in the State by the Directorate of Economics and Statistics, Orissa with effect from the year 1976-77. The scheme envisaged an increase in the scope and coverage of the sample survey by adopting complete enumeration method. Twenty (20) percent sample size was proposed and it was envisaged to divide the total number of villages in the State into five independent, non over-lapping samples. A sample of 20% villages was to be completely enumerated each year, thereby covering all the villages of the State by complete enumeration within a period of five years.

Accordingly, the scheme started operating in the State at

6% level during 1976-77. Subsequently the scheme operated at 10% level during the year 1977-78 and 1979-80 and 1980-81. With effect from the year 1981-82, the scheme is being operated at 20% level. At 20% level, the first round of the survey extended over the 5 year period from 1981-82 to 1985-86 and the second round from 1986-87 to 1990-91.

The estimates formulated on the basis of the results of the sample surveys conducted by the Directorate in respect of paddy and potato crops only have so far been accepted as official crops, the figures reported by the Directorate of Agriculture and Food Production, Orissa are being accepted as official estimates.

For the purpose of the sample survey under the scheme EARAS, an agricultural year, which extends over the period from July to June, is divided into three crop seasons viz. Autumn, Winter and Summer. The period from July to October is considered as Autumn, November to February as Winter and March to June as Summer.

The sampling design adopted for the sample survey under the scheme EARAS is the same for all crops covered under the scheme and is accepted by the Government of India. Team of experts from the Ministry of Agriculture, Government of India as well as the World Bank have reviewed the implementation of the scheme in the state on several occasions and have approved the methodology adopted for the survey.

The Directorate of Economics and Statistics at present is covering 12 more important crops namely Wheat, Ragi, Maize, Barli, Kulthi, Til, Groundnut, Rape and Mustard, Jute, Potato and Sugarcane along with Paddy.

Thus, the two sources of data have put the researchers in a fix. While the sample survey technique adopted by the EARAS is acceptable to us because of its superiority over the other as far as methodology concerned. But it is worth noting the differences in both the sources.

Both sources agree on the area and production of paddy. But they differ on the estimate of area under HYV paddy. The coverage of the HYV wheat and maize also differs between the two sources, the DAFP is always on the inflated side, showing a higher figure (**Table A.1**).

Whereas both the sources agree on the area and production for rice and potato, they differ substantially as regards the rest of 11 items (**Table A.2 and A.3**). The data provided by Directorate of Agriculture and Food Production is always on the higher side. Similar is the case with the estimate of Net area sown, Gross area sown, Net area irrigated

APPENDIX A.1

Area Under HYV and Local Varieties of Paddy, Wheat and Maize Crops by Both Sources.

('000 Hec.)

Crops	Estimated by Sample surveys		Reported by DAFP Orissa	
	1979-80	1980-81	1979-80	1980-81
1	2	3	4	5
1.Paddy				
(a) HYV	179	234	942	1207
(i) Kharif	44	69	807	1042
(ii) Rabi	135	165	135	165
(b) Local	3937	3956	3175	2983
(i) Kharif	3930	3950	3168	2977
(ii) Rabi	7	6	7	6
2.WHEAT				
(a) HYV	7	8	50	67
(b) Local	3	3	1	-
3.MAIZE				
(a) HYV	6	14	40	54
(i) Kharif	6	13	35	48
(ii) Rabi	-	1	5	6
(b) Local	43	33	89	126
(i) Kharif	42	33	89	126
(ii) Rabi	1	-	-	-

Source: Technical Report on Sample Surveys Through Establishment of an Agency for Reporting Agricultural Statistics in Orissa, 1979-80, Directorate of Ecomomics and Statistics, Orissa.

Appendix A.2

Area Under Different Crops by Both the Sources.

('000 Hect.)

Sl No.	Crops	Sample Surveys Estimates		Prepared by DAFP Orissa	
		1979-80	1980-81	1979-80	1980-81
1	2	3	4	5	6
1	Paddy	4117	4191	4117	4191
2	Wheat	10	11	51	67
3	Ragi	103	122	267	336
4	Maize	49	47	129	181
5	Mung	218	243	648	690
6	Birli	144	164	382	410
7	Kulthi	183	191	363	343
8	Til	66	84	181	156
9	Mustard	22	25	145	162
10	Groundnut	46	42	175	172
11	Sugarcane	13	15	47	49
12	Jute	15	13	46	44
13	Patato	8	8	8	8

Source: Technical Report on Sample Surveys Through Establishment of an Agency for Reporting Agricultural Statistics in Orissa, 1979-80, Directorate of Ecomomics and Statistics, Orissa.

APPENDIX A.3

Production Estimate by Both the Sources.

('000 M.T.)

Sl No.	Crops	Sample Surveys estimates		Official estimates reported by DAFP	
		1979-80 15% Level	1980-81 15% Level	1979-80	1980-81
1	2	3	4	5	6
1	Paddy (with husk)	4421	6517	4421	6517
2	Wheat	8	10	82	122
3	Ragi	42	59	147	265
4	Maize	27	23	79	176
5	Mung	22	37	226	372
6	Birli	30	33	126	217
7	Kulthi	32	41	110	160
8	Til	7	11	48	74
9	Mustard	3	4	39	72
10	Groundnut	25	29	123	231
11	Jute	15	15	58	56
12	Patato	44	60	44	60
13	Sugarcane (in terms of Gur)	50	58	282	306

Source: Technical Report on Sample Surveys Through Establishment of an Agency for Reporting Agricultural Statistics in Orissa, 1979-80, Directorate of Ecomomics and Statistics, Orissa.

and Gross area irrigated.

Such distortions in information will affect studies in cropping pattern and other aspects of agricultural production. This is not to say that Directorate of Agriculture and Food Statistics is always on the wrong side; as it may happen that they might be differing in definition of HYV and area under irrigation. But as regards area and output estimate there is a felt need to settle the issue with existing experience and wisdom.

APPENDIX-II

Varieties of HYV Seeds Released From Reasearch Stations In Orissa.

Sl No	Year of Release	Name of Variety	Duration Days	Featues
1	2	3	4	5
1	1973	KALINGA-1	105	Upland, Kharif
2	1973	KALINGA-2	100	Upland, Kharif
3	1973	SEEMA	150	Low Land
4	1973	SHAKTI	137	Disesase Resistant
5	1973	SUPRIYA	125	Disesase Resistant
6	1974	RAJESWARI	135	Adoption to Rabi & Kharif
7	1974	KUMAR	125	Yield Stability
8	1976	PARIJAT	115	Medium & Upland
9	1976	SUPHALA	125	Disease Resistant
10	1979	IR 36; IR 2072	130	Tolerant to Salinity
11	1979	JAGATI	135	Mature 15 Days Early in Rabi
12	1980	KESHARI	95	Rainfed Upland
13	1980	RAMAKRISHNA	130	Tolerant to Water Logging
14	1980	SAMALEI	150	Disease Resistant
15	1980	SATTARI	70	Direct Seeding in Rainfed Uplands
16	1983	kALINGA-3	80	Direct Seeding in Uplands
17	1983	UTKAL PRABHA	155	Low Lands
18	1983	SARATH	70	Direct Seeding in Rainfed Uplands
19	1984	PRATAP	135	Disase Resistant
20	1984	DAYA	135	Medium Lands
21	1984	SHANKAR	125	Disase Resistant
22	1985	GAURI	150	Shallow and Semi Deep Water Areas
23	1985	SARESA	120	Flood Prone Medium Lands
24	1985	RAMBHA	120	Flood Prone Medium Lands
25	1985	UDAYA	135	Disease Resistant
26	1986	DR 92, SUBHADRA	90	Medium Lands
27	1987	ANANDA	110	Rainfed Upland Areas
28	1988	ANANGA	115	Pest Resistant
29	1988	BADAMI	115	Upland Conditions
30	1988	KALASHORE	160	Disease Resistant
31	1988	CR 104	160	Late Planting
32	1988	KALYANI-II	62	Drought Prone Areas
33	1988	KSHIRA	135	Pest and Disease Resistant
34	1988	LALAT	145	sLinity & Water Logging
35	1988	MOTI	145	Disease Resistant
36	1988	PADMINI	145	Disease Resistant
37	1988	PANIDHAN	180	Low Lands Subject to Floods
38	1988	SARABANI	115	Medium Lands
39	1988	TARA	100	Irrigated & Rainfed Areas
40	1988	TULASI	170	Stable Yield Under Low Lands
41	1988	HEERA	68	Drought Prone Area
42	1988	GAYATRI	160	Low Lands
43	1989	BHUBHANI	135	Pest Resistant
44	1992	CR 1002; ADITYA	145	Medium Lowlands (Raifed & Irigated)
45	1992	KANCLAN	160	Low Lands
46	1992	MAHALAXMI	155	Low Lands
47	1992	SHENA	70	Uplands With Uncertain Rainfall

Source: Miracle Rice Vatieties of India(1992), Central Rice Research Institute, Cuttack, India.

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