AGRICULTURAL INFRASTRUCTURE, INPUT USE AND PRODUCTIVITY: A SPATIO-TEMPORAL ANALYSIS OF ORISSA

Dissertation submitted to the Jawaharlal Nehru University in Partial fulfillment of the requirements for the Award of the Degree of

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CERTIFICATE

This is to certify that the Dissertation entitled **"Agricultural Infrastructure, Input Use and Productivity: A Spatio-Temporal Analysis of Orissa"** submitted by **Mr. Manoranjan Pattanayak** for the award of the degree of **Master of Philosophy** (M.Phil) of the Jawaharlal Nehru University is his original work, carried out under my supervision and guidance.

It is hereby certified that his work has not been presented for the award of any other degree or diploma to any other University in India or abroad. The Dissertation being presented is worthy of consideration for the award of M.Phil degree of the Jawaharlal Nehru University.

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Dedicated to
My Parents

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List of Abbreviations

C.V	Coefficient of Variation
CRS	Constant Returns to Scale
DM	Dummy
Ferha	Fertiliser Consumption per hectare
GCA	Gross Cropped Area
GSDP	Gross State Domestic Product
Ha.	Hectare
HYV	High Yield Varieties
Hyvha	Area under hyv per hectare
Irha	Irrigated Area per Hectare
Kgs/ha	Kilograms Per Hectare
m.t	Million Tonnes
N.C	No Crops
no.	Number
NSA	Net Sown Area
NSDP	Net State Domestic product
Per ha.	Per hectare
Rj	Rainfall in June
Ro	Rainfall in October
Rs	Rupees
w.r.t	With Respect to Time
Y	Yield

CHAPTER - 1

1.1 Introduction

The economy of Orissa is characterized by the dominance of Agricultural sector. Agriculture occupies a vital place in the economy of the state from various angles say-contribution to gross state domestic product (hence forth GSDP) to providing employment to the people. Nearly, 85% of its population live in rural Orissa and depend mostly on agriculture for their livelihood. Despite being endowed with vast natural and human resources and achieving substantial progress in many areas during the past fifty years of planned development, Orissa continues to be one of the less developed states with a very high incidence of poverty. Orissa is primarily an agrarian economy with substantial proportion of state domestic product coming from agriculture. A large chunk of work force is engaged in this sector. Thus, poverty, malnutrition, Starvation and low agricultural output goes together in Orissa.As agriculture is the main source of income generation, a bad crop year in State (or, in any district) poses a threat to the food security of poor people. The State is divided into ten agro-climatic regions. Naturally, the question arises how to achieve an increased level of productivity, given the agro-climatic conditions. For this the existing pattern of cropping, crop-yield, agricultural productivity, input use, infrastructural facilities available for agriculture and cropping intensity has to be analysed at the district level and policy recommendations should be made.

This study is an attempt to examine the determinants of Agricultural productivity in Orissa. In examining the issue, we have looked at the district level agricultural productivity and it's relation to district's factors of production like Gross cropped area, Area under HYV, Area irrigated, number of Agricultural labourers, Fertiliser consumption etc. As the districts are different with respect to agro-climatic conditions, in this study also we have studied their Cropping pattern and variability over the years. Accepting the fact that inter district diversity exists, agricultural inter district disparity is mainly of an institutional, socio-political and technological lag

problem. Therefore, an appraisal of inter district development of infrastructure facilities and input-use level has also been carried out in this study.

1.2 Objectives Of The Study

The broad objectives of this study are as follows:

1. To analyze the "*trends and nature of cropping pattern*" at the district Levels in the last one and half a decade i.e. from 1985-86 to 1999-2000.
2. To analyze the "*growth performance of agricultural output*" at the district level during the above-mentioned period.
3. To examine whether the "*degree of regional disparities in productivity levels*" has increased or decreased.
4. To see the relationship of *infrastructure facilities and productivity* levels in Orissa.
5. To analyses the "*association between levels of output with inputs*" at the district level and find out the important /crucial factor which helps in the output growth.

1.3 Methodology, Database and Scope of the Study:

(A) For different objectives different statistical tools have been used. To find out the a) Percentage of gross cropped area under different crops and b) yield level of each crop we have adopted the standard formula as follows:

*a) (Area under crop i/ Gross cropped area of the district)*100*

b) Total output of crop i/Total area under the crop

To find out the percentage contribution of each crop to total output of the district, we have expressed the value of each crop in 1998-99 constant prices. Then value of a particular crop has been divided by total value of the agricultural output of the district. For the temporal assessment of growth of area, yield and output we have used semi log linear trend growth rate. To find out the crop diversification index we have used Herphindal index and Theil entropy index which is explained in detail in the

concerned chapter. To find out the crop concentration index we have used the standard location quotient formula, which is as follows:

=(Area of i th crop in the component areal unit/Area of all crops in the component areal unit) / (Area of i th crop in the entire region/ (Area of all crops in the entire region).

To find out the cropping intensity we have used the following method:

=*Gross cropped area of the district / Net sown area*

To find out the productivity index we have used the *Sapre&Deshpande index*, which is explained in detail in the concerned chapter. To find out the input use index we have used the range equalization method, which is explained in the chapter.

The relative variability of productivity index in different districts has been measured with the help of coefficient of variation, Theil index and Ginni coefficient.

(B) ***Database***

The study is based on secondary source of data. The major sources of the data for this study is *"Orissa Agricultural Statistics"* various issues published by Directorate of Agriculture and Food production, Orissa, Bhubaneswar. The labour data has been taken from *"Orissa statistical Abstract"* which reproduced the census of India report. The price of the crops has been taken from *"Quarterly bulletin on Price statistics"* published by Directorate of Economics and Statistics, Orissa, Bhubaneswar. Besides that, at places help has been taken from *"Orissa state development report 2001"* published by Nabakrushna Choudhury center for development studies, Bhubaneswar, Orissa sponsored by Planning commission.

(C) ***Scope of the Study***

The study covered the period from 1985-86 to 1999-2000 for which the latest data are available. We have taken into consideration the 13 old undivided districts as the unit of study because the year of study starts from 1985-86 at which point of time the no. of districts in Orissa were 13. The 13 districts are Balasore, Bolangir, Cuttack, Dhenkanal, Ganjam, Kalahandi, Keonjhar, Koraput, Mayurbhanj, Phulbani, Puri, Sambalpur and Sundargarh. The coastal districts, which are referred, in this study are

Cuttack, Balasore, Ganjam and Puri. We have made the 15 years into 3 periods- 1985-90, 1990-95,1995-00. Through out the study we have used the phrase 1st (or First) period, 1st(or First) phase, Initial period, Pre reform period for 1985-90 interchangeably. The phrase second period and second phase has been used for 1990-95 interchangeably. The phrase last period, Final phase has been used for 1995-00 interchangeably throughout the study.

1.4 Agriculture and Economic development

In any less developed region (henceforth LDR), agriculture is the prime sector of economic activity. It provides not only food and raw materials but also employment to a very bulky proportion of the population. We can cite the significance of agriculture in various ways:

1). The problem of poverty and hunger is particularly acute in regions which have high density of population, where land-man ratio is low and opportunities for gainful employment are extremely poor. Agricultural development is essential, if poverty and hunger are to be removed. There cannot be lasting peace or stability unless the curse of poverty and inequality is eliminated. However, it can be eliminated through rapid progress in agriculture. 2). The absorption of the additional labour force in urban areas is not a optimistic proposition in LDRs. It is not expected from the present rate of industrialization and existing pattern of structural transformation that it will absorb the additional labour force of the rural population. Hence, under these circumstances the rural economy (i.e., agricultural economy) will have to support the vast population. 3). Scantiness of food and undernourishment can seriously impair productive effort and restrain development. Thus, the liability of providing adequate food grains production and production of protective food in future lies upon the agriculture sector. 4). In future employment programmes in rural areas for building up infrastructures and off farm facilities to soak up the growing labour force would be undertaken .It will thus be necessary to generate a large surplus of wage goods for their sustained supply to the working population at reasonable and stable prices so that there is sufficient economic stability for planned development. 5). Purchase of food grains is a saddle to the state exchequer so the self-sufficiency in both food grains and important cash crops would

eliminate the burden. In addition, the resources so released can be utilized for the purchase of capital goods and raw materials to accelerate the growth of other sectors of the states economy. It would also notably reduce the qualms generally associated to procurement of supply from other states. 6). The agriculture sector has to meet up the escalating demand of raw material. Since, important industries like cotton and jute, textiles, leather and leather products, diary products, vegetable oils, tea, coffee, paper and other wood based products depend for their raw material supply on the production performance in the agriculture sector. 7). It has been observed that the low level of rural incomes and the low standard of living of the rural population is the result of grave underemployment as well as open unemployment in the rural areas. Hence, development of agricultural sector with use of modern technology can bring optimism for progress.

1.5 Interrelationship between Agricultural and Industrial Development

As stated by H. Nicholas agricultural progress is in general a precondition for industrial development.[1] Raising agriculture productivity support and sustain industrial development in numerous significant ways. First, it permits agriculture to discharge part of its labour force intended for industrial employment while meeting the increasing food needs of the non-agriculture sector. Second, it raises agriculture income thereby creating the rural purchasing power needed to buy the new industrial goods and rural savings that may then be mobilized to finance industrial development. Lastly, it enables the agriculture to supply the major wage good (food) of industrial workers at prices favorable to the profitability of new industries.[2]

Industrialisation has many good effects on agriculture productivity growth (a) Industrialisation increase the demand for wage goods of which food is important. This stimulates the production of cash crops, agricultural processing industries and the integration of rural and urban economy. (b) Industrialisation offers a wide range of

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[1] W. H. Nicholas, "The Place of Agriculture in Economic Development", in C. Eicher and Lawrence Witt, (ed.) *Agriculture in Economic Development*, (Bombay: Vora & Co., 1964) pp. 12-13.
[2] W.Arthur Lewis, *Theory of Economic Growth*, (London: Geo. Allen & Unwin, 1955), p. 334.

consumption goods, which increase the greater productive effort, and new and better agricultural production goods. (c) By creating more productive non-agricultural employment opportunities, industrialisation diverts the redundant labour force from agriculture to the benefit of those who remain in agriculture.

Nichollas, W.H (1960) pointed out from the western economy history that agricultural surplus is a pre condition for industrial development. Given initially favourable agricultural condition, too long a neglect of policies promoting increase agricultural productivity may have serious consequence on the rate of general economic progress. The third lesson which Nicholas has pointed out that "too rapid a restructuring of small scale peasant agriculture into large scale, mechanized farming units is likely to create a surplus labour force not easily absorbed into non agricultural employment, a pathological rate of urbanization, the reappearance of feudal agriculture in new forms and conscious policies of mass murder or starvation of the people squeezed out of agriculture".[3] Nicholas (1960) remarked that India has not yet fulfilled the most fundamental precondition for its economic development – the achievement and maintenance of an adequate and reliable food surplus. Hence, its then emphasis on industrialisation is unquestionably premature.[4]

1.6 Review of Literature:

Prof. K. Bharadwaj had studied the production condition of the Indian agriculture from 1954 to 1957. It is carried out in two selected districts in each of the six states (Bombay, Madhya Pradesh, Punjab, West Bengal, Madras and Utter Pradesh). The study emphasizes on the technological input output relation. He has dealt with eight issues in the paper such as (I) Land use and productivity (ii) Intensity of cropping and size of holding (iii) Fragments per acre and the size of holding (iv) Earners per acre and size of holding (v) Allocation of labour and size of holding (vi) Bullock labour days per acre and size of holding (vii) Substitution between bullock and human labour (Viii) Area irrigated and size of holding.

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[3] Nicholas, no. 1, pp.12-13.
[4] Ibid. 39.

He had found that there is generally inverse relationship between yield per acre and average size of holding in all three years for Punjab and not significant for either year for Madhya Pradesh and in other regions, while the relation is statically significant for one year it is not so for another. In general the intensity of cropping is inversely related to the size of holding but while in Madras and Uttar Pradesh, it is statistically significant, it is not so for Punjab and Bombay. It is also found that the number of fragments per acre invariably decreases with an increase in the size of holding. The study shows that there is an inverse relationship between earners per acre and average size of holding. Moreover, he has argued that small farms tend to use relatively greater amount of labour force per acre. In addition, the study found that there is a positive relationship between average size of holding and percentage of labourdays spent on crop production. The result show that in the case of total crop production, in most cases an inverse relation exist between bullock lobourdays per acre and size of holding. Irrigation can raise the productivity of land in three ways (a) By making possible multiple cropping, by increasing the yield per unit cost and by making possible the production of more lucrative crops. The result shows that there is an inverse relation between percentage area irrigated and average size of holding.[5]

Bhalla and Singh have studied development of Indian agriculture from 1962 to 1993. He has taken into account 17 major states, 288 districts and 44crops. He has studied role of modern inputs on agriculture. Cobb-Douglas production function has been used to examine the contribution of modern inputs. The functional form is as follows:

$$\log(output) = \beta_0 + \beta_1 \log(area) + \beta_2 \log(labour) + \beta_3 \log(fert) + \beta_4 \log(tract) + \beta_5 \log(tubewells) + \beta_6 \log(irrigation) + \beta_7 \log(roads) + \beta_8 \log(markets) + \beta_9 \log(rainJune) + \beta_{10} \log(rainOctober) + U$$

The result shows that all the variables show expected behaviour and the production elasticity of modern inputs increases over time at the cost of elasticity of labour. Taking the partial derivative w.r.t. time they have obtained decomposition of growth by factor inputs. The result shows that increasing use of modern inputs was the

[5] K.Bharadwaj, *Production Conditions in Indian Agriculture*, (Delhi: K.P.Bagchi & Co, 1991)

major contributor to growth in production during both the 1980s and 1990s. The contribution of labour and area to the growth of output was lower. The second important result is that the contribution of most of the factors has declined over time.[6]

Bhalla and Singh have examined the relation between labour productivity and modern inputs. By assuming CRS the result, shows that the availability of cultivated area per worker is the single most important factor explaining inter district differences in labour productivity in Indian agriculture.[7]

Prof. Dharm Narain has studied agricultural productivity and its components for the period of 1952-53 to 1972-73. Productivity has been defined in his study as the gross value of agricultural output in constant prices per ha. Of gross cropped area. The index of productivity is of the form $\frac{\sum_i c_{it} y_{it} p_{it}}{\sum_i c_{io} y_{io} p_{io}}$

Where C_{it} and C_{io} shows area under *ith* crop as proportion of total cropped area in the current period and base period respectively. $y_{it} = \frac{o_{it}}{a_{it}}$

And $y_{io} = \frac{o_{io}}{a_{io}}$ where o_{it} =All India production of the *ith* crop in the *tth* yr a_{it} =All India area under *ith* crop in the *tth* yr and o is for base year.He has decomposed the productivity in three parts (1) *cropping pattern changes*, (2) *locational shifts* of area under individual crops, (3*) pure increases* in the yield of individual crop in different states.

In the study he has taken the period 1952-53 to 1972-73 and split it into 2 parts: (1) 1952-53 to 1960-61, (2) 1961-62 to 1972-73. The result shows that almost 70% of the increase in productivity in the first period was produced by changes in the cropping pattern and the locational shifts of areas under individual crops and only about 30% by the pure increase in per ha. Yields. In the second period, the picture

[6] G.S. Bhalla & G.Singh, *Indian agriculture: Four Decades of Development*, (New Delhi: Sage Publications, 2001)
[7] Ibid.

under went a reversal where 60% increase in productivity was due to pure increases in yields and 40% is due to locational shifts.[8]

Recently in a study by Siju and Kombiraju have decomposed the productivity of rice in three parts: (1) yield effect (2) area effect (3) interaction effect. They have found that during the pre-green revolution period (1949-65) area effect was positive and very high and interaction was negative. During the post green revolution period (1966-88) area effect became negative, yield effect was positive and interaction was negative. When they took into account, the entire period (1949-98) all the 3 effects were found to be positive and yield and interaction effects contributing more towards total production.[9]

Kaur and Sethi (1995) studied the nature and degree of inter district variation of crop yields in the state of Punjab during 1966-67 to 1988-89. They have measured crop yield index by the following method:

$a_{id} = \frac{y_{id}}{y_{is}} * 100$ b)Compositeproductivityindex $= \sum_{i=1}^{n} \frac{y_{id}}{y_{is}} * \frac{a_{id}}{\sum a_{is}} * 100$

Where y_{id}=average yield of ith crop in *dth* district and *aid* =Area under *ith crop* under *dth* district.They have found a high degree of variation in yields among major different districts and inter district variation has declined over this period.[10]

Thakur et.al. have found out the resource use efficiency in agriculture taking 300 farm households of Himachal Pradesh as sample. C-D production function has been used. Resource use efficiency has been calculated by: MVP/FC where $MVP = Mpp_i \cdot P_y$_____(1) and FC (i.e. factor cost)=P_{xi}.

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[8] Dharm Narain, "Growth of Productivity in Indian Agriculture", in K.N.Raj, Amartya Sen & C.H.Hanumanta Rao (ed.), *Studies on Indian Agriculture*, (Delhi: OUP, 1988)

[9] T. Siju & S.Kombairaju, "Rice Production in Tamil Nadu: A Trend and Decomposition Analysis",*Agricultural Situation in India*,(Delhi), July, 2001.

[10] P Kaur & K.Sethi, "Inter District Variation in Agricultural Productivity in Punjab", *Indian Journal Of Regional Sciences*, Vol.27, 1995.

Resource use efficiency is attained when added returns resulting from the given use of inputs is higher than to the added costs. Where the ratio of eqn.1 is high, that is called critical resource and use of that is advised to increase.[11]

Borbora and Mahantu (2001) have studied the district wise agricultural production w.r.t. Area, fertilizer use and rainfall as determining factors in the state of Assam. The period of study is from 1990-99. They have found that in most of the districts fertilizer plays important role than rainfall and irrigation.

Dutta et.al have tried to find out inter district backwardness in the agricultural sector in Assam with the help of principal component analysis and identified the factors behind such backwardness with the help of production function analysis. The study shows that rural literacy rate plays the significant role in the agricultural production. Contribution of fertilizer seems to be much better in relation to irrigation.[12]

Chand and Joshi (1996) have made an attempt to measure the agricultural productivity of a higher Himalayan village in order to understand the productivity constraints and their relative role. The analysis shows that manure consumption has shown maximum variation in agricultural productivity. The total variance explained by manure consumption coupled with other variables is 81.7%.[13]

Bhatia (1999) has build a composite index of rural infrastructure (state wise) and examine the relationship between infrastructure development and growth in agriculture. He has constructed the index by assigning arbitrary weights to different sub items of infrastructure. The study shows that Punjab has the highest index followed by Kerala, Tamilnadu, Haryana, which have second and third highest index of infrastructure. Punjab, which has the highest infrastructure, also has the highest yield of food grains and value of agricultural production per ha. Also the estimated

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[11] D.C Thakur, J.P.Bhatia & K.D.Sharma, "Resource Use Efficiency in Crop Production in Different Agro Climatic Zones of Himachal Pradesh", *Indian Journal of Regional Sciences*, Vol.33, no., 2001.
[12] P.C.Dutta, B.Choudhary &N.Roy, "Identification of Backward District for the Regional Agricultural Development – A Case Study of Assam", *Indian Journal Of Regional Science* , Vol.,2001.
[13] R. Chand & K. C. Joshi, "Agricultural Productivity in the Higher Himalaya- A Case Study", *Indian Journal Of Regional Science*, Vol.28, no., 1996.

functional relationship revealed that index of infrastructure is significantly influencing the per ha. Yield of food grains and value of outputs.[14]

Bhalla and Singh have studied the Indian agriculture taking state as the unit of study. They have studied the regional patterns of growth of agricultural output in India since mid 1960s in general and during 1980-83 to 1992-95 in particular. The main components of output growth i.e. yield increases, area increases and cropping pattern changes has been studied across the districts. An attempt is also made to study the contribution to agricultural growth in various regions made by these components. In addition, they have analysed over time the relationship between the growth of male agricultural workers and the growth of output in one hand and the behaviour of male agricultural labour productivity on the other.[15]

In a recent Article, Das and Barua examined the pattern of regional inequalities in India during 1970-92.Their result shows that the highest contribution to the overall inequality among regions is from agriculture. In addition, the Indian experience is characterized by multiple turning points in the u-type relationship. By using their index they have measured the inequality level in the 23 regions. They have found that the annual average rate of growth inequality is highest in agriculture (4.26) followed by NSDP (3.55%).[16]

Now lets focus on another study by Pattanayak and Chattopadhaya. They seek to measure spatial variations in levels of deveiopment of orissa at two time points, 1961 and1971. They have defined area as less developed if per capita value of production of goods and services is less than national average. A vector of 29 Indicators varying over the district of orissa has been taken to represent the levels of development of different activities. They have categorized region as advanced region, less developed region and problematic region. Based on principal component analysis (PCA) .The advanced regions are Sambalpur, Sundargarh, Cuttack Dhenkanal,

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[14] M.S Bhatia, "Rural Infrastructure and Growth in Agriculture", *Economic and Political Weekly*, March 27, 1999, A43-A48.

[15] G.S Bhalla & G.Singh, "Recent Developments in Indian Agriculture: A State Level Analysis", *Economic and Political Weekly*, March 29, 1997.

[16] S.K Das & A.Barua, "Regional Inequalities, Economic Growth and Liberalisation: A Study of the Indian Economy", *Journal of Development Studies*, Vol.32, no.3, 1996,pp 364-90.

Ganjam and Puri, Less Developed regions are Keonjhar, Mayurbhanj, Balasore and Problematic region are Phulbani, Bolangir, and Kalahandi and Koraput.In the advanced region the infrastructure for development is more developed than other region. A no. Of industrial nuclei- have emerged in these districts. Yet socio economic obstacles to technological transformation of resources for economic well-being persist. In the less developed region and problematic region the socio, economic backwardness along with poor infrastructure hinders the pace of development. The author has concluded that emphasis should be given to agricultural infrastructure like irrigation, rural roads, power etc. Simultaneously emphasis must also be given to public health facilities and education.

In another study Kaur and Ghuman sought to analyze inter district disparities in the level of economic development and identified the relative contribution of sectors in the level of economic development. In this study the, level of economic development is measured through average percapita income only. The study has found that the inter district disparities in Punjab have neither widened nor narrowed during the period 1980-81 to1988-89as is confirmed by the erratic behavior of C.V whose value is oscillated between 10.70 to 9.53.The Author concluded that though inter district variation is less, the smaller amount of variation could be met by inter-sectoral substitution of resources.[17]

In another study Banerjee highlights the disparities in agricultural growth rate of UP .The study identified the relative levels of development with the help of sectoral analysis of each block of the 5 districts and highlighted inter district imbalances in terms of an aggregate level of development. In the result of the study, it is found that diversity in sectoral development is the factor responsible for disparity in total development.[18]

Pokhriya And Pankaj Naithani has given a methodological approach to inter district analysis. They have chosen the significant variables rejecting the less significant variable in a multiple regression analysis. By using the weighted standard

[17] D Kaur, & B.S.Ghuman, "Inter District Disparities in Punjab: Implication for Planning", *Indian Journal Of Regional Science* Vol.27, no.&2, 1995.

[18] S Banerjee, "Determination of Agricultural Development: An Inter District Analysis", *Indian Journal Of Regional Science*, Vol.28, no., 1996.

score they have ranked the district as developed to less developed.[19] And Abdul Shabam and C.M.Bhole have measured the inter stare differentials in rural development in India by using P.C.A., cluster analysis and other statistical methods. The study found that inter state disparities in rural development is very high. They have found that at the aggregate level of development Punjab is the most developed state followed by Harayana, Kerala and Karnataka while the least developed states is Bihar, Orissa, Uttar Pradesh and Assam.[20]

[19] H.C. Pokhriyal and P.Naithani, "Identification of Levels of Agricultural Development: A Methodological Analysis", *Journal of Rural Development*, Vol.5, 1996, pp 3-30.
[20] Abdul Shaban and L. M. Bhole, "Regional Disparities in Rural Development in India", *Journal of Rural Development*, Vol.19, no. 1, 2000, pp.103-17

CHAPTER-2

THE ROLE OF AGRICULTURE IN THE ECONOMY OF ORISSA

2.1 The Economy Of Orissa: An Overview

Orissa extends from $17^0$49' N to $22^0$34' N latitude and from $81^0$29' E to $87^0$29' E longitude on the Eastern coast of India. It has an area of about 1,55,707 sq km. Orissa comprising 4.74% of India's land mass accounts for 3.57% of the population of the country[1]. It is surrounded by West Bengal in the North East, Jharkhand in the North, Chattisgarh in the West, Andhra Pradesh in the South and Bay of Bengal in the East.

Presently Orissa has 30 districts, 58 sub-divisions, 314 blocks, 147 tehsils, 50,887 villages, 103 towns and cities. Before 1992, the numbers of districts in Orissa were 13. Since independence, there has been a persistence demand for the reorganization of districts. Therefore, in 3 phases it was made all total 30 districts.

2.2 Agricultural Physiography :Orissa

Physiographically Orissa can be divided into 3 broad regions. These are the (a) Coastal Plains, (B) The Middle Mountainous Regions, (C) The Plateau And Rolling Up Lands.[2]

a) Coastal Plain- The coastal plains of Orissa extend on the Eastern coast of India from the Subarnarekha in the North East to the Rushikulya in the South West. This fertile green tract is known as the *rice bowl* of Orissa. The coastal plain is a gift of six major rivers, which have brought silt from their catchments basins. From North to South the Subarnarekha, the Burhabalanga, the Baitarani, the Brahmani, the Mahanadi, and the Rushikulya are the rivers, which are responsible for its birth and growth. According to locations the coastal plains can be divided in to the following sub regions:

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[1] Census of India report2001, Govt. of India.
[2] B.N Sinha, *Geography of Orissa*, (Delhi: National Book Trust, 1999)

i) The North coastal plains—the deltas of Subarnarekha and Burhabalanga up to the river Baitarani ii)The middle coastal plains—the combined deltas of Baitarani, Brahmani and Mahanadi. iii)The Southern coastal plains—the Rushikulya plains.

b) Middle Mountainous Region- The mountainous portions of Orissa cover about ¾th of the entire state as per the present configuration and hence determine the economic standard of the state. The middle mountainous region can be divided into the following regions:

i) The Similipal and Meghasani mountain ii)The Mankaranacha-Malayagiri and Gandhamardana mountains of the Baitarani and Brahmani interfluves.iii)The watershed between the Brahmani and the Mahanadi v)The common interfluves of the Mahanadi, the Rushikulya and the Vamsadhara.v)The Potangi and Chandragiri mountain ranges.

c) Platues And Rolling Up Lands- The high plateaus are found in the mountain range with an average elevation of 300 to 600 meters. They are almost flat and at places are interrupted by deep river valleys. The platues are morphologically divided into the following divisions:

i) The Panposh-Kendujhar- Pala Lahara plateau of the upper Baitarani catchment basin.ii)The Nabarangapur-Jaypur plateau of the upper Sabari basin.

The rolling up lands are lower in elevation and they vary between 150 and 300 meters. These up lands are the products of river action and flat in nature. They are rich in soil nutrients and afford good opportunities for cultivation of paddy in wet areas.

2.3 Climate:

Of all the elements of climate, precipitation, temperature, wind, cloud amount and humidity are important. Amongst all these precipitation dominates. It's annual average rainfall is about 200 cm. The variability of rainfall is below 15% in the North and North Eastern part of the state. In the southern and South Western and Western parts, the variability of rainfall increases to 15-20 %. Mainly rainfall takes place in Orissa due to South West monsoon. An analysis of the rainfall during the Southwest monsoon reveals that the monsoon rainfall in % of total annual receipts is the highest in Eastern Orissa where it exceeds 80% and the Eastern ghats act like a

divide between the coastal plain and the inland rolling up lands. This leads to the conclusion that cultivation during the rest of the year (excepting the SW monsoon) is a difficult proposition in the West of the Eastern ghat because of the lack of the rain. Hence, supply of irrigation water is of urgent necessity to facilitate double cropping.[3]

Agro Climatic Zones: Orissa has been divided into 10 agro climatic zones.[4] They are as per the table:

Table No: 2.1

Agro-Climatic Zones Of Orissa

Sl No	Region	Districts	Rainfall (cms)	Temperature		Major crops cultivated
				Max	Min	
1.	North Western Plateau	Sundergarh, Kuchinda sub-ivision andSambalpur	160	38	15	Rice
2.	North Central Plateau	Kendujhar and Mayurbhanj	145	--	--	Rice, Maize, Jowar
3.	North Eastern Coastal Plain	Baleshwar, parts of Cuttack and Kendujhar	139.6	35.5	20.8	Rice, Wheat
4.	East and South Eastern Coastal Plain	Cuttack, parts of Puri and Ganjam	166.2	--	--	Rice, Pulses
5.	North Eastern Ghats	Phulbani, Aska, Paralakhemundi and Rayagada blocks of Ganjam	159.7	37	10.4	Rice, Pulses and Oil seeds
6.	Eastern Ghats High Land	Koraput, Dabugaon block	152.2	34.1	7.5	Rice, Wheat and Vegetables
7.	S. Eastern Ghats	Jeypore and Malkangiri sub-divisions of Koraput	220	34.1	13.2	Rice
8.	Western Undulating Terrain	Kalahandi and Dabugaon block of Koraput	90-161.7	45	12	Rice, Wheat and Groundnut
9.	West Central Plateau	Sambalpur, Balangir	119.2	40	12.4	Rice, Pulses and Oilseeds
10.	Middle Central Plateau	Dhenkanal	113-140	--	--	Rice, Groundnuts and Vegetables

Source: Hydrological Atlas of Orissa, Central Ground Water Board,GOI

[3] Ibid.

[4] *Hydrological Atlas of Orissa,* Central Groundwater Board, Ministry of Water Resources, S.E.Region, Bhubaneswar, G.O.I, 1995,pp. 12-13.

2.4 Agriculture in Orissa:

Agriculture continues to be the mainstay of the state's economy with contribution about 28.54% to (Net State Domestic Product) NSDP during 2000-2001. The agriculture alone provides direct and indirect employment to around 73% of the total workforce of the state as per 1991 census.[5] Agriculture in Orissa continues to be characterized by low productivity due to traditional agricultural practices, inadequate capital formation and low investment, inadequate irrigation facility and uneconomic size of holdings. Nearly 62% of the cultivable land is rain-fed and exposed to the vagaries of the monsoon. The per capita availability of cultivated land, which was 0.39 ha. in 1950-51 has declined to 0.14 ha. in 2000-01. Out of the total number of operational holdings of 39.66 lakhs, small and marginal farmers as per agricultural census 1995-96 hold 81.98%. Most of the small and marginal farmers do not have the means to make adequate investment in agriculture due to poverty. Though the contribution of agriculture to NSDP has significantly declined from 67% in 1951 to around 30% in 1998, the percentage of work force engaged in agriculture has remained somewhat unchanged with 73.8% in 1960 and73% in 1990.[6] This implies that there has been an overcrowding in agriculture without any perceptible increase in production. As the pace of industrialization in the state is slow and has not taken off, agriculture continues to provide sources of livelihood to a significant segment of population. Therefore, agricultural growth holds the key to the overall development of a state by way of creating employment, generating income, providing raw materials to the industrial sector and last but not the least ensuring self-reliance in food production and food security to the deprived sections.

2.5 Inter-State Comparison of Agricultural Productivity:

A state and region-wise analysis of levels of yield and compound growth rate as contained in Table 2.2 reveals that the average value of crop yield is the highest in Southern

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[5] *Economic survey of Orissa*, 2001-02, Govt. of Orissa,

[6] *Orissa State Development Report 2001*, (Bhubaneswar: Nabakrushna Choudhury Center for Development Studies)

region of India followed by North-western region, Eastern region and Central region. For the triennium ending 1992-95 the average value of yield is the highest for Kerala and then in descending order are Tamil Nadu, Punjab and Haryana. For Orissa the average value of yield was only Rs.5979 per hectare whereas it was Rs.15626 for Kerala, Rs.14073 for Tamil Nadu, Rs.13597 for Punjab and Rs.7388 for all India.

Table-2.2

State and Region wise Levels and Growth of Crop yield

Sl No.	States/Region	Average value of yield (Rs/ha.)				Percent annual compound growth rate			
		1962-65	1970-73	1980-83	1992-95	70-73 over 62-65	80-83 over70-73	92-95 over 80-83	92-95 over 62-65
1	Orissa	4114.37	4072.7	4374.84	5979.16	-0.13	0.72	2.64	1.25
2	Assam	5727.97	6241.2	6906.69	8196.82	1.08		1.44	1.2
3	Bihar	3679.55	4009.73	4048.56	5678.06	1.08	0.1	2.86	1.46
4	West Bengal	5074.57	5614.56	5943.81	9958.45	1.27	0.57	4.39	2.27
I	Eastern region	4338.3	4671.31	4944	7318.5	0.93	0.57	3.32	1.76
5	Haryana	3927.21	5090.01	6229.13	10128.73	3.3	2.04	4.13	3.21
6	Himachal Pradesh	3048.15	3733.76	3917.69	5195.63	2.57	0.48	2.38	1.79
7	J&K	2986.95	4481.4	5758.75	5567.01	5.2	2.54	-0.28	2.1
8	Punjab	5395.62	7476.29	9707.65	13579.22	4.16	2.65	2.85	3.13
9	Utterpradesh	3970.1	4589.98	5805.13	8656.2	1.83	2.38	3.39	2.63
II	North Western region	4092.75	5024.54	6422.63	9582.5	2.6	2.49	3.39	2.88
10	Gujurat	3673.01	4326.57	5693.43	7460.09	2.07	2.78	2.28	2.39
11	M.P	2603.49	2835.86	3069.65	4773.12	1.07	0.8	3.75	2.04
12	Maharashtra	2989.61	2343.57	3794.68	5176.94	-2.62	4.94	2.62	1.95
13	Rajasthan	1740.45	2217.1	2334.77	3715.22	3.07	0.52	3.95	2.56
III	Central region	2653.78	2763.12	3464.09	4943.84	0.51	2.29	3.01	2.1
14	A.P	4064.96	4363.05	6276.63	9390.64	0.89	3.7	3.41	2.83
15	Karnataka	3207.56	4267.23	4989.92	6969.7	3.63	1.58	2.82	2.62
16	Kerala	11357.65	12957.5	12333.8	15625.96	1.64	-0.49	1.99	1.06
17	Tamilnadu	6689.49	7899.75	8756.47	14073.94	2.1	1.03	4.03	2.51
IV	Southern Region	4873.34	5872.68	6848.2	9990.63	2.36	1.55	3.2	2.42
	All-India	3738.19	4256.79	5090.42	7388.05	1.64	1.8	3.15	2.3
	C.V (%)	56.86	58.19	48.12	46.3	91.34	85.2	39.05	29.26

Source: Calculated from Govt. of India ,Area ,yield and production of Principal Crops In India(Various Issues),Ministry of agriculture ,New Delhi;Bhalla,G.S(ed.)Indian agriculture:Four decades of Development,New Delhi:Sage publication(2001)

As regards annual compound growth rate of yield over the period 1962-1992, it is computed to be the highest for North-Western region followed by Southern region, Central region and Eastern region. A state-wise comparison indicates that the per-cent annual growth rate is the highest for Haryana (3.2) followed by Punjab (3.1) and Andhra Pradesh (2.8). In Orissa the compound annual percentage growth rate is only 1.3, whereas for all-India it is 2.3.

Now coming to the physical crop productivity, it is observed that in the year 1998-99 the yield rate of food-grains in Orissa was only 1080Kg/ha, whereas for all-India it was quite higher i.e. 1620Kg/ha. Also, in the neighbouring state of West Bengal and Andhra Pradesh having similar agro-climatic conditions, the yield was substantially higher i.e. 2200Kg/ha and 2000Kg/ha respectively. The yield rate was highest for Punjab (3740Kg/ha) followed by Haryana (2700Kg/ha), Tamil Nadu (2280Kg/ha) and West Bengal (2200Kg/ha).[7] If we consider the yield rate of rice, which is the staple cereal crop of Orissa, the picture is also not encouraging. The average per hectare yield rate of rice in Orissa is only 1210Kg, whereas the all-India average is 1930Kg.[8]

2.6 Agrarian Structure:

Though several factors are attributed for lower agricultural productivity in Orissa, many consider skewed distribution of agricultural land, small size of operational holding, high incidence of share tenancy and rural poverty are major impediments to agricultural growth. An analysis in trends in the number of operational holdings and area operated reveals that the number of operational holdings in Orissa has increased substantially from about 30 lakh in 1961 to 42 lakh in 1991 (Table 2.3).

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[7] *Agriculture*, CMIE, November-2000.

[8] *Orissa State Development Report 2001*,(Bhubaneswar: Nabakrushna Choudhury Center for Development Studies)

Table-2.3

Characteristics Of Operational And Tenant Holdings In Rural Orissa (1961-62 To 1991-92)

Characteristics	1961-62 (17th)	1971-72 (26th)	1981-82 (37th)	1991-92 (48th)
No. Of operational holding (lakh)	29.66	30.31	29.15	42.3
Area operated (lakh ha.)	42.72	41.9	42.4	47.59
Average area operated (ha.)	1.44	1.38	1.45	1.13
No. Of tenant holding (lakh)	-	-	5.06	6.92
% Of tenant holdings to total operational holdings	-	32.34	17.35	16.37
Total operated area leased in	-	-	4.21	4.51
% Of leased in area to total operated area	-	13.46	9.92	9.48
Area leased in per tenant holding (ha.)	-	-	0.83	0.65

Source: Report of NSS in various round.

During the same period the total operational area has increased from 43 lakh ha to only 48 lakh. Thus within a span of thirty years there has been 42.6% increase in number of operational holdings which far exceeds the 11.4% increase in operated area. As a result the average area operated per household has decreased from 1.44ha in 1961 to 1.13ha in 1991 showing 21.5% decline.

The size-wise distribution of operational holdings and area operated (Table 2.4) shows that in the year 1991-92, more than 80% of farm operators belonged to marginal and small farmer categories cultivating less than 2 hectares of land.

Table no-2.4

Distribution of operational holdings and area operated by size class of land holdings in rural orissa

Size Of Class Of Operational Holding (Ha.)	*% Of Operational Holdings*				*% Of Operated Area*			
	1961-62	*1971-72*	*1981-82*	*1991-92*	*1961-62*	*1971-72*	*1981-82*	*1991-92*
Less than 1.01	39.42	54.52	54.45	59.99	6.97	18.6	17.02	22.09
1.01-2.00	22.92	25.78	26.11	24.34	12.51	27.32	26.48	30.16
2.01-4.00	19.65	13.9	14.08	12.02	20.73	27.06	26.16	27.87
4.01-10.00	13.66	5.25	4.63	3.36	31.04	21.56	17.84	16.2
Above 10.00	4.35	0.55	0.73	0.29	28.75	5.46	12.5	3.68
All sizes	100	100	100	100	100	100	100	100

Source: NSS report on various rounds.

Though they constituted 84%of operational holdings, operated only 52% of total operational area. On the other hand, the large farmers (operating land area more than 4 hectares) constituting only 4% of total holdings cultivated a substantial i.e. 20% of operated areas. Thus in Orissa there is a skewed distribution of land area with its concentration in a few hands of big farmers. However, percentage of area operated by large farmers shows a declining trend during the period 1961 to 1991. Moreover, the holdings are fragmented and scattered. Consolidation of holdings has been completed only in some major irrigation commands.

An inter-state comparison of size of operational holding shows that during 1990-91 it was only 1.34 ha for Orissa where as it was quite large for agriculturally advanced states like Punjab (3.61ha.) and Haryana (2.43ha.).[9] It is not only the size of land holding is small in Orissa but also most of the farmers are ultra poor and nearly resource less. The percentage of rural population below poverty line in Orissa is extremely high (49.7%). Due to the poor resource base the farmers in Orissa are not in a position to invest in costly inputs like chemical fertilizer, Hyv seeds, mechanized farm implements, pump sets etc. Given the low resource base, in

[9] NSS report, 48th round, 1991-92.

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the absence of proper storage, transport and marketing facilities, there is a great risk of post harvest losses of production and income.

As regards incidence of tenancy in Orissa, it belongs to the category of high tenancy states in India. In 1991 the percentage of area leased in to area operated in Orissa was 9.5%, which was greater than all India average of 8.3% .In Orissa, in 1991-92 there were numerically 6.9 lakh tenants holding. They constituted 16.4% of operational holdings. They leased in 4.5 lakh hectares of land, which was 9.5% of total operational area. Average area leased in per tenant holding was only 0.65 ha. But incidence of tenancy revels a declining trend .The proportion of operated leased in has decreased from 13.5% in 1970-71 to 9.5% in 1991-92.

The major manifestation of tenancy in Orissa is share cropping. The break up of total leased in area into different types of tenancy reveals that in Orissa sharecropping is more pervasive than fixed money tenancy (Table 2.5).

TABLE-2.5

Changes in percentage distribution

Of leased in area by terms of lease

Terms of lease	1971-72(26th)	1981-82(37th)	1991-92(48th)
Fixed money	7.6	5.1	19.7
Fixed produce	13.6	8.1	4.7
Share of produce	41.6	42	50.9
Others	37.2	44.8	24.7
All terms	100	100	100

Sources:(i) Report of NSS in various rounds.

The coverage under fixed money and fixed produce was only 19.7% and 4.7% respectively. Proportion of area under share tenancy shows an increasing trend. In 1971-72, 41.8% of leased in area was under share cropping which has increased to 50.9% in 1991.It is to be noted that in agriculturally advanced states like Punjab,Haryana,Tamilnadu fixed tenancy is more prominent than share tenancy.

High incidence of share tenancy with high rents(50% of gross produce), absence of input cost sharing and no security of tenure adversely affects use of yield enhancing inputs and fixed investments in agriculture by the tenants and, thus acts as a barrier to agricultural development in Orissa.[10]

2.7 Plan Outlay On Agriculture

As far plan outlay is concerned, agricultural sector has been utterly neglected. As shown in the table 2.6, percentage plan outlay on agriculture and allied services shows a declining trend.

Table no: 2.6

Percentage share of sectoral allocation of plan outlay on agriculture in orissa

Sl No.	Sector	PERCENTAGE SHARE						
		4th Plan (1969-74)	5th Plan (1974-78)	Two Annual Plan (1978-80)	6th Plan (1980-85)	7th Plan (1985-90)	8th Plan (1992-97)	9th Plan (1997-2002)
1	*Agriculture and allied services*	18.65	14.89	22.01	6.01	7.02	7.49	3.75
2	*Rural developme nt*	16.16	15.67	13.59	9.02	7.45	4.05	5.61
3	*Irrigation and flood control*	45.7*	57.28*	51.01*	31.33	25.78	30.79	22.59
4	*Others*	19.49	12.16	13.39	53.64	59.75	57.67	68.05
5	*Total*	100	100	100	100	100	100	100

* included power sector also

source: Economic survey of Orissa, various issues

The plan outlay on agriculture which was 18.65% of total outlay in the 4th plan (1969-74) declined to 6.01% of total outlay in the 6th plan. The same figure for 9th plan is only 3.75% of total outlay. Again, the plan outlay for rural

[10] *Orissa State Development Report 2001*,(Bhubaneswar: Nabakrushna Choudhury Center for Development Studies)

development that was 16.16% of total outlay in the 4th plan has been declined to 9.02% in 6th plan. And it is 5.61% of total outlay in the 9th plan. The most repulsive fact is that % of total outlay on irrigation and flood control is declining in the face of flood and drought. In the 6th plan, it was 31.33%of total outlay, which has come down to 22.59% in the 9th plan.

Thus a sector that needs much care and attention is receiving the least. In recognition of the crucial role of the sector in state's economy, the state government has announced the agricultural policy in 1996 according to which agriculture got the status of industry. The main objectives set out in the agricultural policy are as follows:[11]

i. To double the production of food grain and oil seed crops by the end of the Ninth Plan period.**ii.** To enhance the status of agriculture from the present level of subsistence agriculture to a profitable and commercial venture, so that young persons can accept agriculture as a means of self-employment.**iii.** To generate adequate employment opportunities.**iv.** To make agriculture the main route of poverty eradication.**v.** To make available the knowledge of modern farming systems at the door step of the farmer.**vi.** To adopt integrated programmes for problem of soils such as water-logged areas, areas with soil erosion, dry/rain fed areas, area under shifting cultivation, waste land, saline and alkaline soil etc.**vii.** To create entrepreneurship in the field of agriculture.**viii.** To create skilled labourers for management of modern agriculture.**ix.** To help mechanization of agriculture to increase productivity.**x.** To establish agro-based industries and food processing industries.**xi.** To be self-sufficient in the production of fruits, flowers, vegetables, potato, onion, milk, egg, fish and meat.**xii.** To increase area under tea, coffee, rubber, cashew and other plantation crops.**xiii.** To provide irrigation facilities to 50% of cultivable land through completion of incomplete irrigation projects and promotion of individual and group enterprise.**xiv.** To take up extensive training in the field of agriculture and related activities.**xv.** To promote private enterprise in the marketing of agricultural produces.**xvi.** To identify

[11] *Economic Survey2001-02,* Government of Orissa.

and promote thrust crops in different agro-climatic zones of the State.**xvii.** To reorient agriculture towards export.

In our subsequent chapter we will see whether the policy announcement has brought any change in output,yield and cropping pattern.

2.8 Structural Transformation In Orissa Economy And Place Of Agriculture:

There has been a marked structural transformation of the orissa economy in the nineties visa-a-vie that of the eighties. The inter sectoral and intrasectoral composition of GSDP underwent a significant change .The service sector has come to occupy a place of prominence in terms of relative contribution to GSDP.

Table No.2.7

Contribution of Sectors to GSDP (%)

Year	Primary (% To GSDP)	Secondary (% To GSDP)	Service (% To GSDP)
1980-81	**50.2**	**19.5**	**30.3**
1981-82	51.3	17.5	31.1
1982-83	47.7	19.3	33.0
1983-84	51.8	18.6	29.6
1984-85	46.6	21.0	32.4
1985-86	49.0	19.0	32.0
1986-87	46.1	20.1	33.8
1987-88	42.7	21.6	35.7
1988-89	41.7	24.3	34.1
1989-90	43.8	22.5	33.7
1990-91	**35.8**	**26.7**	**37.5**
1991-92	36.9	25.1	38.0
1992-93	34.0	26.4	39.6
1993-94	36.8	24.8	38.4
1994-95	35.2	25.9	38.9
1995-96	32.4	28.0	39.6
1996-97	26.8	29.5	43.7
1997-98	**30.3**	**28.6**	**41.1**

Sources: Calculated from NAS, CSO.GOI.

Primary sector whose share was half of GSDP in 1980-81 (*Table 2.7*) has come down 26.8% of GSDP in 1996-97 and 30.3% of GSDP in 1997-98.From 1980-

81 to 1989-90,the contribution of Primary sector to GSDP varied between 50% to 40%. Since 1990-91, it has fallen sharply and now in the last 8yrs it is well between 37% to 30%. Even it was as low as 26.8% in 1996-97.

Secondary sector in Orissa is yet at its primal stage and rising at a sluggish pace at the cost of Primary sector, which is a good sign. In 1980-81, the share of Secondary sector was 19.5% and it reached at 22.8% in 1989-90.in 1990-91 its contribution to GSDP was 26.7% .It reached ever highest in 1996-97 to 29.5 % of GSDP.

In terms of contribution of service sector to GSDP it's position is second highest since 1980's.In 1980-81 it's share was a little less than $1/3^{rd}$ of GSDP which has touched 43.7 % of GSDP in 1996-97 and in 1997-98 it dipped to 41.1 % of GSDP. Since 1990-91, its contribution to GSDP is above 35 % and it crossed 40 % in 1996-97.

Therefore, from Table 2.7, we can conclude that over the yrs Primary sector's share is dilapidated and manufacturing sector's share and service sector's share is going up. However, the virtual position has not been altered.

To study the behaviour of GSDP and its various components over the period of time, we have fitted the following linear equation. Here, we have taken Year as the independent variable and shown the movement of GSDP.

Table No: 2.8

Changing Share Of Sectors With Respect To Years

Equation		1	2	3	4	5	6	7	8
Dependent variable*		PRI	PRI	AG GSDP	AG GSDP	SEC	SEC	TER	TER
Coefficient of independent Variable	Constant	54.24	52.83	48.41	46.82	16.84	17.47	28.89	29.66
	X (Year)	-1.38	-1.04	-1.29	-0.9	0.67	0.52	0.71	0.52
	Dummy		-4.17		-4.68		1.84		2.27
t STAT	Constant	47.35	47.03	37.58	37.42	26.04	24.22	42.08	42.63
	X (Year)	-13.03	-6.4	-10.94	-5.17	12.43	4.56	10.96	5.07
	Dummy		-2.72		-3.09		1.45		2.47
R SQUARE		0.91	0.93	0.89	0.91	0.89	0.9	0.88	0.91
F STAT		174.88	109.09	130.02	84.09	130.47	72.71	129.23	76.81
D-W STAT		2.36	2.45	2.24	2.37	2.22	2.14	2.26	2.41

**PRI= Share of primary sector in GSDP, AG GSDP= Share of Agr. in GSDP, AG PRI= Share of agr. In primary sector, SEC= Share of secondary sector in GSDP, TER= Share of tertiary sector in GSDP, dummy =1 for post reform period.*

From equation 1, it is found that the share of primary sector is going down over the periods. There is fall in share of primary sector by 1.38% as one unit change in time occurs. The model is highly significant with high r^2 value. In equation 2, dummy has been taken for pre-reform and post-reform period. The equation says that, holding all other factors constant; the share of primary sector was higher in GSDP during pre-reform period (1980-81 to 1989-90) in comparison to post reform period. Thus, this supports the structural change hypothesis that, as economic development takes place, the share of primary sector in general and agricultural sector in particular in Aggregate state income goes down. In equation 3, dependent variable is share of agriculture in GSDP. The result says that, share of agriculture is going down over the periods in gross state domestic product. In equation 4, the dummy is significant at 1 percent level. The result says that, there is a fall in share of agriculture in GSDP during post reform period in comparison with pre-reform period.

From equation 5, it is clear that the share of secondary sector is increasing over the years. The model is highly significant with high r^2 value. From equation 6, it could be inferred that during the post reform period, there is not much increase in the share of secondary sector in GSDP as t-statistics of Dummy is not significant. From equation 7, it is observed that share of service sector is increasing in the post-reform period. And equation 8 says that, share of service sector is increasing in the post-reform in comparison with pre-reform period.

Table 2.9; shows the share of agriculture in GSDP and share of agriculture within the Primary sector. From *col.3*, it is clear that agriculture is the single most important sector within Primary sector. Its share is mote than 80 % of the value of Primary sector. In addition, in 1997-98, it was 84.6 %. The *column 2* shows share of agriculture in GSDP.In 1997-98 the share of agriculture was alone more than $1/4^{th}$ of GSDP. Since 1987-88, it is less than 40 % of GSDP and gradually declining .Yet, its share is higher than many intra sector items of all the sectors.

Table-2.9

Share of Agriculture in GSDP and Primary sector

Year	(Percentage Share of *agriculture* in *GSDP)*	(Percentage Share of *agriculture* in *primary sector)*
1980-81	44.2	88.1
1981-82	45.2	88.1
1982-83	41.3	86.7
1983-84	46.3	89.3
1984-85	41.4	88.8
1985-86	44.0	89.9
1986-87	41.2	89.5
1987-88	38.0	88.9
1988-89	37.5	90.0
1989-90	39.4	90.1
1990-91	31.2	87.0
1991-92	32.8	88.9
1992-93	29.5	86.6
1993-94	32.3	87.9
1994-95	30.6	87.1
1995-96	28.2	87.0
1996-97	22.0	81.8
1997-98	25.6	84.6

Sources: Calculated from NAS, CSO, GOI.

We have break up the period 1980-81 to 1997-98 in two parts .One is from 1980-81 to 89-90 (i.e. pre-reform period) and another is from 1990-91 to 1997-98(post-reform period). *Table 2.10;* shows average of growth rate of GSDP in both the periods. From the table it is evident that annual average rate of growth in agriculture was 4.8 % in the 1st phase (1980-81 to 89-90) which was declined to –0.7 %. That is in the second period the annual average of rate of growth of agriculture was negative. Within the primary sector forestry and logging has an annual average of negative growth in both the period. Fishing and Mining & quarrying has positive growth rate in both the periods and the second period has seen a higher growth rate than the first period.

Table-2.10

Annual Average Of Growth Rate Of GSDP Sector Wise

	80-81to 89-90	90-91 to 97-98
Agriculture	4.8	-0.7
Forestry & logging	-1.3	-5.1
Fishing	8.8	10.8
Mining & quarrying	9.7	10.3
Manufacturing	8.2	4.2
Construction	4.9	8.7
Electricity, gas	6.9	4.0
Transport, storage	7.5	7.2
Trade, hotels	6.0	4.4
Banking & Insurance	15.0	9.4
Real estate, ownership of business service	2.8	3.0
Public administration	7.1	3.9
Other services	7.1	4.4

Sources: Calculaed from NAS,CSO,GOI.

** It is simple arithmetic growth rate averaged for 10 years for 1st period and 8years for second period. The formula is* $(y_{t+1}-y_0)/y_t$.

Within the secondary sector in the 1st phase, the annual average growth rate of transport and storage was stagnant in almost in both the periods varying between 7.5 to 7.2. Trade and hotels has faced a decline in the 2nd phase i.e. 4.4 % which was 6 % in the 1st period. The banking and insurance sector whose growth rate was very high i.e. 15 % in the 1st phase has been declined to 9.4 % in the second phase.

Table No: 2.11

Intra-Sectoral Distribution Of GSDP In Pre-Reform And Post-Reform Period

(Rs In Lakh)

Sector	Total GSDP (80-81 to 89-90)	Total GSDP (90-91 to 97-98)	1st period (%share to GSDP)	2nd period (% Share to GSDP)
Agriculture	1826470	1342467	41.6	28.9
Forestry & logging	159992	86285	3.6	1.9
Fishing	65195	123185	1.5	2.6
Mining & quarrying	120804	248303	2.8	5.3
Agriculture and allied services	----------	----------	49.5	38.7
Manufacturing	525713	660733	12.0	14.2
Construction	173758	234968	4.0	5.1
Electricity, gas	83371	108175	1.9	2.3
Industry	----------		17.8	21.6
Transport, storage	147745	222857	3.4	4.8
Trade, hotels	592438	714278	13.5	15.4
Banking & Insurance	87873	176573	2.0	3.8
Real estate, ownership business	201756	207261	4.6	4.5
Public administration	199121	239909	4.5	5.2
Other services	207555	285168	4.7	6.1
service sector	----------	---------- --	32.7	39.7

Sources: Calculated from NAS, CSO, GOI

Table 2.11; shows the contribution different sectors to GSDP in both periods. It is shown in the table that agriculture which was contributing 41.6 % of GSDP in the 1st

phase has lost its share to 28.9 % of GSDP in the second phase .The share of Primary sector in the 1st phase was 49.5 % which now declined to 38.5 % of GSDP .The share of industry has been increased which was 17.8 % in the 1st phase and whose share now in the second phase increased to 21.6 %. Similarly, incase of service sector whose share was 32.7 % of GSDP during the 1st phase has increased to 39.7 % of GSDP in the second period. Hence the most important fact is that the share of Primary sector and Secondary sector has increasing and the relative position in terms of contribution to GSDP has also been changed with service sector has come to occupy 1st position followed by Primary sector and Secondary sector.

Also from the figure it is clear that the share of agriculture over the yrs has been declining in Orissa and Secondary sector and Tertiary sector are almost increasing at the same pace. Though service sector has crossed the Primary sector long ago (i.e. 1990-91) secondary sector has not yet crossed on a sustained basis to Primary sector in terms of contribution to GSDP.

Fig (1)

Sectoral composition of GSDP

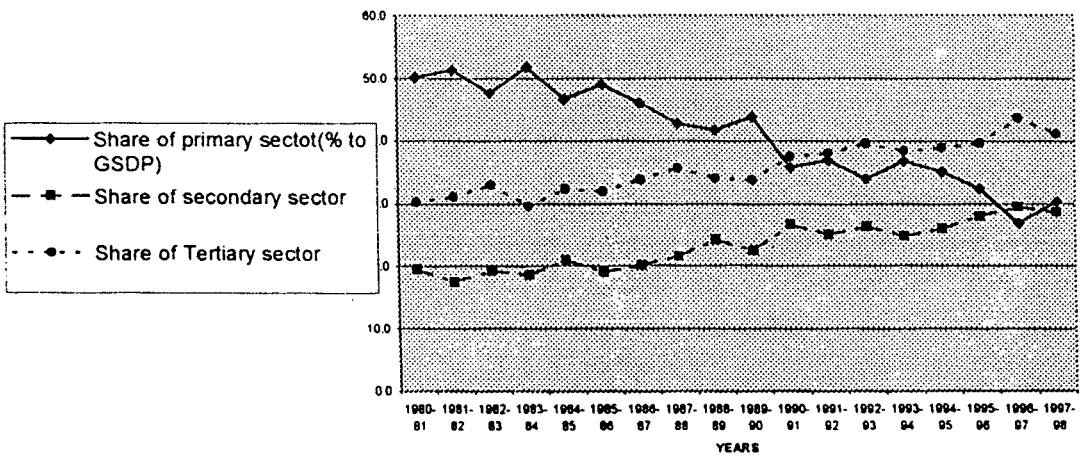
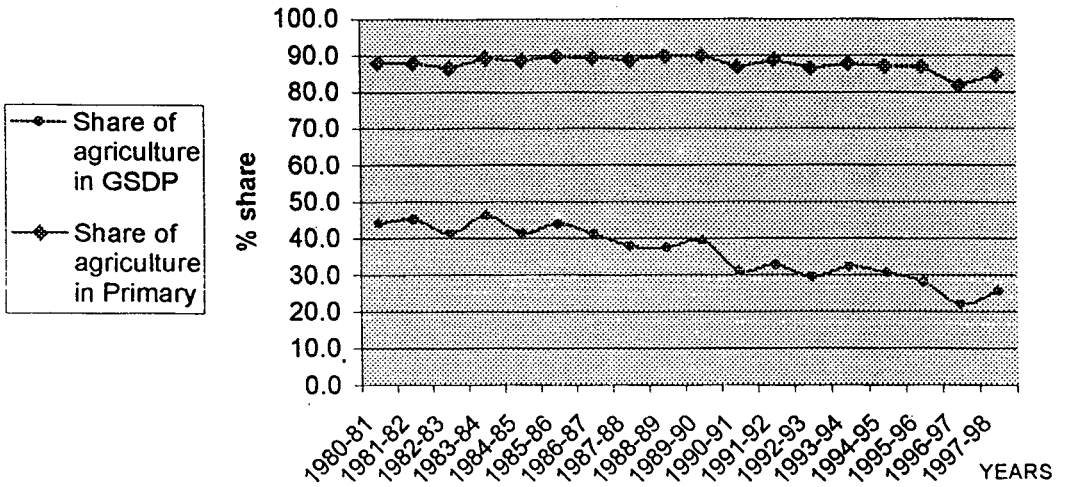


Fig.(2)

Share Of Agriculture In GSDP And Primary Sector



2.9 Conclusion:

From the above analysis, it is apparent that, agriculture in Orissa is dependent upon southwest monsoon and to increase cropping intensity, supply of water by artificial means is of urgent necessity. Secondly, contribution of agriculture to NSDP has come down from 67% in 1951 to around 30% in 1998. But, the percentage of workforce engaged in agriculture has remained unchanged. Thus, there has been an overcrowding in agriculture without any perceptible increase in production. Thirdly, it has been that uneven distribution of agricultural land, small size of operational holding, high incidence of share tenancy, and rural poverty are the major obstacles for the improvement agricultural productivity. Fourthly, it is seen that, plan outlay in agriculture is declining over the period of time in Orissa. Hence, it could be viewed as institutional negligence of agricultural sector in the overall economy. Fifthly, it is found that, share of primary sector in Gross state domestic product is declining and share of secondary sector and tertiary sector is increasing. Along with that, it is observed that in the post reform period, the share of primary sector is going down rapidly and share of secondary and tertiary sector is going up.

CHAPTER 3

NATURE AND TRENDS OF CROPPING PATTERN IN ORISSA: A DISTRICT LEVEL ANALYSIS

3.1 Cropping Pattern

Cropping pattern has been defined as, the proportion of area under different crops at a particular period/Point of time. A change in the cropping pattern means a change in the proportion of area under different crops.

3.1.1 Factors affecting cropping pattern: In any locality, the prevalent cropping system is the cumulative results of past and present decision by individuals, Communities or government and their agencies along with the natural factors. These decisions are usually based on experience, tradition, expected profit, personal preference and resources, social and political factor etc.

In this context, the *National commission on Agriculture* also pointed out that, "the cropping patterns depends primarily on soils and climatic factor, but as they evolve, also represent the integrated effect of the requirements, local habits and economic factors through time". *(The National Commission on Agriculture, vol. IV, page 125-126).* Among the factors which affect, the cropping pattern must are (a) climate, Rainfall and irrigation facilities (b) price of crop and income level of farmer (c) Govt. Price policy (d) social factors (e) socio-economic conditions (f) Type of soils (f) size of the farms (g) Infrastructural factors and influence of technology.

Before analyzing the cropping pattern and growth levels in respect of area, production and yield of selected crops, it would be worthwhile to preface this study with some basic ideas about crops, their sowing and harvesting seasons in Orissa.

There are main two crop seasons in orissa e.g. khariff or the season of summer crops and Rabi or the season of winter crops. Therefore sowing in Orissa, in the Khariff season begins generally on the onset of Southwest monsoons in the mid-June, while the Rabi season starts at the beginning of cold weather season, i.e. at the end of October or early November, when the Monsoon has receded. The food crops grown in Rabi season are: Paddy, Jowar, Bajra, Maize, Pigeon Pea,

Green Gram, Black Gram, Groundnut and Sugarcane. These crops require high temperature and plentiful supply of water. The food crops of Rabi season are: Wheat, Lentils, Bengal Grams, Peas and potatoes. These crops require cold weather and moderate supply of water. The harvesting periods of Khariff crops starts at the end of Monsoon, i.e. September to October and the Rabi crops are generally harvested from March to April.

Since, this study is based on Selected crops, therefore, it would be rational to examine their relative position with respect to Area, Production and Yield. The crops selected are: Paddy, Wheat, Maize, Jawar, Ragi (cereals), Biri, Mung, Kulthi, Arhar, Gram (pulses), Til, Mustard, Groundnut (oil seeds), Onion, Potato, Sugarcane, Jute and Cotton (cash crops).

This study has been taken up with the following specific objectives:

(a) To examine the nature and trends of cropping pattern in Orissa (district wise).

(b) To examine if there exists any significant variation in cropping pattern over the periods across the districts.

(c) To study the major crops which are concentrated at the districts over the period of time.

(d) To examine whether there is crop specialization taking place across the districts or diversification of crops going on.

(e) And finally to study what are the main determinants of crop specialization/diversification in Orissa over the periods.

SECTION 2

3.2 AREA, PRODUCTION AND YIELD AT THE DISTRICT LEVEL:

In order to study the changes in cropping pattern with respect to 18 major crops during the three periods i.e. 1985-1990, 1990-1995 and 1995-2000, we have taken into account all the undivided 13 districts of orissa.

3.2.1 BALASORE:

With a total area of 6,311 sq. km, the district of Balasore forms the part of coastal region in the eastern side of the state. As far the Infrastructuarl development index is concerned, the District ranks third in 2000-01*(as per Orissa state development Report, 2001)*.

Table No.3.1

Crop-Wise Area, Production And Yield In Balasore District –1985-86 To 1999-00

PERIODS / CROPS	FIRST PERIOD			SECOND PERIOD			THIRD PERIOD			ANNUAL COMPOUND GROWTH RATE(%)								
	85-90			90-95			95-00			85-90			90-95			95-00		
NAME OF CROPS	% TO GCA	Y(KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	Y(KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	Y(KGS/HA)	% TO TOTAL OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT
PADDY	61.52	1750.00	65.87	60.96	1969.40	66.79	74.52	1909.70	79.10	*0.37*	10.94	11.35	0.97	11.09	12.17	*-0.33*	1.88	1.55
WHEAT	0.75	1885.80	1.27	0.46	1627.60	0.60	0.25	1461.80	0.30	2.54	-0.82	1.69	-17.79	8.01	-11.21	5.19	0.82	6.06
MAIZE	0.23	1062.40	0.15	0.24	1178.60	0.15	0.19	1147.00	0.13	4.49	4.91	9.62	-1.16	5.29	4.06	*0.53*	1.38	1.92
JAWAR	0.01	598.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.57	-17.81	-11.60	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*
RAGI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*
BIRI	5.53	567.20	6.23	6.13	569.40	6.33	4.15	421.80	3.32	*-0.20*	3.22	3.01	*-0.39*	-5.36	-5.73	5.56	*-0.03*	5.53
MUNG	7.27	521.20	9.33	6.99	494.00	7.69	3.76	388.10	3.86	3.50	-4.99	-1.67	-2.04	3.04	0.94	1.63	13.26	15.11
KULTHI	0.63	496.60	0.29	0.20	491.20	0.08	0.14	449.20	0.05	4.05	-0.69	3.33	-6.97	-0.26	-7.22	2.32	2.09	4.45
ARHAR	0.14	546.00	0.17	0.16	700.20	0.22	0.07	682.10	0.10	-2.68	6.28	3.44	-4.77	5.92	0.86	11.21	2.68	14.19
GRAM	0.14	563.80	0.15	0.07	388.20	0.06	0.10	309.40	0.06	6.00	-1.77	4.12	204.15	-0.02	4.08	-7.15	13.12	5.04
TIL	1.23	508.80	1.26	1.00	465.00	0.83	0.48	442.70	0.42	*-0.23*	-1.87	-2.09	-9.98	10.23	-0.77	10.51	3.77	14.68
MUSTARD	1.99	548.40	2.38	2.46	610.00	3.03	1.44	363.30	1.09	10.92	5.22	16.71	-8.76	-11.38	-19.14	-11.48	-17.78	-27.22
GROUNDNUT	1.84	1583.40	5.30	2.00	1739.00	5.79	1.40	1377.50	3.21	-10.34	2.50	-8.10	-16.25	-5.19	-20.59	1.32	-1.85	*-0.55*
ONION	0.60	5401.00	2.59	0.65	8137.80	3.87	0.76	6782.40	3.77	2.97	-6.70	-3.93	2.40	12.13	14.82	-1.41	-3.66	-5.02
POTATO	0.04	8881.60	0.19	0.05	10502.60	0.22	0.06	12064.10	0.31	*-0.51*	2.51	1.99	-5.11	3.33	-1.95	9.44	-5.53	3.39
SUGARCANE	0.31	6464.20	2.90	0.29	7024.20	2.64	0.36	6753.10	3.34	11.11	-1.01	9.98	-7.31	2.57	-4.93	-30.74	-6.03	-34.91
JUTE	0.98	1620.00	1.92	0.78	1971.00	1.69	0.69	1179.22	0.92	-4.75	*0.00*	-4.75	-4.68	3.94	-0.93	-12.57	-16.65	-27.13
COTTON	0.00	34.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-4.75	*0.00*	-4.75	-4.68	3.94	-0.93	-12.57	-16.65	-27.13

Source:calculated from Orissa agricultural statistics, Various issues. N.B. n.c for no crops

The 18 major crops covered 83.22% of GCA in the first period whereas in the last period, it covered 88.37% of GCA. From the Table 3.1, it is evident that, Paddy is the principal crop of the District followed by Biri and mung in all the periods. The average percentage of GCA under paddy in First period was 61.52%, which increased to 74.52% in the last period. The average yield level of paddy in first period was 1750 kgs/ha, which increased to 1964.4 kgs/ha in the second period. In the final period, the yield level was higher than 1st period by 159.7 kgs/ha but lower than second period by 59.7 kgs/ha Thus, in general the yield level of paddy was found to be higher in second period. Wheat covered only 0.75% of GCA in First period, which came down to 0.25 % in the final period. The yield level of wheat during final period has gone down significantly to 1461.8 kgs/ha, which was less by 424 kgs/ha and 165.8 kgs/ha in comparison to 1st and second period respectively. Maize is one kind of coarse cereal very scatterdly cultivated in orissa. The average percentage of GCA under maize during first period was 0.23 %, which increased to 0.24 % in the second period and came down to 0.19 % of GCA in the last period. The yield level in the first period was 1062 kgs/ha, which increased to 1178.6 kgs/ha in the second period but came down marginally to 1147.00 kgs/ha in the final period.

Biri is one of the important crops in the District. During first period, 5.53 % of GCA was under Biri, whereas the Share in the second and third period was 6.13 % and 4.15 % respectively. Thus unlike Paddy the share increased in the second period by 0.6 %, which came down by 1.38 % in the final period in comparison to first period. As far yield level of Biri is concerned it was 567.2 kgs/ha in the first period and increased marginally to 569.5 kgs/ha in the second period. But in the third period it came down to 421.8 kgs/ha. Mung is another important pulses in the district. 7.27 % of GCA was under the crop in first period, which came down to 6.99 % and 3.76 % in the second and third period respectively. As far yield level is concerned, it was very high in the 1st period (521 kgs/ha), which came down to 494 kgs/ha and 388.1 kgs/ha in the second and third period respectively. Area under kulthi in the first period was 0.63 %, which came down to 0.20 % and 0.14 % in the second and third period respectively. The yield level of Kulthi, which was 496.6 kgs/ha, declined to 491.2 kgs/ha in the second and third period respectively.

Arhar amounts less than 1 % of GCA in the District. In the 1st period, 0.14 % of GCA was under Arhar whereas in the 2nd and 3rd period the respective figures stands as 0.16 % and 0.07 % .The yield level of Arhar which was 546 kgs/ha in the 1st period increased to 700.2 kgs/ha in the 2nd period which again came down to 682.1 kgs/ha in the final period.

Til is one of the important oil seeds which amounts to 1.23 % of GCA during the 1st period in the district. But, for the second and third periods, the respective figures are 1 % and 0.48 %. Thus it is declining over the periods. The yield level of Til which was 508.8 kgs/ha in the 1st period came down to 465 kgs/ha in the second period and in the third period the yield level is the lowest that is, 442.7 kgs/ha. Mustard is another important cash crop of the district. In the 1st period the district had devoted 1.99 % of GCA for the crop, which has increased to 2.46 % in the second period. But, in the 3rd period it came down to 1.44 %. As far as yield level is concerned, it was 548.4 kgs/ha in the 1st period, which increased to 610 kgs/ha in the second period but it, again came down to 363.3 kgs/ha in the 3rd period.

Groundnut is one of the important oil seeds in Orissa. In the 1st period 1.84 % of GCA was under the crop, which increased to 2 % in the second period and came down to 1.4 % in the 3rd period. Its yield level was very high in comparison to many other crops. In the first period it was 1583.4 kgs/ha, which increased to 1739 kgs/ha in the second period. But in the 3rd period it has came down by 361.5 kgs/ha that is to 1377.5 kgs/ha.

Onion is another cash crop of Orissa. In Balasore district, during 1st period 0.60 % of GCA was under the crop, which increased to 0.65 % in the 2nd period and 0.76 % in the 3rd period. As far as yield level is concerned it was 5401 kgs/ha in the 1st period, which increased to 8137.8 kgs/ha in the second period. Though area devoted to onion is high in the 3rd period yet its yield level has came down to 6782.4 kgs/ha. Potato is one of the important food items of Orissa. In the 1st period 0.04 % of GCA was under the crop, which increased to 0.05 % and 0.06 % of GCA in the second and third period respectively. In case of yield, it was 8881.6 kgs/ha in

the 1st period, which increased to 10,502 kgs/ha in the second period, and it is 12,064.1 kgs/ha in the final period. Thus one can find a positive relationship between areas devoted and yield level in case of potato.

Sugarcane or Gur accounts for 0.31 % of GCA of the districts in the 1st period, which came down to 0.29 % in the final period. The yield level of Sugarcane, which was 6464.2 kgs/ha in the 1st period, increased to 7024.2 kgs/ha in the second period in spite a fall in the percentage area devoted to this crop. In the 3rd period though area has increased under the crop but yield level has gone down to 6753.1 kgs/ha.

The percentage share of area under Jute in the 1st period was 0.98 % GCA, which came down to 0.78 % in second period and again, has fallen in third period to 0.69 %. The yield level of Jute, which was 1620 kgs/ha in the 1st period, has gone up to 1971 kgs/ha in the second period despite a fall in area by 0.20 %. During the final period the yield level was the lowest which was 1179.9 kgs/ha with a fall in area by 0.09 % in comparison to second period.

OBSERVATIONS

(1) Paddy is the principal crop of the district as far area and contribution to total output is concerned. Pulses are second in the list followed by oil-seeds and cash crops. This is same over all the periods.

(2) In comparison to first period, percentage area has gone down for Paddy, Wheat, Mung, Kulthi, Gram, Til, Mustard, Groundnut and Jute in the second period.

(3) And in comparison to second period, percentage area has gone down for Wheat, Maize, Biri, Mung, Kulthi, Arhar, Til, Mustard, Groundnut and Jute in the third period.

(4) Over all the periods, there is secular decline in area of Wheat, mung, Kulthi, Til and Jute.

(5) In comparison to first period, there is a decline in yield of Wheat, mung, Kulthi, Gram and Til in the second period.

(6) In comparison to second period, in the third period, yield level of all crops has gone down except potato.

(7) Over all the periods, there is a secular decline in yield levels of Wheat, mung, Kulthi, Gram and Til

3.2.2 BOLANGIR

With a total area of 8,913 sq kms, Bolangir district forms the part of western Orissa. As far as the Agricultural infrastructural development index is concerned, the district ranks 6th in both the period i.e. 1990-91 and 2000-01. The 18 major crops covered 84.36% of GCA in the first period, which increased to 85.06% and 86.77% in the 2nd and 3rd period respectively.

Table No: 3.2

Crop-Wise Area, Production And Yield In Bolangir District—1985-86 To 1999-00

PERIODS / CROPS	FIRST PERIOD			SECOND PERIOD			THIRD PERIOD			ANNUAL COMPOUND GROWTH RATE								
	1985-1990			1990-1995			1995-00			1985-1990			1990-1995			1995-00		
NAME OF CROPS	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT
PADDY	48.85	1786.00	53.83	49.40	2116.20	56.70	53.87	2061.10	62.06	*0.21*	5.54	5.77	0.14	0.34	0.48	0.13	10.26	10.41
WHEAT	1.14	1364.80	1.41	0.69	1520.40	0.83	0.50	1243.00	0.52	-6.17	0.85	-5.38	-6.90	1.63	-5.38	4.87	2.34	7.32
MAIZE	0.57	911.20	0.32	0.55	787.80	0.23	0.59	792.50	0.26	*0.34*	*-0.12*	*0.23*	-1.76	*0.63*	-1.15	*-0.05*	3.56	3.51
JAWAR	0.16	747.60	0.06	0.13	740.20	0.05	0.15	305.00	0.02	-1.25	*0.27*	-0.99	-7.26	-3.36	-10.37	2.21	-1.58	*0.59*
RAGI	1.46	650.77	0.59	1.00	675.80	0.35	0.64	364.30	0.13	-6.37	*-0.05*	-6.41	-6.90	-4.87	-11.43	24.65	12.49	40.22
BIRI	5.23	378.80	3.96	4.76	435.80	3.69	4.26	378.00	2.98	-1.32	*-0.01*	-1.33	0.79	1.26	2.06	2.01	8.52	10.70
MUNG	7.06	418.00	7.31	7.59	482.60	8.07	7.92	367.10	6.72	1.22	0.97	2.20	5.79	4.26	10.30	7.90	7.75	16.26
KULTHI	4.49	366.60	1.53	4.51	370.40	1.38	4.66	310.70	1.22	3.29	*-0.67*	2.60	-0.11	-3.01	-3.12	1.70	12.11	14.01
ARHAR	1.73	663.60	2.53	1.99	671.20	2.60	2.27	471.10	2.14	8.48	*0.57*	9.09	1.23	-2.14	-0.94	1.77	7.74	9.65
GRAM	1.22	449.40	1.03	0.72	393.00	0.50	0.34	368.30	0.21	4.74	-1.22	3.46	-19.67	-7.75	-25.90	11.40	8.81	21.21
TIL	5.43	527.60	5.86	6.23	458.60	5.11	5.16	370.90	3.60	5.09	1.39	6.55	-0.29	1.31	1.02	1.55	3.26	4.86
MUSTARD	1.39	420.80	1.28	1.86	462.40	1.66	1.31	388.80	1.06	13.83	*0.23*	14.09	*0.75*	1.08	1.84	-16.11	-13.38	-27.33
GROUNDNUT	3.61	863.60	5.67	3.74	1137.00	6.74	2.81	1254.40	5.85	16.61	-2.68	13.49	-10.18	3.86	-6.71	-1.07	3.67	2.55
ONION	1.19	7698.00	7.43	0.97	7751.20	5.34	0.86	7660.40	4.75	*-0.48*	-0.14	*-0.62*	-3.57	0.76	-2.84	-3.28	6.31	2.83
POTATO	0.02	6727.00	0.06	0.02	7681.20	0.07	0.02	8257.50	0.05	-8.76	3.68	-5.40	6.74	-7.49	-1.26	-9.25	3.77	-5.83
SUGARCANE	0.71	6871.40	7.11	0.79	6557.00	6.65	0.94	6587.13	8.11	5.43	2.96	8.55	2.86	-3.88	-1.13	-8.45	5.98	-2.97
JUTE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*
COTTON	0.10	113.22	0.03	0.09	137.02	0.03	0.49	197.20	0.30	*N.C*	*N.C*	*N.C*	-	-	-	-	-	-

Source: As in Table no 3.1

From the Table 3.2, it is evident that, paddy is the principal crop of the districts as 48.85% of GCA was under the crop in the first period which increased to 49.40% and 53.87% in the second and third period respectively. Thus, there is 5% increase in the GCA in the last period in comparison to first period. The yield level of paddy is also very high in the district (i.e. higher then the state average in all periods). In the first period, the yield level of paddy, which was 1786.00 kgs/ha, increased to 2116.20 kgs/ha in the second period. But in the third period, it has gone down marginally to 2061.10 kgs/ha. In first period the percentage of GCA under wheat, which was 1.14%, came down to 0.69% and 0.50% during 2nd and 3rd period respectively. The yield level of wheat in the first period was 1364.80 kgs/ha, which increased to 1520.4 kgs/ha in the second period but came down to 1293 kgs/ha in the third period. But, in all period it is less than the state average. Maize is one of the coarse cereals of the districts. In first period 0.57% of GCA was under the crop, which increased to 0.59% of GCA in the final period. But, the yield level of the Maize, which was 911.20 kgs/ha in the first period, came down to 792.5 kgs/ha despite increased percentage of GCA in the last period. In all the period, the percentage area under the crop as well as the yield level is less than the state average. In case of Jawar 0.16% of the GCA was under the crop in the first period, which came down by 0.01% in the final period, likewise, the yield which was 797.50 kgs/ha (i.e. higher than state average) came down to 305 kgs/ha in the final period. Similar is the case of Ragi where percentage area and yield level has gone down in the final period in comparison to second period.

Biri is one of the important pulses of the district. In the first period 5.23% of GCA was under the crop, which has fallen to 4.76% and 4.26% in the second and third period respectively. The yield level of Biri, which was 378.8 kgs/ha, has increased to 435.8 kgs/ha in the second period, came down to 378 kgs/ha in the final period. The percentage area and yield level was less than the state average in all the periods. In case of mung, the percentage of GCA in the first period was 7.06%, which increased to 7.59% and 7.92% in the second and third period respectively. But, the yield level during the third period (367.10 kgs/ha) was less than the yield in the first period. The area under Kulthi in the first period was 4.49% which has marginally increased to 4.66% in the third period but the yield level during the third period (310 kgs/ha) has fallen in comparison to first period

(366.6 kgs/ha). Though in the district, the percentage area under the crop was higher than the state average in all periods, but yield level was less than the state average. In case of Arhar, although the percentage area under the crop in the final period was higher than first period, yet the yield level was less in final period (471.10 kgs/ha) in comparison to first period. In case of Gram, the percentage area under the crop as well as yield level during third period (0.34%, 368.30 kgs/ha) was less than first period (1.22%, 449.4 kgs/ha). The percentage area as well as yield level of the crop in the third period was less than the state average.

Til is one of the important oilseeds of the district. The percentage area under the crop in first period was 5.43%, which came down by 0.27% during the final period to 5.16%. Similarly, the yield level, which was 527.6 kgs/ha in the first period, has come down to 370.9 kgs/ha in the final period. The percentage area under the crop in all periods was higher than the state average. Except, the yield level of third period, in other periods, the yield was higher than the state average. Mustard accounted for 1.39% of GCA in the first period, which has increased to 1.86% in the second period but has gone down by 0.55% in final period in Comparison to second period. Similarly, the yield level, which was 420.8 kgs/ha in the first period, has gone down to 388.8 kgs/ha in the third period. The percentage area under Groundnut as well as yield level in first and third period is less than the state average. The percentage area under the crop in the first period was 3.61%, which has gone down to 2.81% in the final period, but the yield level, which was 863.00 kgs/ha in the first period, has increased to 1254.4 kgs/ha in the third period. Onion accounted for 1.19% of GCA in the first period, which has gone down to 0.86% in the third period. Similarly, the yield level, which was 7698 kgs/ha in the first period, has gone drown to 7660.4 kgs/ha in the third period. The percentage area as well as yield level is less than the state average. Potato, sugarcane and cotton together accounted for less than 1% of GCA (i.e. 0.83%) in the first period, which increased to 1.45% in the last period. In the last period, except potato, the yield level of sugarcane and cotton was higher than the state average.

OBSERVATIONS

(1) Paddy is the principal crop of the district followed by mung, Biri, Kulthi and Oil seeds (On the basis of % area contributed) in all the periods.

(2) In comparison to first period, percentage area has gone down for Wheat, Jawar, Ragi, Biri, Groundnut, Onion and Cotton in the second period. And in the 3rd period, % Area has gone down for Wheat, Ragi, Biri, Groundnut, Mustard, Groundnut, Onion and Potato, in comparison to 2nd period. And there was a secular decline in the % share of GCA of Wheat, Ragi, Biri, Groundnut and Onion.

(3) In case of yield level in second period, yield of Maize, Jawar, Gram, Til, and Sugarcane was less than the first period and except the yield of Maize, Groundnut, potato and Sugarcane, the yield level of all other crop during third period was less than second period.

(4) The yield level of Jawar, Gram & Til is declining over all the period.

(5) During the first period, the following crops percentage share of GCA was less than the state average: Wheat, Maize, Jawar, Ragi, Biri, Mung, Mustard, Potato and Jute. In the final period, it is in case of Maize, Jawar, Ragi, Biri, Gram, Mustard, Groundnut, Potato and Jute. Thus, more than 50% crops share in GCA is less than state average.

(6) In case of yield, except, Paddy, Jawar, Ragi, Til and Sugarcane, yield of all other crops during the first period was less than state average. In the final period, except Paddy, Mustard, Groundnut, Onion, and Sugarcane, the yield level of all other crops is less than the state average.

3.2.3 CUTTACK

With a total area of 11,142 sq.kms, the district of Cuttack forms the part of coastal region in the eastern side of the state. As per the *Orissa development report*, the infrastructure development index of the district is very high and ranks second in 1990-91 and 2000-01. Average size of land holding in the district was 1.05 ha in 1990. The 18 major crops covered 84.14% of GCA in first period, which increased to 87.71% in the final period.

TABLE NO: 3.3

CROP-WISE AREA, PRODUCTION AND YIELD IN CUTTACK DISTRICT—1985-86 TO 1999-00

PERIODS / CROPS	FIRST PERIOD			SECOND PERIOD			THIRD PERIOD			ANNUAL COMPOUND GROWTH RATE(%)								
	85-90			90-95			95-00			85-90			90-95			95-00		
NAME OF CROPS	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT
PADDY	44.98	1979.00	46.05	46.73	2061.40	47.38	54.05	1729.80	53.82	*0.63*	9.87	10.57	-1.66	5.04	3.30	*0.46*	-14.33	-13.94
WHEAT	0.40	1937.30	0.59	0.22	1950.20	0.32	0.16	1493.55	0.19	-8.28	2.76	-5.74	-23.99	-3.39	-26.57	19.53	-5.40	13.07
MAIZE	0.30	1086.40	0.16	0.34	1196.00	0.19	0.37	1230.20	0.26	15.59	8.92	25.90	-4.16	5.04	*0.67*	-5.58	-2.78	-8.20
JAWAR	0.06	727.60	0.02	0.04	767.60	0.01	0.03	261.40	0.00	-2.47	4.06	1.49	-29.89	-2.57	-31.69	-3.60	-5.49	-8.89
RAGI	0.80	736.70	0.28	0.44	914.40	0.19	0.20	825.00	0.00	-7.42	3.19	-4.46	-18.99	-2.63	-21.12	-26.55	-5.38	-30.50
BIRI	10.42	625.00	10.95	10.26	603.00	9.88	9.86	464.80	8.71	*-0.43*	0.68	*0.25*	1.87	-3.25	-1.44	-3.91	-2.56	-6.37
MUNG	10.38	536.00	11.56	9.72	472.60	9.07	8.13	411.40	7.75	2.80	1.07	3.89	2.23	1.16	3.41	-12.13	3.49	-9.07
KULTHI	4.43	558.60	1.92	3.30	622.60	1.53	3.04	481.90	1.28	*-0.09*	7.15	7.05	*0.69*	-1.66	-0.98	-2.71	-1.00	-3.68
ARHAR	0.50	717.20	0.67	0.57	803.60	0.80	0.40	740.25	0.63	14.61	2.99	18.04	-7.88	*-0.28*	-8.13	-8.59	-1.29	-9.76
GRAM	0.10	696.40	0.11	0.08	577.80	0.07	0.08	570.40	0.08	-3.69	-1.77	-5.40	-2.38	-3.79	-6.08	-1.00	-7.23	-8.15
TIL	1.14	492.80	0.95	1.10	465.00	0.83	0.88	421.35	0.70	3.22	-0.98	2.21	3.19	*-0.05*	3.14	-14.95	3.41	-12.05
MUSTARD	1.09	503.00	1.00	1.46	488.60	1.23	1.32	385.60	1.04	-1.69	-3.05	-4.69	4.77	-5.72	-1.23	-8.75	1.38	-7.50
GROUNDNUT	6.56	1508.00	16.28	7.95	1664.00	19.17	6.66	1211.45	13.75	-21.13	-7.51	-27.06	0.39	0.69	1.08	-10.96	2.19	-9.01
ONION	0.32	7431.00	1.62	0.35	7326.20	1.65	0.42	6708.65	2.11	1.63	-0.99	*0.62*	2.21	*-0.11*	2.09	4.57	-1.77	2.73
POTATO	0.30	11662.40	1.41	0.30	12964.20	1.47	0.30	13387.65	1.81	7.22	5.04	12.63	1.18	3.97	5.20	-4.60	-0.25	-4.83
SUGARCANE	0.37	6907.00	3.11	0.41	6754.90	3.18	0.71	6148.87	6.11	3.34	2.85	6.28	3.23	-2.24	0.92	-12.58	-7.46	-19.10
JUTE	1.98	1656.00	3.30	1.53	2026.08	3.03	1.09	1373.05	1.75	-11.41	4.31	-7.59	-19.75	-7.87	-26.07	-17.33	-8.12	-24.04
COTTON	0.00	126.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-11.41	4.31	-7.59	-19.75	-7.87	-26.07	-17.33	-8.12	-24.04

Source: As in Table no 3.1

From the Table 3.3, it is evident that Paddy is the principal crop of the district through out all periods followed by Biri, Mung, Groundnut and Kulthi. The average percentage of gross cropped area under Paddy in the first period was 44.98%, which has increased to 54.08% in the last quinquennial. But, the yield of Paddy, which was 1979 kgs/ha in the first period, has came down to 1729 kgs/ha in the last period. Among Cereals, after Paddy, Ragi occupies the second place in first and second period whose share of area was 0.80% and 0.44% respectively and yield level was 736.7 kgs/ha and 914.40 kgs/ha. In the final period, percentage area has come down to 0.20% and the yield level to 825 kgs/ha. During final period, maize has more coverage after Paddy among Cereals. It accounted for 0.37%of GCA and yield level was 1,230 kgs/ha. The percentage area under Maize is increasing over the period. Wheat ranks three among Cereals as far area is concerned in all periods. But, over the periods, the yield level of Wheat as well as share of area is declining. Jawar accounted for lowest percentage of area in all the periods among Cereals and its share over the periods is declining.

Among pulses, Biri accounts for highest percentage share of Area in all the periods. During first period the area and yield was 10.42% and 625.00 kgs/ha respectively which has came down to 9.86% and 764.80 kgs/ha in the third period. Mung is the second important pulses whose area share was 10.38% in the first period, which has declined to 8.13% in the second period. Similarly the yield level, which was 536 kgs/ha in the first period has, came down to 411.4 kgs/ha in the final period. Similarly the percentage share of area and yield level of Kulthi also declined in the third period in comparison to first period. In the first period the share of area and yield level was 4.43% and 558 kgs/ha, which has came down to 3.04% and 481.9 kgs/ha in the final period. Arhar and gram together accounts less than 1% of GCA in all the periods. The share of area of both pulses has gone down in third period in comparison to first period.

Among oilseeds, Groundnut is the most important one as it enjoys largest % of GCA in all periods. In first period, it accounted 6.56% of GCA with yield level 1,508 kgs/ha. In the final period though its area share has gone up

marginally by 0.10%, its yield level has gone down significantly by 297 kgs/ha The area share of mustard has gone up in third period to 1.32% as against 1.09% in the first period but its yield level has gone down to 385 kgs/ha as against 503 kgs/ha in the first period. Sugarcane is one of the important cash crops of the district. Its area share has gone up (0.71%) and yield level has gone down (6148.87 kgs/ha) in third period with comparison to first period where the respective figure share are 0.37% and 6907 kgs/ha. Jute is the most important cash crop, yet its area share and yield level has gone down in third period (1.09%, 1373 kgs/ha) in comparison to first period where the respective figures are 1.98% and 1656 kgs/ha. Unlike Jute, in case of Potato, though its area share was constant, yield level was increasing. In case of onion though the share of area was increasing but its yield level was going down.

OBSERVATIONS

(1) Paddy is the single most important crop of the districts as explained by percentage of GCA under Paddy and contribution to total output followed by Biri, Mung, Kulthi and Groundnut in all periods.

(2) In comparison to first period % share of Area has gone down for all except Maize Arhar, Mustard, Groundnut, Onion, Potato and Sugarcane in second period. Similarly in third period except Paddy, Maize, Onion, Potato and Sugarcane, % share area of all other crops has gone down in comparison to second period. As far yield level is concerned, yield of Biri Mung, Gram, Til, Mustard, Onion and Sugarcane has gone down in second period in comparison to first period. Likewise in third period, yield of all crops except Maize and Potato has gone down in comparison to second period. In all the periods there is a secular decline in share of Area of Wheat, Jawar, Ragi, Biri, Mung, Kulthi, Til and Jute and as far yield is concerned, it is in case of Biri, mung, Til, Mustard, Onion and Sugarcane.

(3) In the first period, share of area less than the state average was in case of majority of crops except Biri, Mung, Groundnut, Sugarcane and Jute.

(4) In case of yield, Arhar and Til's yield level was less than the state average. In the final period, except, Paddy,

Biri, mung, Groundnut, Potato and Sugarcane, the % share area of all other crops were less than the stage average. And the yield of Paddy, Jawar, Mustard, Groundnut and Sugarcane was less than the state average.

3.2.4 DHENKANALA

With a total area of 10,827 sq.km, the district of Dhenkanala forms the part of Central region of the state. As per *Orissa developmental report (2001)*, in infrastructural development index, the rank of the district was 10 in 1990-91which improved to 8 in 2000-01. The average size of land holding was 1.85 ha in 1985, which came down to 1.22 ha in 1990. The 18 major crops covered 83.49% of GCA in the first period, which has increased to 83.55% in the second period. In the third period, these 18 crops covered 87.15% of GCA.

Table No-3.4

Crop-Wise Area, Production And Yield In Dhenkanala District—1985-86 To 1999-00

PERIODS / CROPS	FIRST PERIOD			SECOND PERIOD			THIRD PERIOD			ANNUAL COMPOUND GROWTH RATE								
	85-90			90-95			95-00			85-90			90-95			95-00		
NAME OF CROPS	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT
PADDY	37.27	1622.40	33.41	35.22	1960.00	36.50	39.40	1682.70	43.52	-1.40	6.22	4.73	-0.07	5.42	5.35	1.23	6.73	8.04
WHEAT	0.40	1916.40	0.62	0.27	1893.80	0.40	0.23	1379.40	0.31	-3.94	-0.33	-4.26	-12.03	-5.01	-16.44	5.09	*0.27*	5.37
MAIZE	1.37	1000.60	0.74	1.25	1041.00	0.68	1.25	726.30	0.59	-12.46	-0.59	-12.97	1.12	-4.12	-3.05	*0.51*	10.90	11.47
JAWAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*
RAGI	0.57	619.06	0.19	0.22	645.20	0.07	0.06	509.60	0.02	-29.64	7.22	-24.57	-9.13	-4.76	-13.45	16.58	13.89	32.77
BIRI	8.07	590.40	8.56	9.03	609.40	9.45	9.57	305.10	6.55	2.72	6.58	9.48	2.85	-7.84	-5.22	9.09	18.07	28.80
MUNG	9.39	590.80	12.24	9.53	531.80	10.79	9.74	311.90	8.64	1.52	2.63	4.19	3.03	-0.97	2.03	11.47	19.26	32.93
KULTHI	4.91	580.60	2.37	4.80	598.80	2.30	4.24	317.20	1.33	3.22	2.94	6.26	0.34	*-0.71*	*-0.38*	-0.90	24.59	23.47
ARHAR	2.97	771.40	4.52	2.92	818.00	4.52	2.43	676.30	3.94	3.51	3.37	6.99	-2.76	*0.49*	-2.28	3.92	16.54	21.11
GRAM	0.26	752.80	0.33	0.26	660.20	0.27	0.30	453.60	0.33	3.93	4.60	8.72	-10.61	2.18	-8.66	1.23	1.63	2.88
TIL	7.09	581.60	7.53	10.45	521.40	9.34	10.99	290.80	7.47	4.73	8.73	13.87	11.21	-9.25	0.92	12.35	24.09	39.42
MUSTARD	1.29	593.00	1.47	1.54	652.60	1.87	1.67	280.00	1.08	1.42	3.90	5.37	*-0.52*	-6.42	-6.91	0.96	-22.99	-22.25
GROUNDNUT	8.36	1266.60	17.16	6.45	1184.20	12.24	5.51	1101.20	11.73	*-0.47*	2.37	1.88	-19.69	-5.58	-24.17	-0.37	7.28	6.89
ONION	0.76	8287.40	4.58	0.86	8898.00	5.30	1.08	8778.30	8.47	6.71	1.96	8.80	1.66	-1.53	*0.10*	5.63	7.43	13.48
POTATO	0.13	9395.20	0.52	0.14	10347.40	0.60	0.16	9869.80	0.78	10.13	-1.32	8.68	2.17	3.86	6.12	-0.87	4.73	3.82
SUGARCANE	0.63	6931.00	5.74	0.60	7460.50	5.64	0.48	6952.74	5.22	0.82	2.91	3.75	-17.16	-1.88	-18.72	-6.80	-5.83	-12.23
JUTE	0.01	1087.20	0.01	0.00	252.00	0.00	0.00	0.00	0.00	4.01	-6.43	-2.68	-	-	-	*N.C*	*N.C*	*N.C*
COTTON	0.02	150.96	0.01	0.01	114.24	0.00	0.04	85.12	0.01	4.01	-6.43	-2.68	-	-	-	-	-	-

Source: As in Table 3.1

From the table 3.4, it is evident that Paddy is the principal crop of the district. In the first period, it covered 37.27% of GCA, which has increased to 39.40% in the final period. The yield level which was 1622 kgs/ha in the first period has gone up to 1682 kgs/ha in the final period, thus in comparison to first period, the area has gone up by 2.13% whereas the yield level has gone up by 60.3 kgs/ha. In the district, after Paddy, Mung, Biri, Groundnut, Til and Kulthi enjoys higher % of GCA. Maize is second among Cereals as per area coverage. In the first period the share in GCA of Maize was 1.37%, which came down to 1.25% in the final period. The yield level of maize, which was 1,000 kgs/ha in the first period, has gone down to 726.30 kgs/ha in the final period. The share of Wheat in GCA was very less and going down over the periods along with its yield level.

Among pulses, mung has covered 9.39% of GCA in the first period, which increased to 9.74% of GCA in the final period, but the yield level of mung, which was 590.8 kgs/ha in the first period, has gone down to 311.90 kgs/ha Biri accounted for 8.07% of GCA in the first period, which has increased, to 9.57% in the final period. But like mung, its yield level was gone down to 305.10 kgs/ha from 590.9 kgs/ha in the first period. Under Kulthi 4.91% of GCA was there in the first period, which has gone down by 0.67% in the final period. The yield level of Kulthi, which was 580.6 kgs/ha in the first period, has gone down to 317.20 kgs/ha in the final period.

Among oilseeds, Til and Groundnut has largest percentage share in GCA. In first period 7.09% of GCA was under Til which increased to 10.99% in the final period. The yield level of Til which was 581.6 kgs/ha in the first period has gone down to 290.8 kgs/ha thus facing almost half a decline in yield level. Groundnut has 8.36% of GCA coverage in the first period, which has gone down to 5.51% in the final period. Also the yield level, which was 1266 kgs/ha in the first period, was gone down by 165 kgs/ha in the final period.

Among cash crops, Onion enjoys highest percentage of GCA followed by Sugarcane and Potato. In the first period, 0.76% of GCA was under Onion, which has gone up to 1.08 kgs/ha in the final period. Similarly there is an improvement in the yield level as the yield level, which was 8287.4 kgs/ha in

the first period, has gone up to 8778.3 kgs/ha in the final period. In case of Sugarcane, 0.63% of GCA was under the crop during first period, which has gone down to 0.48% in the final period. But, the yield level, which was 6931 kgs/ha in the first period, has gone up to 6952 kgs/ha in the final period. In case of potato 0.63% GCA was under the crop in the first period, which has gone down to 0.16% in the final period. Similarly, the yield level, which was 9395.2 kgs/ha in the first period, has gone up to 9869.8 kgs/ha in the final period. Jute and cotton together enjoys less than 0.05% of GCA of the district, thus insignificant in coverage as well as contribution to overall production.

OBSERVATIONS

(1) Paddy is the single most important crop of the district in terms of area coverage as well as contribution to total output in all the period followed by Biri, Mung, Kulthi, and Groundnut and Til.

(2) In comparison to first period % share of area has gone down for Paddy, Wheat, Maize, Ragi, (i.e. Cereals), Kulthi, Arhar (pulses), Groundnut, Sugarcane and Jute in second period. In case of yield, the yield of Wheat, mung, Gram, Til, Groundnut and Cotton has gone down in second period. In third period, the % share area of Wheat, Ragi, Kulthi, Arhar, Groundnut, and Sugarcane has gone down in comparison to second period. And in case of yield level, except, Sugarcane the yield of all other crops has gone down in third period.

(3) There is a secular decline in area share of Wheat, Ragi, Kulthi, Arhar, Groundnut and Sugarcane and in case of yield; it is for Wheat, mung, Gram, Til, Groundnut and Cotton.

(4) In the first period, share of area less than the state Average was in the case of Paddy, Wheat, Maize, Ragi, Gram, Mustard, Jute and Cotton. And in the third period, it is in case of Paddy, Ragi, Gram and Cotton.

(5) In the first period, the yield level of Paddy, Maize, and Gram was less than the state average whereas in third period, except, Onion, potato and Sugarcane, the yield of all other crops was less than state average.

(6) As far yield level is concerned, the second period's performance was better than the other two periods.

3.2.5 GANJAM

With a total area of 12,531 sq. km, the district of Ganjam forms the part of Coastal region of the state in the southeastern side of the state. As per *Orissa development report (2001)*, Ganjam ranks 5th in the infrasturctural development index. The average size of land holding of the district was 1.23 ha in 1980, which has come down to 1.03 ha in 1990 (CMIE, Oct 2000). The 18 major crops of the district covered 86.6% of GCA in first period, which has gone up to 86.43% of GCA in the final period.

TABLE NO: 3.5

CROP-WISE AREA, PRODUCTION AND YIELD IN GANJAM DISTRICT—1985-86 TO 1999-00

	FIRST PERIOD			SECOND PERIOD			THIRD PERIOD			ANNUAL COMPOUND GROWTH RATE(%)								
	85-90			90-95			95-00			85-90			90-95			95-00		
NAME OF CROPS	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT
PADDY	35.86	2473.80	49.32	36.00	2923.40	51.82	40.51	2092.20	49.99	1.20	7.73	9.02	1.69	2.63	4.37	1.85	6.35	8.32
WHEAT	0.06	1546.50	0.07	0.03	1746.20	0.04	0.01	1753.00	0.02	-2.09	-5.64	-7.61	-40.29	-2.76	-41.93	7.59	1.66	9.38
MAIZE	1.55	924.00	0.76	1.55	1059.80	0.80	1.78	1139.60	1.18	1.76	-5.78	-4.12	5.21	8.03	13.66	1.55	-1.91	*-0.38*
JAWAR	0.47	597.20	0.13	0.35	692.20	0.10	0.41	558.40	0.12	4.41	-5.63	-1.46	*0.32*	-5.92	-5.62	*-0.05*	12.20	12.14
RAGI	7.61	730.71	2.93	6.87	845.80	2.74	7.60	957.10	4.11	*-0.42*	13.14	12.66	-1.03	0.22	-0.81	7.31	8.48	16.41
BIRi	6.20	458.00	4.92	7.35	500.40	5.91	6.88	483.80	6.38	1.11	-8.69	-7.68	-1.35	-1.02	-2.36	10.32	1.76	12.27
MUNG	16.22	433.80	15.45	17.11	488.00	16.57	16.01	482.30	18.49	-6.03	-13.99	-19.18	-4.01	-1.03	-5.00	12.36	4.37	17.27
KULTHI	3.87	364.00	1.14	3.32	407.60	1.01	3.17	412.30	1.16	3.46	-7.67	-4.48	-4.96	2.40	-2.68	5.78	2.55	8.47
ARHAR	1.90	609.80	2.21	1.72	712.00	2.15	1.68	671.70	2.41	4.28	-4.76	*-0.68*	-2.66	10.13	7.20	9.31	2.94	12.52
GRAM	0.04	590.00	0.04	0.03	607.00	0.03	0.04	608.20	0.04	-8.15	-14.14	-21.14	-24.45	-0.42	-24.77	9.17	*-0.03*	9.14
TIL	4.45	479.80	3.73	4.50	370.60	2.65	4.07	442.30	3.51	12.49	-5.24	6.59	-5.01	14.32	8.60	19.03	2.87	22.45
MUSTARD	0.45	488.20	0.41	0.45	514.20	0.40	0.54	538.70	0.60	-4.46	-3.83	-8.12	1.68	2.03	3.74	-2.72	3.66	0.84
GROUNDNUT	6.14	1025.60	9.97	4.96	1139.40	8.01	2.72	1180.90	5.61	*0.05*	-7.66	-7.62	-17.33	7.76	-10.91	4.90	2.69	7.72
ONION	0.16	6000.00	0.66	0.23	6577.80	0.97	0.26	6914.10	1.34	-12.70	1.61	-11.29	-3.10	-1.35	-4.41	4.64	-1.82	2.73
POTATO	0.06	6825.20	0.18	0.05	8145.20	0.14	0.04	5717.50	0.09	20.91	1.37	22.56	-2.00	8.39	6.22	-10.81	8.52	-3.21
SUGARCANE	0.88	7156.20	7.96	0.77	7442.00	6.63	0.49	7074.80	4.77	7.66	1.90	9.71	-15.99	1.14	-15.03	0.59	-1.32	-0.74
JUTE	0.09	977.04	0.09	0.00	885.60	0.00	0.00	150.44	0.00	1.71	-2.66	-0.99	-30.94	-29.83	-51.54	*0.00*	-8.21	-8.21
COTTON	0.07	163.88	0.03	0.07	137.70	0.02	0.24	221.39	0.17	1.71	-2.66	-0.99	-30.94	-29.83	-51.54	*0.00*	-8.21	-8.21

Source: As in Table no 3.1

From the table 3.5, it is evident that Paddy is the principal crop of the district w.r.t. Area coverage and contribution to total output in all periods followed by mung, Biri, Ragi Groundnut and Kulthi. In first period, Paddy covered 35.86% of GCA, which has increased to 40.5% of GCA in the final period. The average yield level of paddy, which was 2473.8 kgs/ha in the first period, has gone up to 2923 kgs/ha in the second period but has gone down substantially (i.e. 2092 kgs/ha) in the final period. Ragi ranks second in Area coverage among Cereals in the district. In first period, 7.61% of GCA was under Ragi, which remain same in the final period. But, the yield level, which was 730.71 kgs/ha in the first period, has gone up to 957 kgs/ha in the final period. Maize covered 1.55% of GCA in the first period with yield level 924 kgs/ha. In the final period, 1.78% of GCA was being covered by Maize with an increased yield level of 1139.6 kgs/ha. Wheat and Jawar gets least priority among Cereal in the district.

Among pulses, mung covered 16.22% of GCA in first period with yield level 433.80 kgs/ha. In the final period, the area covered under mung was 16.01 % (marginally less than first period) with a higher yield level i.e. 982.3 kgs/ha. Biri is the second important pulses of the district. The area covered under Biri during first period was 6.20% of GCA with yield level of 458.00 kgs/ha. In the final period, 6.88% of GCA was under Biri with an increased yield level of 483.8 kgs/ha. In first period, 3.87% of GCA was under Kulthi with yield level of 364 kgs/ha. In the final period, though the share of Area has gone down by 0.7%, the yield has increased by 38.3 kgs/ha. In case of Arhar, in the final period though the area share has gone down but the yield level increased by 62 kgs/ha in comparison to first period.

In case of oilseeds, Groundnut is the most important one in the district. The percentage area under Groundnut during the first period was 6.14%, which has gone down to 2.72% in final period. But the yield level, which was 1025 kgs/ha in the first period, has increased to 1180.9 kgs/ha. In first period 4.45% of GCA was under Til with yield level 479.8 Kgs/ha but in the final period there was a decline in area share by 0.38% and yield level by 37.5 kgs/ha. In case of

Sugarcane 0.88% of GCA was under the crop in first period with yield level 7156 kgs/ha but in final period, the area and yield has gone down to 0.49% and 7074.8 kgs/ha respectively. Potato and Cotton, the two other important cash crops of the district, whose area coverage was less than 0.15% of GCA in the first period increased to 0.28% of GCA in the final period. The yield level of Potato has gone down during final period whereas the yield level of Cotton has gone up in comparison to first period.

OBSERVATIONS

(1) Like other districts, Paddy is the principal crop of the district followed by mung, Ragi, Biri and Kulthi w.r.t. Percentage shares in GCA and contribution to total output.

(2) In comparison to first period, the share of area has gone down for Wheat, Ragi, Kulthi, Arhar, Gram, Groundnut, Potato, and Sugarcane in second period but the yield level of Til and cotton has gone down in second period.

(3) In comparison to second period, during third period, the share of area has gone down for Wheat, Biri, Potato, and Sugarcane. And in case of yield, the yield level has gone down for paddy, Jawar, Biri, Arhar, Potato and Sugarcane in third period with comparison to second period.

(4) Over all the periods, there is a secular decline in area share of Wheat, Kulthi, Arhar, Groundnut, Potato and Sugarcane.

(5) In comparison to state average, % share of area during first period of Paddy, Wheat, Maize, Kulthi, Gram, Mustard, Onion, potato and Jute was less than the state average. In final period, it is in case of Paddy, wheat, maize, Kulthi, Gram, Mustard, Groundnut, Onion, Potato and Cotton.

(6) As far yield level is concerned, in first period, except, Paddy, Ragi, Mustard, Sugarcane, Jute and Cotton, other crops have yield level less than state average. In third period, only of Maize, Arhar, Groundnut, and Potato has yield level less than state average.

(7) In general, the district has performed well in second period on the basis of crop yield.

3.2.6 Kalahandi

With a total area of 11,772 sq km, the district of Kalahandi forms the part of hilly and plateau region in the western side the state. As per *Orissa development report (2001)* Kalahandi is in the bottom as far the infrastructure development index is concerned. The average size of land holding was 1.89 ha in 1990.The 18 major crops covered 76.74% of GCA in first period, which has increased to 80.14% in the second period and 86.17% in the final period.

From the Table 3.6, it is clear that Paddy is the principal crop of the district. In first period, 38.31 % of GCA was under the crop with yield level 1156 kgs/ha. In the final period, there is an increase in both share of area as well as yield. 43.06% of GCA was under the crop with 1460 kgs/ha yield level. Ragi is second important cereal of the district. In first period, 4.03% of GCA was under the crop with yield level of 633.5 kgs/ha. But in the final period both yield level (984.4 kgs/ha) and area share (1.72%) has gone down. In case of maize, during first period, 2.26% of GCA was under the crop with yield level 974 kgs/ha. In the final period share of area has gone down (1.14%) but the yield level has gone up (1121 kgs/ha). In case of Jawar 0.72% of GCA with yield level 6.31 kgs/ha was under the crop in the first period. But, in the final period, the share of area has gone down (0.29%) along with yield level (396.2 kgs/ha).

Among pulses mung has 6.71% of GCA with yield level of 565.00 kgs/ha during the first period. In the final period, the area share (9.78%) has gone up but the yield level (310 kgs/ha) has gone down. In case of Biri, 5.25% of GCA with yield level of 562.4 kgs/ha was under the crop during first period but in the final period, the area share has gone up (7.30%) but the yield level has gone down (341.20 kgs/ha). In first period, 5.20 % of GCA was under the Kulthi with yield level of 577.8 kgs/ha but, in the final period, the share of area has gone up (6.05%). But the yield level has gone down (369.8 kgs/ha).

TABLE NO: 3.6

CROP-WISE AREA, PRODUCTION AND YIELD IN KALAHANDI DISTRICT—1985-86 TO 1999-00

	FIRST PERIOD			SECOND PERIOD			THIRD PERIOD			ANNUAL COMPOUND GROWTH RATE								
	1985-90			1990-95			1995-00			1985-90			1990-95			1995-00		
NAME OF CROPS	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT
PADDY	38.31	1156.40	37.35	38.62	1495.40	42.00	43.06	1460.80	48.61	*-0.36*	*0.16*	*-0.20*	*0.69*	3.04	3.75	-0.56	7.57	6.97
WHEAT	0.25	1539.00	0.47	0.12	1345.40	0.16	0.19	978.20	0.21	-27.79	-0.09	-27.85	11.71	-8.94	1.73	7.78	9.69	18.22
MAIZE	2.26	974.40	1.82	1.44	899.60	0.95	1.14	1121.90	0.98	-6.18	2.39	-3.94	-4.41	-20.92	-24.41	-0.41	*-0.06*	-0.47
JAWAR	0.72	631.00	0.33	0.26	592.60	0.09	0.24	396.20	0.06	-11.71	-8.29	-19.03	-3.45	-7.72	-10.91	0.99	5.02	6.06
RAGI	4.03	633.50	2.03	2.65	740.40	1.38	1.72	484.40	0.64	-4.43	7.01	2.28	-4.60	-11.48	-15.56	24.09	9.14	35.43
BIRI	5.25	562.40	8.18	7.12	538.00	9.02	7.30	341.20	6.58	6.10	2.43	8.68	4.58	-6.54	-2.26	5.39	23.72	30.38
MUNG	6.71	565.60	13.12	9.68	484.20	13.60	9.78	310.10	9.87	13.94	4.93	19.56	2.17	-6.98	-4.96	8.21	14.03	23.39
KULTHI	5.20	577.80	3.92	5.59	525.00	3.22	6.05	369.80	2.66	14.83	9.90	26.20	-2.36	-3.71	-5.98	-0.59	16.32	15.64
ARHAR	2.82	790.80	6.75	3.42	701.40	6.20	3.51	467.60	4.58	4.75	5.32	10.32	4.51	-8.82	-4.71	7.63	10.55	18.99
GRAM	1.33	704.40	2.47	1.27	585.20	1.66	1.63	538.20	2.09	10.05	9.79	20.83	-0.45	-10.44	-10.85	3.23	7.16	10.62
TIL	4.44	449.60	5.56	4.47	401.00	4.30	4.51	216.70	2.59	3.56	5.42	9.17	-0.96	-7.19	-8.08	2.35	23.46	26.36
MUSTARD	2.10	508.80	3.16	1.83	444.20	2.09	1.78	324.60	1.64	-4.98	0.86	-4.17	-1.51	-2.94	-4.41	-4.44	-3.98	-8.25
GROUNDNUT	2.23	1067.40	5.99	2.36	1381.00	7.01	3.47	1192.10	9.47	8.68	5.67	14.85	0.98	4.42	5.45	-0.70	7.47	6.72
ONION	0.58	6923.20	4.42	0.52	4674.40	2.33	0.65	6184.60	4.11	-3.66	-2.08	-5.66	7.62	-3.23	4.15	1.04	11.47	12.63
POTATO	0.00	5506.80	0.01	0.00	7132.40	0.02	0.01	6818.90	0.02	-19.73	-1.93	-21.28	41.42	-0.63	40.54	-27.52	-8.29	-33.53
SUGARCANE	0.33	6336.80	4.24	0.54	6332.80	5.80	0.49	5976.99	5.27	2.65	-0.43	2.21	2.29	2.20	4.54	-5.54	-10.76	-15.70
JUTE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*
COTTON	0.18	221.34	0.18	0.27	163.20	0.16	0.65	252.33	0.60	-	-	-	-	-	-	-	-	-

Source: As in Table no 3.1

Among oilseeds, Til is the most important one in the district. In first period, 4.99% of GCA was under the crop with yield level 449.6 kgs/ha. But, in the final period, though the share of Area has marginally gone up (4.51%) but the yield level had gone down to 216.7 kgs/ha. In case of Groundnut, during first period, 2.23 % of GCA was under the crop with yield level of 1067 kgs/ha. In the final period both the area share (3.97 %) as well as yield level (1192 kgs/ha) has gone up. In case of Mustard, in the final period both the share of area (1.78%) as well as yield level (324.6 kgs/ha) has gone down.

Among cash crops, onion is the most important one. During first period, 0.58 % of GCA was under the crop with yield level 6923 kgs/ha. But, in the final period, though the area share has gone up (0.65 %) but the yield level has gone down (6184 kgs/ha). In case of Sugarcane, during first period, 0.33 % of GCA was under the crop with yield level 6336 kgs/ha. In the final period, though the area share has gone up (0.49%) but the yield level has gone down to 5976.9 kgs/ha. In case of Cotton, 0.18% of GCA was under the crop with yield level of 221.34 kgs/ha. In the final period both share of area (0.65%) as well as yield level (252 kgs/ha) has gone up.

OBSERVATIONS

(1) Paddy is the principal crop of the district w.r.t area under the crop as well contribution to total output.

(2) In comparison to first period, the % share of area of Wheat, Maize, Ragi, Gram, Mustard and Groundnut has gone down in the second period. In case of yield, except, Paddy, Ragi, Groundnut, Onion and Potato, the yield level of all other crops has gone down in second period.

(3) In comparison to second period, in third period, the share of area of Maize, Jawar, Ragi, Mustard and Sugarcane has gone down. In case of yield, except the yield level of Maize, Onion and Cotton, the yield level of all other crop has gone down.

(4) There is a secular decline in area share of Jawar, Ragi and Mustard. And in case of yield, it is for Wheat, Jawar, Biri, Mung, Kulthi, Arhar, Gram, Til Mustard and Sugarcane.

(5) In first period, with comparison to state average, the area share of Paddy, Wheat, Biri, Mung, Groundnut, Potato, Sugarcane and Jute was less. And in case of yield, the yield level of Paddy, Wheat, Maize, Jawar, Til, Groundnut, Potato, Sugarcane and Cotton was less than the state average.

(6) In the final period, the area share of Paddy, Wheat, Maize, Ragi, Groundnut and Potato was less than the state average. And in case of yield, except, the yield level of Ragi, Gram and Cotton, the yield level of all other crops was less than the state average.

(7) In terms of yield level, the first period's performance was better than the other two periods.

3.2.7 KEONJHAR

With a total area of 8,303 sq.km, the district of Keonjhar forms the part of northern region of the state. As per *Orissa development report (2001)*, the district ranks 11th in the infrastructural development index (2001). The average size of land holding of the district was 1.28 ha as per the latest report (1990). The 18 major crops covered 80.71% of GCA in the first period, which came down to 77.91% in the last period. From the table 3.7 it is evident that Paddy is the principal crop of the district, which covers more than 50% of GCA in all the periods. In first period, 51.28% of GCA was under the crop with yield level 1342kgs/ha. In the final period, share of Paddy in GCA has gone up to 53.63% with increased yield level of 1412.8 kgs/ha. Maize is the second important cereal of the district. In the first period, 5.18% of GCA was under the crop with yield level 1022 kgs/ha but in the final period, the share in GCA as well as yield level has gone down to 3.92% and 861 kgs/ha respectively. Ragi is another important coarse cereal which covered 1.15% of GCA with yield level 574.27 kgs/ha but in the final period, the share in area has gone down (0.13%) but yield level has increased (607.8 kgs/ha).

TABLE NO: 3.7

CROP-WISE AREA, PRODUCTION AND YIELD IN KEONJHAR DISTRICT—1985-86 TO 1999-00

	FIRST PERIOD			SECOND PERIOD			THIRD PERIOD			ANNUAL COMPOUND GROWTH RATE								
	85-90			90-95			95-00			85-90			90-95			95-00		
NAME OF CROPS	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT
PADDY	51.28	1342.20	55.25	51.33	1616.40	60.85	53.63	1412.80	61.49	-1.45	5.33	3.81	-0.43	2.57	2.13	-0.54	-5.87	-6.38
WHEAT	0.49	1825.60	1.11	0.35	1629.00	0.62	0.37	1598.40	0.72	-7.48	-9.14	-15.94	0.29	5.41	5.72	-1.99	-15.48	-17.16
MAIZE	5.18	1022.60	4.40	5.10	1028.60	3.85	3.42	861.00	4.62	-3.72	14.06	9.82	1.80	-1.50	*0.28*	5.28	-2.07	3.10
JAWAR	0.18	975.80	0.13	0.16	800.00	0.08	0.10	634.80	0.04	-17.47	-1.72	-18.89	-3.51	-12.72	-15.78	23.86	-11.01	10.22
RAGI	1.15	574.27	0.01	0.28	716.80	0.00	0.13	607.80	0.00	-15.58	0.92	-14.80	-7.70	-1.11	-8.72	21.72	-6.60	13.69
BIRI	4.75	606.00	7.63	4.47	625.80	6.76	3.59	471.60	4.37	*-0.23*	1.89	1.65	-2.33	-4.55	-6.77	4.48	-21.41	-17.89
MUNG	2.78	588.40	0.00	2.71	514.80	0.00	2.17	454.40	0.00	*-0.78*	1.43	0.64	-0.28	-2.99	-3.26	-4.33	-15.81	-19.45
KULTHI	4.73	447.60	2.61	3.75	445.20	2.23	4.66	439.00	2.45	-3.37	14.48	10.63	4.76	*-0.68*	4.04	0.25	-23.66	-23.47
ARHAR	2.08	820.20	4.92	2.45	877.40	5.62	2.56	919.80	6.85	5.04	12.78	18.46	14.22	-4.01	9.64	-5.20	3.10	-2.26
GRAM	0.54	651.00	0.90	0.39	543.80	0.59	0.71	847.60	1.59	-1.87	9.53	7.48	7.64	-1.63	5.89	7.01	8.92	16.56
TIL	2.12	506.40	2.97	2.19	423.00	2.25	1.82	355.20	1.80	*-0.16*	3.61	3.44	5.63	1.62	7.34	-12.27	-16.00	-26.31
MUSTARD	2.30	429.00	2.96	2.32	479.00	2.87	2.47	465.20	3.27	-1.53	11.04	9.34	1.03	1.02	2.06	2.90	-14.71	-12.24
GROUNDNUT	1.87	1293.80	0.00	1.49	1442.00	0.00	1.31	1351.80	0.00	3.42	-7.94	-4.79	4.90	6.19	11.39	-16.01	-14.14	-27.89
ONION	0.24	4511.00	1.20	0.26	4113.20	1.09	0.27	5599.60	1.79	8.32	5.59	14.37	-11.79	-8.24	-19.06	5.57	18.28	24.87
POTATO	0.06	8914.00	0.00	0.05	9033.60	0.00	0.05	9816.40	0.00	-6.27	-7.94	-13.71	4.94	0.80	5.78	-0.45	2.61	2.15
SUGARCANE	0.16	6082.40	0.00	0.19	6169.50	0.00	0.09	5462.60	0.00	34.18	*0.31*	34.60	-25.61	*0.11*	-25.53	-18.60	-9.68	-26.48
JUTE	0.78	1570.68	2.01	0.70	1880.64	1.92	0.53	2146.20	1.91	-4.29	17.67	12.63	-12.16	3.65	-8.95	-3.17	-10.41	-13.25
COTTON	0.00	113.22	0.00	0.00	0.00	0.00	0.02	37.40	0.00	-4.29	17.67	12.63	-12.16	3.65	-8.95	-3.17	-10.41	-13.25

Source: As in Table no 3.7

Biri is one of the important pulses of the district. In first period 4.75% of GCA with yield level 606 kgs/ha was under the crop. But, in the final period, the area share (3.59%) as well as yield level (471.00 kgs/ha) has gone down. Kulthi is the second important pulses of the district. In the first period, 4.73% of GCA was under the crop with yield level 497 kgs/ha. But during final period, the area share (4.66%) as well as yield level (439 kgs/ha) has gone down. In case of mung, in first period, 2.78% of GCA was under the crop with yield level 588 kgs/ha but in the final period, the share in Area (2.17%) as well as yield level (454 kgs/ha) has gone down. In case of Arhar, the share in Area (2.56%) and yield level (919.8k) has gone up in the final period in comparison to first period.

Among oilseeds mustard is the most important one. In the first period, 2.3% of GCA was under the crop with yield level of 429 kgs/ha. In the final period, there was an increase in Area share (2.47%) and yield level (465.2 kgs/ha). Til occupied second place among oilseeds w.r.t. area share. In first period, 2.12% of GCA was under Til with yield level of 506 kgs/ha but in the final period, the area share (1.82%) as well as yield level (355.2 kgs/ha) has gone down. Among cash crops, Jute is the most important one. In first period 0.78 % of GCA was under the crop with yield level 1570 kgs/ha. In the final period, there was a fall in area share by 0.25% but the yield level has gone up to 576 kgs/ha. Sugarcane is the second important cash crop. During first period, 0.16% of GCA was under the crop with yield level 6,082 kgs/ha but in the final period there was a fall in area share (0.09%) as well as yield level (2146.2 kgs/ha). In case of Onion 0.24% of GCA was under the crop with yield level 4511 kgs/ha. In the final period both area share (0.27%) as well as yield level (5599 kgs/ha) has gone up.

OBSERVATIONS

(1) Paddy is the principal crop of the district, w.r.t. Area share as well as contribution to total output.

(2) In comparison to first period, except, Paddy, Til, Mustard, Onion and Sugarcane, the area share of all other crops has gone down in the second period. And in comparison to second period, in third period, the area share of Maize,

Jawar, Ragi, Biri, Mung, Til, Groundnut, Sugarcane, and Jute have gone down. There is a secular decline is area share of Maize, Jawar, Ragi, Biri, Mung, Groundnut and Jute.

(3) In case of yield, in second period, the yield of Wheat, Jawar, mung, Kulthi, gram, Groundnut and Onion have gone down in comparison to first period. In third period, the yield of all most all crops except Gram, Onion, Potato, Sugarcane and jute have gone down in comparison to second period. There is a secular decline in yield level of Jawar, Mung, Kulthi and Groundnut.

(4) Comparing with state average, in first period, the area share of Wheat, Jawar, Ragi, Biri, Mustard, Til, Groundnut and Onion was less. And in third period, the area share of Jawar, Ragi, Biri, Mung, Oil, Groundnut, Onion and Potato are less than state average.

(5) As far yield level is concerned, in first period, the yield of Paddy, Ragi, Kulthi, Til, Mustard, Onion and Sugarcane was less than state average. And in third period, the yield of Paddy, Maize, Til, Onion and Sugarcane was less than state average.

(6) The second period's performance was better than the other two periods.

3.2.8 KORAPUT

With a total area of 26,961 sq.km the district of Koraput, forms the part of hilly and plateau region, in the southwestern part of Orissa. As per *Orissa development report (2001),* the district ranks 10th in the infrastructural development index. The average size of land holding was 1.70 ha in 1990. Like, other district, Paddy is the principal crop of the district. The 18 major crops covered 70.07 % of GCA in the first period, which has increased to 75.06% in final period.

In first period, Paddy covered 35.38% of GCA with yield level 1722 kgs/ha. In the final period, 38.94% of GCA was under the crop with yield level 2036 kgs/ha. The district is the highest producer of Ragi. In first period, 10.66% of GCA was under the crop with yield level 757.77 kgs/ha. In the final period, there is a fall in area share (10.57%) as well as yield level (750 kgs/ha). In case of Maize, 4.58% of GCA was under the crop during first period with yield level 1169.4 kgs/ha. In the final period, there was an increase in area share (5.46 %) with increased yield level (1209.7 kgs/ha).

Table No: 3.8

Crop-Wise Area, Production And Yield In Koraput District--- 1985-86 To 1999-00

	FIRST PERIOD			SECOND PERIOD			THIRD PERIOD			ANNUAL COMPOUND GROWTH RATE								
	85-90			90-95			95-00			85-90			90-95			95-00		
NAME OF CROPS	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT
PADDY	35.38	1722.20	50.39	35.65	1895.60	52.94	38.94	2036.30	63.91	*-0.27*	-3.14	-3.41	0.79	0.75	1.55	1.40	1.92	3.35
WHEAT	0.33	1719.80	0.70	0.13	1443.00	0.21	0.05	1175.90	0.08	-12.71	-3.88	-16.09	-35.84	*0.07*	-35.80	-25.15	-7.80	-30.99
MAIZE	4.58	1169.40	4.38	4.83	1221.60	4.53	5.46	1209.70	5.15	2.04	14.77	17.12	2.98	-1.22	1.73	9.10	-6.61	1.90
JAWAR	1.26	885.80	0.79	0.99	684.40	0.46	0.60	670.80	0.29	-5.35	-5.95	-10.98	-6.28	-6.15	-12.04	-14.80	-3.28	-17.59
RAGI	10.66	757.74	6.37	10.54	931.20	7.29	10.57	750.00	0.02	-0.44	4.72	4.25	*-0.16*	-4.58	-4.73	*0.24*	2.75	3.00
BIRI	2.39	524.40	3.38	2.65	589.80	3.97	2.51	356.15	2.46	2.38	5.75	8.27	1.37	-5.84	-4.55	-5.86	-14.75	-19.75
MUNG	1.54	560.80	2.90	1.42	518.20	2.33	1.13	342.20	1.41	7.85	6.49	14.86	*-0.12*	-1.56	-1.67	-17.65	-15.91	-30.76
KULTHI	4.08	558.40	2.85	5.54	475.20	3.04	4.37	362.35	2.03	1.52	16.95	18.73	-8.20	13.30	4.01	-13.80	-20.88	-31.80
ARHAR	2.66	856.40	6.75	2.73	824.20	6.29	2.58	496.90	3.79	2.64	11.64	14.59	1.16	-1.71	-0.56	-4.45	-6.37	-10.53
GRAM	0.71	654.60	1.17	0.50	748.60	0.92	0.43	429.25	0.46	-8.67	*-0.31*	-8.95	-14.75	-5.44	-19.39	-3.67	-19.45	-22.40
TIL	3.29	594.60	5.46	3.31	499.80	4.28	3.29	338.45	2.99	8.72	12.72	22.55	-3.54	1.20	-2.38	-2.63	-17.79	-19.95
MUSTARD	1.46	547.40	2.33	1.46	506.40	2.04	1.29	335.60	1.30	-0.08	10.22	10.13	*0.42*	-1.12	*-0.71*	-8.56	-13.97	-21.33
GROUNDNUT	0.40	1042.40	1.03	0.65	1201.60	1.81	1.50	1011.20	3.63	18.28	2.03	20.69	9.27	1.09	10.46	19.16	0.90	20.24
ONION	0.47	8009.60	4.12	0.38	7742.20	3.02	0.41	6002.65	2.61	-4.01	-7.24	-10.96	-3.47	-0.61	-4.06	-2.11	-7.95	-9.89
POTATO	0.04	8191.80	0.19	0.04	8725.60	0.23	0.04	6940.00	0.18	*-0.78*	-2.92	-3.68	-1.71	4.32	2.53	-20.38	-3.00	-22.77
SUGARCANE	0.69	5211.00	7.01	0.54	6440.75	6.49	0.72	6050.38	8.26	3.62	8.82	12.75	-3.80	-7.13	-10.66	-0.79	*0.62*	*-0.18*
JUTE	0.02	1239.12	0.03	0.01	1143.36	0.03	0.00	207.40	0.00	-3.70	2.06	-1.72	-16.26	-15.55	-29.28	-8.51	-16.32	-23.44
COTTON	0.14	207.06	0.14	0.13	177.82	0.12	1.17	347.00	1.42	-3.70	2.06	-1.72	-16.26	-15.55	-29.28	-8.51	-16.32	-23.44

Source: As in Table no 3.1

Among pulses, Kulthi and Biri are the most important one. In first period, 4.08% of GCA was under Kulthi with yield level 448 kgs/ha. But, in the final period, the area share was fallen to 4.37% along with the fall in yield level (362.35 kgs/ha). In case of Biri, 2.39% of GCA was under the crop with yield level 524 kgs/ha. In the final period, though there was an increase in area share (2.51%) but yield level has gone down to 356.15 kgs/ha. Arhar also occupies a significant place in the district. In the first period, 2.66% of GCA was under the crop with yield level 856.4 kgs/ha but in the final period, there was a significant fall both in area (2.58%) as well as yield level (496.20 kgs/ha).

Among oil seeds, Til is the most important one in the district. In the first period, 3.29% of GCA was under the crop with yield level 594.6 kgs/ha whereas in final period though area share was stagnant but the yield level has gone down to 338.45 kgs/ha. In case of Mustard, 1.46% of GCA was under the crop with yield level 547.4 kgs/ha but in the final period, there was a fall in both area share (1.29%) as well as yield level (335.6 kgs/ha).In case of groundnut, 0.40% of GCA with yield level 1042 kgs/ha was under the crop. In the final period, the area share has gone up to 1.50% but yield level has gone down to 1011.2 kgs/ha.

Among cash crops Sugarcane is the most important one. In first period, 0.69% of GCA with yield level 5261 kgs/ha was under the crop. In the final period, there was an increase in area share as well as yield level. The area share has gone up to 0.72% with yield level 605 kgs/ha. In case of Cotton, 0.14% of GCA was under the crop with yield level 207 kgs/ha during first period. In the final period area share has gone up to 1.17% with increased yield level (347 kgs/ha). In first period, 0.47% of GCA was under onion with yield level 8009.6 kgs/ha. In the final period, both area share (0.41%) as well as yield level (6002 kgs/ha) has gone down.

OBSERVATIONS

(1) Like other district, Paddy is the principal crop of the district w.r.t area share and contribution to total output. Production of coarse cereals and area share under coarse cereal is higher in comparison to other districts

(2) In comparison to first period, the area share has gone down for Wheat, Jawar, Ragi, mung, Gram, onion Sugarcane, Jute and Cotton in second period. And in third period, the area share of Wheat, Biri, Mung Kulthi, Arhar, Gram, Til and Mustard has gone down in comparison with second period. There is a secular decline in area share of Wheat, mung and Gram.

(3) As far yield level is concerned, in second period, except, paddy, maize, Ragi, Biri, Potato and Sugarcane, yield of all other crops have gone down in comparison with first period. And in third period, except Paddy and Cotton, the yield level of all other crops has gone down in comparison to second period. There is a secular decline in yield level of all crops except, Paddy, Maize, Ragi, Biri, Potato, and Sugarcane.

(4) In first period, the area share of Paddy, Wheat, Biri, Mung, Kulthi, Mustard, Groundnut, Onion and Potato was less than the state average. And in third period, the area share of Paddy, Wheat, Biri, Til, Mustard, Groundnut, Onion and Potato was less than state average.

(5) In case of yield, in first period, only the yield level of Biri, Groundnut and Sugarcane was less than state average. And in third period, except, Paddy, Maize, Jawar, Ragi and Cotton, the yield of all other crops was less than state average,

(6) Amongst all periods, the performance of agriculture in first period was better than the other two periods.

3.2.8 MAYURBHANJ

With a total area of 26,961 sq.km, the district of Mayurbhanj forms the part of Northern region of the state. As per *Orissa development report (2001)*, the district ranks 12th in the infrastructural development index. The average size of land holding of the district is 1.70 ha as per latest report (1990). The 18 major crops covered 78.87% GCA in the first period which increased to 81.20% in the final period.

Table No: 3.9

Crop-Wise Area, Production And Yield In Mayurbhanj District—1985-86 To 1999-00

	FIRST PERIOD			SECOND PERIOD			THIRD PERIOD			ANNUAL COMPOUND GROWTH RATE (%)								
	85-90			90-95			95-00			85-90			90-95			95-00		
NAME OF CROPS	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT
PADDY	59.93	1617.60	70.99	72.77	1842.40	74.27	66.97	1640.00	82.02	*0.43*	1.91	2.36	0.78	5.62	6.45	-0.91	*-0.26*	-1.18
WHEAT	0.73	1837.70	1.46	0.38	1788.00	0.56	0.20	1383.00	0.30	-10.39	-1.85	-12.05	-33.01	-1.50	-34.01	15.44	-13.81	*-0.51*
MAIZE	1.98	963.20	1.39	2.48	991.60	1.35	2.14	997.80	1.58	*0.46*	13.30	13.82	-1.54	0.78	-0.77	-1.52	4.91	3.32
JAWAR	0.21	924.00	0.12	0.20	833.00	0.08	0.13	566.40	0.05	-5.91	2.48	-3.57	-8.08	-7.25	-14.74	-12.48	-4.45	-16.38
RAGI	0.19	572.79	0.07	0.10	537.20	0.03	0.02	509.20	0 01	-6.75	18.01	10.05	-30.69	0.87	-30.09	1.97	-9.50	-7.72
BIRI	3.64	599.20	5.21	3.95	575.40	4.11	2.50	394.80	2.47	2.43	3.59	6.11	-5.57	-1.97	-7.43	-8.84	-10.36	-18.28
MUNG	2.27	615.00	4.11	2.46	488.20	2.69	1.40	374.80	1.63	2.24	7.94	10.35	-4.97	-5.03	-9.75	-5.81	-8.29	-13.62
KULTHI	3.35	505.40	1.86	3.67	489.40	1.52	2.70	317.40	0.97	2.51	-4.72	-2.32	-3.61	-8.53	-11.83	-4.34	-10.35	-14.24
ARHAR	1.61	889.80	3.76	2.13	905.80	3.84	1.53	727.40	2.98	-2.45	5.40	2.82	-3.38	-2.55	-5.85	-1.88	-4.52	-6.31
GRAM	0.99	689.60	1.54	1.02	672.80	1.17	0.42	613.40	0.60	*-0.52*	-8.29	-8.76	-10.00	-2.02	-11.81	-9.56	-1.89	-11.27
TIL	1.20	509.60	1.49	1.59	447.20	1.30	1.01	392.40	1.01	6.22	2.18	8.54	-1.65	4.22	2.50	-11.04	-7.49	-17.70
MUSTARD	1.21	416.00	1.30	1.39	484.80	1.31	0.74	364.40	0.73	-1.19	14.13	12.77	-8.58	*0.65*	-7.99	-4.41	-15.49	-19.22
GROUNDNUT	0.90	1205.00	2.36	1.24	1419.40	2.84	0.86	1139.00	2.16	5.13	-0.14	4.99	-12.65	6.59	-6.90	3.94	-3.07	0.75
ONION	0.44	8259.80	3.52	0.61	7616.40	3.38	0.48	6794.80	3.11	1.59	-5.62	-4.12	-3.19	-4.03	-7.09	-0.52	2.36	1.83
POTATO	0.03	7919.20	0.12	0.03	8265.60	0.10	0.02	8577.00	0.09	-2.36	1.32	-1.07	-11.65	*0.19*	-11.47	1.27	-1.48	*-0.23*
SUGARCANE	0.05	5292.40	0.43	0.16	6318.00	1.32	0.02	5941.00	0.23	45.67	4.41	52.09	14.13	12.07	27.90	-30.94	-4.84	-34.28
JUTE	0.12	1458.00	0.26	0.11	1160.64	0.14	0.06	710.00	0.06	-9.56	-2.63	-11.94	-6.25	-11.76	-17.28	-9.45	-3.63	-12.73
COTTON	0.01	139.40	0.01	0.00	0.00	0.00	0.00	0.00	0.00	-9.56	-2.63	-11.94	-6.25	-11.76	-17.28	-9.45	-3.63	-12.73

Source: As in Table No 3.1

Like other districts Paddy is the principal crop of the district as more than 50% of GCA was under the crop in all the periods. In first period, 59.93% of GCA was under Paddy with yield level 1617 kgs/ha. In the final period the area share (66.97%) has increased along with yield level (164 kgs/ha). Maize is the second important cereal. In first period, 1.98% of GCA was under the crop with yield level 963.2 kgs/ha. In the final period, there was an increase in area share (2.14%) along with yield level (997.8 kgs/ha). In first period 0.72% of GCA was under Wheat with yield level 1837.7 kgs/ha. In the final period, there was a decline in area share (0.20%) as well as yield level (1383 kgs/ha).

Among the pulses, Biri is the most important one. In first period, 3.64% of GCA was under the crop with yield level 599.2 kgs/ha. In the final period, the area share has gone down to 2.54% along with yield level (394.8 kgs/ha). Kulthi is the second important pulse of the district. In the first period, 3.35% of GCA was under the crop with yield level 505.4 kgs/ha. But, in the final period, the area share (2.70%) as well as yield level (317.4 kgs/ha) has gone down. In case of mung during first period, 2.27% of GCA was under the crop along with yield level 615 kgs/ha. Like other pulses, in third period, the area share (1.40% of GCA) as well as yield level (374.8 kgs/ha) has gone down. In case of Arhar also in third period, area share has gone down along with yield level in comparison to first period.

Among oilseeds, the area share of Til in first period was 1.20% along with yield level 509.6 kgs/ha. In the final period, the area share (1.01%) has gone down along with yield level (392 kgs/ha). In case of Mustard, 1.21% of GCA was under the crop in first period along with yield level 416 kgs/ha. But in the final period, there was a fall in area share (0.74%) along with yield level (364.4 kgs/ha). Groundnut's area share in first period was 0.9% with its yield level 1205 kgs/ha. But, in the final period, the area share has gone down to 0.86% along with its yield level (1139.00 kgs/ha).

Among cash crops, onion is the important one. In first period, 0.44% of GCA was under the crop with yield level 8259.8 kgs/ha. In the final period though area share (0.98%) has gone up but yield level (6794.00 kgs/ha) has gone down. In case of Jute, 0.12% of GCA was under the crop in first period with yield level 1458 kgs/ha. But in the final period, the area share has gone down to 0.06% with a fall in yield level (710 kgs/ha). Sugarcane covered

0.05% of GCA during the first period with its yield level 5292.4 kgs/ha. In the final period, though area share (0.02%) has gone down but yield level has increased to 5,945 kgs/ha. Potato covered less than 0.05% of GCA in all the periods.

OBSERVATIONS

(1) Like other district, Paddy is the principal crop of the district w.r.t area share and contribution to total output.

(2) In comparison to first period, the area share has gone down for Wheat, Jawar, Ragi and Jute in second period. In third period, the area share of all crops has gone down in comparison to second period. There is a secular decline in area share of Wheat, Jawar, Ragi and Jute through out the period.

(3) In case of yield, in second period, except, Paddy, Maize, Arhar, Mustard, Groundnut, Potato and Sugarcane, the yield level of all other crops are less than first period. In third period, except, Maize, Potato, the yield of all other crops was less than second period.

(4) In first period, except, Paddy, Wheat, maize, Arhar, Gram, the area share of all other crops was less than state average. And in third period, except Paddy, the area share of all other crops was less than state average.

(5) In case of yield, in first period, the yield, level of paddy, Maize, Ragi, Til, Mustard, Potato and Sugarcane was less than state average. In third period, except, Paddy, Maize, Arhar, the yield level of all other crops was less than state average.

(6) The performance of Agriculture in the district was better during first period in comparison to other two periods.

3.2.10 PHULBANI

With a total area of 11,119 Sq.km, the district of Phulbani, forms the part of Central region with more hilly and plateau areas. As per *Orissa development report (2001)*, Phulabani ranks 9th in the infrastructural development index. The average size of land holding is 1.38 ha as per the latest report (1990). The 18 major crops covered 71.06% of GCA in the first period, which has increased to 75.54% of GCA in the final period.

Table No: 3.10

Crop-Wise Area, Production And Yield In Phulbani District—1985-86 To 1999-00

	FIRST PERIOD			SECOND PERIOD			THIRD PERIOD			ANNUAL COMPOUND GROWTH RATE								
	85-90			90-95			95-00			85-90			90-95			95-00		
NAME OF CROPS	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT
PADDY	30.28	1719.20	47.18	32.86	1952.40	57.08	40.61	1813.30	61.41	*0.32*	-2.21	-1.90	1.56	1.47	3.05	1.43	9.77	11.35
WHEAT	0.24	1052.20	0.32	0.15	1546.00	0.30	0.05	1367.60	0.08	-11.65	8.45	-4.19	-31.36	-2.87	-33.33	1.18	-1.94	-0.78
MAIZE	5.88	1130.80	5.80	6.10	1111.60	5.95	6.41	1329.90	6.97	4.08	-6.42	-2.59	-0.20	12.09	11.87	1.14	6.07	7.28
JAWAR	0.39	909.40	0.27	0.22	668.20	0.14	0.27	262.80	0.05	-4.36	*-0.65*	-4.98	-8.91	-2.47	-11.15	-2.10	20.71	18.18
RAGI	2.19	626.09	1.23	1.17	469.00	0.45	1.11	568.90	0.50	-17.57	-2.69	-19.79	-7.15	24.44	15.54	1.53	1.00	2.54
BIRI	4.30	374.60	4.65	3.37	303.60	2.88	3.21	350.80	3.13	-3.15	2.70	-0.54	-5.05	25.06	18.74	1.70	3.39	5.15
MUNG	5.02	400.00	7.10	4.30	346.40	5.30	4.12	326.90	4.60	-6.43	13.22	5.94	-2.26	18.86	16.17	5.41	8.19	14.04
KULTHI	8.01	497.20	5.30	6.84	352.20	3.24	6.63	264.30	2.00	*-0.04*	-7.74	-7.78	-0.85	26.99	25.92	-10.23	19.58	7.34
ARHAR	3.93	709.00	8.78	3.45	643.40	7.00	3.25	781.60	7.41	2.81	*-0.30*	2.50	-5.64	6.32	0.32	7.00	-6.14	0.42
GRAM	0.11	598.40	0.18	0.14	604.00	0.23	0.08	262.90	0.07	14.92	3.60	19.05	-14.46	-12.34	-25.02	6.14	1.83	8.09
TIL	3.51	510.00	5.14	3.17	216.40	1.97	2.25	317.30	2.06	*-0.21*	-9.12	-9.31	*-0.31*	25.96	25.57	12.64	2.10	15.01
MUSTARD	5.60	321.60	5.60	7.25	356.20	8.01	5.87	298.40	5.22	-2.40	-7.16	-9.39	5.61	-8.25	-3.10	-12.13	-6.10	-17.49
GROUNDNUT	0.84	1082.00	2.36	1.05	1069.20	2.98	0.90	1092.50	2.43	3.87	9.62	13.86	-1.52	8.09	6.45	-2.45	9.25	6.58
ONION	0.35	4412.00	1.75	0.29	6160.20	2.06	0.34	5095.50	1.92	-13.09	8.66	-5.56	*-0.61*	-1.27	-1.87	-3.76	10.99	6.81
POTATO	0.13	5930.80	0.53	0.15	6659.20	0.67	0.20	6591.20	0.86	-5.24	-7.48	-12.33	7.62	*0.36*	8.01	0.51	*-0.66*	*-0.16*
SUGARCANE	0.28	6527.80	3.80	0.14	5376.00	1.71	0.16	4402.00	1.28	10.66	-0.02	10.65	-35.04	-6.45	-39.23	3.33	1.19	4.56
JUTE	0.00	379.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-29.29	-25.57	-47.37	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*
COTTON	0.01	138.04	0.01	0.01	183.60	0.01	0.07	81.90	0.02	-29.29	-25.57	-47.37	-	-	-	-	-	-

Source: As in Table no 3.1

During first period, 30.28% of GCA was under Paddy with yield level 1719 kgs/ha. In the final period, the area share has gone up to 40.61% with yield level 1813 kgs/ha. Maize is the second important cereal of the district. In first period, 5.88% of GCA was under the crop with yield level 1130 kgs/ha. In the final period, the area share (6.4%) has gone up along with yield level (1329 kgs/ha). Ragi occupied 2.19% of GCA in the first period with yield level 626 kgs/ha. During the final period, there was a fall in area share (1.11/%) along with yield level (568.9 kgs/ha). In first period, Jawar occupied 0.39% of GCA in first period with yield level 909.4 kgs/ha. In the final period, there is a fall in area share (0.27%) along with yield level (262.8 kgs/ha).

Among pulses, Kulthi occupies important place in the district. In first period, 8.01% of GCA was under the crop with yield level 497.2 kgs/ha. In the final period, there was a fall in area share (6.63%) along with the yield level (264.3 kgs/ha). Mung occupies second place w.r.t area share. In first period, 5.02% of GCA was under the crop with yield level 400 kgs/ha. During the final period, there was a fall in area share (4.12%) along with yield level (326.9 kgs/ha). In case of Biri, during first period, 4.30% of GCA was under the crop with yield level 374.6 kgs/ha. But, in the final period, there was a fall in area share (3.21%) along with yield level (350.8 kgs/ha).

Among oil seeds, mustard is the most important one. In first period, 5.60% of GCA was under the crop, with yield level 321.6 kgs/ha. In the final period, though there is an increase in area share (5.87%) but yield level has gone down to 298.5 kgs/ha. In case of Til 3.51% of GCA was under the crop during first period with yield level 510 kgs/ha. In final period, there was a fall in area share (2.25%) with a fall in yield level (317.3%). In case of Groundnut, 0.84% of GCA was under the crop with yield level 1082 kgs/ha. In final period there was an increase in area share (0.9%) along with its yield level (1092 kgs/ha).

Among cash crops, onion is the most important one. During first period, 0.35% of GCA was under the crop with yield level 4,412 kgs/ha. In the final period, with 0.34% of GCA, the yield level has gone up to 5095 kgs/ha. In case of Sugarcane, 0.28% of GCA was under the crop with yield level 6527 kgs/ha. In the final period, the area share (0.16%) has gone down along with the yield level (4402 kgs/ha). For potato, there was an increase in area share (0.20%) along with yield level (6591 kgs/ha) in final period comparing with first period.

OBSERVATIONS

(1) Like other districts, *Paddy* is the principal crop of the districts w.r.t. Area share and contribution to output.

(2) In second period, except the area share of paddy, Maize, Gram Mustard, Groundnut and Potato, the area share of all other crops has gone down in comparison with first period. In third period, except, the area share of Paddy, Maize, Jawar, Onion, potato, and Sugarcane, the area share of all other crops has gone down. There is a secular decline an area share of Wheat, Ragi, Biri, mung, Kulthi, Arhar, and Oil in all the periods.

(3) In case of yield, in second period, the yield level of all crops except, Paddy, Wheat, gram, Mustard, Onion and Potato has gone down in comparing with first period. During third period, except, Maize, Ragi, Biri, Arhar, Oil and Groundnut, the yield of all other crops has gone down in comparing with second period. There is a secular decline in yield level of Jawar, mung, Kulthi and Sugarcane in all periods.

(4) In first period, except, Maize, Jawar, Kulthi, Arhar, Til, Mustard, Potato, and Sugarcane, the area share of all other crops was less than state average. In third period, except, Maize Jawar, Kulthi, Arhar, Mustard, and Potato, the Area share of all other crops are less than state average.

(5) In case of yield, except, Paddy, maize, Jawar, Ragi and Sugarcane, the yield level of all other crops are less than state average during first period. In final period, except, Paddy, Maize, Arhar, the yield level of all other crops are less than state average.

(6) The performance of the district in first period is better than the other periods on the basis of yield levels.

3.2.11 PURI

With a total area of 10,182 sq. km, the district of Puri forms the part of coastal region in the eastern side of state. As per *Orissa development report (2001)*. the district ranks first in the infrastructural development index. The average size of land holding of the district is 1.01 ha as per latest report (1990). The 18 major crops covered 84.39% of GCA in first period, which increased to 86.82% in the final period.

Table No: 3.11

Crop-Wise Area, Production And Yield In Puri District—1985-86 To 1999-00

	FIRST PERIOD			SECOND PERIOD			THIRD PERIOD			ANNUAL COMPOUND GROWTH RATE								
	85-90			90-95			95-00			85-90			90-95			95-00		
NAME OF CROPS	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT
PADDY	49.41	2053.20	56.83	53.67	2186.80	62.11	56.35	1878.87	62.17	*-0.09*	8.65	8.55	*0.27*	2.62	2.90	1.15	4.00	5.19
WHEAT	0.18	1549.10	0.23	0.09	1576.60	0.11	0.06	1371.53	0.07	-20.39	*0.43*	-20.05	-9.60	-1.22	-10.70	0.85	4.24	5.13
MAIZE	0.65	836.80	0.30	0.73	944.00	0.36	0.76	951.53	0.43	3.90	*-0.09*	3.81	2.58	0.69	3.29	*0.42*	-4.54	-4.14
JAWAR	0.06	902.00	0.03	0.03	594.00	0.01	0.03	398.00	0.01	-36.42	-2.14	-37.78	19.83	-5.76	12.93	-4.36	*-0.30*	-3.10
RAGI	1.78	673.18	0.67	0.77	597.40	0.23	0.42	663.40	0.16	-11.45	-1.23	-12.54	-14.57	-1.58	-15.92	7.77	-2.06	5.56
BIRI	7.95	504.40	7.55	6.88	525.60	6.18	6.54	412.67	5.17	-6.35	-26.61	-31.27	-0.75	6.71	5.91	3.01	7.79	11.04
MUNG	11.23	482.00	12.59	10.90	483.20	11.15	11.42	383.87	10.43	-7.35	-30.86	-35.94	2.23	6.17	8.53	11.62	6.08	18.41
KULTHI	5.83	445.00	2.17	5.45	510.80	2.20	4.97	471.93	2.10	6.96	-12.43	-6.33	-1.25	5.75	4.42	6.29	1.61	7.99
ARHAR	0.35	805.20	0.57	0.35	839.60	0.55	0.24	624.53	0.34	4.93	1.39	6.40	1.66	-0.43	1.23	18.23	*-0.54*	17.59
GRAM	0.02	409.60	0.02	0.01	524.00	0.01	0.02	448.20	0.02	-34.62	-3.25	-36.75	49.56	3.40	54.64	18.84	*0.38*	19.29
TIL	2.10	471.40	1.84	1.60	440.00	1.22	1.43	420.13	1.21	*-0.54*	-10.29	-10.78	1.48	8.00	9.60	7.34	5.68	13.44
MUSTARD	0.86	399.80	0.69	0.78	476.40	0.68	0.68	370.13	0.55	-5.14	-11.72	-16.26	-1.32	3.49	2.12	-5.67	-10.73	-15.78
GROUNDNUT	2.52	1262.20	5.41	2.41	1556.00	5.77	2.55	1297.67	5.88	-19.99	-8.37	-26.69	6.03	6.53	12.95	1.35	9.26	10.74
ONION	0.26	6671.60	1.25	0.27	7522.60	1.42	0.29	5699.87	1.29	8.10	-8.30	-0.87	1.19	2.91	4.14	-1.66	-10.88	-12.36
POTATO	0.18	10895.80	0.85	0.20	10713.00	0.89	0.14	10224.27	0.65	7.63	*-0.51*	7.08	-1.67	5.35	3.59	3.83	*0.57*	4.43
SUGARCANE	0.93	7342.80	8.92	0.72	7923.93	7.08	0.88	7763.73	9.52	-10.34	1.15	-9.31	-4.31	0.33	-3.99	-10.09	*-0.31*	-10.36
JUTE	0.06	1143.36	0.07	0.02	1454.76	0.03	0.02	616.72	0.02	-12.31	-9.05	-20.24	45.40	1.80	48.02	-7.88	8.00	*-0.50*
COTTON	0.00	122.06	0.00	0.00	68.00	0.00	0.01	28.67	0.00	-12.31	-9.05	-20.24	45.40	1.80	48.02	-7.88	8.00	*-0.50*

Source: As in Table no 3.1

Paddy is the principal crop of the district. During first period, 49.41% of GCA was under the crop with yield level 2053 kgs/ha. In the final period, the area share (56.35%) has gone up but the yield level (1878 kgs/ha) has gone down. Ragi is the second important crop with area share 1.78% and yield level 673.18 kgs/ha in first period. During the final period, the area share (0.42%) as well as yield level (663.4 kgs/ha) has gone down. In case of Maize, 0.65% of GCA was under the crop with yield level 836.8 kgs/ha during first period. In the final period, the area share (0.76%) as well as yield level (951 kgs/ha) has gone up.

Among pulses, mung is the most important one. During first period 11.23 % of GCA was under the crop with yield level 482 kgs/ha .In the final period, the area share (11.42 %) has gone up but yield level (383.8 kgs/ha) has gone down. In case of Biri, 7.95% of GCA was under the crop with yield level 504 kgs/ha in first period. But, during the final period, the area share (6.54%) as well as yield level (412.67 kgs/h) has gone down. In case of Kulthi, 5.83% of GCA was under the crop with yield level 445 kgs/ha in first period. During the final period, though the area share has gone down but the yield level (4.97%) has gone up (471.93 kgs/ha).

Among oil seeds, Groundnut is the most important one. In first period 2.52% of GCA was under the crop with yield level 1262 kgs/ha. In the final period, the area share (2.55%) as well as yield level (1297.6 kgs/ha) has gone up. In case of Til, 2.10% of GCA was under the crop with yield level 421.9 kgs/ha during first period. In the final period, the area share (1.43%) as well as yield level (420 kgs/ha) has gone down. In case of Mustard the area share (0.68%) as well as yield level (370 kgs/ha) has gone down in third period in comparison with first period.

Among cash crops, the area coverage of Sugarcane was very high. In first period, 0.93% of GCA was under the crop with yield level 7342 kgs/ha. In the final period, though the Area share (0.8%) has gone down but the yield level has gone up (7763.7 kgs/ha). In case of Onion 0.26% of GCA was under the crop with yield level 6671 kgs/ha in first period. During final period, the area share has gone up to 0.29% but the yield level has gone down to 5699 kgs/ha.

In case of potato, 0.18% of GCA was under the crop with yield level 10,895 kgs/ha but in the final period the area share (0.14%) as well as yield level (10,224.27 kgs/ha) has gone down in comparison with first period.

OBSERVATIONS

(1) Like most of the districts, Paddy is the principal crop of the district w.r.t. Area coverage as well as contribution to total output.

(2) In second period, except the area share of Paddy, Onion and Potato, share of all other crops has gone down in comparison with first period. In third period, except paddy, maize, mung, Gram, Groundnut, Onion and Sugarcane, the area share of all other crops has gone down in comparison with second period. There is secular decline is area share of Wheat, Jawar, Ragi, Biri, Kulthi, Arhar and Mustard.

(3) In comparison with first period, the yield level of Jawar, Ragi, Til, Potato and Cotton, has gone down in second period. In third period, the yield level of all crops except Maize has gone down in comparison to second period.

(4) In first period, except the area share of Paddy, Biri, Mung, Kulthi, Potato and Sugarcane, area share of all other crops was less than state average. In final period, except, Paddy, Biri, Mung, Kulthi, Potato and Sugarcane, area share of all other crops was less than the state average.

(5) Similarly in first period, except the yield level of Paddy, Jawar, Ragi, Arhar, Groundnut, Potato and Onion, the yield level of all other crops was less than state average. In the final period, except, Paddy, Ragi, Kulthi, Til, Groundnut, Potato, Sugarcane and Jute, the yield level of all other crops was less than the state average. The performance of agriculture in the district was better in second period than the other two periods as far as yield level of crops are concerned.

3.2.12 SAMBALPUR

With a total area of 17,516 sq. km, the district of Sambalpur forms the part of northwestern region of the state. As per *Orissa development report (2001)*, the district ranks 4th in the infrastructural development index. The average size of land holding in the district was 1.71 h as per latest report (1990). The 18 major crops covered 84.02% of GCA in first period, which has gone up to 88.8% in the final period.

Table No: 3.12

Crop-Wise Area, Production And Yield In Sambalpur District—1985-86 To 1999-00

	FIRST PERIOD			SECOND PERIOD			THIRD PERIOD			ANNUAL COMPOUND GROWTH RATE(%)								
	85-90			90-95			95-00			85-90			90-95			95-00		
NAME OF CROPS	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT
PADDY	58.41	1805.00	61.81	57.72	2447.20	65.67	63.14	2191.55	68.07	*-0.58*	4.91	4.30	*0.02*	2.40	2.42	-0.45	1.70	1.24
WHEAT	0.69	1666.10	0.99	0.36	1814.60	0.45	0.30	1687.90	0.37	-13.23	-1.54	-14.56	-9.02	2.06	-7.14	-4.23	-4.42	-8.46
MAIZE	0.38	1101.20	0.24	0.41	1133.00	0.21	0.39	1528.90	0.29	3.84	9.74	13.96	-1.47	-3.67	-5.08	*-0.37*	*-0.21*	*-0.57*
JAWAR	0.10	809.80	0.04	0.06	725.80	0.02	0.05	530.00	0.01	-2.90	-3.55	-6.35	0.93	-8.99	-8.15	-3.79	-14.76	-17.99
RAGI	0.18	710.22	0.07	0.07	892.60	0.03	0.04	801.41	0.00	-4.98	6.94	1.62	-22.29	-0.87	-22.96	-6.16	-10.58	-16.08
BIRI	4.06	559.20	4.36	4.97	585.20	4.40	4.78	538.75	4.19	4.49	5.91	10.66	2.71	-0.90	1.79	-8.32	-10.01	-17.49
MUNG	5.61	501.80	6.66	6.23	507.60	5.91	5.71	536.45	6.07	2.42	11.62	14.32	1.13	3.55	4.72	-2.90	-3.63	-6.42
KULTHI	2.81	555.80	1.38	2.09	575.20	0.85	1.45	341.95	0.46	-3.68	-3.28	-6.84	-1.88	-11.58	-13.25	-25.24	-4.01	-28.23
ARHAR	0.39	628.60	0.53	0.56	784.40	0.72	0.42	760.25	0.55	2.29	-1.61	*0.64*	-3.09	8.42	5.07	-1.54	-12.92	-14.26
GRAM	0.22	645.00	0.25	0.15	656.60	0.15	0.14	535.75	0.11	9.62	4.96	15.05	-7.67	-5.68	-12.91	1.54	-7.27	-5.84
TIL	3.63	603.60	4.24	4.66	551.20	3.87	5.01	483.71	4.01	*-0.24*	5.64	5.38	9.77	-4.76	4.54	-7.35	-7.20	-14.03
MUSTARD	1.23	525.40	1.35	1.69	564.00	1.55	1.49	537.45	1.38	7.68	3.70	11.67	3.05	-1.64	1.36	-3.37	-7.02	-10.16
GROUNDNUT	5.27	1217.00	11.14	6.00	1376.60	11.35	4.86	1267.15	8.98	7.04	-4.02	2.74	-5.39	0.57	-4.85	-9.17	-1.65	-10.67
ONION	0.50	6795.60	2.61	0.51	8748.00	2.75	0.56	6720.75	2.60	*-0.21*	-2.12	-2.32	4.73	4.70	9.66	-6.30	-21.74	-26.67
POTATO	0.12	8031.20	0.45	0.12	8840.80	0.39	0.12	9256.60	0.43	2.73	0.76	3.51	2.21	1.92	4.16	-4.23	2.32	-2.02
SUGARCANE	0.41	6872.40	3.88	0.24	6140.30	1.67	0.35	6204.65	2.47	-15.04	2.50	-12.92	-2.13	-6.93	-8.91	-22.84	4.09	-19.69
JUTE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*
COTTON	0.01	159.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*

Source: As in Table no 3.1

Paddy is the principal crop of the district. In first period, 58.41% of GCA was under the crop with yield level 1,805 kgs/ha. In the final period, the area share (63.14%) as well as yield level has gone up. Wheat occupies second largest place in the district. In first period, 0.69% of GCA was under the crop with yield level 1666.10 kgs/ha. In the final period, though the area share (0.30%) has gone down but yield level has gone up to 1687. 9 kgs/ha. In case of Maize, 0.38% of GCA was under the crop with yield level 1101.2 kgs/ha during first period. In final period, the area share (0.39%) as well as yield level (1528 kgs/ha) has gone up. The area share of Jawar and Ragi, which was 0.28% in the first period, has gone down to 0.09% of GCA in the final period.

Among pulses, mung is the most important one. In first period, 5.61 % of GCA was under the crop with yield level 501.8 kgs/ha. During the final period, the area share (5.71%) as well as yield level (536.4 kgs/ha) has gone up. In case of Biri, 4.06% of GCA was under the crop with yield level 559.2 kgs/ha during first period. But, in the final period, the area share (4.78%) as well as yield level (538. 7 kgs/ha) has gone down. In case of Kulthi, 2.81% of GCA was under the crop with yield level 555.8 kgs/ha in first period. But, in the final period, the area share (1.45%) as well as yield level (341.9 kgs/ha) has gone down. Arhar and Gram together occupied 0.61% of GCA in the first period, which came down to 0.54% in the final period.

Among oilseeds, Groundnut is the most important one. In first period, 5.27% of GCA was under the crop with yield level 1217 kgs/ha. In the final period, the area share has came down to 4.86% but the yield level has gone up to 1267.15 kgs/ha.Til occupied 3.63% of GCA with yield level 603 kgs/ha during first period. But, in the final period, though the area share has gone up to 5.01%, the yield level has gone down to 483.7 kgs/ha. In case of Mustard, 1.23% of GCA was under the crop with yield level 524.4 kgs/ha during the first period. But, in the final period, the area share (1.49%) as well as yield level (537.4 kgs/ha) has gone up.

Among cash crops, onion gets the top priority in the district. In first period, 0.5% of GCA was under the crop with yield level 6,795 kgs/ha. But, in the final period, though the area share (0.56%) has gone up, but the yield level (6,720 kgs/ha) has came down. In case of Sugarcane, 0.41% of GCA was under the crop with yield level 6872 kgs/ha in the first period. But, in the final period,

the area share (0.35%) as well as yield level (6,204 kgs/ha) has gone down. In case of Potato, 0.12% of GCA was under the crop with yield level 8,031 kgs/ha in first period. In the final period, though area share was constant yield level has gone up to 9,256 kgs/ha

OBSERVATIONS

(1) Like other district, Paddy is the principal crop of the districts.

(2) In second period, except maize, Biri, Mung, Arhar, Til, Mustard and Groundnut, the area share of all other crops was less than first period. During third period, except Maize, Biri, Potato and Onion, area share of all other crops was less than second period.

(3) In case of yield, the yield of Jawar, Til and Sugarcane in first period was less than first period. In third period, except, Maize, mung, potato and Sugarcane the yield of all other crops was less than second period.

(4) In first period, except, Paddy, Wheat, Til, Groundnut, onion, Potato and Sugarcane, the area share of all other crops was less than state average. In third period, the area share of maize, Jawar, Ragi, Biri, Mung, Kulthi, Arhar and Gram was less than state average.

(5) In first period, the yield level of mung, Arhar and Potato was less than state average whereas in third period, the yield level of Kulthi, and sugarcane was less than state average.

(6) In general, the performance of agriculture in second period was better than the other two periods.

3.2.13 SUNDARGARH

With a total area of 9,712 sq km, the district of Sundargarh forms the part of hilly region in the northern side of the state. As per *Orissa development report (2001)*, the district ranks 7^{th} in the infrastructural development index. The average size of holding is 1.77 ha as per latest report (1990). The 18 major crops covered 79.39% of GCA in first period, which has gone up 83.33% in final period.

Table No: 3.13

Crop-Wise Area, Production And Yield In Sundargarh District—1985-86 To 1999-00

	FIRST PERIOD			SECOND PERIOD			THIRD PERIOD			ANNUAL COMPOUND GROWTH RATE								
	85-90			90-95			95-00			85-90			90-95			95-00		
NAME OF CROPS	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT
PADDY	54.07	1196.00	57.16	52.68	1435.40	60.85	57.61	1382.20	62.61	*-0.07*	*-0.14*	*-0.21*	-0.12	1.13	1.01	*0.50*	1.15	1.65
WHEAT	1.48	1673.30	3.18	0.76	1806.09	1.62	0.58	1580.80	1.11	-13.93	5.14	-9.51	-3.33	1.86	-1.52	-6.49	-4.55	-10.74
MAIZE	1.48	852.20	1.12	1.80	1180.00	1.64	1.69	1595.80	2.13	8.42	7.72	16.79	-7.92	2.27	-5.83	5.30	6.37	12.00
JAWAR	0.57	608.40	0.26	0.43	796.80	0.24	0.23	816.80	0.12	*0.00*	-1.05	-1.05	-8.04	-1.51	-9.42	-1.89	-6.13	-7.91
RAGI	0.34	500.76	0.14	0.34	842.40	0.22	0.28	785.20	0.16	13.53	1.16	14.85	-6.81	2.50	-4.48	9.47	-10.85	-2.41
BIRI	4.36	533.00	6.67	4.55	603.20	7.21	4.88	518.40	6.54	*0.05*	6.70	6.76	2.09	-1.64	*0.42*	-3.87	-7.38	-10.97
MUNG	3.84	524.00	7.13	3.46	514.00	5.78	3.45	524.40	5.73	-2.47	1.15	-1.35	-3.01	4.57	1.42	-0.67	-9.36	-9.97
KULTHI	4.30	542.40	3.11	4.44	535.00	2.89	4.69	416.00	2.29	4.05	2.43	6.58	*-0.19*	5.03	4.83	1.86	-20.62	-19.14
ARHAR	1.71	733.20	4.02	1.81	854.80	4.48	2.06	831.40	4.83	6.89	17.51	25.61	-3.73	1.03	-2.74	-2.10	-14.80	-16.59
GRAM	0.90	627.60	1.50	0.70	675.60	1.17	0.91	490.80	1.09	-2.78	5.75	2.81	4.07	-2.19	1.79	-1.20	-13.54	-14.58
TIL	2.87	528.00	4.43	3.76	335.00	3.39	3.86	412.60	4.09	3.67	3.33	7.13	4.09	14.68	19.38	*-0.64*	-9.21	-9.79
MUSTARD	1.21	512.40	1.93	1.36	632.20	2.44	1.01	402.00	1.23	-7.47	6.75	-1.22	4.56	*0.11*	4.67	-19.19	-23.44	-38.13
GROUNDNUT	1.54	1114.80	4.54	1.53	1419.20	5.18	1.56	1416.40	5.16	5.04	7.77	13.20	-1.38	1.64	0.24	-11.62	-2.05	-13.43
ONION	0.47	5753.40	3.11	0.39	2955.00	1.18	0.33	4985.60	1.71	1.19	-24.60	-23.71	3.42	4.74	8.32	-2.86	10.37	7.22
POTATO	0.14	7752.60	0.74	0.13	7874.60	0.66	0.15	6992.00	0.65	4.46	-0.42	4.02	3.27	1.16	4.47	*0.31*	3.91	4.23
SUGARCANE	0.08	5464.80	0.94	0.08	7360.60	1.05	0.05	5874.42	0.55	10.03	-2.08	7.74	*-0.66*	*0.27*	*-0.39*	-1.53	-0.88	-2.39
JUTE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*	*N.C*
COTTON	0.03	141.78	0.02	0.01	134.64	0.00	0.00	0.00	0.00	-	-	-	-	-	-	*N.C*	*N.C*	*N.C*

Source: As in Table no 3.1

From table no 3.13 it is evident that during first period 54.07% of GCA was under Paddy with yield level 1,196 kgs/ha. In the final period the area share (57.65%) as well as yield level (1,382 kgs/ha) has gone up. In first period, 1.48% of GCA was under Wheat with yield level 1,673 kgs/ha. In the final period, the area share (0.58%) as well as yield level (1580 kgs/ha) has gone down. In case of Maize also, 1.48% of GCA was under the crop with yield level 852 kgs/ha in first period. In the final period, the area share (1.69%) as well as yield level (1595.8 kgs/ha) has gone up.

Among pulses, 4.36% of GCA was under Biri with yield level 533 kgs/ha during 1st period. In the final period, the area share (4.88%) has gone down. In case of mung, 3.84% of GCA was under the crop with yield level 524 kgs/ha. In the final period, the area share (3.45%) has gone up with stagnant yield level. In case of Kulthi, 4.30% of GCA was under the crop with yield level 524 kgs/ha. In the final period, the area share (4.69%) has gone up but yield level (416 kgs/ha) has gone down. In case of Arhar, during first period, 1.71% of GCA was under the crop with yield level 733 kgs/ha. In the final period, the area share (2.06%) as well as yield level (831 kgs/ha) has gone up.

Among oilseeds, Til occupied 2.87% of GCA with yield level 238 kgs/ha during 1st period. In the final period, though the area share (3.56%) has gone up but yield level (412 kgs/ha) has gone down. In case of Groundnut, 1.54% of GCA was under the crop with yield level 1114.0 kgs/ha in first period. In the final period, the area share (1.56%) as well as yield level (1466 kgs/ha) has gone up. In case of Mustard, 1.21% of GCA was under the crop with yield level 512 kgs/ha but in the final period, the area share (1.01%) as well as yield level (502 kgs/ha) has gone down.

Among cash crops onion occupied 0.47% of GCA with yield level 5,753 kgs/ha in the first period. In the final period, the area share (0.33%) as well as yield level (4,985 kg) has gone down. In case of potato, 0.14% of GCA was under the crop with yield level 7,752 kgs/ha in the first period. In the final period, the area share (0.15%) has marginally gone up but yield level (6,992 kgs/ha) has gone down. And in case of Sugarcane, 0.08% of GCA with yield

level 6426.8 kgs/ha was under the crop in first period. During the final period, with area share 0.04%, the yield level (6,245 kgs/ha) has gone down.

OBSERVATIONS

(1) Like most of the districts, in Sundargarh also Paddy is the principal crop w.r.t. Area coverage as well as contribution to total output.

(2) The area share of all crops except, Maize, Ragi, Kulthi, Arhar, Til and Mustard, has gone down in second period comparing with first period. In third period, except, Paddy, mung, Arhar, Gram, Til, Mustard and Potato, the area share of all other crops has gone down in comparison with second period.

(3) In second period, the yield of mung, Kulthi, Til Onion and Cotton has gone down in comparison with first period. In third period, except, Maize Jawar, Mung, oil and Onion the yield level of all others crop has gone down in comparison with second period.

(4) Similarly in first period, except, paddy, Wheat, Jawar Kulthi, Arhar, gram and Potato, the area share of all other crops was less than the state average. In third period, the area share of Maize, Ragi, Biri, mung, Mustard, Groundnut, and onion was less than state average. In first period, the yield level of Paddy, Maize, Jawar, Ragi, Groundnut, onion and Potato was less than state average. In third period, the yield level of Paddy, Gram, Onion, potato and Sugarcane was less than state average.

(5) The agricultural performance of the district was better in second period in comparison with two other periods.

SECTION 3

Inter-District Analysis Of Cropping Pattern

From our above analysis it is found that paddy is the single most important crop in each and every district. But there is variation in area coverage under each crop among districts and this is changing over time.

Table No: 3.14
Inter-District Comparison Of Cropping Pattern: 1985-86 To 1999-00

	FIRST PERIOD		SECOND PERIOD		THIRD PERIOD
			CEREALS		
(1) A> 50%	Mayurbhanj, Balasore Keonjhar, Sundargarh Koraput, Sambalpur, , Bolangir, Puri	1	Mayurbhanj, Balasore, Sambalpur, Keonjhar, Sundargarh, Puri, Koraput, Bolangir,	1	Balasore, Mayurbhanj , Sambalpur, Sundargarh, Keonjhar, Koraput, Cuttack, Ganjam
		2	Cuttack, Ganjam, Kalahandi, Phulbani		
(2) 40%< A < 50%	Cuttack, Kalahandi, Ganjam			2	***
(3) A < 40%	Dhenkanala, Puri	3	Dhenkanala	3	Phulbani, Kalahandi, Dhenkanala
			COARSE CEREALS		
(1) A > 5%	Koraput, Ganjam, Phulbani Kalahandi, Keonjhar	1	Koraput, Ganjam, Phulbani, Keonjhar	1	Koraput, Ganjam, Phulbani
(2) 1%<A<5%	Puri, Sundargarh, Mayurbhanj Bolangir, Dhenkanala, Cuttack	2	Kalahandi, Mayurbhanj, Sundargarh Bolangir, Puri, Dhenkanala	2	Keonjhar, Kalahandi, Mayurbhanj, Sundargarh, Bolangir, Dhenkanala, Puri
(3) A< 1%	Sambalpur, Balasore	3	Cuttack, Sambalpur, Balasore		
				3	Cuttack, Sambalpur, Balasore
			PULSES		
(1) A > 20%	Ganjam, Cuttack, Dhenkanala Puri, Phulbani, Kalahandi	1	Ganjam, Kalahandi, Dhenkanala, Cuttack, Puri	1	Kalahandi, Ganjam, Dhenkanala, Puri Cuttack
(2) 10% <A< 20%	Bolangir,Sundargarh, Keonjhar, Balasore, Sambalpur, Mayurbhanj Koraput	2	Bolangir, Phulbani, Sundargarh, Sambalpur, Keonjhar	2	Bolangir, Phulbani, Sundargarh Keonjhar, Sambalpur, Koraput
(3) A < 10%	***	3	***		
				3	Mayurbhanj, Balasore
			OIL SEEDS		
(1) A > 10%	Dhenkanala, Ganjam, Bolangir, Sambalpur, Phulbani,Cuttack, Kalahandi, Keonjhar	1	Dhenkanala, Sambalpur, Bolangir, Phulbani, Cuttack	1	Dhenkanala, Sambalpur,
		2	Ganjam, Kalahandi, Sundargarh, Keonjhar, Balasore, Koraput,	2	Kalahandi, Bolangir, Phulbani, Cuttack, Ganjam, Sundargarh, Koraput, Keonjhar
(2) 5% < A < 10%	Sundargarh, Puri, Koraput, Balasore	3	Puri, Mayurbhanj		
(3) A < 5%	Mayurbhanj				
				3	Puri, Balasore, Mayurbhanj
			CASH CROPS		
(1) A > 2%	Cuttack, Bolangir	1	Cuttack	1	Cuttack, Koraput, Bolangir
(2) 1% <A<2%	Balasore, Dhenkanala, Puri, Koraput, Ganjam, Keonjhar, Kalahandi, Sambalpur	2	Bolangir, Balasore, Dhenkanala, Kalahandi, Puri, Keonjhar, Koraput, Ganjam	2	Bal sore, Kalahandi, Dhenkanala, Puri, Sambalpur, Ganjam
(3) A < 1%	Phulbani, Sundargarh, Mayurbhanj	3	Mayurbhanj, Sambalpur, Sundargarh, Phulbani	3	Keonjhar, Phulbani, Mayurbhanj, Sundargarh

Source: As in table no 3.1 , A= Percentage share in GCA

3.3.1 PADDY

From the Table no.3.14 it is clear that during first period (a) Mayurbhanj, Balasore, Sambalpur, Keonjhar, Sundargarh, Koraput, Bolangir and Puri districts have more than 50% of GCA under Paddy. Among these districts except Balasore and Puri, all are non-coastal hilly region. Cuttack, Kalahandi and Ganjam have less than 50% (i.e. 40 to 50%) of GCA under Paddy. And Dhenkanal and Phulbani have less than 40% (i.e. 30 to 40%) of GCA under paddy during first period.

During second period, the same eight districts have more than 50% of GCA under Paddy, though relative position of last three districts have been changed. Phulbani's share under paddy has increased in second period, and joined in the less than 50% group. In second period, Dhenkanala is the only districts, which has less than 40% of GCA under paddy.

During final period, along with the existing districts, Cuttack and Ganjam have joined with the group of more than 50% of GCA under Paddy. Dhenkanala's area share under Paddy has gone up and joined in the less than 50% area share group. From the above it is clear that, above mentioned 8 districts have maintained more than 50% of area under Paddy and during the last period, two new districts; that is Cuttack and Ganjam have entered in to the group.

3.3.2 PULSES

In case of pulses Ganjam, Cuttack Dhenkanala, Puri (all coastal and central districts) Phulabani and Kalahandi have area share more than 20% of GCA during first period. All other districts have area share less than 10% (i.e. 10-20 %) under pulses.

During second period, except Phulbani, all other districts, which were in more than 20% group during first period, also have maintained their position. The other 8 districts have area share less than 20% (10-20%) under pulses.

During third period, the same 5 districts of second period were in the top list with more than 20% of GCA under pulses. Muyurbhanj and Bolangir who were in the second level during the second period have lost their area share and have gone down to third level with less than 10% of GCA under the crop. All other districts have area share more than 10%(but less than 2o%) during the final period also.

From the above it is obvious that coastal districts have more area share in pulse than non-coastal districts.

3.3.3 OIL SEEDS

During first period, Dhenkanala, Ganjam, Bolangir, Sambalpur, Cuttack, Kalahandi and Keonjhar have more than 10% of GCA under oilseeds. Sundargarh, Puri, Koraput and Bolangir have less than 10% (5-10%) of GCA under the crop. Mayurbhanj was in the lowest level with less than 5% of GCA under oilseeds.

During second period, Kalahandi and Keonjhar's area share has gone down and have joined in the second level (i.e. less than 10% of GCA). Remaining 5 districts of top slot in first period have maintained their position. In second level, (i.e. less than 10% category), along with Ganjam and Keonjhar, there are 6 districts. Puri district, which was in second level in first period, had gone down to third category as its area share had reduced. Puri and Mayurbhanj were in the last slot (i.e. less than 5%) in second period.

In third period, only Dhenkanala and Sambalpur have more than 10% of GCA under oilseeds. Bolangir, Puri, Cuttack whose area share was more than 10% in second period had joined in second level with less than 10% of GCA under the crop. In second level, now there are 8 districts. In third level i.e. less than 5% of GCA, there are 9 districts with inclusion of Bolangir.

From the above analysis, it is clear that the districts share under oil seeds is going down as the number of districts in the top slot has gone down (8 in first period, 5 in second period and 2 in third period) and number of district in bottom category is increasing (1 in first period, 2 in second period and 3 in third period).

3.3.4 CASH CROPS

During first period, Cuttack and Bolangir have more than 2% of GCA under Cash crops. Bolangir, Dhenkanala, Puri, Koraput, Ganjam, Keonjhar Kalahandi and Sambalpur have area share less than 2% (i.e. 1-2%) in first period. Phulbani, Sundargarh, Mayurbhanj have area share less than 1% under cash crops in first period.

In second period, Bolangir's share has gone down so it joined in second level i.e. area share less than 2%. Sambalpur whose rank was in second level in first period had lost area and joined in 3rd level in second period. Thus, there are 4 districts in bottom category whose area share is less than 1% under cash crops during second period.

But, in third period there is an improvement. Koraput and Bolangir have joined with Cuttack in the first level (i.e. more than 2% of GCA). Sambalpur which was in the bottom level in second period has joined in second level but Keonjhar which was in second level in second period had lost area and joined in 3rd level i.e. less than 1% of GCA under cash crop in third period.

SECTION 4

3.4.1 Cropping Pattern And It's Implication For Orissa's Food Economy

As per the latest estimation of the planning commission, Orissa has the highest proportion of population living below poverty line. In the year 1999-00, the % of people living below poverty line (BPL) in the state was 47.2% whereas; it was 42.6% in case of Bihar. On the other hand, the all India average was found to be 26.10%.

Besides, in Orissa, region like southern and northern are not well developed as compared to the coastal region. One of the important reasons for this is the higher concentration of ST population in the above two region. In 1983, the % share of ST population in the coastal region of rural Orissa was 7.2%, whereas it was as high as 39.7% in the southern region and 34.5% in the northern region *(Orissa development report, 2001)*.

Poor people, though do not like, but to survive eat coarse cereals like Jawar, Maize, and Ragi as it costs less. In *first period*, there are 5 districts whose area

share under coarse cereals was more than 5%. These districts are Koraput, Phulbani, Kalahandi, Keonjhar (all non-coastal hilly region with tribal dominance) and Ganjam, Puri, Sundargarh, Mayurbhanj, Bolangir, Dhenkanala, Cuttack had area share less than 5% but more than 1%. Sambalpur and Bolangir had area share less than 1%.

During second period, there was a significant change. There were 4 districts whose area share was more than 5% under coarse cereals and 3 districts whose area share was even less than 1% (i.e. on the contrary during first period 6 districts were in first category and only 2 district in 3rd category). Kalahandi, the district where incidence of poverty is very high, had lost area by 3% under coarse cereals in second period. In third period, there are only 3 districts (i.e. Koraput, Ganjam and Phulbani) whose area share under coarse cereals is more than 5%. Keonjhar had lost 2% area under coarse cereals in third period in comparison to second period.

Thus from above it is very apparent that area coverage under coarse cereals as well as yield level is going down over the years in the district where incidence of poverty is very high. Not only that, from earlier analysis it is seen that the area share of districts for cash crop is going up (i.e. In first period, there is only one district whose area share was greater than 2% under cash crop, in second period it turned to two and three in third period). Surprisingly the new addition districts are non-coastal region (i.e. Koraput and Bolangir). Thus, a review of the situation is needed and steps most be taken to ensure minimum food to poor people.

SECTION 5

3.5.1 Crop Diversification

Crop diversification is a concept, which is opposite to crop specialization. The level of crop diversification largely depends upon the agro climatic/socio-economic condition and technological development in the region. In general, it is presumed that higher the level of agricultural technology, lesser the degrees of diversification. As agriculture in less developed region is more dependent upon nature, the risk of crop loss is very high. In the areas where the variability of rainfall is high and adequate sources of irrigation are not available, farmers grow several crops in a season to get some thing from their fields in case of extreme weather. Further, diversification is also considered essential to reap scale

economies arising out of complementary and supplementary enterprises. The diversification of crops also generate more employment as the farmers and agricultural workers remain busy in the sowing, weeding, harvesting and marketing of different crops throughout the year.

To study the extent of diversification, various methods are available in the literature. The most commonly used methods are Herphindal index and Theil's entropy index -:

Herphindal index is defined as;

$$H = \sum_{i=1}^{n} p_i^{\,2}$$

pi =Proportion of area under i th crop

$$= \frac{A_i}{\sum_{i=1}^{n} A_i}$$ In which A_i=Area under i th crop and $\sum_{i=1}^{n} Ai$ = Total cropped area

The value of H-index varies between zero to one. It is one in case of perfect specialization and zero in case of perfect diversification.

The Entropy index is defined as:

$$Entropy(E) = \sum_{i=1}^{n} p_i \log(1/p_i)$$

Table No: 3.15
Crop Diversification Index—1985-86 To 1999-00

	85-90	85-90	90-95	90-95	95-00	95-00	Percentage Growth Of Herphindal Index		
DISTRICT	ENT	HER	ENT	HER	ENT	HER	90-95 over 85-90	95-00 over 90-95	95-00 over 85-90
BALASORE	0.47	0.56	0.46	0.56	0.32	0.72	0.20	27.52	27.78
BOLANGIR	0.72	0.36	0.71	0.36	0.66	0.40	0.94	12.44	13.51
CUTTACK	0.70	0.33	0.68	0.34	0.61	0.41	4.82	19.18	25.22
DHENKANAL	0.81	0.24	0.81	0.23	0.78	0.25	-6.39	10.25	3.64
GANJAM	0.81	0.23	0.79	0.24	0.76	0.27	3.18	13.69	17.42
KALAHANDI	0.82	0.28	0.81	0.27	0.79	0.28	-3.31	5.41	2.03
KEONJHAR	0.66	0.42	0.62	0.44	0.58	0.49	5.77	9.05	15.73
KORAPUT	0.78	0.29	0.78	0.29	0.77	0.30	-1.79	5.65	3.79
MAYURBHANJ	0.48	0.58	0.46	0.60	0.37	0.68	2.94	13.67	17.12
PHULBANI	0.85	0.22	0.80	0.25	0.74	0.32	12.56	24.87	42.81
PURI	0.64	0.38	0.58	0.43	0.56	0.45	12.14	4.79	19.27
SAMBALPUR	0.55	0.50	0.56	0.47	0.51	0.52	-5.94	10.60	4.40
SUNDARGARH	0.60	0.48	0.60	0.47	0.57	0.49	-1.93	5.06	3.08

Source: As in Table no. 3.1

The value of entropy index varies from zero to log n. When there is perfect specialization *'E'* takes the value of zero and when there is perfect diversification *'E'* takes the value of log n.

From the table 3.15, it is evident, that in first period, Mauyrbhanj, Balasore and Sambalpur are highly specialized districts with value of H-index greater than 0.5. In the same period Phulbani, Ganjam and Dhenkanal are highly diversified districts with value of H-index less than 0.25. In the second period, Mauyrbhanj and Balasore have H-index greater than 0.5 (i.e. highly specialized) whereas Dhenkanal, Ganjam and Phulbani are least specialized (i.e. more crop diversification) district.

In the final period, Balasore, Mayurbhanj, Sambalpur are the highly specialized districts (H index > 0.5). And Koraput, Ganjam, Kalahandi, Dhenkanal are least specialized districts. In this period, there are 9 districts whose H-index value is greater than 0.4. Thus, it is evident that in Orissa, crop specialization is taking place. The average value of H-index in Orissa was 0.25 in first period, which was gone up to 0.40 in the final period.

From the crop concentration table, it is clear that in those districts where specialization is taking place, mostly the Area share of paddy(along with pulses) is going up at the cost of other crops. In the first period, the area share under paddy of 3 highly specialized districts are 59.93%, 61.52% and 58.41% higher than all other districts. In second period, the two highly specialized districts i.e. Mauyrbhanj and Balasore area share under Paddy was 72.77% and 60.96% respectively. Thus, when specialization is taking place, the area is going to be concentrated under few crops (i.e. this will be clear from crop concentration analysis).

3.5.2 Determinants of Crop diversification

Among the host of factors, crop yield and cropping intensity are the most important one. It is expected that as yield level of crop increases, then those crops are going to take major chunk of area in a cropping season. But, if cropping intensity increases i.e. if the same plot of land is cultivated more than once in an agricultural year then crop diversification will take place. The reason being that, to

maintain the nutritional status of the land, farmers have to do rotation cropping. That is they do different crops in a year in different crop season. Hence we hypothesize that the crop yield will be positively and cropping intensity negatively correlated with crop specialization index. Let's look at the equation.

Third period:(1995-2000)

Log (H)= -3.50+1.14(log Y)-1.84(log ci)

(-0.91) (1.88) (-2.31) R2=0.38 n=13

Where, Y= yield level at 98-99 constant prices, ci= cropping intensity and H= Herphindal index n= no. Of observation

Second period:(1990-1995)

Log (H)= -1.40+0.71(log Y)-1.42(log ci)

(-0.59) (1.99) (-6.80) R^2=0.44

** Values in parenthesis are t values.*

First period: (1985-1990)

Log (H) = 0.37+0.55(log Y)-1.77(log ci)

(0.11) (0.85) (-2.36) R^2=0.30

The dependant variable is the Herphindal index. Yield level and cropping intensity are the independent variable. During 3rd period, it is found from the equation that, yield level is significant at 10 % level and cropping intensity is significant at 5 % level. The model says that if yield level will increase, crop specialization will also increase. This is as per our hypothesis, because higher is the yield level; more is the incentive to cultivate the crop. Cropping intensity has a negative sign. This says that when cropping intensity increases, the value of Herphindal index will go down means crop diversification will take place.

During the second period also the result is as per expectation with positive sign of yield level and negative sign of cropping intensity. Both are highly

significant. But, during first period though sign of crop yield and cropping intensity is as per our hypothesis but coefficient of yield level is not significant.

SECTION 6

3.6.1 Crop Concentration[1]

Crop concentration means the "*variation in the density of crops in an area or region at a given point/period of time*". The concentration of a crop in an area largely depends on its terrain, temperature, moisture, price and income, social factors, govt. policy, type of soils and many others.

Location quotient method of crop concentration: The location quotient method has been applied for the determination of crop concentration. By applying the technique, if the index value is greater than unity, the component areal unit accounts for a share greater than it would have had if the distribution were uniform in the entire region and therefore, the areal unit has a concentration of great agricultural significance.

In the table 3.16 the crop concentration index of 5 major crops has been given.

Table No: 3.16

Crop Concentration Index Of 5 Major Crops---1985-86 To 1999-00

BALASORE	80-85		90-95		95-00
PADDY	1.29	PADDY	1.28	PADDY	1.57
MUNG	0.15	MUNG	0.15	BIRI	0.09
BIRI	0.12	BIRI	0.13	MUNG	0.08
MUSTARD	0.04	MUSTARD	0.05	MUSTARD	0.03
GROUND NUT	0.04	GROUND NUT	0.04	GROUND NUT	0.03
BOLANGIR	**85-90**		**90-95**		**95-00**
PADDY	1.03	PADDY	1.04	PADDY	1.13
MUNG	0.15	MUNG	0.16	MUNG	0.17
TIL	0.11	TIL	0.13	TIL	0.11
BIRI	0.11	BIRI	0.10	KULTHI	0.10
KULTHI	0.09	KULTHI	0.09	BIRI	0.09
CUTTACK	**85-90**		**90-95**		**95-00**
PADDY	0.94	PADDY	0.98	PADDY	1.14
BIRI	0.22	BIRI	0.22	BIRI	0.21
MUNG	0.22	MUNG	0.20	MUNG	0.17
GROUND NUT	0.14	GROUND NUT	0.17	GROUND NUT	0.14
KULTHI	0.09	KULTHI	0.07	KULTHI	0.06
DHENKANALA	**85-90**		**90-95**		**95-00**
PADDY	0.78	PADDY	0.74	PADDY	0.83
MUNG	0.20	TIL	0.22	TIL	0.23
GROUND NUT	0.18	MUNG	0.20	MUNG	0.20

[1] Location quotient formula has been used to find crop concentration index .

CONTD....					
BIRI	0.17	*BIRI*	0.19	*BIRI*	0.20
TIL	0.15	*GROUND NUT*	0.14	*GROUND NUT*	0.12
GANJAM	**85-90**		**90-95**		**95-00**
PADDY	0.75	*PADDY*	0.76	*PADDY*	0.85
MUNG	0.34	*MUNG*	0.36	*MUNG*	0.34
RAGI	0.16	*BIRI*	0.15	*RAGI*	0.16
BIRI	0.13	*RAGI*	0.14	*BIRI*	0.14
GROUND NUT	0.13	*GROUND NUT*	0.10	*TIL*	0.09
KALAHANDI	***85-90***		***90-95***		***95-00***
PADDY	0.80	*PADDY*	0.81	*PADDY*	0.90
MUNG	0.14	*MUNG*	0.20	*MUNG*	0.21
BIRI	0.11	*BIRI*	0.15	*BIRI*	0.15
KULTHI	0.11	*KULTHI*	0.12	*KULTHI*	0.13
TIL	0.09	*TIL*	0.09	*TIL*	0.09
KEONJHAR	**85-90**		**90-95**		**95-00**
PADDY	1.08	*PADDY*	1.08	*PADDY*	1.13
MAIZE	0.11	*MAIZE*	0.11	*KULTHI*	0.10
BIRI	0.10	*BIRI*	0.09	*BIRI*	0.08
KULTHI	0.10	*KULTHI*	0.08	*MAIZE*	0.07
MUNG	0.06	*MUNG*	0.06	*ARHAR*	0.05
KORAPUT	***85-90***		***90-95***		***95-00***
PADDY	0.74	*PADDY*	0.75	*PADDY*	0.82
RAGI	0.22	*RAGI*	0.22	*RAGI*	0.22
MAIZE	0.10	*KULTHI*	0.12	*MAIZE*	0.11
KULTHI	0.09	*MAIZE*	0.10	*KULTHI*	0.09
TIL	0.07	*TIL*	0.07	*TIL*	0.07
MAYURBHANJ	***85-90***		***90-95***		***95-00***
PADDY	1.26	*PADDY*	1.53	*PADDY*	1.41
BIRI	0.08	*BIRI*	0.08	*KULTHI*	0.06
KULTHI	0.07	*KULTHI*	0.08	*BIRI*	0.05
MUNG	0.05	*MAIZE*	0.05	*MAIZE*	0.04
MAIZE	0.04	*MUNG*	0.05	*ARHAR*	0.03
PHULBANI	**85-90**		**90-95**		**95-00**
PADDY	0.64	*PADDY*	0.69	*PADDY*	0.85
KULTHI	0.17	*MUSTARD*	0.15	*KULTHI*	0.14
MAIZE	0.12	*KULTHI*	0.14	*MAIZE*	0.13
MUSTARD	0.12	*MAIZE*	0.13	*MUSTARD*	0.12
MUNG	0.11	*MUNG*	0.09	*MUNG*	0.09
PURI	***85-90***		***90-95***		***95-00***
PADDY	1.04	*PADDY*	1.13	*PADDY*	1.18
MUNG	0.24	*MUNG*	0.23	*MUNG*	0.24
BIRI	0.17	*BIRI*	0.14	*BIRI*	0.14
KULTHI	0.12	*KULTHI*	0.11	*KULTHI*	0.10
GROUND NUT	0.05	*GROUND NUT*	0.05	*GROUND NUT*	0.05
SAMBALPUR	***85-90***		***90-95***		***95-00***
PADDY	1.23	*PADDY*	1.21	*PADDY*	1.33
MUNG	0.12	*MUNG*	0.13	*MUNG*	0.12
GROUND NUT	0.11	*GROUND NUT*	0.13	*TIL*	0.11
BIRI	0.09	*BIRI*	0.10	*GROUND NUT*	0.10
TIL	0.08	*TIL*	0.10	*BIRI*	0.10
SUNDARGARH	**85-90**		**90-95**		**95-00**
PADDY	1.14	*PADDY*	1.11	*PADDY*	1.21
BIRI	0.09	*BIRI*	0.10	*BIRI*	0.10
KULTHI	0.09	*KULTHI*	0.09	*KULTHI*	0.10
MUNG	0.08	*MUNG*	0.08	*MUNG*	0.08
TIL	0.06	*TIL*	0.07	*TIL*	0.07

Source: Calculated from Orissa agricultural statistics, various issues.

In Balasore districts during first period, the five most concentrated crops are (a) paddy (b) Mung (c) Biri (d) Groundnut and (e) Oil. In second period instead of groundnut, Til's concentration is more and same in third period. In case of Bolangir district, the five mostly concentrated crops are (a) paddy (B) mung (c) Biri (d) Kulthi (e) Til. In third period, the concentration index of groundnut is more than Til.

In Cuttack district, the five most concentrated crops are paddy, mung Biri, Kulthi and groundnut. And it is same for all periods. But, crop concentration index of paddy is less than one during first and second period. In case of Dhenkanala, the five most concentrated crops are (a) Paddy (b) mung (c) Biri (d) Groundnut and (e) Til and this is same for all the other two periods. In case of Ganjam, the five mostly concentrated crops are (a) Paddy (b) mung (c) Biri (d) Ragi and (e) Groundnut and in third period index value of Til is more than groundnut. But index value of paddy is less than one. In Kalahandi district, the five mostly concentrated crops are (a) Paddy (b) mung (c) Biri (d) Kulthi and (e) Til. And this is same for all other period. But, the index value of Paddy is less than 1.

In case of Keonjhar district, the five mostly concentrated crops are (a) Paddy (b) Maize (c) Mung (d) Biri and (e) Kulthi and in third period the index value of Arhar is more than mung. This is the only district where Arhar is highly concentrated. In case of Koraput district, the five concentrated crops are (a) Paddy (b) Ragi (c) Maize (d) Kulthi and (e) Til. In second and third periods, these are the same crops, which are highly concentrated. But the index value of paddy is less than 1.

In case of Mayurbhanj, the five mostly concentrated crops are (a) paddy (b) maize (c) mung (d) Biri and (e) kulthi. And this is same in all periods. In case of Phulbani, the five concentrated crops are paddy, Maize, mung, Biri, Kulthi and mustard. And this is same in all periods. But, the index value of Paddy is less than 1. In case of Puri, the five mostly concentrated crops are Paddy, mung, Biri, Kulthi, groundnut and Til.This is same for all periods. In case of Sambalpur, the five mostly concentrated, crops are paddy, mung Biri, Groundnut, and Til. This is same for all period. In case of Sundargarh district paddy, mung, Biri, Kulthi and Til is mostly concentrated. And this is same for all periods.

OBSERVATIONS

(1) In Cuttack (first and second period), Kalahandi and Phulbani paddy's concentration is less than one. It shows less area in comparison to state average is devoted for Paddy. Also, it says that paddy is highly concentrated in the districts in comparison to other crops.

(2) Keonjhar is the only district where Arhar is also highly concentrated.

(3) In Koraput maize, Ragi is also highly concentrated.

(4) In Mauyrbhanj and Phulbani maize is highly concentrated than other districts.

(5) In almost all district Paddy, Mung, Biri, Kulthi, groundnut, Til and Mustard are highly concentrated.

SECTION 7

3.7.1 Conclusion

From our above analysis we have seen that orissa is basically a mono-crop state where more than 50% of GCA in majority of districts are under paddy. Out of the rest area pulses have gained the maximum followed by oilseeds and cash crops. Millets like Jawar, Bajra, and Maize etc have been found to be grown in larger areas in non–coastal districts. In case of yield level, the coastal districts along with well-irrigated districts such as Sambalpur and a part of Bolangir have dominated the other. And the inter-district variability of yield level is very high. Except paddy, the inter-district variability of yield level in other crops is increasing. In case of Paddy the c.v. has came down from 20.77% in first period to 14.98% in the final period. Not only that the inter district variability of area share under different crops are increasing over the years (except paddy, where it is coming down). From this it is very clear that although the districts are converging w.r.t. Area share and yield level in paddy, they are diverging in all other crops. One of the reasons for this increasing preference for production of paddy could be explained in terms of irrigation facilities. It is known that rice is grown in those areas where sufficient water is available either through rain or irrigation. We have seen that, out of 13 districts 11 districts irrigated area have increased in third period in comparison to second period.

Secondly, food habits of the people in non-coastal part (where larger % of ST people are living) are changing due to modernization. Thus, commensurate with food habits, to increase production of paddy, People are devoting more areas. Thirdly, govt. minimum support price in case of paddy and wheat is increasing at a higher rate than other crops. Thus, it also gives incentive to increase production.

Also, in our above analysis we have seen that, in Orissa crop specialization is taking place. In other words cropping pattern is monotonically biased towards few crops (especially paddy). From the fitted relationship, we have found that as the yield level increases, it positively affects the H-index. That means specialization is directly correlated with high yield. And it is found that in case of paddy 10 districts yield level of paddy in third period is higher than first period. But, in most of the other crops, the yield level in third period has gone down for every district in comparison to first and second period.

3.7.2 Future Of Cropping Pattern In Orissa

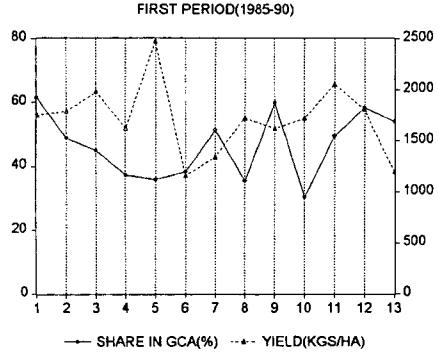
Orissa is a state of small farmers. In future the size of holding will diminish. The state has to produce enough for its people without deterioration the quality of the land and environment. This is a challenge of the future for the farmers. It is suggested that output of all existing crops should be increased so as to meet the diversified consumption needs of the people. And there should be a shift towards high valued crops, which leads to a more efficiency utilization of land. But, when doing this, the state mechanism should look after the poor people who are so far dependent upon coarse cereals.

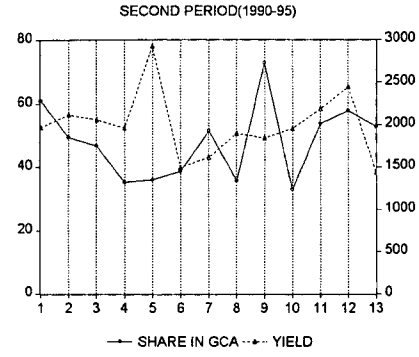
Fig no. 3

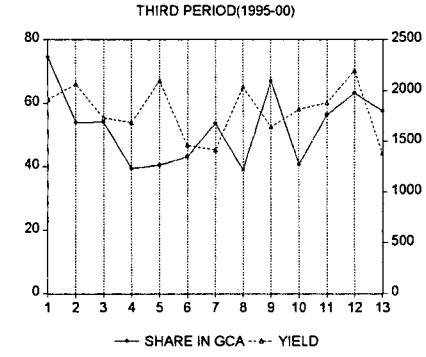
SHARE OF CROPS IN GCA AND YIELD LEVEL-1985-86 TO 1999-00

1. Balasore, 2. Bolangir, 3. Cuttack, 4. Dhenkanala, 5. Ganjam, 6. Kalahandi, 7. Keonjhar, 8. Koraput, 9. Mayurbhanj, 10. Phulbani, 11. Puri, 12. Sambalpur, 13. Sundargarh (The Districts are shown in Horizontal axis). The left hand vertical axis shows percentage share of crops in GCA and right hand vertical axis shows yield level (kgs/ha).

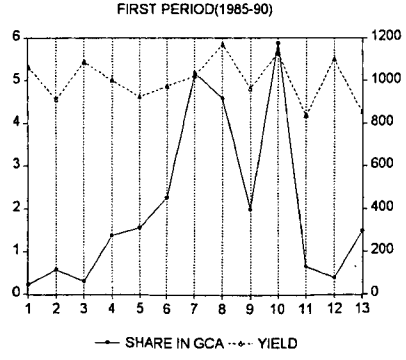
PADDY

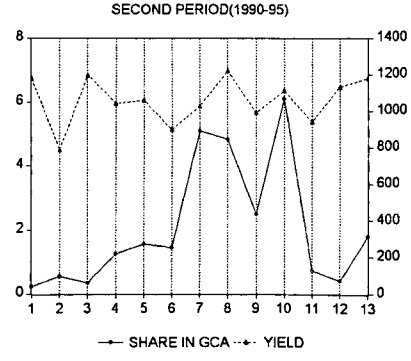


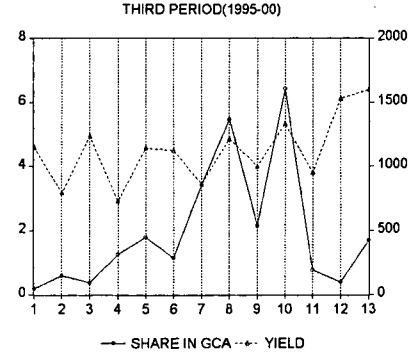




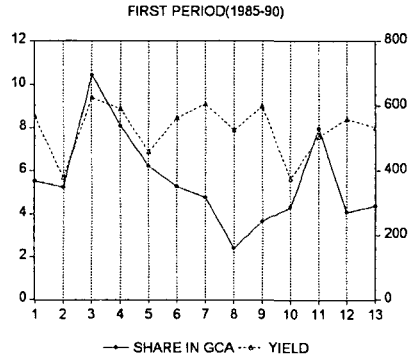
MAIZE

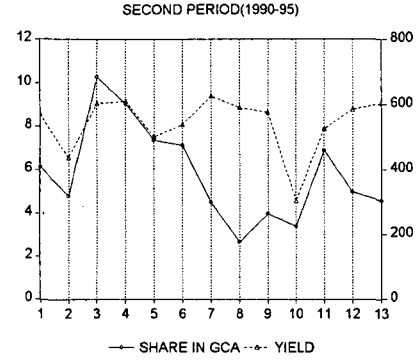


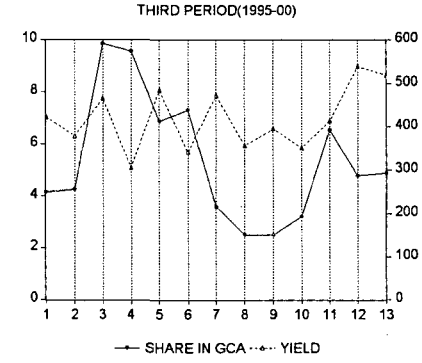




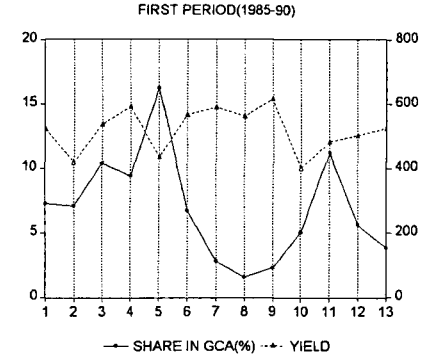
BIRI

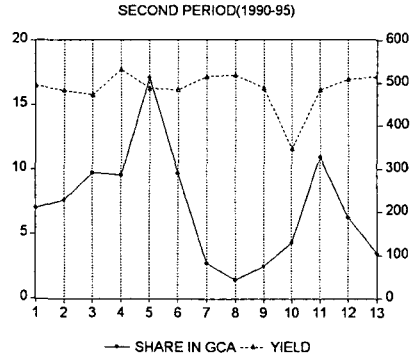

FIRST PERIOD(1985-90)
SHARE IN GCA
YIELD


SECOND PERIOD(1990-95)
SHARE IN GCA
YIELD


THIRD PERIOD(1995-00)
SHARE IN GCA
YIELD

MUNG


FIRST PERIOD(1985-90)
SHARE IN GCA(%)
YIELD


SECOND PERIOD(1990-95)
SHARE IN GCA
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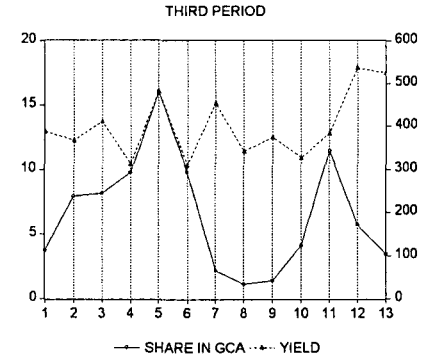
THIRD PERIOD
SHARE IN GCA
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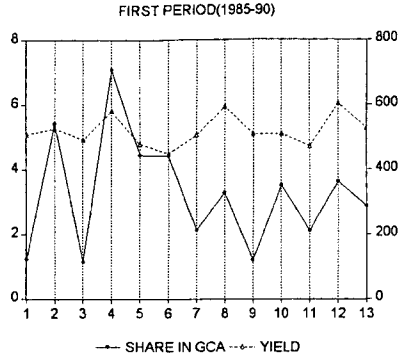

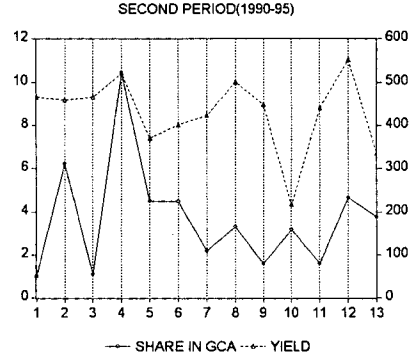

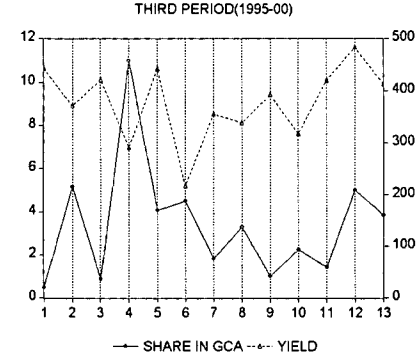

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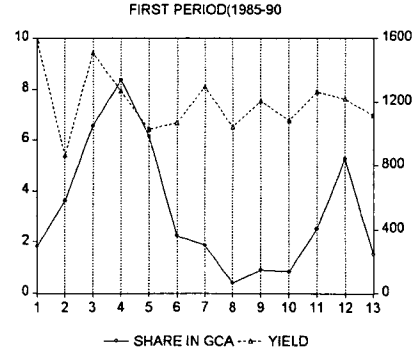

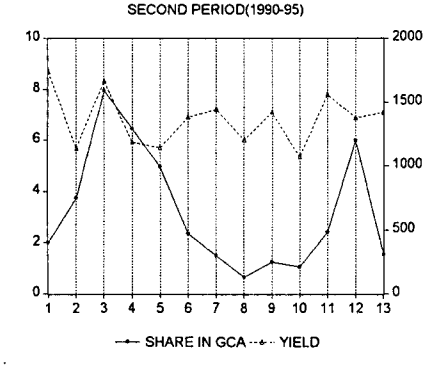

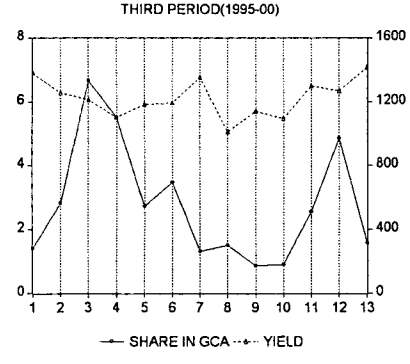

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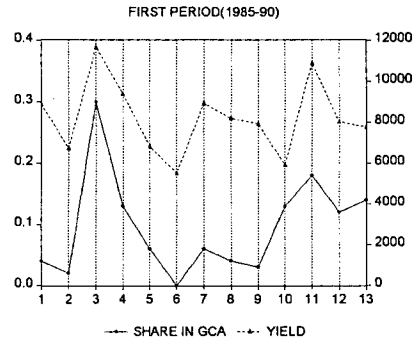

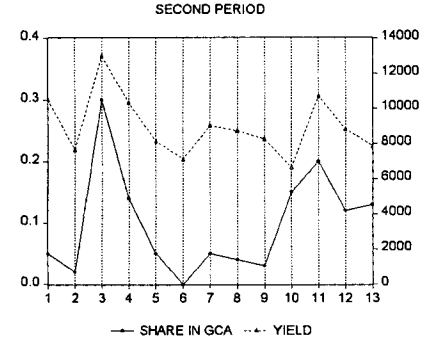

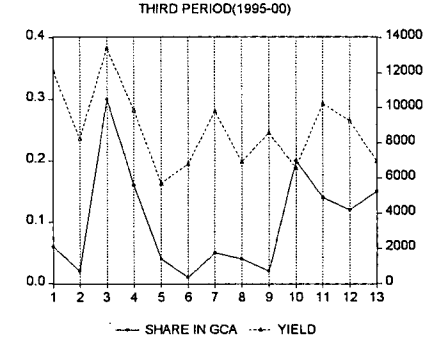

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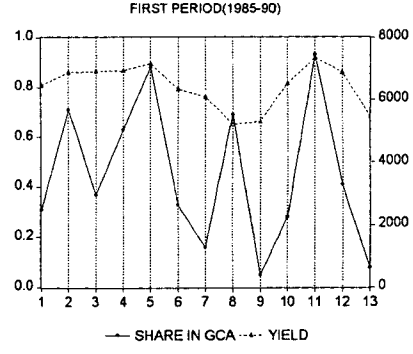
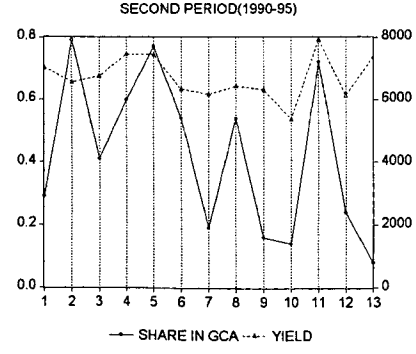
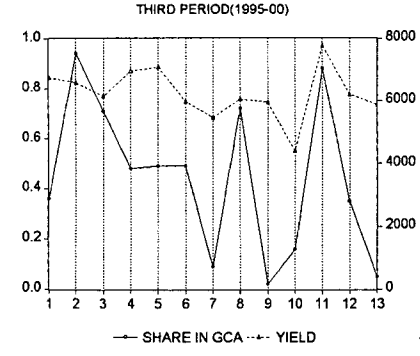






CHAPTER 4

AGRICULTURAL PRODUCTIVITY AND REGIONAL IMBALANCES IN ORISSA: A DISTRICT LEVEL ANALYSIS

4.1 Introduction: Orissa has still to overcome the problem of poverty and starvation. Nearly, 80% of population is dependent upon agriculture for their lively-hood. Though the share of agriculture in the state domestic product has come down rapidly, the proportion of population dependent on the agricultural sector has changed only marginally. Hence, a greater responsibility lies upon agricultural sector for solving the food problem of majority people of the state. From agro-climatic point of view, Orissa is a heterogeneous state with varied kind of climate across the districts. Also there is a large gap in socio-economic condition of people in different districts. The coastal part of Orissa is naturally endowed with fertile land (i.e. alluvial soil) in comparison to non-coastal hilly districts. Thus, taking into these entire factors, one can expect the existence of inter-district difference in agricultural productivity level.

This study has been taken up with these following objectives:

(a) To study which are the most agriculturally productive districts in Orissa over the periods.

(b) To examine whether the inequality/disparity level in the productivity level is increasing or declining over the years across the districts.

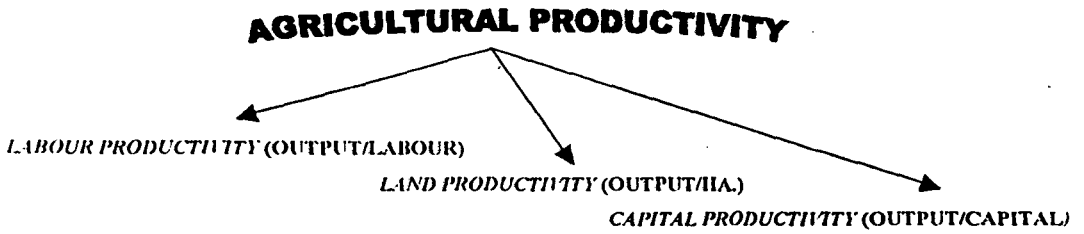
(c) To study which are the districts with high level of input in use in the farm sector.

(d) To examine whether the high level of input use explain the higher productivity.

(e) And finally, to study which are the most infrastructurally advanced districts in Orissa and whether the productivity level is high in highly infrastructurally developed districts.

4.2.1 Agricultural Productivity:

Agricultural productivity may be defined as the ratio of the index of total agricultural output to the index of total input used in farm production. It is therefore a measure of the efficiency with which inputs are utilized in production, other things being equal. According to Dewett, "productivity expresses the varying relationship between agricultural output and one of the major inputs, like land or labour or capital, other complementary factors remaining the same..."[1] The connotation of agricultural productivity engaged the attention of many an economist at the 23rd Annual Conference of the Indian Society of Agricultural Economics. Some economist suggested that the yield per acre should be considered to indicate agricultural productivity. But it was criticized on the ground that it measures only the productivity of land. It was suggested for instance, that productivity could also by measured in terms of per unit of labor and different regions compared on that basis. It was further suggested that, the marginal returns per unit of scarce resource should be considered.



After a through discussion, it was generally agreed that the yield per acre may be considered to represent the agricultural productivity in a particular region, and that other factor of production be considered as the possible causes for the variation while comparing it with other regions.[2] According to Saxon, productivity is a physical relationship between the output and the input which gives rise to that output. Horring

[1] K.K Dewett & G.Singh ,"*Indian Economics*", (Delhi: 1966), pp 66.
[2] See for detail "Regional variations in Agricultural Development and productivity", *Indian journal of Agricultural Economics*, Vol –19,no. 1, 1964, pp. 168-266.

defines the term productivity that is generally used rather broadly to denote the ratio of output to any or all associated input in real terms.[3]

Productivity of land: Land is the most important input for agricultural production. Productivity of land is of primary importance in States with a high density of population. Where the measures are limited, the principal means of raising production to keep pace with the growth of population and the demand for improved diets is by raising yields per hectare. Productivity of land can be increased either by more intensive system of cultivation or towards higher value crops. That means productivity of land may be increased by raising multiple crops in a year on the same land or by progressively changing land from low value crops to high value crops.

Productivity of labour: Productivity of labour is important from different angle. It determines the *"purchasing power"* of the population engaged in agriculture. Productivity of labour can be expressed by the hour of work needed to produce a unit of agricultural output or by the total agricultural output per unit of labour. Labour input may be expressed as the total number in the labor force or the total number of man-hour engaged in agriculture. Similarly, the total agricultural output may be taken as the gross farm output or it may be taken as the value added by labor & other factors in agriculture, i.e. the value of fertilizers, pesticides, fuel and other inputs from outside the agricultural sector is subtracted from the value of the output in order to determine the net contribution of labour.

Productivity of Capital: It is very difficult to measure the productivity of capital in agriculture. It is generally utilized for the purchase of land for improvement of land, land reclamation, drainage, irrigation purposes, livestock purchases, feeds and seeds, fertilizers, agricultural implements and machinery, crop protection chemicals etc. Choice of inputs determines the increase in agricultural productivity.

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[3] M Shaffi, *Agricultural Productivity and regional Imbalances*, (Delhi: Concept Publishing company, 1984), pp. 148-172.

4.2.2 Approaches To The Measurement Of Agriculture Productivity:

Different methods have been suggested for measuring agricultural productivity. However, so far there is no unanimity among the researchers as which measure is the best. Thompson while measuring the relative productivity of British expressed it in terms of gross output of crops and livestock.[4] Ganguli first took into account the area under any crop "X" in a particular unit area belonging to a certain region. This area is expressed as a proportion of the total cropped area under all the selected crops. Secondly, Ganguli tried to obtain the index no. of the yield. This is found by dividing the yield per ha. of region "A" of crop "X" by the yield per ha. of crop "X" in the entire region. Thirdly, the proportion of the area under "A" and the corresponding index no. of the yields were multiplied.[5]

Kendall used a system of four-coefficient (a) productivity coefficient (b) ranking coefficient (c) money value coefficient (d) starch equivalent or energy coefficient. Kendall pointed out that the productivity coefficient and the ranking coefficient are concerned only with the yield per acre but are not weighted according to the volume of production. He therefore evolved a measure of crop productivity by using index number technique. In this technique, the yield of different crops should be expressed in terms of some common units. There are two common units (a) money value as expressed in price and (b) energy as expressed in starch equivalent. In this method, the crop production of each unit area is valued by multiplying the volume of production of a particular crop by the price and then adds the results for the selected number of crops together. The total is divided by the total acreage in the unit area under the total selected crop. The result gives for each unit area a figure of money value per acre/ha.under the crops considered. Kendall suggests starch equivalent as the most suitable unit. The basic question arises in this technique is whether the gross starch equivalent of the various crops should be considered or the net equivalent. Again he mention that, money value coefficient does not take into consideration the value of the

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[4] R.J Thompson, (1926) "The productivity of British and Danish Farming" *Journal of the Royal Statistical society*, Vol 89, 1926, pp 218 cited in M. Shaffi, no.3.
[5] Shaffi, no.3.

by products of the crops. However, there is nearly as much starch equivalent in the straw produced on a ha. of land as the grain itself. Therefore, it becomes necessary to estimate the production by weight of byproduct to the main products.

In the ranking coefficient, method he took the acre yields of the ten leading crops in 48 administrative areas of England. The places occupied by each country in respect of selected crops were then averaged and thus ranking coefficient of agricultural efficiency of each country obtained.[6]

Hirsch has suggested, *'crop yield index'* as the basis of productivity measurement. It expressed the average of the yields of various crops on a farm or in a locality relative to the yields of the same crops on another farm in a second locality.[7] Zobel has attempted to determine the labour productivity. He considered productivity of labour as the ratio of total output to the total man-hours consumed in the production of that output resulting in output per man-hour.[8]

Enyedi while describing geographical type of agriculture in Hungary refers to a formula for determining agricultural productivity as follows:[9]

$Y/Y_n : T/T_n$

Where

Y= total yield of the respective crops in the unit area,

Y_n=total yield of the crop at the national level,

T=total cropped area of the unit,

T_n=total cropped area at the national level.

Sapre and Deshpande refined further the Kendall's ranking coefficient method. For this they used 'weighted average of ranks' instead of the simple average ranks. Thus, it incorporates the proportion of the crops (area) to the total area of the district. In

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[6] M.G Kendall, "The Geographical distribution of Crop Productivity in England" *Journal of Royal Statistical society*, 1939, pp 162 cited in Shaffi, no.3.

[7] H.G Hirsch "Crop Yield Index" *Journal of Farm Economics*, Vol 25, no. 3, pp 583 cited in Shaffi, no. 3.

[8] Shaffi, no.3.

[9] Ibid.

order to assess the weighted ranks, the ranking position of a crop is multiplied by the magnitude of it to the total cropped area.[10]

Khusro has linked assessment of productivity with the output per unit of a single input and output per unit of cost of all inputs in the agricultural production.[11] Tambad has adopted crop yield index as the basis for measuring agricultural productivity. He has expressed the average yield of various crops on a farm or in a region relative to the yield of same crops on a farm or in a second region. It can be expressed as:[12]

$$\text{Crop yield index} = \frac{\sum_{i=1}^{n} \frac{y_i}{y_{i0}} A_i}{\sum_{i=1}^{n} A_i}$$

Where i =1,2,3...n are the no. of crops considered in a unit area or year.

Yi =is the yield per acre of crops i, in a farm area or year,

A_i=is the weightages of crop i, denoted by the area under the crop as a percentage of total cropped area, and

y_{i0}=is the average yield per acre of crop i, at the group of farms or entire region or the base yr.

Shafi has expressed the productivity on the basis of labour population engaged in agriculture. According to him gross production in any unit area /number of man hours (or the total no.of workers) gives agricultural productivity. Bhatia while

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[10] S. C. Sapre and C. D. Deshpande, "Inter-District Variation in Agricultural Efficiency in Maharashtra State", *Indian Journal of Agricultural Economics*, Vol. 19, no. 1,1964, pp. 242-252.

[11] A.M Khusro, "Measurement of Productivity at Micro and Macro Levels", *Journal of the Indian Society Of Agricultural Statistics*, Vol 27, no. 2, 1965, pp. 278.

[12] S.B Tambad, (1965): "Spatial and temporal Variations in Agricultural Productivity in Mysore" *Indian Journal Of Agricultural Economics*, Vol 20,1965 and Tambad S.B &K.V Patel "crop yield index as a measure of productivity" *Economic and political Weekly*, 5(25),1970, pp 878-879.

assessing the productivity in UP during 1953-63 adopted Ganguli's method of productivity measurement and his equation is as follows:[13]

$I_{ya}=y_c/y_r*100$

Where,

I_{ya} =is the yield index of crop a,

y_c =is the average acre yield crop 'a' in the component unit and

y_r = is the average acre yield crop 'a' in the entire study area.

$$\text{And } E_i = \frac{i_{ya} * c_a + i_{yb} * c_b + ...+ i_{yn} * c_n}{c_a + c_b + ...+ c_n}$$

Where,

E_i =is the agricultural efficiency index

i_{ya}, i_{yb}, etc.=are the indexes of various crops, and

c_a, c_b, etc.=represents the proportion of cropland devoted to different crops.

Sinha has adopted a standard deviation formula to determine agriculture efficiency in India. For this purpose, he selected all the twenty-five major crops grown in the country, which were grouped into cereals, pulses, oilseeds and cash crops, and specific yields per ha. of cereals, pulses and oilseeds were taken. Finally, the standard scores were computed and to give them weightage, these values were multiplied by the acreage figures, i.e., the area of cultivation under the crops.

Singh has devised a new technique for the measurement of agricultural efficiency, which consists of the measurement of carrying capacity per unit area in terms of population in relation to output per unit area.

Shafi has modified the formula of Enyedi in determining productivity index. In the modified formula the summation of the total yield of all the crops in the district is

[13] S.S Bhatia, "Spatial variations, Changes and Trends in agricultural Efficiency in Utter pradesh, 1953-63", *Indian Journal of Agricultural economics*. 22(1).1967, pp 66-80

divided by the total area under the crop considered in the district and the position thus obtained is examined in relation to the total yield of all the crops considered at the national level divided by the total area under those crops. The formula would be read thus:[14]

$$(\frac{y_w}{t}+\frac{y_r}{t}+\frac{y_{mi}}{t}+.....):(\frac{Y_w}{T}+\frac{Y_r}{T}+\frac{Y_{mi}}{T}.....n)$$

Or

$$\frac{\sum_{i=1}^{n} y}{t}:\frac{\sum_{i=1}^{n} Y}{T}$$

Where

y_w, y_r, etc.=total yield of the respective crop in the district.

Y_w, Y_r, etc.=total yield of the respective crop at the national level.

t=area planted under the crop in the district, and

T=area planted under the crop at the national level.

4.3.1 Productivity Level And Inter District Disparities:

In this study to assess the agricultural productivity *Sapre and Deshpande* index has been used. Sapre and Deshpande refined the Kendall's ranking Coefficient method. This method is one of the widely used methods because along with crop yield level's rank, it takes into account the proportion of area under the crop. Instead of using simple averaged ranks they used weighted average of ranks. This can be expressed as:

$$S\ \&\ Dindex = \frac{r_{1i}p_{1i} + r_{2i}p_{2i} + ...+ r_{ni}p_{ni}}{p_{1i} + p_{2i} + ...+ p_{ni}}$$ Where $r_1....r_n$ represents the rank of the crops as per their yield level in district i in comparison to other district and $p_1.....p_n$ represents the proportion of area devoted to these crops in district i.

[14] M. Shafi , "Measurement of agricultural productivity of Great Indian plains" *The Geographer*, Vol 19, 1972, pp 7-9

Table No: 4.1
Ranks Of Districts As Per Productivity Index---
1985-86 To 1999-00

DISTRICTS	1985-90	DISTRICTS	1990-95	DISTRICTS	1995-00
CUTTACK	3.17	SAMBALPUR	2.98	SAMBALPUR	1.46
SAMBALPUR	4.61	DHENKANALA	4.84	GANJAM	2.85
PURI	5.07	PURI	4.96	BALASORE	5.08
DHENKANALA	5.80	CUTTACK	5.19	BOLANGIR	5.20
BALASORE	5.94	GANJAM	5.37	PURI	5.90
GANJAM	6.17	BALASORE	5.87	CUTTACK	5.96
SUNDARGARH	7.16	KORAPUT	6.39	KORAPUT	6.56
BOLANGIR	7.18	BOLANGIR	6.59	DHENKANALA	6.85
KORAPUT	7.41	MAYURBHANJ	9.22	PHULBANI	8.01
PHULBANI	8.54	KEONJHAR	9.33	MAYURBHANJ	9.65
MAYURBHANJ	8.81	PHULBANI	10.01	KEONJHAR	9.77
KEONJHAR	9.12	KALAHANDI	10.22	SUNDARGARH	10.07
KALAHANDI	9.32	SUNDARGARH	10.38	KALAHANDI	10.78
THEIL INDEX	0.02	***THEIL INDEX***	0.03	***THEIL INDEX***	0.04
C.V	28.17	***C.V***	35.33	***C.V***	41.88
GINNI COEFF.	0.15	***GINNI COEFF.***	0.19	***GINNI COEFF.***	0.23

Source: Calculated from Orissa agricultural statistics, various issues.

From the table 4.1 it is clear that, in first period, Cuttack is the most productive district. The value of Sapre and Deshpande index (hence forth S&D index) is 3.17, followed by Sambalpur, Puri, Dhenkanal, Balasore and Ganjam. **As it is evident from Sapre & Deshpande index, lower is the value of index, higher is the productivity level.** Thus, in the top 6 positions, there are 4 coastal districts[15] and only two non-coastal districts. The bottom most districts are Kalahandi, Keonjhar, Mayurbhanj, Phulbani and Koraput.

In the second period, Sambalpur is the most productive district followed by Dhenkanal, Puri, Cuttack, Ganjam & Balasore. Thus the same six districts, which were in the top position in the first period, are also in the top position in the second period. The bottommost districts in the second period are Sundargarh, Kalahandi, Phubani, Keonjhar and Mayuabhanj. Like first period, the entire four coastal districts are highly

[15] Coastal districts are: Cuttack, Balasore, Ganjam and Puri.

productive along with Sambalpur and Dhenkanala. And all the hilly and plateau regions are less productive. Bolangir is at the middle zone in both the periods.

In the final period, Sambalpur is at the top position in the productivity index followed by Ganjam, Balasore, Bolargir, Puri, and Cuttack. In the bottom-most position Kalahandi, Sundargarh, Keonjhar, Mayurbhanj and Phulbani are there. In this period, the only exception is that, Bolangir has entered in the top slot at the cost of Dhenkanal. Like other two periods, in this period also all these coastal districts are in the top slot along with Sambalpur and Bolangir. And rests of the hilly districts are in the bottom position.

From the Table 4.1 it is also evident that, the level of inequality in the productivity index is increasing over the years. We have used three measure (i) *Theil index* (ii) *Co-efficient of variation and (iii) Ginni Coefficient.*

Theil's measure: T = log n – H

$H = \sum xi \log 1/xi$

Where X_i = proportion to total score

N = no. of observation.

The arithmetic formula to find Ginni coefficient is,

$$G = 1 + 1/n - \frac{2}{n^2 x}(nx_1 + (n-1)x_2 + \ldots\ldots + x_n)$$

Where $x_1 \ldots x_n$ = productivity index

x = mean value or Aug. value of productivity index

The coefficient of variation is measured by

C.V. = (Stdev/mean)*100

From the Table 4.1, it is clear that, in first period, Theil index was 0.02, C.V. was 28.17 % and Ginni coefficient was 0.15. In the second period, Theil index has increased by 0.1, C.V. has gone up by 7.16% and Ginni coefficient has gone up by 0.04. This shows that in second period the inter district differences in productivity is

larger. In third period, Theil index has gone up to 0.04, C.V has increased by 6.55% and Ginni coefficient has gone up by 0.04. Thus, in third period, inter district differences in productivity is more or higher than second period and first period.

It is needless to say that output is a function of input. Thus, it can be hypothesized that, more is the input application more will be the output, given other things. Index of input use has been constructed in this study by range equalization method.

Three inputs has been taken i.e. (1) % of the GCA irrigated (2) % of GCA on HYV (3) Fertilizer consumption (kgs/ha). Though agriculture is dependent upon many factors or inputs, due to paucity of data, only three inputs has been considered. By Range equalization method, we have construed the index. The formula has been used as:

$$R = \frac{actualX_{ij} - \max imumX_{ij}}{\max imumX_{ij} - \min imumX_{ij}}$$

Where i=1,2,3 & j=1,2,3...13

Table No: 4.2
Index Of Input Use Of Districts—1985-86 To 1999-00

DISTRICTS	*1985-90*	*1990-95*	*1995-00*
Balasore	0.89	0.81	0.90
Bolangir	0.64	0.62	0.62
Cuttack	0.75	0.79	0.78
Dhenkanala	0.50	0.44	0.36
Ganjam	0.79	0.68	0.69
Kalahandi	0.07	0.06	0.13
Keonjhar	0.27	0.27	0.25
Koraput	0.30	0.33	0.39
Mayurbhanj	0.49	0.54	0.43
Phulbani	0.34	0.09	0.02
Puri	0.54	0.55	0.59
Sambalpur	0.72	0.66	0.69
Sundargarh	0.25	0.27	0.26
C.V (%)	48.96	53.05	56.68

Source: As in Table no.4.1

From the Table 4.2, it is evident that, in first period, Balasore, Ganjam, Cuttack, Sambalpur, Bolangir and Puri are in the top position so far as input use is concerned. Kalahandi, Sundargarh, Keonghar, Koraput and Phulbani are in the bottom level. Thus, all the four costal districts along with Sambalpur and Bolangir are in the top position of index of input use. And all other non-coastal hilly regions are in the bottom level. In the second period, the same 6 districts are in the top position and the same 5 districts are in the bottom position of input use index. In the final period, though the same 6 districts are in the top position, in the bottom level there has been a minor charge. Instead of Koraput; Dhenkanal is in the bottom five group. Thus, from the above, it can be easily concluded that all the coastal districts along with Sambalpur and Bolangir have higher input use index than non-coastal hilly district. Besides that, inter district differences in input use is also increasing. In first period, C.V. Was 48.96%, which has gone up to 53.05% in the second period and to 56.08% in the third period.

4.3.2 *Relationship Between Input Use And Productivity*

It is generally believed that higher is the level of input use; higher will be the productivity level. To study this we have used three methods. First, we have studied the *correlation* between *input use and productivity* of 13 districts in each period. Secondly, we have calculated *spearman's rank* correlation coefficient of *input use and productivity* of each 13 districts. And thirdly, we have tried to find out how much variation in productivity index is being explained by the index of these inputs by a linear regression model.

Table No: 4.3

Relationship Between Input Use Index And Productivity Index

Coefficient / Periods	Pearson's coefficient	Spearman's coefficient
FIRST PERIOD	-0.734* (.004)	-0.714* (.006)
SECOND PERIOD	-0.754* (.003)	-0.691* (.009)
THIRD PERIOD	-0.728* (.005)	-0.832* (.000)

** Correlation is significant at 0.01 level.*

(a) Values in parenthesis are P- values.

From table 4.3 it is evident that during first period, the correlation coefficient of input use index and productivity index is -.73, which is significant at 1% level. This says that, input use index and productivity index is negatively correlated. And, if input use index increases by 1, productivity index will go down by 0.73. **It is known that incase of *Sapre and Deshpande* index, lower is the value of index, higher is the productivity level**. Thus, it is expected that, input use and productivity index should be *negatively correlated*. Also, in first period, the Spearman's rank correlation coefficient between input use index and productivity index is -.71 and it is significant at 1% level. The high value of rank correlation coefficient indicates that there is a close relationship between rank of index of input use and rank of productivity: Districts with higher input use rank in first period, also have high productivity rank (i.e. low productivity index) and vice –versa.

Also, in second period, the correlation coefficient of input use index and productivity index is -.75 and significant at 1% level. The spearman's rank correlation coefficient is -.69 and significant at 1% level. Thus in this period also there is high correlation between input use index and productivity index. The higher is the input use index lower will be the productivity index (i.e. higher will be productivity level).

In the final period, the correlation coefficient of input use index and productivity index is -.72, which is significant at 1% level. In this case, the rank correlation coefficient is as high as -.83 and significant at 1% level. Like other periods, in this case, higher is the input use index; lower will be the productivity index (i.e. higher will be the productivity level.)

Thus, from above analysis, we have found a very close association between input use index and productivity Index. In all cases, it is significant at 1% level.

The linear regression model -: The theory of production in its simplest form postulates that, there exist a positive relationship between input use and production, *ceteris paribus*. When the level of input use increases, production also increases and vice-versa. In this study, when the districts have higher level of agricultural productivity, the S&D Index will have lower value and vice-versa.

First period

$Log(PR_1) = 0.70 - 0.30 \log(INP_1)$, adj $r^2 = 0.42$

(12.86) (-3.32) n=13 *figures in parenthesis are t values.

Where PR_1=productivity index and INP_1=input use index and 1 stands for first period.

From above, it is found that input use index is significant at even less than 1% level. If there will be increase in input use index by 1%, the productivity index will go down by 0.30%. As explained earlier in case of S&D index, lower the value of index, higher is the productivity level. R^2 is 42% that is 42% variation in productivity index is being explained by the input use index.

Second period

$Log(PR_2) = 0.68 - 0.30 \log(INP2)$ adj $R^2=0.40$

(12.45) (-4.48) n=13

Here, the input use index is even significant of 1% level. If there is 1% increase in input use index, productivity index will go down by 0.30%. Thereby productivity will go up. R^2 is 0.40 that is 40% variation in productivity index is being explained by input use index. The model is significant at even 1% level.

Third period

$Log(PR_3) = 0.43 - 0.37\log(INP3)$ adj $R^2=0.31$

(2.80) (-3.04) n=13

Here, the input use index is significant at even 0.01% level. If the input use index will go up by 1% productivity index will go down by 0.37%, thereby productivity will go up.

4.3.3 *Agricultural Infrastructure And Productivity*

In a state like Orissa, the importance of seven major infrastructural facilities should not be understated as they have a major role to play in accelerating the pace of Agricultural development. These are: *energy, transport irrigation, finance, communication, education and health.*

Table No. 4.4
Infrastructural Development Index Of Orissa
(District-Wise), 1990-91

	Districts	Transport	Energy	Irrigation	Banking	Communication	*Education*	Health	Weighted IDI value	Rank
1	2	3	4	5	6	7	8	9	10	11
1	Balasore	114.98 (29.89)	121.44 (29.16)	123.38 (24.68)	89.31 (10.72)	90.73 (5.44)	131.38 (7.88)	111.10 (6.67)	114.4	4
2	Bolangir	123.62 (32.14)	114.65 (27.52)	99.16 (19.38)	90.44 (10.85)	71.12 (4.27)	117.65 (7.06)	64.88 (3.89)	105.56	6
3	cuttack	124.85 (32.46)	130.07 (31.22)	172.48 (34.5)	100.17 (12.02)	105.32 (6.32)	152.16 (9.13)	119.18 (7.17)	132.82	2
4	Dhenkanal	80.99 (21.06)	114.36 (27.45)	64.47 (12.89)	99.84 (11.98)	81.37 (4.88)	89.92 (5.40)	89.05 (5.34)	89	10
5	Ganjam	77.03 (20.03)	99.38 (23.85)	107.38 (21.45)	108.76 (13.05)	84.54 (5.07)	77.08 (4.62)	97.23 (5.83)	93	8
6	Kalahandi	68.53 (17.82)	79.54 (19.09)	37.93 (7.59)	100.82 (12.10)	68.09 (4.09)	86.46 (5.19)	70.39 (4.22)	70.1	13
7	keonjhar	71.29 (18.54)	118.25 (28.38)	74.74 (14.95)	97.25 (11.65)	91.20 (5.47)	93.95 (5.64)	101.94 (6.12)	90.75	9
8	Koraput	74.06 (19.26)	63.23 (15.27)	58.95 (11.79)	79.91 (9.59)	71.49 (4.29)	101.00 (6.06)	86.51 (5.19)	71.45	12
9	Mayurbhanj	100.10 (26.03)	88.27 (21.18)	97.19 (19.44)	103.89 (12.47)	100.12 (6.01)	111.31 (6.68)	72.02 (4.32)	96.13	7
10	Phulbani	74.35 (19.33)	43.05 (10.33)	73.95 (14.79)	101.95 (12.23)	110.06 (6.60)	122.19 (7.33)	121.00 (7.26)	77.87	11
11	Puri	140.34 (36.49)	126.73 (30.42)	198.63 (39.73)	116.21 (13.95)	137.54 (8.25)	100.46 (6.03)	134.57 (8.07)	142.94	1
12	Sambalpur	104.34 (27.09)	109.11 (26.19)	119.62 (23.92)	100.65 (12.08)	102.59 (6.16)	84.38 (5.06)	101.60 (6.10)	106.6	5
13	Sundergarh	146.26 (38.03)	124.68 (29.92	64.74 (12.95)	107.46 (12.9)	160.56 (19.63)	86.02 (5.16)	152.51 (9.15)	117.74	3
	Orissa	100.00 (26.00)	100.00 (24.00)	100.00 (20.00)	100.00 (12.00)	100.00 (6.00)	100.00 (6.00)	100.00 (6.00)	100.00	
	C.V(In %)	27.70	26.05	46.21	9.29	27.27	20.93	25.49	22.15	

N.B. Figures in parentheses refer to weighted value.
Source:Orissa state Development Report,2001.

Table No: 4.5

Infrastructure Development Index Of Orissa (District Wise)

2000-01

Sl No.	Districts	Transport	Energy	Irrigation	Banking	Communication	Education	Health	Weighted IDI value	Rank
1	2	3	4	5	6	7	8	9	10	11
1	Balasore	119.82 (31.15)	119.16 (28.60)	132.84 (26.57)	87.77 (10.53)	94.03 (5.64)	128.55 (7.71)	128.13 (7.69)	117.89	3
2	Bolangir	110.63 (28.76)	111.47 (26.75)	109.97 (21.99)	88.92 (10.67)	76.61 (4.60)	118.32 (7.10)	89.47 (5.37)	105.24	6
3	cuttack	128.00 (33.28)	112.42 (26.98)	123.23 (24.65)	101.98 (12.24)	91.14 (5.47)	149.58 (8.97)	137.27 (8.24)	119.83	2
4	Dhenkanala	100.88 (26.22)	109.40 (26.26)	60.79 (12.16)	99.01 (11.88)	113.21 (6.79)	87.38 (5.24)	80.44 (4.83)	93.38	8
5	Ganjam	114.81 (29.85)	99.36 (23.85)	132.42 (26.48)	98.18 (11.78)	96.60 (5.80)	103.61 (6.22)	109.09 (6.55)	110.53	5
6	Kalahandi	74.40 (19.34)	78.62 (19.11)	66.23 (13.25)	93.88 (11.27)	77.93 (4.68)	95.99 (5.76)	98.57 (5.91)	79.32	13
7	keonjhar	56.79 (14.77)	119.05 (28.57)	68.12 (13.62)	92.07 (11.05)	96.45 (5.79)	91.30 (5.48)	94.02 (5.64)	84.92	11
8	Koraput	89.58 (23.29)	82.29 (19.75)	85.24 (17.05)	73.22 (8.79)	77.50 (4.65)	105.47 (6.33)	84.86 (5.09)	84.95	10
9	Mayurbhanj	91.91 (23.90)	55.26 (13.26)	70.23 (14.05)	98.18 (11.78)	95.81 (5.75)	109.38 (6.56)	100.84 (6.05)	81.35	12
10	Phulbani	62.75 (16.31)	98.31 (23.59)	63.80 (12.76)	98.68 (11.84)	113.43 (6.81)	125.41 (7.5)	107.20 (6.43)	85.26	9
11	Puri	124.18 (32.29)	114.42 (27.46)	115.15 (23.03)	132.23 (15.87)	142.27 (8.53)	100.99 (6.06)	128.11 (7.69)	120.93	1
12	Sambalpur	115.15 (29.94)	97.53 (23.41)	136.06 (27.21)	109.26 (13.11)	97.36 (5.84)	86.29 (5.18)	105.73 (6.34)	111.03	4
13	Sundergarh	118.37 (30.78)	120.00 (28.80)	69.37 (13.87)	107.60 (12.91)	136.29 (8.18)	88.14 (5.29)	86.28 (5.18)	105.01	7
	Orissa	100.00 (26.00)	100.00 (24.00)	100.00 (20.00)	100.00 (12.00)	100.00 (6.00)	100.00 (6.00)	100.00 (6.00)	100	
	C.V(%)	23.57	18.94	31.92	13.92	20.59	17.78	17.35	15.62	

N.B. Figures in parenthesis refer to weighted value.

Source: Orissa State Development report,2001.

As an indicator of energy, percentage of villages electrified had been taken. Electricity is required for charging the lift irrigation point, harvesting the crops, for sowing and for many more activities. As indicator of transport facilities (i) surfaced

roads per 100 sq km area (ii) unsurfaced roads per 100 sq km area (iii) Railway route length per 100 sq km area has been taken. As an indicator of irrigation, percentage of gross cropped area irrigated has been taken. For finance, bank branches per lakh population and per capita agricultural credit has been taken. As indicator of Communication Post offices per lakh population and telephone line per 100 persons has been taken. As indicator of education, primary schools per lakh population have been taken. And as indicator of health, primary health centers per lakh population and hospital beds per lakh population have been taken.

As per CMIE report (2000, Oct) among the 15 major states of India in early 1990s, Orissa's rank was found to be 12 in the descending order. Like the case of inter-state level development disparity in infrastructure, the development picture of the infrastructure among the districts of Orissa is found to be equally elusive and highly imbalanced. From the table 4.4, it is evident that in the period 1990-91, infrastructurally most developed districts are (a) Puri (b) Cuttack (c) Sundargarh (d) Balasore (e) Sambalpur and (f) Bolangir. The least infrastructurally developed districts are (a) Kalahandi (b) Koraput (c) Phulbani (d) Dhenkanala and (e) Keonjhar. If one look at the productivity index of S&D, it is clearly seen that during 1st and 2nd period, Kalahandi, Keonjhar Mayurbhanj, Phulbani Koraput are the least agriculturally efficient districts. Thus it is a fact that those districts, which are in the bottom level of infrastructural development index, are also in the bottom level of agricultural productivity index.

In 2000-01, from the Table 4.5, it is clear that Kalahandi, Mayurbhanj, Keonjhar, Koraput, Phulbani, Dhenkanala and Sundargarh are in the bottom level of infrastructural development index and Puri, Cuttack, Balasore, Sambalpur, Ganjam and Bolangir are in the top level of infrastructure development. Also, from the productivity index Table 4.1, it is clear that during final period Sambalpur, Ganjam, Balasore, Bolangir, Puri and Cuttack are in the top level of productivity index. And those districts, which are backward in the infrastructural development index, are also backward in the productivity index; say Kalahandi, Sundargarh, Keonjhar, Mayurbhanj, Phulbani and Dhenkanal.

Thus, it could be concluded with high precision that, those districts, which are backward in infrastructural facilities, are also backward in Agricultural efficiency

index. A state, which is predominated by the backward subsistence oriented agricultural economy, the development of infrastructure is the urgent necessity and also the inter-district disparity in infrastructure development should be done away with to have equitable agricultural growth.

4.4.1 Decomposition of production into Area and yield effect

In the earlier sections, we have studied that; there exists an inter district variation in agricultural productivity in Orissa. This says while some districts crop yield is very high at the same time; it is low in some other. It is needless to say that in some districts, though there is low agricultural productivity but total agricultural output may be higher than the highly productive districts because, production is a function of area as well as yield.

So, the objective of this section is (1) To study the contribution of area, yield and interaction of area and yield in increasing the total output during 1990-95 & 1995-00 in comparison to 1985-90(i.e. the base period). 'I' indicates change in 1990-95 over 1985-90 and II indicates change in 1995-00 over 1985-90. We have tried to study the changing share of area and yield in different districts, keeping the base constant i.e. 1985-90. The formula of decomposition is as follows:[16]

$$\Delta P = A_b * \Delta y + Y_b * \Delta A + \Delta_a * \Delta_y$$

Where, the first term in the right hand side represents the yield effect, the second term represents the area effect and the third term represent the interaction effect.

$$\Delta P = P_C - P_B,\ \Delta Y = Y_C - Y_B,\ \Delta A = A_C - A_B.$$

A_B, P_B and Y_B are the area production and yield of various crops for the base period that is 1985-90. And A_C, P_C and Y_c are the area, production and yield of various crops for the current period i.e. 1990-1995 and 1995-2000.

[16] For detail on decomposition look at K.N Raj, Amartya Sen and C.H Hanumantha Rao (eds), *Studies on Indian agriculture*, 1988, Oxford university press, and T. siju and S. Kombairaju, "Rice production in Tamilnadu: A trend and decomposition analysis", *Agricultural situation in India*, July 2001,pp143-146.

Table no. 4.6

CONTRIBUTION OF AREA ,YIELD AND THEIR INTERACTION TOWARDS INCREASING PRODUCTION (In 000,kgs)

BALASORE	EFFECT	PADDY	WHEAT	MAIZE	JAWAR	RAGI	BIRI	MUNG	KULTHI	ARHAR	GRAM	TIL	MUSTARD	GROUNDNUT	ONION	POTATO	S.CANE	JUTE	COTTON
I	YIELD	88707 4	-1264.4	179.2	0.0	-26.3	-1299.7	80.0	-22.5	144.9	-162.6	1880.0	-353.0	806.5	473.3	10777.5	2266.1	-0.1	1141.3
I	AREA	56493 5	-3083.3	165.7	0.0	-26.3	1188.3	4283.5	-1348.8	105.9	-228.9	3565.8	-454.9	2497.4	497.4	3845.5	-1357.6	-0.1	129.3
I	INTERACTION	7082.7	422.2	18.1	0.0	26.3	-62.0	16.6	14.7	29.9	71.3	350.4	39.2	280.5	90.8	1948.6	-294.1	0.1	11.2
I	TOTAL	152283.5	-3925.5	363.0	0.0	-26.3	-173.4	4380.1	-1356.6	280.8	-320.2	5796.2	-768.7	3584.4	1061.5	16571.6	614.4	-0.1	1281.8
II	YIELD	64569 6	-2076.3	130.5	0.0	-26.3	-6360.1	-5284.1	-197.3	127.9	-235.6	-2487.7	-532.8	-2423.3	929.3	5440.0	-2845.7	-0.1	588.8
II	AREA	44506 0	-6477.7	-448.3	0 0	-26.3	-13608.5	-7045.8	-1675.5	-278.5	-200.7	-6333.6	-2700.7	-2635.6	479.6	2398.0	-4050.0	-0.1	336.1
II	INTERACTION	4061 5	1456.4	-35.7	0 4	26.3	3475.2	1806.2	159.9	-69.4	90.6	823.6	350.9	889.6	171.9	613.3	1102.0	0.1	15.0
II	TOTAL	113137 1	-7097 6	-353 6	0 4	-26.3	-16493 3	-10523.7	-1712.9	219.9	-345.7	-7997.7	-2882.6	-4169 3	1580.8	8451.3	-5793.7	-0.1	939.9
BOLANGIR																			
I	YIELD	101233.4	1110.5	-445.2	229.6	-7.5	2860.9	1872.3	107.0	82.3	-431.0	6190.9	-2350.4	363.7	105.0	398.6	0.0	14.6	-1401.6
I	AREA	32801 7	-3588 1	3 6	-1669.9	-116.6	2367.6	-572.0	558.7	1505.0	-1296.1	1718.6	3652.0	1460.2	174.9	-8683.3	0.0	-2.5	5263.5
I	INTERACTION	6064 5	-409.1	-0.5	-64.2	1 2	365 9	-86.1	5.8	17.2	162.7	544 1	-477.6	144.4	24.8	-60.0	0.0	-0.5	-240.8
I	TOTAL	140099 5	-2886.6	-442.1	-1504 5	-123.0	5594.3	1214.3	671.5	1604.6	-1564.4	8453.5	824.0	1968.2	304.7	-8344.8	0.0	11.6	3621.1
II	YIELD	84340 7	-869.3	-428.3	-2627.5	-451.5	-2254.2	-26.3	-1573.9	-2084.4	-619.8	8849.3	-5337.8	-279.7	168.4	-281.7	0.0	51.4	-1267.3
II	AREA	37166 7	-5616.2	-5 5	-3456.9	-80.7	1596.8	-2631.1	64.5	1962.9	-2508.6	-4796.4	-1423.5	-334.1	-107.6	-17489.9	0.0	268.1	8575.5
II	INTERACTION	5724.8	501 2	0 7	1521.7	47.8	-194 4	5.6	-9.8	-569.4	452.7	-2170.5	422.8	25.4	-24.5	85.4	0.0	198.9	-354.8
II	TOTAL	127232 2	-5984.2	-433 0	-4562 7	-484.4	-851.8	-2651 9	-1519.2	-690.9	-2675.6	1882.3	-6338.5	-588.5	36.2	-17686.1	0.0	518.4	6953.5
CUTTACK																			
I	YIELD	44804 3	62 2	402 5	1715.5	28.2	-7956 2	-2770.5	3429.6	526.0	-149.2	12376.7	-381.7	-189.6	4696.9	-406.0	8875.3	-6.3	-676.5
I	AREA	45635 7	-4161 3	447 6	-3223 8	-165.9	-4061 8	-916 3	-7540.0	583.8	-181 1	25841.1	-186.3	2258.5	-209.9	2600.8	-9078.2	-6.3	3218.7
I	INTERACTION	1900 1	-27 7	45 2	-777 6	-9.1	480.4	32 3	-863.9	70.3	30.8	2673.2	10.5	-64.7	-23.4	-36.7	-2028.8	6.3	-70.9
I	TOTAL	92340 2	-4126 8	895 2	-2285 9	-146 9	-11537 6	-3654.5	-4974 2	1180.1	-299.4	40891.0	-557.5	2004.2	4463.5	2158.2	-2231.7	-6.3	2471.2
II	YIELD	-135500.5	-2139.8	528 0	-7081.9	-328 2	-15636 3	-20174 3	-4110.2	140.3	-158.5	-23527.7	-981.0	-1546.2	6224.7	-2798.4	-6785.7	-6.3	-3372.2
II	AREA	63023 2	-5966.9	306 4	-5504.6	-277.9	-20840 8	-13116 3	-11874 7	-1273.7	-292.5	-12661.2	-2145.7	454.7	-4804.9	4131.6	-20481.4	-6.3	21563.7
II	INTERACTION	-7936.0	1366.8	40 6	5481 2	178.1	4844.7	3362 0	1630.5	-40.9	52.9	2489.8	311.1	-106.1	-710.8	-401.6	3499.5	6.3	-2366.9
II	TOTAL	-80413 3	-6739.9	875.0	-7105 3	-428.1	-31632 4	-29928.6	-14354.4	-1174.4	-398.1	-33699.0	-2815.6	-1197.6	709.0	931.6	-23767.6	-6.3	15824.6
DHENKANAL																			
I	YIELD	81239.4	-58.4	356 5	95.5	0.0	-3577 2	990.0	577.1	892.9	-155.4	-4448.1	-2757.3	494.7	792.2	3011.5	-53.5	-4.6	2164.6
I	AREA	-6544 8	-1481.4	-398.2	-1355.7	0.0	2014.6	5036.1	327.5	350.2	31.6	-13479.2	14171.3	1214.5	1014.7	6878.5	-54.4	-12.4	-291.1
I	INTERACTION	-1361 9	17.5	-16.1	-57.2	0.0	-201.2	162.1	10.3	21.2	-3.9	876.9	-1466.8	122.1	102.8	506.8	41.8	3.0	-22.2
I	TOTAL	73332 7	-1522.3	-57.8	-1317.5	0.0	-1763.7	6188.2	914.8	1264.2	-127.7	-17050.4	9947.2	1831.2	1909.7	10396.8	-66.1	-13.9	1851.3
II	YIELD	14510.5	-1387.1	-2420.4	-400.0	0.0	-16909.7	-14865.3	-8351.9	-1822.1	-502.1	-8928.6	-13319.2	-2597.9	394.9	2421.1	-69.6	-8.2	88.9
II	AREA	-4237 7	-2236.4	-1288 8	-2039 2	0.0	-1044.5	3354.7	-3539.3	-3438.9	84.3	-26218.6	11987.9	1043.7	995.9	13375.9	-69.6	16.6	-8220.2
II	INTERACTION	-157 5	626.7	353 3	360.6	0.0	493.1	-1621.1	1605.7	424.0	-33.5	3423.8	-5994.0	-550.9	50.3	792.3	69.6	-7.2	-25.8
II	TOTAL	10115 3	-2996 8	-3355 9	-2078 6	0 0	-17461.1	-13131.7	-10285.5	-4837.1	-451.3	-31723.5	-7325.3	-2105.1	1441.1	16589.3	-69.6	1.2	-8157.1
GANJAM																			
I	YIELD	133983 5	92 7	1752 6	7276.4	373.2	7308.0	2186.1	1401.7	1610.9	5.1	5606.5	-4037.3	96.5	678.5	751.1	-67.8	-15.5	2082.9
I	AREA	60355 8	-343 3	916 6	-1217.4	-467.0	7994.1	6519.2	-894.0	-208.6	5.9	-6799.7	1582.4	144.5	-682.5	4452.0	-707.4	0.0	-2719.4
I	INTERACTION	10969.3	-44.3	134.7	-191 7	-74.3	998.8	603.5	-107.1	-35.0	0.2	-754.5	-360.1	7.7	-132.0	428.7	66.2	0.0	-108.6
I	TOTAL	205308 6	-295.0	2804 0	5867 3	-168.1	16300 9	9308 8	400 6	1367 4	11.2	-1747.7	-2815.1	248.7	-136.0	5631.9	-709.0	-15.5	-745.0
II	YIELD	-113719 1	95 8	2782 5	14313 5	-152 4	6539 4	1330 2	1552 7	975 7	5 5	7924.0	-1386.5	187.4	-569.4	1188.3	-613.3	34.0	-593.2
II	AREA	27800 6	-550.6	606 1	-3789 5	-461 0	-5462 4	456 2	-2889 4	-1809.9	-10.6	-31057 2	-2835.6	207 0	-1679.0	3972.0	-717.1	200.6	-25547 6
II	INTERACTION	-4288 4	-73.5	141 4	-1174.0	30.0	-610 7	25 7	-383 4	-183.7	-0.3	-4702.8	221.6	21.4	272.5	605.1	606.7	70.4	290.6
II	TOTAL	-90206.9	-528.3	3530.1	9350 0	-583 5	466.3	1812 1	-1720 1	-1017.9	-5.5	-27836.0	-4000.4	415.8	-1975.9	5765.5	-723.8	305.0	-25850.3

		PADDY	WHEAT	MAIZE	JAWAR	RAGI	BIRI	MUNG	KULTHI	ARHAR	GRAM	TIL	MUSTARD	GROUNDNUT	ONION	POTATO	SUGARCAN	JUTE	COTTON
KALAHANDI																			
I	YIELD	103328 6	-380.4	-1343 3	3424.9	-219 5	-4344 2	-1018.5	-2183.9	-2004.7	-1262.6	5566 4	-1717.8	-1077.4	35.8	-10438.9	0.0	-83.6	-10.6
I	AREA	20745 8	-1519 0	-5805.5	-6267.9	-2261.5	15546.1	9968.0	3077.4	4847.6	39.4	2077.2	896.5	-721.5	66.1	-2270.8	0.0	187.3	11735.8
I	INTERACTION	6081 7	191 1	445.7	-1057.6	137.6	-2237 4	-432.5	-281.2	-548.0	-6.7	610.3	-96.9	91.6	19.5	737.6	0.0	-49.2	-7.4
I	TOTAL	130156.0	-1708.3	-6703 1	-3900.6	-2343.4	8964 6	8517.1	612.2	2294.9	-1229.8	8253.8	-918.2	-1707.3	121.4	-11972.1	0.0	54.5	11717.8
II	YIELD	92782 3	-1102 0	2648 8	-4777.3	-1342.1	-13635 5	-9232.9	-8603.3	-7247.4	-1760.4	2213.4	-8232.1	-3072.1	28.9	-3428.6	0.0	44.6	-950.6
II	AREA	29600.4	-808.0	-8962 5	-11932 7	-2425.6	12293 9	8037.8	2942.2	3564.9	1352.4	9472.1	-330.0	-1513.2	121.1	2187.7	0.0	789.3	7008.5
II	INTERACTION	7844 4	294 4	-1356.7	2808 5	902.6	-5553.5	-3161.4	-1059.1	-1457.0	-319.1	1106.6	170.9	547.8	28.9	-233.4	0.0	110.5	-397 9
II	TOTAL	130427 2	-1615.5	-7670.4	-13901.5	-2865 1	-6895 2	-4356.5	-6720.3	-5139.5	-727.0	12792.1	-8391.1	-4037.4	178.9	-1474.2	0.0	944.4	5659.9
keonjhar																			
I	YIELD	58260 4	-398 1	129 0	677 3	-135 0	-848 0	389 3	-47 0	493.2	-239 7	1148.0	-732.3	477.3	28.5	-398.6	1006.1	-1.1	55.7
I	AREA	966 4	-1075 3	-290 4	-2058 2	-121 0	-162 4	-655.7	-1744 7	1297.6	-406 2	-1982.1	156.0	43.8	-160.5	351.9	-562.3	-1.1	839.4
I	INTERACTION	197 4	115 8	-1 7	-510 8	21 8	20 3	-21 4	9 4	90.5	66 9	-227 0	-25.7	5.1	-2.2	-31.0	-111.0	1.1	12.0
I	TOTAL	59424 2	-1357 6	-163 2	-1891 7	-234 2	-990 1	-287 8	-1782 4	1881.2	-579 0	-1061 2	-602.0	526.2	-134.1	-77.8	332.9	-1.1	907.1
II	YIELD	15000 7	-460 1	-3473 1	159 3	-261 9	-1543 9	-2642 6	-168 5	858.8	439 6	449 3	-1327.5	345.6	214.8	1090.8	1868.1	-0.8	-396.7
II	AREA	1841 5	-965 7	-8420 1	-2440 6	-361 0	-1612 2	-3133.0	-410 0	1323.8	384.1	-3283.7	-758.6	151.0	-285.2	333.8	-1756.0	6.8	-1630.1
II	INTERACTION	96 9	120 2	1330 6	-142 5	126.2	367 2	694.8	7.9	160.8	116.0	-147.2	226.5	12.7	-28.9	80.6	-643.4	-4.5	166.1
II	TOTAL	16939.0	-1305.6	-10562 6	-2423.8	-496.8	-2789.0	-5080.7	-570.6	2343.3	939.7	-2981.6	-1859.6	509.3	-99.4	1505.1	-531.3	1.5	-1860.6
KORAPUT																			
I	YIELD	65071 1	-969.4	2534 2	19605.5	-2681 4	-694 1	1656.7	-3604.1	-907.5	703.5	674 1	-3305.9	-634.9	201.8	-1342.9	-15.9	-43.0	8957.5
I	AREA	86960 8	-3343 3	10669 6	9762 7	-1358.8	360 0	3312.1	12753 9	3819.5	-1005.5	3717.2	2776.8	1072.9	1097.7	-3668.4	7.4	28.2	-4200.1
I	INTERACTION	8755 7	538 1	476.3	2234 9	308.9	-27 3	413.1	-1900.3	-143.6	-144.4	567.7	-442.7	-80.4	71.5	122.5	-0.6	-4.0	-991.2
I	TOTAL	160787 6	-3774 5	13680 1	31603.1	-3731 3	-361 4	5381.9	7249.5	2768.4	-446.4	4959.0	-971.8	357.6	1371.0	-4888.8	-9.0	-18.8	3766.3
II	YIELD	117871 1	-1904 7	1956 5	-85326 9	-2862 5	-3561 9	-4262 1	-8492 5	-10132.1	-1686.5	-132.1	-8932.5	-3279.9	-473.2	-10078.9	-171.3	205.7	6114.0
II	AREA	89502 7	-5042 5	13254 0	2270 2	-5945.5	-2184.9	1180 9	2572 0	109.6	-1840.7	12775.7	749.2	-735.7	573.4	-3796.6	-178.4	2348.1	2991.1
II	INTERACTION	16323.8	1594.7	456.8	-2261 8	1443.1	851 7	-378.9	-903.0	-46.0	633.7	-382.4	-322.7	284.7	-87.6	951.3	148.6	1586.9	481.8
II	TOTAL	223697 6	-5352.5	15667 2	-85318 5	-7364.9	-4895.1	-3460.1	-6823.5	-10068.5	-2893.6	12261.2	-8506.0	-3731.0	12.6	-12924.2	-201.1	4140.6	9586.9
MAYURBHANJ																			
I	YIELD	73802 7	-199.4	308.1	-36.9	-107.0	-1573.8	-474.2	-293.8	140.9	-91.4	1060.9	-411.8	456.1	50.6	-1562.2	-201.0	-10.0	256.4
I	AREA	7389.2	-4151.4	464.3	-321.9	-251.3	-722.0	-1110.9	-787.4	847.1	-535.1	877.2	341.4	-112.3	-158.4	2841.4	-282.9	-10.0	2466.3
I	INTERACTION	1026.9	112 3	13.7	20.0	24.8	148.9	44.1	24.9	15.2	13.0	156.1	-41.8	-18.6	-6.9	-221.3	57.7	10.0	477.9
I	TOTAL	82218.8	-4238.5	786.1	-338.8	-333.6	-2147 0	-1541.0	-1056.3	1003.2	-613.5	2094.2	-112.2	325.2	-114.7	1057.9	-426.2	-10.0	3200.6
II	YIELD	7354.0	-1824.7	375.4	-66.0	-420.5	-2981.4	-4072.9	-3452.4	-1430.1	-414.7	-326.6	-773.5	-342.1	96.0	-3557.0	-505.6	-10.0	162.2
II	AREA	20892.9	-5459.8	30 8	-548.7	-454.6	-3246.0	-4310.6	-2331.9	-904.0	-2260.5	-674.8	-728.7	-1188.9	-443.5	66.1	-551.1	-10.0	-762.1
II	INTERACTION	289.3	1350.9	1.1	60.9	175.9	1267 8	1470.5	867.4	165.0	249.8	37.0	167.6	147.5	-36.8	-11.7	282.7	10.0	-93.4
II	TOTAL	28536 2	-5933 6	407.3	-553.8	-699.2	-4959 6	-6913.1	-4916.9	-2169.1	-2425.4	-964.4	-1334.7	-1383.6	-384.3	-3502.7	-774.0	-10.0	-693.4
PHULBANI																			
I	YIELD	25777 0	431 1	-412 5	-1255 1	-340 6	-982 5	-1114 7	-4238 1	-941 5	2.2	-39 2	-3759 8	706.9	343.8	2230.7	-3.8	2.3	-1170 2
I	AREA	13939.3	-363.0	601 8	-2355.3	-576 6	-1114 4	-1322 3	-2259.3	-1341.4	56 2	785.5	-694.6	1848.6	332.1	-1050.1	-3.8	0.6	-3303.1
I	INTERACTION	1890 8	-170 4	-10.2	591 0	152.9	149.3	250.6	658.9	124.1	0.5	-9.3	399.9	198.9	40.8	-416.1	3.8	0.2	582.8
I	TOTAL	41607 1	-102 3	178.9	-3019.5	-764.2	-1947 6	-2186.4	-5838.5	-2158.8	59.0	737.0	-4054.6	2754.4	716.7	764.6	-3.8	3.0	-3890.5
II	YIELD	10401 4	275 3	4277 1	-456 9	-913 0	-1339 9	-373.7	-6807.2	1042.0	-132.9	32.2	-2467.7	-474.0	311.7	872.1	-3.8	-2.8	-2159.8
II	AREA	12708 3	-767 1	-3229 6	-2992 7	-578.4	-2549 6	-2386 2	-4959 1	-3481.2	-101.7	-476.1	-3191.6	-1090.9	668.0	-1261.8	-3.8	20.2	-3551.1
II	INTERACTION	695 6	-229 9	-568 6	273 3	411 2	465 9	151 6	2322.9	-356 5	57.0	-4.6	1205.9	78.7	76.6	-195.5	3.8	-8.2	1156.4
II	TOTAL	23805 4	-721 6	478 9	-3178 3	-1080 1	-3423 6	-2608 3	-9443.3	-2795.7	-177 6	-448 5	-4453.4	-1486 2	1076.3	-585.2	-3.8	9.2	-4554.5

PURI		PADDY	WHEAT	MAIZE	JAWAR	RAGI	BIRI	MUNG	KULTHI	ARHAR	GRAM	TIL	MUSTARD	GROUNDNUT	ONION	POTATO	SUGARCAN	JUTE	COTTON
I	YIELD	52146 8	39 8	549 7	-1067.7	-157 7	106.5	1330.9	3031 7	96.4	15.1	5840.7	-521.4	522.7	-259.9	1773.5	140.8	-1.4	4259.7
I	AREA	31709 6	-1230 0	351 5	-5584 7	-250 8	-3055.9	-5416.2	-2152.9	-117.6	-22.9	-2070.0	-2143.0	-378.2	1242.1	-80.1	-356.7	-2.7	-13877.9
I	INTERACTION	2063 3	-21 8	45 0	628.7	85.6	-7 6	-227.6	-318.3	-5.0	-6.4	-481.8	142.7	-72.5	-20.8	-10.2	-97.2	1.2	-1098.3
I	TOTAL	85919 7	-1212 1	946 2	-6023 8	-322 8	-2957.0	-4313.0	560.4	-26.2	-14.2	3288.9	-2521.7	72.0	961.3	1683.2	-313.1	-2.9	-10716.5
II	YIELD	-68045 8	-256 8	588.4	-137 8	-258 0	-8706.6	-5758.7	1240.9	-506.2	5.1	705.1	-851.3	-202.4	-954.9	-2025.1	-238.0	-2.4	3085.4
II	AREA	38325 0	-1620 4	334 7	-7438.6	-290.4	-2825.5	-7708.2	-4439.3	-842.2	19.7	-1772.1	-2928.3	-742.0	-4554.4	213.5	-329.3	7.1	-7181.3
II	INTERACTION	-3254 1	185.7	45.9	108.1	162.3	575.3	1401.9	-268.7	189.0	1.9	-49.8	318.5	55.1	280.7	-31.1	151.7	-5.4	-411.7
II	TOTAL	-32974 9	-1691 4	969 0	-7468 4	-386 2	-10956.8	-12065.0	-3467 1	-1159 5	26.6	-1116.8	-3461.2	-889.4	-5228.7	-1842.7	-415.7	-0.8	-4507.5
SAMBAL PUR																			
I	YIELD	334550 2	912 7	106 5	288.5	-75 6	290.2	940.3	485.9	547.8	22.4	7500.6	-1698.5	425.1	885.7	8688.2	0.0	-13.0	-2686.8
I	AREA	55543 5	-4438.5	667.3	-620 7	-291.5	4760.1	6359.2	-2819.0	1126.5	-291.5	12605.7	7313.2	2687.9	546.1	3058.0	0.0	-13.0	-9181.5
I	INTERACTION	19761 8	-395 6	19 3	-159 4	30 2	55.0	295.7	-98.4	279.2	-5.2	1653.1	-634.9	197.5	55.1	878.6	0.0	13.0	978.1
I	TOTAL	409855 5	-3921 4	793 1	-491 6	-336 9	5105 3	7595 2	-2431.5	1953 4	-274 4	21759.4	4979.8	3310.5	1486.9	12624.8	0.0	-13.0	-10890.2
II	YIELD	201370 9	134 0	1432 8	-1119 7	-251 8	1733 7	-739.6	-5358.5	462.9	-211.1	2356.8	-3886.1	132.7	1340.6	-333.1	0.0	-13.0	-2450.6
II	AREA	66113.5	-5798 0	74.9	-890.6	-382.2	195.7	3397.7	-6785.2	113.1	-434.7	-4970.2	7135.8	1120.2	-80.3	3302.7	0.0	-13.0	-4027.2
II	INTERACTION	14158.6	-75.9	29.1	897.5	132.1	13.5	-124.3	2610.7	23.7	73.6	-204.8	-1417.3	25.7	-12.3	-36.4	0.0	13.0	391.3
II	TOTAL	281643.0	-5739.9	1536.8	-1122.8	-502.0	1942.9	2533.9	-9531.0	599.7	-572.2	-2818.2	1832.3	1278.5	1248.0	2933.2	0.0	-13.0	-6086.0
sundargh																			
I	YIELD	53453.7	812.0	2000.9	476.2	445.0	-158.4	1263.2	-131.4	856.3	177.7	1937.8	-2285.5	600.2	69.5	-5484.9	0.0	-0.9	644.6
I	AREA	-734.3	-4874.3	1282.4	12.0	-329.8	-635.1	662.0	540.2	456.1	-459.4	91.4	2137.3	372.0	-77.5	-1875.6	0.0	-14.2	-98.4
I	INTERACTION	-147.0	-386.8	493.7	8.2	-102.1	12.1	87.2	-7.4	75.6	-35.1	25.0	-781.3	87.0	-1.2	912.3	0.0	0.7	-34.1
I	TOTAL	52572.4	-4449.1	3778.0	496.5	13.1	-781.3	2012.4	401.5	1388.0	-316.8	2054.2	-929.4	1059.2	-9.2	-6448.2	0.0	-14.4	512.1
II	YIELD	41575.1	-565.6	4538.9	396.5	492.2	6.3	-262.7	-2244.4	691.5	-506.4	1920.0	-1366.6	-553.1	-433.5	-1504.9	0.0	-18.7	139.3
II	AREA	10197.1	-6306.7	584.6	-141.2	-883.4	-1028.1	884.8	606.4	901.8	-35.1	-118.2	1944.1	-484.7	232.6	-3532.6	0.0	-18.7	-721.4
II	INTERACTION	1587.5	348.6	510.1	-80.2	-302.6	-0.8	-24.2	-141.3	120.8	7.7	-32.0	-424.9	104.4	-22.8	471.4	0.0	18.7	-54.1
II	TOTAL	53359.7	-6523.7	5633.7	175.1	-693.8	-1022.5	597.8	-1779.3	1714.1	-533.9	1769.8	152.6	-933.4	-223.8	-4566.0	0.0	-18.7	-636.2

N.B: "I" shows change in 1990-95 over 1985-90 and "II" shows change in 1995-00 over 1990-95.

In case of paddy, (Table no. 4.6) during phase I (i.e. 1990-95 over 1985-90), all district have positive area, yield and interaction effect except Dhenkanal and Sundargarh. In case of Dhenkanal and Sundarghar though yield effect is positive, but area and interaction effect is negative. But, total effect is positive, as sum of Area and interaction effect is less than yield effect.

During IInd phase i.e. 1995-00 over 1985-90, only in case of Cuttack, Dhenkanal, Ganjam, Kalahandi and Puri, the total effect was negative. It is mainly due to negative yield effect in case of Cuttack, Ganjam, Puri and negative area effect in case of Dhenkanala. All other districts have positive total effect that means there is increased level of production in 1995-00 over 1985-90.

In case of wheat, the sum of effects (i.e. total effect) is negative in all districts. The sole reason for that along with yield, there is a sharp fall in area in each and every district during 1990-95. Thus, in some district (say, Bolangir, Cuttack, Ganjam, Phulbani, Puri, Sambalpur, Sundargarh) though yield effect was positive but the negative area effect is far more than yield effect, thereby, there was a sharp fall in total production.

In second period in almost all districts, the total effect (sum of effects) is negative in case of wheat. This is due to negative yield as well as Area effect. Thus, the total production in second phase is less than first. This has occurred due to both decline in yield level as well as Area under wheat.

In case of maize, the sum of effects is negative in case of Bolangir, Dhenkanala, Kalahandi, Keonjhar, and Phulbani during 1st phase (i.e. 1990-95 over 1985-90). This says that during 1990-95 the total production has gone down in comparison to 1985-90. In case of Bolangir, Dhenkanala and Phulbani there is a sharp fall in area, which is higher than even positive yield effects (in some district), which made the total effect negative. In case of Kalahandi and Keonjhar, there is sharp fall in area under maize, which accounted for low level of production during 1990-95.

During second phase (i.e.1995-00 over 1985-90), the sum of effects is negative in case of Balasore, Bolangir, Dhenkanala Kalahandi Keonjhar and Phulbani. This

says a fall in production during 1995-00 over 1985-90. It is mainly due to yield effect in case of Bolangir and Dhenkanala along with negative area effect (but negative area effect <negative yield effect) and due to negative area effect in case of rest districts.

Among pulses Biri is the most important one. During 1st phase (i.e. 1990-95 over 1985-90), in Balasore, Cuttack, Dhenkanala Kalahandi, Koraput, Mayuabhanj, Phulbani, Puri and Sundargarh districts, the sum of effects is negative. This says that, in 10 districts production of Biri was gone down during 1990-95 in comparison with 1985-90. In cases of Balasore, Cuttack, Dhenkanala, Kalahandi, Keonjhar, Koraput, Mayuabhanj, the area effect is negative and more prominent than yield effect and in rest of 3 districts the negative yield effect is more prominent than negative area effect. Only in 3 districts production of Biri has gone up during 1990-95 w.r.t. 1985-90.

In second phase (1995–00 over 1985-90), sum of effects is negative in case of Balasore, Bolangir, Cuttack, Dhenkanala, Ganjam, Kalahandi, Keonjhar, Koraput, Mayuabhanj, Phulbani, and Puri. This says that in case of 11 districts, production of Biri has gone down during 1995-00 in comparison with 1985-90. In case of Bolangir, Dhenkanala Kalahandi, Koraput and Puri, there is more decline in yield than area and in rest 6 districts the decline of area is more prominent than yield level.

In case of mung, in first phase (1990-95 over 1985-90) Cuttack, Keonjhar Mayurbhanj, Phulbani and Puri districts have negative sum of effects. This says that production of mung has fallen in 1990-95 in comparison to 1985-90. Except Cuttack in case of Keonjhar, Mayurbhanj, Phulbani and Puri the fall in yield level is more prominent than area. Thus, one can say that in 1990-95, there is sharp fall of yield level of mung. In second phase (i.e. 1995-00 over 1980-85), the sum of effects are negative in case of Balasore, Bolangir, Cuttack, Dhenkanala, Ganjam, Kalahandi, Keonjhar, Koraput, Mayurbhanj, Phulbani and Puri. That is in case of 11 districts production level has gone down in 1995-00 over 1980-85. In case of Cuttack, Dhenkanala, Kalahandi and Koraput the fall in area is more prominent, though there is both fall in area as well as yield. In rest of the 7 districts, the fall in yield level is more prominent. Thus, we can say that during 1995-00, there is sharp fall in yield level of mung in comparison to 1985-00.

In case of Kulthi, during 1st phase (1990-95 over 1985-90), Balasore, Cuttack, Keonjhar, Koraput, Mayuabhanj, Phulbani, Puri, Sambalpur and Sundargarh have sum of effects negative. This says that during 1990-95 the production level in 8 districts is less in comparison to 1985-90. Except Phulbani, in the other 7 districts the decline in area level is more prominent than the fall in yield. During second phase, there is a fall in the production level of Kulthi in almost all districts. In case of Bolangir, Dhenkanala, Ganjam, Kalahandi and Koraput the decline in yield level is more prominent than area. And in other districts the decline in area is very high. Hence, we can conclude that, during 1995-00, there is sharp decline in Area under Kulthi in comparison 1985-90.

In case of Til, during 1st phase (i.e. 1990-95 over 1985-90), there is a decline in production level at Dhenkanal, Ganjam and Keonjhar. In case of rest 11 districts production has gone up during 1990-95 in comparison with 1985-90. The decline in production is mainly due to decline of Area though yield level also has fallen. During second phase (1995-00 over 1985-90), there is fall in production level of Til at Balasore, Cuttack, Dhenkanal, Ganjam, Keonjhar, Mayurbhanj, Phulbani, Puri, Sambalpur and Sundargarh. This means that during 1995-00, the production of Til in the above 10 districts is less than 1985-00. Only in case of Cuttack the decline in yield level is very high and in rest of 9 districts, the decline in area under Til is very prominent though yield level also has gone down in most of the districts. It may be concluded they the area under Til is going down over the periods.

In case of groundnut, during first phase (i.e. 1990-95 over 1985-90), production level has gone down for Kalahandi, that is to say in Kalahandi district the production of groundnut during 1990-95 is less than 1980-85. In rest 12 districts, the production level has gone up during 1990-95 in comparison with1985-90. During second phase production level has gone down in 10 districts except Ganjam, Keonjhar and Sambalpur. In case of Cuttack, Kalahandi, Koraput and Sundargarh the yield level has gone down more in comparison to other districts. In rest 7 districts, the decline in area is very high. Thus, during second period, in most of the districts the area under groundnut has gone down. In case of onion, during 1st phase (1990-95 over 1985-90)

production has gone down at Ganjam, Keonjhar, Mayurbhanj and Sundargarh .It is mainly due to decline in area under onion. During second phase (1995-00 over 1985-90) also production has gone down at Ganjam, Keonjhar, Mayurbhanj and Puri and Sundargarh.This says that production level of onion has gone down during 1995-00 in comparison with 1985-90. In most of the Districts, this is due to decline in area under onion.

In case of Sugarcane during 1st phase (1990-95 over 1985-90) production level has gone down at Cuttack, Dhenkanala, Ganjam, Koraput,Mayurbhanj & Puri. This says that during 1990-95, the production level of Sugarcane is less than the outputs level during 1985-90.In most of the districts it is observed that, there is sharp decline in area Under Sugarcane. During second phase (1995-00 over 1985-90) production level has gone down at Balasore, Bolangir, Ganjam, Keonjhar, Koraput, Mayurbhanj & Puri and it is also observed that in these districts during 1995-00, there is a decline in area under Sugarcane. In case of Cotton, during 1st phase (1990-95 over 1985-90) production level has gone down for Ganjam, Phulbani, Puri and Sambalpur. And during second phase (1995-00 over 1985-90) production level has gone down at Ganjam, Keonjhar, Dhenkanala, Mayurbhanj, Phulbani, Puri, Sambalpur and Sundargarh. This says that output level has gone down during 1995-00 of Cotton in comparison to 1985-90 at the above districts. During both phases it is found that the output level though has gone down due to both decline in area and yield level but the decline in area is more prominent than yield level.

4.5 CONCLUSION:

From the above analysis, it is apparent that, coastal districts are highly productive in comparison to non-coastal hilly districts. But, Sambalpur and Bolangir are two exceptions in the sense that, though they are non-coastal districts but have attained higher productivity level. The reason may be that, Sambalpur and Bolangir district have high level of infrastructural facilities amongst the non-coastal districts. During 1990-91, the rank of Sambalpur in the infrastructural development index was 5 and Bolangir secured sixth position. During 2000-01, the rank of Sambalpur in the

infrastructural development index is 4th and Bolangir has 6th rank as in 1990-91. These two districts infrastructural development index is higher than any other non-coastal districts. Secondly, Sambalpur district is well irrigated due to Hirakud dam and one part of Bolangir district (now it's Sonepur district) also irrigated by Hirakud dam. In this study, it is also found that, inter district disparity in productivity index is increasing over the periods. Also in case of input use index, the coastal districts (along with Sambalpur and Bolangir) have higher input use index than non-coastal district.

Thus, the non-coastal districts are under a vicious circle:

Low-level of productivity ⟶ Low per-capita income ⟶ Lower input use

The infrastructural facility must be developed in the underdeveloped districts of Orissa to resolve the inter district productivity differences. Along with that, poor peasants should be provided with cheap agricultural inputs and the agricultural credit facility system must be strengthened.

CHAPTER-5

DETERMINANTS OF AGRICULTURAL PRODUCTIVITY: A CROSS SECTIONAL -TIME SERIES ANALYSIS OF ORISSA

5.1 *Introduction*

Agriculture is a complex and multi-dimensional enterprise. Its development depends on various factors like agro-climatic conditions, technology, inputs, systems of land holdings and other socio-economic factors. There are host of factors, which determine agricultural productivity. The most atypical feature about agriculture is that, contribution of factors to the increment of agricultural output is region specific. For example, Chemical fertilizers may be very effective in increasing output level of plain lands, whereas its application may not significantly increase output level in hilly region. Secondly, the modern day agricultural inputs are in a kind of package application. To be precise, high yielding variety requires high fertilizer use and fertilizer application require well-irrigated and well drainage system of lands. Thus, it is very difficult to study in isolation the factors, which affect the agricultural productivity the most in Orissa, given the heterogeneity of agro-climatic conditions.

Despite all these limitation, an attempt has been made to study the agricultural productivity in Orissa with respect to area, irrigated area, area under hyv, labour, fertilizer use and rain fall.

This study has taken up with the following specific objective -:

(1) To examine which of the factors (proportion of area irrigated, proportion of area under hyv, fertilizer consumption per hectare, labour, area availability per agricultural worker, rain fall in the month of June and October) have greater importance in explaining land productivity and labour productivity in Orissa agriculture.

5.2 Model specification:

In most of the empirical study on agricultural productivity, the Cobb-Douglas production function has been extensively employed to measure the nature and contribution of individual factors to output. When variables are entered in logarithmic form estimated coefficients are interpreted as elasticities, the sum of all estimated coefficients provide information about the nature of returns to scale, intercept term is interpreted as disembodied technical change and the marginal productivity of resources can be derived from the estimated coefficients.

In this study also Cobb-Douglas kind of production function has been used. The functions are as follows:

$$Y_{it} = \beta_1 L_{it}^{\beta_2} I_{it}^{\beta_3} H_{it}^{\beta_4} F_{it}^{\beta_5} Rj_{it}^{\beta_6} Ro_{it}^{\beta_7} \quad \text{(1)}$$

Where Y is the per hectare agricultural output at 98-99 constant prices, L is the number of agricultural workers, I is the proportion of area irrigated (irrigated area/hectare), H is the proportion of area under HYV, F is the fertilizer consumption per hectare (kgs/ha), Rj is the rain fall in the month of June and Ro is the rainfall in the month of October.

Due to high correlation of area under HYV and fertilizer consumption per hectare, the duo has been taken separately in two different equations. Thus, the two equations are as follows:

$$Y_{it} = \beta_1 L_{it}^{\beta_2} I_{it}^{\beta_3} H_{it}^{\beta_4} Rj_{it}^{\beta_6} Ro_{it}^{\beta_7} \quad \text{(2)}$$

$$Y_{it} = \beta_1 L_{it}^{\beta_2} I_{it}^{\beta_3} F_{it}^{\beta_5} Rj_{it}^{\beta_6} Ro_{it}^{\beta_7} \quad \text{(3)}$$

Taking log the equation 2 and 3 can be expressed as: -

$$Log(Y_{it}) = \beta_1 + \beta_2 Log(L_{it}) + \beta_3 Log(I_{it}) + \beta_4 Log(H_{it}) + \beta_6 Log(Rj_{it}) + \beta_7 Log(Ro_{it}) + U_{it}$$

_____(Eqn 2*)

$$Log(Y_{it}) = \beta_1 + \beta_2 Log(L_{it}) + \beta_3 Log(I_{it}) + \beta_5 Log(F_{it}) + \beta_6 Log(Rj_{it}) + \beta_7 Log(Ro_{it}) + U_{it}$$

_____(Eqn 3*)

For measuring the productivity of labour, different kind of functional form has been used, where in the left hand side (dependent variable) instead of output per hectare, output per labour has been taken. That can be expressed as:

$$Log(X_{it}) = \beta_1 + \beta_2 Log(AL_{it}) + \beta_3 Log(I_{it}) + \beta_4 Log(H_{it}) + \beta_6 Log(Rj_{it}) + \beta_7 Log(Ro_{it}) + U_{it}$$

_____(Eqn 4)

$$Log(X_{it}) = \beta_1 + \beta_2 Log(AL_{it}) + \beta_3 Log(I_{it}) + \beta_5 Log(F_{it}) + \beta_6 Log(Rj_{it}) + \beta_7 Log(Ro_{it}) + U_{it}$$

_____(Eqn 5)

Where X_{it} is the agricultural output per labour and AL_{it} stands for area availability per labour. The no. of cross-section is 1 to 13 and t = no. of years is from 1 to 15.

Panel estimation using GLS:

The basic equation from which the model is developed is given by:

$y_{it} = x_{it} + u_{it}$ Where i=1...m is the no. of units (or panels) and t = 1...n is the no. of observations for panel i. In case of Ordinary least squares, the coefficients has been estimated by:

$$\hat{\beta}(ols) = (x'x)^{-1} x'y$$

And the GLS results are given by:

$$\hat{\beta}(gls) = (x'\hat{\Omega}x)^{-1} x'\hat{\Omega}^{-1} y$$

Where the Ω is the estimated variance-covariance matrix. In many cross-sectional data sets, the variance for each of the panels generally differs. And in this study, this is confirmed by cook-weisberg test, the presence of heteroscedasticity across panels. Thus cross-sectional weighted regression is appropriate when the residuals are cross section heteroscedastic. And that is the reason for which in this study generalized least squares estimator has been adopted instead of ordinary least squares estimators.

5.3.1 Determinants Of Agricultural Productivity (Land Productivity)

In this study 5 major inputs have been taken as the determinants of Agricultural productivity. They are as follows (a) Agricultural labourer (b) Irrigated Area (c) Area under Hyv (d) Fertilizer Consumption and (e) Rainfall. Though, there are many other important variables which could explain the Agricultural productivity in a significant manner due to paucity of data, this study is limited with the above mentioned factors.

Agricultural labourer: There is not any systematic availability of district wise labour data in time series for orissa. In the "census of India report", it is given at a point of time in a decadal interval. So, labour data has been extrapolated for the rest of the years. Here we have taken total number of labourer as the labour input.

Irrigated Area: The data for irrigated area has been taken from the "Orissa agricultural Statistics". There are 3 kinds of irrigation scheme (a) major and medium schemes (b) minor (flow) and minor (lift) and other sources. Major irrigation schemes have been defined as project having culturable command area (CCA) of more than 10,000 ha. Medium schemes have been defined as projects which are having culturable command area (CCA) between 2000 ha and 10,000 ha. Minor -schemes are those projects, which are having cultural command area (CCA) less than 2000 hectare. In this study, we have taken the total irrigated area of the districts. And to get proportion of area irrigated, the total irrigated area of the districts has been divided by the gross cropped area of the districts.

Area Under HYV: The data for district wise area under HYV has been given in Orissa agricultural statistics. In India, since Mid-sixties, the new high yielding variety seeds were introduced. But, in Orissa, till 80's, the use of High Yielding varieties was very limited which we will discuss in detail in the following paragraphs. To get the proportion of area under HYV, the area under HYV was divided by the gross cropped area of each district.

Fertilizer Consumption - Fertilizer Consumption is one of the important variables of this study. The data for fertilizer has been collected from Orissa Agricultural statistics. We have taken the sum of Chemical fertilizer such as nitrogen (N), phosphorus (P_2O_5) and Potash (K_2O) as the total fertilizer consumption in agricultural sector.

Rainfall: Orissa agriculture basically depends upon southwest monsoon, as the irrigation facilities are inadequate. We have taken the rainfall data for the month of June and October. The reason is that, rainfall during the month of June and October periods related with two main sowing seasons of Khariff and Rabi. During he Khariff crop, adequate rainfall is required; otherwise production level will go down. But, the Rabi crops as such do not require much rainfall. The year wise data, for the district wise rainfall has been taken from the Orissa agricultural statistics.

Dummy Variables: In this study 3 dummy variables have been taken. It is well known that, in any underdeveloped states, where the infrastructure development for agriculture is poor, then there agricultural activities are the gamble of monsoon. Generally nature is highly erratic. Thus, in the season, when the amount of rainfall is expected and timely, then it has good effect on agricultural output. But, if there is no rainfall or rainfall much higher than requirement, then it will negatively affect the production level of the crops. It is reported in the orissa agricultural statistics yearbook that average Normal rainfall during the month of June is 219.0 mm and in October is 170.6 mm. In this study, we have classified normal rainfall as: Normal rainfall ± 50% deviation from normal. If it goes beyond that 50% deviation we have considered that as abnormal. That may be flood, if it is normal + more than 50% of normal rainfall.

And drought if it is less than, normal rainfall - 50% of normal rainfall. The dummy 1 stands for normal rainfall in the month of June (khariff season) and dummy 2stands for the normal rainfall in the month of October. Dummy variables are qualitative variables. Thus, in our model to take care of the climatic effect we have incorporated dummy for climate.

We have taken another dummy for periods. From 1985 to 1995, the value of dummy is 1 and for 1995-00, the value of dummy is zero. The reason for taking this dummy is that, in Chapter 3, we have seen that, in most of the districts the crop yield level was gone down during last quinquennial. The yield level of most of the crops were high during first and second period in comparision to third period. To confirm this in our econometric study we have taken that dummy.

5.3.2 Result (Panel Evidence Of Agricultural Productivity i.e. Land Productivity In Orissa 1985-86 Tc 1999 - 2000).

From the table 5.1, it is evident that cutput per hectare is the dependent variable. Labour, irrigated areas per hectare, Area Under HYV per hectare, rainfall in the month of June, rainfall for the month of October are the independent variable. As explained earlier we have taken 3 dummies i.e. Normal rainfall in the month of June (DM_1), normal rainfall in the month of October (DM_2), and year dummy i.e. 1985-1995, the value of dummy is 1.

The results of the estimation of the cobb-Douglas production function for all the 13 districts for the period 1985-96 to 1999-00 is summarized in table 5.1. All the included variables show expected behavior as the estimated value of coefficients bear expected positive signs. The only exception is the coefficient for "rainfall-October" variable. The variable has negative sign with insignificant coefficient. But, this is not surprising because the Rabi crops do not require much rainfall. The underlying hypothesis in this production relationship is that the increased use of lanu (irrigated and HYV sown area), labour, fertilizer and timely and adequate rainfall during the months of June and October periods related with two main sowing seasons of Khariff and Rabi in Orissa agriculture leads to increased agricultural productivity.

Table No 5.1

(Determinants of Land productivity in Orissa, A panel data Result)

Coefficients: generalized least squares

Estimated covariances	= 13	Number of obs	= 195
		Number of groups	= 13
14Estimated coefficients	= 9	No. of time periods=	15
		Wald chi2(8)	= 217.94
Log likelihood	= 260.9614	Pr > chi2	= 0.0000

outha	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
labour	.1513003	.0241939	6.254	0.000	.1038811	.1987195
irha	.0614259	.0234678	2.617	0.009	.0154299	.1074219
hyvha	.178673	.0409167	4.367	0.000	.0984777	.2588683
rj	.0742968	.0181149	4.101	0.000	.0387923	.1098013
ro	-.0041004	.0107863	-0.380	0.704	-.0252413	.0170404
dm3	.061113	.0111899	5.461	0.000	.0391812	.0830448
dm1	.0203725	.0099551	2.046	0.041	.0008609	.0398842
dm2	.0171585	.0091428	1.877	0.061	-.000761	.0350781
_cons	3.008266	.1423243	21.137	0.000	2.729315	3.287217

N.B outha= output per hectare, irha= irrigated area per hectare, hyvha= area under hyv per hectare, rj= Rainfall in the month of June, ro= rainfall in the month of October, dm3= for 1985-1995 the value of dummy is 1, dm1 and dm2 is dummy for normal climate in the month of June and October respectively.

Table No 5.2

Coefficients: generalized least squares

Estimated covariances	= 13	Number of obs	= 195
		Number of groups	= 13
Estimated coefficients	= 9	No. of time periods=	15
		Wald chi2(8)	= 205.71
Log likelihood	= 264.4012	Pr > chi2	= 0.0000

outha	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
labour	.1418194	.0240521	5.896	0.000	.0946781	.1889607
irha	.0376992	.020564	1.833	0.067	-.0026054	.0780039
ferha	.1048998	.0169349	6.194	0.000	.0717079	.1380916
rj	.07025	.0178093	3.945	0.000	.0353443	.1051556
ro	-.002468	.0109932	-0.225	0.822	-.0240144	.0190783
dm3	.0654404	.0105385	6.210	0.000	.0447852	.0860955
dm1	.0203058	.009853	2.061	0.039	.0009942	.0396174
dm2	.0223193	.009036	2.470	0.014	.0046091	.0400295
_cons	2.828447	.1317545	21.468	0.000	2.570213	3.086681

N.B ferha= fertilizer consumption per hectare.

The labour coefficient i.e. the elasticity of labour input with respect to output per hectare is 0.15. This says that, if the labour input will increase by 1%, the output will go up by 0.15%. From the table, it is clear that, labour is an important variable with higher coefficient value. The coefficient is also significant at 1% level. As explained earlier since in Orissa, the level of modern input use is not very h high & infrastructural facilities is not well developed, labour is one of the few important variables which could explain the changing productivity in agriculture in a significant manner. The coefficient of proportion of area irrigated is 0.06. The coefficient shows the elasticity of proportion of area irrigated with respect to output per hectare. If there will be 1 percentage increase in irrigated area per hectare, output will go up by 0.06%. The value of the coefficient is very low in comparison to all other variables. This says that, though irrigation facilities affect positively to the production level but in comparison to other variables it's contribution is less. The reason behind this could be attributed to the less and insufficient irrigation facilities. It is observed in our study that, during 1985-90, only 32.91% of GCA was irrigated at Balasore district, which increased to 35.07% during 1995-00. In case of Cuttack districts, during 1985-90, 34.39% of GCA was irrigated which increased marginally to 34.74% during 1995-00. Ganjam another coastal district, has 30.18% of GCA under irrigation during 1985-90. During 1995-00, it has gone upto 33.47%. The situation is very shaky in case of non-coastal hilly districts. In case of Kalahandi, during 1985-90, only 9.14% of GCA was irrigated which has gone up to 17.15% during 1995-00. In case of Keonjhar, another non-coastal district, during 1985-90, only 8.76% of GCA was irrigated which has gone upto 20.79% during 1995-00. In case of Mayurbhanj, during 1985-90, only 17.11% of GCA was irrigated, which has gone upto 20.56% during 1995-00.

Thus, from this analysis it is obvious that in the coastal districts, less than 40% of GCA was irrigated and in case of non-coastal districts, less than 30% of GCA was irrigated during the last quinquennial. It was less than national average as well as less than many agriculturally well developed states. So, in this scenario, it is not astonishing that, contribution of irrigated area to the per hectare output is low.

The coefficient of proportion of area under HYV (i.e. high yielding varieties) is 0.17. This says that input (i.e. hyv/ha) elasticity with respect to per hectare output is 0.17. If the proportion of area under Hyv goes up by 1% per hectare output will go up by 0.17%. Since mid-sixties, HYV cultivation has started in India. But, its spread to Orissa is of very recent past. HYV seeds require, high irrigation facilities along with increased fertilizer consumption. Since, both irrigation facilities as well fertilizer consumption is very low in Orissa, the spread of HYV is very limited. If we will look at the district wise scenario, the picture will be very clear. From the *5.5*, it is very clear that, at Balasore district, during 1985-90, only 31.48% of GCA was under HYV, which has gone upto 50.50% during 1995-00. In case of Cuttack, during 1985-90, only 24.19% of GCA was irrigated which has gone upto 43.85% during 1995-00. In case of Ganjam district 32.87% of GCA was under HYV during 1985-90, which has gone upto 36.53% during 1995-00. Among, the non-coastal districts, in case of Kalahandi, only 10.86% of GCA was under HYV during 1985-90, which has gone upto 25.43% during 1995-00. In case of Keonjhar district, only 16.17% of GCA was under HYV during 1985-90, which has gone upto 28.88% during 1995-90. In case of Mauyrbhanj, during 1985-90, only 20.84% of GCA was under HYV, which is increased to 33.44% during 1995-00. Thus, from the above analysis, it is apparent that, there is a wide disparity between coastal and non-coastal districts as far the area under HYV is concerned. But it is also observed that, the area under HYV is increasing in a significant manner in almost all districts. Modern day agriculture is more responsive to scientific cultivation with high quality input use. Also, our estimation results confirm this. Among, the co-efficient of all variables, the co-efficient of per hectare area under HYV is very high. This is also significant at 1% level.

The coefficient of rainfall during the month of June is 0.07. It is discussed above that, irrigation facilities in orissa is very poor. And in almost all districts less than 50% of GCA was irrigated during the last period (1995-00). Thus, in true sense agriculture of Orissa is a gamble of monsoon. Rainfall in the month of June affects the summer crops. The Khariff season begins generally on the onset of southwest monsoon in mid-June in Orissa. The food crops grown in Khariff season are: rice,

jawar, Bajra, Maize, Pigeon pea, green gram, black gram, groundnut and sugarcane. These crops require high temperature and plentiful supply of water. Thus, we have earlier hypothesized that adequate and timely rainfall has positive impact on agricultural productivity. Also, it is found that the coefficient of rain-June is positive (i.e. 0.07) and it is significant at 1% level. The coefficient of rainfall in the month of October is negative and insignificant. The Rabi season starts at the beginning of cold weather season i.e. at the end of October or early November, when the monsoon has receded. The food crops of Rabi season are: wheat, lentils, barley, Bengal gram, peas and potatoes. These crops require cool weather and less supply of water. Thus, the coefficient turns out to be insignificant which could be interpreted, as rainfall during the month of October does not have any impact on the productivity level of agriculture.

The DM_1 stands for the dummy variables for the defined normal rainfall during the month of June. The dummy acts as a proxy for the natural calamities. It is known that, if there is more rainfall it turns out to be 'flood' and if there is less rainfall, it is equivalent to 'drought'. Also, the cyclone, Hailstorm, whirlwind and Tornado, generally accompanied by rainfall. Thus, rainfall is the best proxy for 'erractic-climate" behavioiur. The co-efficient of dummy for the month of June is 0.02 and it is significant at 5% level. This says that, if there is no natural calamity in the month of June, or if the nature is normal, then there will be increased level of output and productivity. The DM_2 stands for dummy for the defined normal rainfall during the month of October. This says that, if there is no natural calamity, there will be more production and higher productivity level.

DM_3 stands for the year dummy (i.e. Dm_3 =1 for 1985-86 to 1994-95 and dm_3 =0 for 1995-96 to 1999-00). From our tabular analysis in chapter 3, we have found that in most of the districts, the yield level of crops have gone down during the last period. To confirm this in our econometrics study, we have taken that dummy. The coefficient of dummy is positive and significant at 1% level. Thus, it says that productivity level during the first and second period (1985-90) was higher than the

productivity level during the last period. Though input use level has gone up during the last period, the fall in productivity level may be due to flood during 1994-95 and 1995-96, drought during 1996-97 and super cyclone and flood during 1999-2000.

The model is highly significant as the Wald chi-square is significant as 1% level. From the above analysis, one can conclude that, in Orissa (taking 13 districts and 15 years i.e. 1985-96 to 1999-00) land productivity is highly influenced by HYV, followed by labourer, rainfall and irrigated area.

As explained earlier due to multi-collinearity problem, we could not take fertilizer consumption per hectare in our second equation. Thus, in the third equation(Table 5.2) we have excluded proportion of Area under HYV and included fertilizer consumption per hectare. All other variable remain the same. The model is also highly significant. The coefficient of fertilizer consumption per hectare is 0.10. This is the value of input (Fertilizer consumption per hectare) elasticity with respect to per hectare output. This says that if fertilizer consumption per hectare goes up by 1%, the per hectare output level will go up by 0.10%. Fertilizer is an important input in modern day agriculture. The green revolution in India had started with seed (HYV) – Fertilizer- irrigation technology. Thus, the "Trio" goes together. The deficiency of any of these could hamper the productivity level. The fertilizer consumption per hectare in Orissa is also not very high. In case of Balasore district, during the first period (1985-90), the per hectare consumption of fertilizer was very low i.e. 23.99 kgs/ha. But, it has come down to 19.39 kgs/ha during the last period i.e. 1995-00. In case of Cuttack district, the per hectare consumption of fertilizer during the first period was 20.99 kgs/ha which has come down to 16.91 kgs/ha during the last period. In case of non-coastal, Kalahandi district, the per hectare consumption of fertilizer was 10.62 kgs/ha during the first period which is come down to 7.65 kgs/ha during the last period. In case of Keonjhar district, the per hectare consumption of fertilizer was 14.13 kgs/ha during the fist period which has come down to 11.09 kgs/ha during the last period. Thus, the most disturbing picture is that, not only fertilizer consumption per hectare is low in comparison to national average but it is also declining over the period of time.

The reason may be due to regular increase in the fertilizer price and institutional reduction of subsidies in the post-liberalization period.

Like equation 2, in equation 3, also all other variables are highly significant and the relative contribution is same as in equation 2, though the value of coefficient has changed due to the inclusion of one new variable and exclusion of proportion of Area under HYV.

5.3.3 Determinants of Labour productivity in Orissa - A Panel data evidence

The labour productivity has been defined as per capita output of labour. Ceteris paribus, if the output level goes up, labour productivity goes up. Otherwise, if the growth rate of output surpasses the growth rate of agricultural labourer, then also labour productivity goes up.

In case of this study, there are 13 districts and 15 years, thus the total no. of observation is 195. The functional form for the labour productivity has been as follows. We have defined labour productivity as a function of:

$$Log(X_{it}) = \beta_1 + \beta_2 Log(AL_{it}) + \beta_3 Log(I_{it}) + \beta_4 Log(H_{it}) + \beta_6 Log(Rj_{it}) + \beta_7 Log(Ro_{it}) + U_{it}$$

(All the variables are defined earlier in equation 4)

And in equation (5) we have excluded Area under HYV per hectare and introduced Fertilizer consumption per hectare. In both equation i.e. 4&5, we have taken 3 dummies as defined in the earlier discussions.

Table No 5.3
(Determinants of labour productivity in Orissa, A panel data Result)

Coefficients: generalized least squares

Estimated covariances	= 13	Number of obs	= 195
		Number of groups	= 13
Estimated coefficients	= 9	No. of time periods	= 15
		Wald chi2(8)	= 595.86
Log likelihood	= 247.7811	Pr > chi2	= 0.0000

outla	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
irha	.0628218	.0262711	2.391	0.017	.0113314	.1143122
hyvha	.2558373	.0426049	6.005	0.000	.1723332	.3393414
areala	1.018561	.0532672	19.122	0.000	.9141592	1.122963
rj	.0567305	.018598	3.050	0.002	.020279	.0931819
ro	.0091593	.0115732	0.791	0.429	-.0135238	.0318423
dm1	.0170472	.0107247	1.590	0.112	-.0039728	.0380673
dm2	.01585	.0099741	1.589	0.112	-.0036989	.0353989
dm3	.0651885	.0125636	5.189	0.000	.0405642	.0898128
_cons	3.860174	.0551793	69.957	0.000	3.752025	3.968323

N.B outla= output per labour, areala= Area per labour, all other variables defined in table no 5.1

Table no. 5.4

Coefficients: generalized least squares

Estimated covariances	= 13	Number of obs	= 195
		Number of groups	= 13
Estimated coefficients	= 9	No. of time periods	= 15
		Wald chi2(8)	= 716.05
Log likelihood	= 253.4363	Pr > chi2	= 0.0000

outla	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
irha	.0342329	.022378	1.530	0.126	-.0096272	.078093
ferha	.1357489	.0173198	7.838	0.000	.1018027	.1696951
areala	.9849871	.0498578	19.756	0.000	.8872675	1.082707
rj	.0485197	.0176717	2.746	0.006	.0138838	.0831557
ro	.0085155	.0116493	0.731	0.465	-.0143168	.0313478
dm1	.0151814	.0103578	1.466	0.143	-.0051196	.0354824
dm2	.0194224	.0096126	2.021	0.043	.0005822	.0382627
dm3	.0714169	.0120093	5.947	0.000	.0478791	.0949547
_cons	3.584401	.0567241	63.190	0.000	3.473223	3.695578

The result from table 5.3 shows that, the availability of area cultivated per Agricultural worker is the single most important factor explaining the labour productivity. The coefficient of area availability per labour is 1.01 and significant at 1% level. This says that if area availability per agricultural worker goes up by 1%, the productivity level of agricultural worker will go up by 1.01%. Also, this result is partially confirmed by another study by Orissa development report, 2001, where it is found that average size of operational holding has a positive relationship with agricultural productivity. Basically, in Orissa, Agricultural workers are mainly family workers. Thus, increase size of operational holding refers to the increase in availability of land per family. Hence, this study suggests that, in Orissa, large farm size has high productivity than small farm size. This is mainly due to easy application of modern inputs in large farm (say, Tractor, power trailer etc.) The second important variable, which affects positively the labour productivity, is the proportion of Area under HYV. The value of the coefficient is 0.25 and is significant of 1% level. Higher is the Area under HYV Cultivation, more will be the level of Agricultural output and more will be the output per labour.

Irrigated area per hectare has positive impact on the increase of labour productivity. The coefficient of irrigated area per hectare is 0.06 and is significant at 1% level. If the irrigated area per hectare increases, the output level will go up and in turn the labour productivity will go up. Rain (June) has positive co-efficient (i.e. 0.05) and significant of 1% level. The explanation of this has been given earlier as the khariff crops are more responsive to rainfall. Thus, more is the amount of rainfall (but not more than defined normal rainfall in this study); more will be the level of output and per worker output. Rainfall in the month of October turns out to be insignificant in this model and it does not have any impact on the productivity level growth of the workers. The dummy 3 is significant at 1% level. This suggests that the productivity level of worker was higher during 1985-1995 in comparison to last period i.e.1995-00.

In equation 5(Table 5.4) we have excluded the proportion of Area under HYV and included the fertilizer consumption per hectare. The result shows that Area

availability per workers is the single most important variable, which affects the labour productivity in a positive and significant manner. The coefficient of area per labour is significant at 1% level. The second important variable, which affects productivity of labour, is fertilizer consumption per hectare. Rainfall in the month of June is positive and significant and like earlier equation, the rainfall in the month of October does not have any impact on the productivity growth of the labour. The dummy 3 is positive and significant which says that, during 1985-1995, the productivity of working was higher than the last period i.e. 1995-96 to 1999-00.

5.4 Conclusion-:

From the above analysis, it is found that proportion of area under hyv is significantly affecting the land productivity. The reason is that high yielding varieties are scientifically made and some times genetically modified seeds. And those seeds have higher productive capacity than the traditional seeds. Besides hyv, labour, rainfall and irrigated area are the other variables, which affect land productivity significantly. Role of fertilizer in increasing productivity of land cannot be undermined and it's also evident from our study. In case of labour productivity, area availability per labour is the single most important factor, which explains larger variation in productivity followed by proportion of area under hyv, proportion of area irrigated, and rainfall in the month of June. It is clear that fertilizer consumption per hectare is also significantly affecting labour productivity. Hence, the model suggests that increased use of input can bring out a positive change in land and labour productivity in Orissa.

CHAPTER- 6

SUMMARY AND CONCLUSION

Fifty years of developmental effort of the state has not made any significant impact on poverty. Still, nearly fifty percent of the population of the state is living below poverty line. Industrial development is at its infancy and viable alternative sources of employment are illusive in the state, which may be the reason for large-scale exodus for searching livelihood. Agriculture is the only sector, which is so far the livelihood-providing sector for most of the people. Unfortunately, Agriculture in Orissa continues to be characterized by low productivity due to traditional agricultural practices, inadequate capital formation and low investment, inadequate irrigation facilities and uneconomic size of holdings. In case of inter state comparison it has been found that, the productivity level of Kerala, Tamil Nadu, Punjab, Haryana, Uttar Pradesh and Andhra Pradeshs's rank is higher than Orissa.

The agrarian structure of the state is hurdled with umpteen bottlenecks. The skewed distribution of agricultural land, small size of operational holding, high incidence of share tenancy and rural poverty are the major impediments to agricultural growth in the state. It has been seen that within a span of fifty years, there has been 42.6 percent increase in number of operational holding which far exceeds the 11.6 percent increase in operated area. As a result, the average area operated per household has decreased from 1.44 ha in 1961 to 1.43 ha in 1991. Along with that, there is skewed distribution of land area in the state with its concentration in a few hands of big farmers. From the inter state comparison it has been revealed that, size of operational holding is quite high in states like Punjab and Haryana.

The economy of Orissa is agrarian rural economy with slow pace of urbanization. The farmers in Orissa are very poor and due to poor resource base, the underprivileged farmers in Orissa are not in a position to invest in costly inputs like chemical fertilizers, HYV seeds, and mechanized implements, pump sets etc which

may be one of the reason for low-level of production. Orissa belongs to the category of high tenancy state. It has been seen in chapter two that, share cropping is very prominent in the state. The coverage under fixed money and fixed produce is very less. But, agriculturally advanced states like Punjab, Haryana and Tamilnadu have higher percentage of fixed tenancy. Thus, high incidence of share tenancy with high rents affects adversely the productivity level improvement in agricultural sector. In the state, agricultural sector has been utterly neglected as far as Plan outlay in agriculture is concerned. Over the years Plan outlay in agriculture is declining so is the case of Plan outlay on irrigation and flood control.

Every economy goes through structural transformation over a period of time. It has been experienced all over the world that, over a period of time share of primary sector goes down in the national income and share of manufacturing sector and service sector goes up. Also it is exhibited in Orissa in this study. Before two decades, the share of Primary sector in GSDP was almost half followed by service sector and manufacturing sector. Since the beginning of 90's share of primary sector in GSDP has gone down rapidly and share of service sector and manufacturing sector has gone up. But, this is half told story. The other side is not so much enthusiastic. Though the contribution of agriculture to GSDP has gone down in a perceptible manner, the percentage of work force engaged in agriculture has remained almost unchanged. Hence, the benefit of modernization and growth has been shared by few and more than $1/3^{rd}$ of population has been deprived of this benefit of growth, which goes against the trickle down theory. Thus, what may be suggested is that, structure of work force must be changed by institutional arrangement and agricultural sector must be protected from being over crowded and future fragmentation and sub-division. Unless the benefit of growth shared equally, it will aggravate the socio-economic problem, which may hinder further progress of the economy.

Orissa has been divided into ten agro-climatic zones. Every agro-climatic zone has its special characteristics. There is variability of rainfall, the kind of soil is different and temperature is also not the same. It has been also exhibited in its cropping pattern. As defined earlier, cropping pattern means the proportion of area

under different crops at a particular point/period of time. This cropping pattern is not a static phenomenon. As the local requirement changes and standard of living improves, people also change their food habit. To be specific, cropping pattern is largely influenced by (i) Climate, rainfall and irrigation facilities (ii) Price of crop and income level of farmer (iii) Govt. price policy (iv) Social factors (v) Socio-economic conditions (vi) Type of soils (vii) Size of farms and infrastructural facilities. This study is confined to explain the nature and trends of cropping pattern over the period of time. Any future study should explore this changing pattern of cropping taking into consideration all those above mentioned factors. From this study, it is revealed that paddy is the single most important crop of the districts. This is mainly due to the food habit as well suitable climate for paddy production in Orissa. Cereals as a whole secured more than fifty percent of gross cropped area in both coastal and non-coastal districts. In districts like Koraput, Kalahandi, Keonjhar and Mayurbhanj etc (all tribal dominated hilly districts) along with paddy the share of coarse cereals in GCA is also very high. This is apparent from the structure of population and their socio-economic conditions.

In this study apprehension has been expressed in this changing structure of cropping pattern. It has been observed that, area coverage under coarse cereals as well as yield level is going down over the years in the districts where the incidence of poverty is very high. Hence, in these tribal dominated districts, this changing structure of cropping pattern may pose food security problem, which must be closely monitored by state mechanism.

Pulses are second as far as area share is concerned followed by oil seeds and cash crops in most of the districts. Pulses require high temperature with assured irrigation facilities. Districts like Ganjam, Cuttack, Dhenkanal, Puri and Kalahandi have greater percentage of gross cropped area under pulses. Bolangir, Sambalpur, Phulbani, Sundargarh, Keonjhar and Koraput have lesser percentage share of area under pulses. The reason for this may be (i) Irrigation facilities (ii) Food habits. As explained above those districts where the proportion of area under coarse cereals is high, mostly those districts have lesser percentage area under pulses. Pulses are not the

staple food in any district. It is used for preparing dishes. Hence, it is costlier and in tribal dominated districts its demand is less due to their food habits.

As far oilseeds are concerned, Dhenkanal, Ganjam, Bolangir, Sambalpur, Phulbani, Cuttack, Kalahandi and Keonjhar have higher percentage of gross cropped area under oilseeds. The price of oilseeds is higher than cereals. One disturbing factor, which is observed in this study is that, the area share of oilseeds is declining over the years. During first period there are 8 districts whose area share was more than 10% of GCA but during final period there are only 2 districts whose area share under oilseeds is more than 10% of GCA. In this study, we could not give any satisfactory explanation due to lack of information. Any future study should look at this through (i) input price- that is the price of raw seeds, price of fertilizer, the storage facilities in the districts, Govt's price policy, crop insurance policy and the opportunity cost of farmers.

In this study we have defined jute, cotton, sugarcane, potato and onion as cash crops. During first period of our study (1985-1990), there are only 2 districts whose area share was more than 2% of GCA under cash crops, 8 districts whose area share was more than 1% and less than 2% and 3 districts whose area share was less than 1%. During final period, there are 3 districts with more than 2% GCA under cash crops and 4 districts with area share less than 1% of GCA. One remarkable point is that, in Orissa, the area under cash crops is very less in comparison to agriculturally developed states like Punjab, Haryana, Tamil Nadu and Kerala. Cash crops are input-intensive in the sense, they require higher use of fertilizer, timely irrigation, scientific way of cultivation and HYV seeds for more out-put. In our analysis we have seen that, the level of fertilizer consumption is very less in comparison to national average and irrigation facilities are yet to develop as more than 50% of GCA is rain-fed. Thus, the socio-economic factors are more responsible for this less preference for cash crops than any agro-climatic conditions. Thus, there should be institutional promotion of cash crop cultivation in the state by authorities, providing subsidized inputs (say fertilizers), arranging regular irrigation facilities and HYV seed supply through state

agricultural co-operatives. Agricultural sector in the state must be promoted as business-profit making enterprise, instead of livelihood providing sector only.

Crop diversification is a concept, which is opposite to crop specialization. The level of crop diversification largely depends upon the agro-climatic, socio-economic condition and technological development in the region. From this study it has been observed that, in Orissa, over the years, crop specialization is taking place. It is exhibited by the incremental value of Herphindal index in each period. From the crop-concentration analysis, it is evident that those districts where crop-specialization is taking place, mainly the area under Paddy (also pulses) is going up. Mainly, there are two determinants of crop diversification (i) yield level (ii) cropping intensity. Yield level is positively related with crop specialization and cropping intensity is negatively related. It has been seen that, during third period, 10 districts yield level of Paddy has gone up in comparison to first period. Thus, there is a natural tendency to devote more area for Paddy. Along with paddy, the other crops which are highly concentrated in most of the districts are mung, Biri, Kulthi, Groundnut and Til. The overall scenario which has emerged from this inter-district cropping pattern analysis is that, though the districts are converging with respect to proportion of area devoted for paddy and yield level of paddy, they are diverging in almost all other crops.

Not only there are inter-district differences in cropping pattern, there is also inter-district difference in productivity level. In this study, *Sapre and Deshpande* index has been construed to rank the district as per the productivity level. It is observed that, during the study periods, all the coastal districts are in the higher level of productivity index (i.e., lower value of S&D index). Sambalpur amongst the non-coastal districts and Bolangir during last period are in the group of top 6 districts as per productivity index. This inter-district difference in productivity also very well explained by the input use index. Those districts, which are highly productive, also have higher level of input in use.

Not only there is inter-district difference in productivity, it is also increasing. The coefficient of variation of productivity index, which was 28.17%, has gone up to 41.88% during the final period. Also, the disparity level in input use index is

increasing. From the infrastructure development index of two point of time i.e., 1990-91 and 2000-01, it has been observed that all the coastal districts are highly developed in comparison to non-coastal districts and amongst the non-coastal districts Sambalpur and Bolangir have higher index value. Thus, those districts where infrastructure development is high also productivity level is very high. This study has reached at this conclusion that, to wipe out inter-district disparity in productivity level, first, inter-district difference in infrastructure development must be solved and secondly, inter-district difference in input use must be done away with by the state mechanism via various methods like providing cheap credit, input at cheaper cost, providing sustainable irrigation facilities and finally education.

From our econometric study of determinants of agricultural productivity, contribution of factors to the productivity level has been known. Among the host of factors we have taken 5 major factors like, irrigated area, area under HYV, labour, fertilizer, rainfall. It has been found that area under HYV is highly influencing land productivity. HYV as the name itself suggest has higher output giving capacity. Thus to have higher level of output and productivity more hectares of area should come under HYV in Orissa. Second important factor is labour. In any economic activity, labour is the main input. Thus if the number of labour increased per hectare output will go up. As Orissa's farmers are poor, due to low-income base they are unable to hire much labour as per the requirement. Thus, this study suggests increasing the number of labour to have higher level of productivity. In Orissa at most of the districts less than fifty percent of GCA is irrigated. Thus, its contribution to productivity level is less. But, the sign of the coefficient is positive and significant which suggests that if more hectares area will be irrigated, per hectare output will go up in a significant manner. Rainfall in the month of June is also an important factor, which contributes to the productivity level. After HYV and labour, fertilizer is the third input, which is contributing highly to the productivity level. In Orissa fertilizer consumption per hectare is very low. This study suggests increasing the fertilizer consumption to have more output. The dummy variables, which are taken in this study, suggest that, when there is no natural calamity productivity level is higher and vice-versa. As one cannot

control the nature, only alternative left out is to take precautionary measure. The state government should improve the flood and drought control measures. As far the determinants of labour productivity is concerned in this study it has been revealed that area availability per labour is the most important one. Besides that, area under HYV, fertilizer consumption, irrigated area and rainfall is also significantly influencing labour productivity. As we have explained earlier productivity of labour is important in the sense it determines the purchasing power of the population engaged in agriculture. So higher is the purchasing power higher will be the level of investment in agriculture directly (by purchasing inputs) as well as indirectly (via consuming more agricultural goods) which will help for the improvement of agricultural productivity.

POLICY SUGGESTIONS:

Though agriculture is the dominant sector in Orissa, it has been utterly neglected during the fifty years of plan period. Percentage plan outlay on agriculture and allied services shows a declining trend in this analysis. Thus, plan outlay on agriculture and allied services, rural development, irrigation and flood control need to be stepped up. Secondly, as Orissa suffers from natural calamities almost every year of varying intensity, there is need for providing crop insurance facility to farmers in the event of crop failure. Thirdly, Public investment is necessary for accelerating agricultural growth in Orissa. Hence, it must be expedited. Fourthly, Agricultural sector in Orissa has the potential of providing employment directly as well as indirectly (via agro based industries) which must be tapped off by making the sector a profitable business enterprise from this subsistence cultivation. Fifthly, infrastructure facilities must be developed in the underdeveloped districts. Transportation, Storage, Marketing facilities must be developed. Sixthly, the system of middleman must be done away with. The farmers should be the sellers either to the people or to the govt. agencies. Seventhly, Credit facilities should be strengthened. Self-help groups should be promoted. And the needy farmers should get the credit at the appropriate time with minimum possible rate of interest. Eighthly, Agricultural inputs like quality seeds,

chemical fertilizers, Pesticides should be made available to the farmers in time and as per requirement at reasonable prices. Agricultural credit co-operative societies should be promoted. Ninthly, Farmers should be motivated to undertake joint farming and sharing of inputs to minimize the cost of production. Tenthly, The coverage of crop insurance should be extended and it must be delivered to the farmers without official red-tapisim. And lastly, instead of low valued crops, farmers should be encouraged to cultivate high valued crops and for that necessary help should be provided by the state mechanism.

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Appendix: A

Inter District Variability of Share in GCA, Yield and Share in Total Output of Crops (C.V. in Percentage)

Crops	1985-90			1990-95			1995-00		
	% To GCA	Yield (Kgs/Ha)	% To Total Output	% To GCA	Yield (Kgs/Ha)	% To Total Output	% To GCA	Yield (Kgs/Ha)	% To Total Output
Paddy	22.32	20.77	20.00	24.97	19.79	18.43	21.88	14.98	17.97
wheat	73.84	15.13	84.49	73.36	10.87	86.09	76.93	14.95	92.79
Maize	95.58	10.46	115.71	96.75	12.20	118.99	100.49	23.38	118.46
Jawar	111.71	35.59	128.41	121.75	46.00	130.54	103.49	59.61	132.94
Ragi	136.46	32.48	161.34	170.06	37.08	204.45	191.15	76.01	253.22
Biri	36.90	15.37	34.54	38.52	16.39	37.40	45.66	17.35	40.85
Mung	60.30	13.26	53.29	61.71	9.38	61.47	68.22	19.12	73.69
Kulthi	38.78	14.89	54.94	41.60	16.86	50.77	45.69	18.14	51.18
Arhar	66.45	13.86	77.72	61.56	10.86	70.25	65.73	20.27	77.19
Gram	93.48	15.92	102.24	102.98	18a.62	108.55	114.73	30.27	128.34
Til	54.49	9.06	53.00	69.79	20.20	73.56	81.05	19.36	69.78
Mustard	74.60	15.77	68.68	84.10	16.06	84.43	82.02	20.89	83.47
Ground nut	78.49	16.50	81.21	73.86	15.38	74.43	67.20	9.82	66.70
Onion	54.88	20.10	62.01	48.35	26.98	56.54	49.44	16.13	64.21
Potato	86.07	21.82	101.69	85.85	19.28	102.13	88.13	25.70	111.75
Sugarcane	65.29	11.09	67.20	60.76	10.43	67.45	69.55	13.26	76.13
Jute	191.85	79.44	183.17	194.95	99.84	191.14	192.48	140.34	195.45
Cotton	131.33	32.62	176.48	177.32	88.73	194.22	173.46	122.87	210.50

Source: Calculated from Orissa Agricultural Statistics.

Appendix: B

Agricultural Productivity (Rs/ha)

Districts	1985-90	1990-95	1995-00
Balasore	8790.64	9768.24	9118.79
Bolangir	8620.87	9703.9	9245.75
Cuttack	10295.7	10746.35	8835.96
Dhenkanala	9761.03	10123.48	7829.13
Ganjam	9708.17	10635.85	8807.89
Kalahandi	6940.8	7678.66	6714.01
Keonjhar	6832.2	7790.45	7025.57
Koraput	7754.16	8008.16	7411.5
Mayurbhanj	7745.46	8571.12	7371.14
Phulbani	7153.37	7128.95	7181.84
Puri	9492.74	10045.53	8694.97
Sambalpur	9096.11	11216.69	10276.95
Sundergarh	6376.03	7094.98	6844.54

Source: Calculated from Orissa Agricultural Statistics

Appendix: C

District wise Cropping Intensity: 1985-86 to 1999-00

District	*85-86 to 89-90*	*90-91 to 94-95*	*95-96 to 99-00*
Balasore	147.55	156.64	133.24
Bolangir	135.84	141.87	137.78
Cuttack	177.88	178.70	170.11
Dhenkanal	146.60	149.96	145.89
Ganjam	180.18	187.02	163.82
Kalahandi	143.09	151.37	144.58
Keonjhar	135.89	136.68	134.14
Koraput	139.87	156.79	138.00
Mayuabhanj	126.99	105.18	121.23
Phulbani	149.59	140.60	129.58
Puri	170.78	166.32	169.08
Sambalpur	135.33	140.41	130.61
Sundargarh	133.33	126.95	120.97
Orissa	148.52	151.50	142.79
C.V	*11.33*	*13.80*	*11.34*

Source: Calculated from Orissa Agricultural Statistics

Appendix: D

Crop-Wise Area, Production And Yield In Orissa (Average)—1985-86 To 1999-00

	FIRST PERIOD			SECOND PERIOD			THIRD PERIOD			ANNUAL COMPOUND GROWTH RATE								
	85-90			90-95			95-00			85-90			90-95			95-00		
NAME OF CROPS	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	% TO GCA	YIELD (KGS/HA)	% TO TOTAL OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT	AREA	YIELD	OUTPUT
PADDY	46.06	1708.88	51.94	46.91	1992.46	55.39	51.87	1791.64	60.85	*-0.05*	4.63	5.44	*0.24*	3.25	3.75	*0.33*	2.40	1.69
WHEAT	0.51	1643.09	0.81	0.27	1668.22	0.39	0.21	1421.08	0.28	-11.61	-0.14	-11.13	-13.50	-0.58	-12.95	2.65	-2.93	-1.69
MAIZE	1.75	1004.66	1.17	1.81	1059.48	1.14	1.81	1125.55	1.36	2.76	4.32	8.66	*0.74*	0.59	1.43	6.87	2.84	6.06
JAWAR	0.35	716.42	0.15	0.24	607.29	0.09	0.19	415.43	0.06	-6.02	-3.80	-10.55	-5.50	-5.75	-11.07	-6.71	-3.65	-7.53
RAGI	2.82	597.22	1.25	2.48	677.55	1.18	2.32	601.99	0.49	-2.96	4.86	3.10	-2.31	-1.44	-5.63	3.71	0.90	17.19
BIRI	5.81	527.94	6.64	6.12	543.43	6.42	5.69	418.30	5.08	*0.36*	0.88	-0.41	0.94	-1.80	-1.68	1.14	-1.51	2.32
MUNG	7.36	517.77	9.62	7.62	486.58	8.64	6.90	401.07	7.37	*-0.13*	0.62	-3.07	*0.35*	0.97	1.05	3.24	1.01	8.09
KULTHI	4.21	505.00	2.07	4.01	492.20	1.75	3.74	381.08	1.40	3.38	0.22	4.93	-2.29	0.42	-0.35	-3.35	-3.22	-4.48
ARHAR	1.60	731.02	2.80	1.73	779.69	2.76	1.64	680.84	2.35	4.37	5.22	9.97	*0.05*	*0.48*	-0.68	1.39	-1.16	1.01
GRAM	0.48	620.23	0.60	0.38	587.45	0.42	0.38	498.15	0.40	1.11	-0.59	3.29	-6.41	-2.15	-11.43	1.88	*0.49*	1.83
TIL	3.23	520.74	3.62	3.65	430.32	3.15	3.46	377.27	2.71	4.44	1.36	7.72	2.34	2.20	1.98	3.05	-0.83	4.43
MUSTARD	1.49	480.54	1.60	1.72	513.15	1.75	1.44	388.78	1.26	1.30	1.72	3.14	*0.52*	-2.33	-3.37	-7.06	-10.62	-15.76
GROUNDNUT	3.57	1189.40	8.60	3.65	1363.74	8.73	3.14	1222.56	7.21	-1.53	-0.72	-5.39	-6.47	2.44	-4.24	-3.57	0.85	-1.75
ONION	0.48	6694.66	0.22	0.48	6786.38	0.20	0.52	6455.94	0.23	*-0.71*	-4.33	-3.85	*0.55*	*0.48*	1.59	*0.47*	*0.73*	*0.60*
POTATO	0.11	8168.05	0.04	0.11	8991.18	0.04	0.10	8808.69	0 04	4.73	-0.03	7.12	1.05	2.23	4.53	-2.79	*0.33*	-1.67
SUGARCANE	0.04	6426.85	4.94	0.04	6715.42	4.36	0.04	6245.57	5.04	*0.71*	1.61	2.98	-5.54	-0.86	-7.26	-8.95	-2.33	-10.70
JUTE	0.38	839.63	0.06	0.29	828.78	0.05	0.21	491.00	0.03	-8.45	-1.36	-4.97	-15.37	-6.21	-19.61	-14.49	-9.99	-22.54
COTTON	0.05	140.84	0.00	0.05	85.86	0.00	0.27	96.23	0.02	-8.45	-1.36	-4.97	-15.37	-6.21	-19.61	-14.49	-9.99	-22.54

Source: Calculated from Orissa Agricultural Statistics.

Appendix: E

Sector Wise Growth Rate—1980-81 To 1997-98

	Agriculture	Forestry & logging	Fishing	Mining & quarrying	Manufacturing	Construction	Electricity,gas and water supply	Transport,storage &communication	Trade,hotels and restaurants	Banking & Insurance	Real estate,ownership Of dwellings	Public administration	Other services	% growth rate of GSDP
1981-82 over 1980-81	2.6	1.2	5.6	-0.1	-15.4	-9.2	12.6	5.8	3.6	11.2	2.6	4.2	-3.2	0.3
1982-83 over 81-82	-13.2	-1.1	-0.4	-1.0	-0.8	29.4	-5.6	-3.2	-4.9	14.7	2.6	13.0	4.4	-4.9
1983-84 over 83-82	33.5	-1.2	21.9	12.2	18.0	6.9	17.8	0.5	14.6	1.0	3.4	4.9	-2.3	19.1
1984-85 over 83-84	-13.9	-12.5	1.8	1.3	22.4	-19.1	9.9	11.3	2.1	17.3	2.8	-0.9	16.0	-3.8
1985-86 over 84-85	18.2	3.0	10.8	9.9	-5.3	19.3	-5.6	17.4	7.5	16.7	2.7	12.1	13.7	11.1
1986-87 over 85-86	-4.7	-2.9	4.2	12.8	8.0	-0.3	16.0	14.3	2.7	24.0	2.7	17.7	6.3	1.8
1987-88 over 86-87	-10.0	-9.8	8.8	13.3	4.1	-2.4	11.9	4.7	-1.4	12.9	2.2	4.4	8.4	-2.3
1988-89 over 87-88	18.5	6.0	5.1	26.2	46.8	24.0	-0.3	10.2	28.9	10.0	3.3	4.9	4.8	20.0
1989-90 over 88-89	12.4	5.2	21.1	12.9	-3.8	-4.6	5.4	6.2	0.7	27.1	2.4	3.9	15.6	6.9
Average growth rate(80-81 to 89-90)	4.8	-1.3	8.8	9.7	8.2	4.9	6.9	7.5	6.0	15.0	2.8	7.1	7.1	5.4
1990-91 over 89-90	-32.9	-18.2	5.2	13.6	-16.0	47.5	11.8	3.9	-16.1	3.4	2.8	-0.1	-0.4	-15.0
1991-92 over 90-91	17.6	-10.3	9.6	-4.4	17.1	-17.8	12.6	4.8	30.0	-0.3	2.9	2.2	8.4	11.7
1992-93 over 91-92	-11.0	3.4	16.5	24.2	0.5	2.0	-2.1	7.0	-0.1	11.4	2.9	8.5	0.6	-0.9
1993-94 over 92-93	17.0	-4.5	12.8	15.1	-8.2	5.7	9.2	3.7	6.0	-5.5	3.0	-0.7	6.2	6.7
1994-95 over 93-94	-0.9	-2.8	14.0	-3.9	14.5	13.1	7.3	11.4	4.3	17.6	3.0	1.9	6.4	4.7
1995-96 over 94-95	-3.1	-10.4	2.7	22.6	21.1	-0.1	-16.4	14.0	3.5	24.5	3.0	8.3	3.8	5.2
1996-97 over 95-96	-28.6	-1.1	10.5	6.1	-8.2	1.5	-3.8	5.3	-6.8	11.9	3.0	2.9	7.3	-8.3
1997-98 over 1996-97	35.9	2.8	15.0	9.1	12.5	18.0	13.3	7.3	14.5	11.9	3.1	8.3	3.3	16.3
Average growth rate(90-91 to 97-98)	-0.7	-5.1	10.8	10.3	4.2	8.7	4.0	7.2	4.4	9.4	3.0	3.9	4.4	2.5

Source: Calculated from NAS, CSO, GOI