

CHANGES IN CROPPING PATTERN IN ODISHA AGRICULTURE IN NEO-LIBERAL PERIOD

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ABSTRACT

Role of agriculture remains vital in enabling the State to attain and maintain food self-sufficiency, especially, in a poverty-stricken State like Odisha. Despite the changes in the macroeconomic policy framework in the neo-liberal period, the agricultural sector in Odisha neither experienced any significant growth subsequent to the initiation of economic reforms in 1991 nor it derived the expected shift in cropping pattern. Sustainable growth of agriculture depends significantly on the process of agricultural transformation, which in turn is well connected with shifts in cropping patterns. The paper discusses the cropping pattern changes that have taken place in area allocation as well as in terms of production and productivity of major crop groups at the State level and across physiographic zones of the State. It is observed that there are variations in the share of area, production and productivity of major crop groups over the time at the State level and as well as across the physiographic zones. Sluggish shift in the cropping pattern towards non-foodgrain crops in the State is because of slow expansion of irrigation, low level of fertiliser consumption, slow technology adoption and low level of infrastructure. The slowdown in the process of cropping pattern change means that most government efforts to diversify agriculture have failed to take off.

Introduction

The degree, allocation and utilisation of land are factors that have long been recognised as fundamental factors for agricultural development and poverty

reduction (Malthus, 1798; Ruthenberg, 1980).

Composition of cropping pattern of agriculture in a particular country or region of the world tends to change over time and space. Agriculture is an inherently spatial process, with

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yields being greatly influenced by local factors such as climate and weather, soil type, temperature, and topography (Alexandratos and Bruinsma, 2012). Accordingly, agricultural production and productivity are perceptible to spatial and inter-temporal variations. Sustainable growth of agriculture depends significantly on the process of agricultural transformation, which in turn is well connected with shifts in cropping patterns (Rahman, 2009). In recent years, the growing demand for agricultural production has forced the farmers to adopt intensification of agriculture practices along with the increased use of high-yielding crop varieties for maintaining higher levels of production (Weinberger and Lumpkin, 2007).

India made remarkable progress in the agricultural sector over the last five decades. From 'hand to mouth' situation in the early sixties, the country not only became self-reliant in foodgrains but also got sufficient resilience to tide over adverse conditions (Hazra, 2001). India's agriculture passed through four distinct phases of strategy. First, starting with the intensification of efforts in identified areas, using traditional technology and expansion of area during the pre-green revolution period. Second, use of modern inputs and high-yielding varieties in irrigated areas during the late sixties and the seventies (Green Revolution). Third, focus was on infrastructure including irrigation, research, extension, provision of agricultural inputs in eighties. And fourth, era of liberalisation and relaxation of controls during the nineties (post-reforms period). As a result, although country's

agriculture gained in strength and resilience over the years, growth in agriculture is highly skewed across some States and few crops (Bhalla and Singh, 2009). Odisha is one such State, which also experienced similar kind of development in the agricultural sector over the last five decades as the nation did. Being one of the poorest States of the country agriculture occupies the centre stage in the overall development of Odisha's economy. Nearly 84 per cent of Odisha's population lives in rural areas. Agriculture remains the mainstay of the State's economy and a major source of livelihood for a large majority of population (Mishra, 2009). Agriculture in Odisha continues to provide employment to more than 60 per cent of the total workforce. However, over the years, in line with the trends in rest of the economy, share of agriculture to the Gross State Domestic Product (GSDP) recorded a substantial decline. In the 1950s, the share of agriculture to GSDP was about 70 per cent, which came down to skimpy less than 20 per cent in 2009-10 (at constant prices 1999-2000), (Government of Odisha, Economic Survey, 2011-12). The nature and extent of variability in the cropping pattern, its sources and implications, however, did not receive systematic attention till recently, at any rate in Odisha.

Quite a few researchers tried to study the changes in the cropping pattern of Odisha's agriculture at the State level as well as at the physiographic zone level. Therefore, the objective of this study is to examine area, production and productivity performance of

major crop groups—how they change over time—giving more explicit attention to the spatial dimensions of Odisha agriculture. The present study also analyses the relationship, if any, between the levels and growth of agricultural output and the use of modern inputs like irrigation, fertilisers, etc. The study finds that there are variations in the share of area, production and productivity of major crop groups over the time period at the State level as well as across the physiographic zones. However, major changes in area allocation to different crops have not taken place during the study period. The process of diversification in cropping pattern from foodgrains to non-foodgrains is very slow both in terms of production and productivity of the major crop groups. Sluggish shift in the cropping pattern towards non-foodgrain crops in the State is because of slow expansion of irrigation, low level of fertiliser consumption, slow technology adoption, and low level of infrastructure. Given the challenges agriculture in Odisha is faced with market-oriented approach and failed to bring in crop diversification.

Agriculture in Odisha: A Historical Account

Agriculture played an important role in the development process of Odisha and also the focus of the planners and policy makers changed from time to time towards the development of this sector. During pre-green revolution period (1950-1965) emphasis was on to increase production of foodgrain crops through double cropping, distribution of improved quality seeds, emphasis on green manuring, composting and increased

consumption of fertilisers (Vyas, 1996). However, during the green revolution period (1965-1980), the objective was to increase the foodgrain crops through strategising for optimum cropping pattern under HYV programme, agriculture information service and provision of long-term credit facility (Rao, 1996). In the early 80s (post-green revolution period/ pre-economic reform period: 1980-1991), efforts were made to bring convergence between agricultural development programmes and poverty alleviation programme (Chand, 2003). During this period some new heads were added to the agriculture sector such as food storage and warehousing, agriculture research and education. In the name of New Economic Reforms (1991) a structural change took place at the national as well as at State level. However, during the post-economic reform period (1991-onwards), the issues were to raise the productivity, increase the cultivable area of pulses and commercial crops, effective utilisation of irrigation facility and development of rural market for the improvement of the agriculture (Mishra and Chand, 1995; Chand, 2001). Other issues such as mechanisation of agriculture, development of agro-based industries, promoting private enterprises in marketing of agricultural products were also emphasised. To realise the objectives, target was to intervene in the areas of seed, fertiliser, farm mechanisation, commercial crops, credit and reclamation of problematic soils. Further, it was also targeted to mechanise the farm sector through provision of updated technological

machineries. To strengthen the economic conditions of the farmers, an attempt was made to diversify the cropping pattern through introduction of commercial crops. In addition, it was also proposed to encourage contract farming, agri-business houses and consortia (Chand, 2003).

Due to diverse agro-climatic conditions in the State, a varied number of crops are produced and can be classified into two groups – foodgrains and non-foodgrains. Due to the challenge of feeding large population around 75 per cent of the total cultivated area is under foodgrain (cereals and pulses). Changes in the cropping pattern in Odisha are generally viewed as a shift from traditionally grown less remunerative crops to more remunerative crops (Mohanty et al., 2013). Changes in the cropping pattern take place due to distinct soil problems, market infrastructure and governmental policies and thrust on some crops in a given time. During the period of green revolution, with the introduction of modern agricultural technology, there is a continuous surge for diversifying agriculture in terms of crops, primarily on economic considerations (Joshi et al., 2006). The cropping pattern changes, however, are the outcome of the interactive effect of many factors like resource related factors (irrigation, rainfall and soil fertility), technology related factors (seed, fertiliser, and storage and processing), institutional and infrastructure related factors (farm size, extension, marketing systems,

investment, output and input prices, government regulatory policies, and research). Odisha agriculture has experienced the change in the relative importance of these factors over time. Furthermore, agricultural liberalisation and globalisation policies are also determining crop composition both at the micro and macro levels (Vyas, 2001).

As economic reforms are said to have brought about a clear shift in the focus on growth strategy, it may be useful to analyse the scenario of cropping pattern in the State during this neo-liberal reforms period. The present study aims at examining the cropping pattern in Odisha with respect to area, production and yield.

Database and Methodology

The study is based on secondary data. The data have been collected from various issues of Odisha Agriculture Statistics published by Directorate of Agriculture and Food Production, Odisha. Crop group-wise distribution of area to total area, yield to total yield and production to total production are discussed to understand the changes that have taken place over time. Triennium Ending (TE) data (1993/94 - 1995/96) to TE (2008/09 - 2010/11) have been considered to understand the pace of changes. The State has been divided into four physiographic zones as there are vast variations in agro-climatic conditions. A zone-wise analysis has been undertaken on the basis of 30 districts (Table 1).

Table 1: Division of Districts According to Physiographic Conditions

	Northern Plateau (NP)	Central Table Land (CTL)	Eastern Ghat(EG)	Coastal Plains(CP)
Climate & Soil Type	Climate: mostly hot & moist and sub-humid	Climate: mostly hot & moist and sub-humid	Climate: have hot and moist, sub-humid, warm and humid	Climate: includes moist & sub-humid, hot & moist, hot & humid
	Soil types: include lateritic, red & yellow, red & brown, mixed red & black	Soil types: range from red & yellow, red & black, black, brown forest and lateritic	Soil types: red, mixed red & black, black, lateritic, alluvial	Soil types: red, deltaic, lateritic, deltaic alluvial, coastal alluvial, saline
Districts	Keonjhar, Mayurbhanj, Jharsuguda, Sundargarh	Bolangir, Sonepur, Dhenkanal, Angul, Sambalpur, Bargarh, Deogarh	Kalahandi, Nuapara, Koraput, Malkangiri, Nawarangpur, Rayagada, Kandhamal, Boudh	Balasore, Bhadrak, Cuttack, Jagatsinghpur, Jajpur, Kendrapara, Ganjam, Gajapati, Puri, Khurda, Nayagarh

Source: Economic Survey of Odisha-2011-12.

Cropping Pattern Changes: A State Level Analysis

Measuring changes in the share of area, production and yield at the State level across crop groups explains the cropping patterns that are predominant in Odisha under the neo-liberal period. The analysis indicates long-term changes in cropping pattern that have occurred with changes in socio-economic conditions and macroeconomic environment with respect to food security, policy support and incentives and farmers' preference in response to market demands in the State.

Temporal Changes in the Share of Area under Major Crops

The share of area for major crop groups to gross cropped area in the State is considered

important as it indicates the changes in cultivated area that have occurred over the years. This is reflective of the relative share of area of major crop groups in GCA. Distribution of area to gross cropped area of the State for major crop groups is shown in Table 2. A careful analysis of trends in area of production to GCA reveals that area under cereals has been reported 52.28 per cent during 1994-96, whereas it has sustained at 58.29 per cent and 58.87 per cent during TE 1997-99 and 2000-02, respectively, thereafter it has shown a declining trend. During TE 1994-96, share of pulses has been registered 22.41 per cent of the gross cropped area. It has remained almost stagnant over the next three triennium ending periods. The share of pulses has increased marginally

after TE 2003-05. However, share of foodgrains has varied between 74.6 and 77.6 per cent to GCA during the study periods. A constant decline in the area share of oilseeds has been observed upto TE 2003-05. However a marginal increase at 5.4 per cent and 13.4 per cent has been recorded in the succeeding time periods. Area under fibers in the State has hovered around 1 per cent excluding TE 2003-05, when

more than 3 per cent area has been used for cultivation of fibers. The percentage of area used for vegetables cultivation diverged between 5.31 to 8.62 per cent during the study period 1994-2011. Condiments and spices have not gained much importance with respect to area used over the years, as understood from the figures.

Table 2: Share of Area under Major Crops in Odisha (Percentage of GCA)

Year	Cereals	Pulses	Foodgrains	Oil Seeds	Fibers	Vegetables	Condiments & Spices
TE 2009-11	53.05	22.67	75.72	10.73	1.08	7.26	1.65
TE 2006-08	54.64	21.60	76.25	9.29	1.10	7.32	1.63
TE 2003-05	57.69	18.23	75.92	8.78	3.40	5.31	1.72
TE 2000-02	58.87	18.76	77.64	9.49	1.17	5.51	1.77
TE 1997-99	58.29	18.55	76.84	10.53	0.99	5.84	1.73
TE 1994-96	52.28	22.41	74.68	11.74	0.77	8.62	1.86

Source: Odisha Agriculture Statistics, Directorate of Agriculture and Food Production, Odisha.

From the above analysis it is observed that three-fourths of the area under cultivation is used for food grain (cereals and pulses) cultivation while one-fourth of the area is utilised for non-foodgrain cultivation. Under foodgrain, cereals occupy the centre stage and vegetables and oilseeds under non-foodgrain. The skewed distribution of area towards cereals may be because of adaptability to a wide range of land types (rain-fed uplands, medium lands

and low lands irrigated khariff, irrigated rabi and under a wide range of climatic conditions) and water regimes including conditions of water stagnation where no other crop could possibly be grown. Again it is observed that a very low proportion of area is used for vegetable cultivation. This may be due to lack of adequate irrigation facilities and suitability of soil types for vegetable cultivation.

Temporal Changes in the Share of Production of Major Crops

Study of production of major crops to the total production is crucial from the view point of understanding the contribution of different crop groups to agriculture sector and in turn to the GSDP of the State. An analysis of share of production showing the changes in cropping pattern is presented in Table 3. Share of cereal production in the State ranged between 38.21 and 49.15 per cent over the study periods. However, share of pulses production to total production in the State has not been appreciable as it ranged between 3 to 6 per cent, although a considerable proportion of GCA has been used for pulses production. In TE 1997-99 and TE 2000-02, both cereals and pulses production have been

recorded high that added to foodgrains production at more than 54 per cent at the State level. During TE 1994-96, production of oilseeds has been 5.15 per cent of total production, thereafter it has shown a declining trend over the study periods. Production of fiber condiments and spices in the State has never been appealing. Production share of vegetables over the time periods has remained remarkable. It has become highest in TE 2003-05 at 51.76 per cent to the total production. It is interesting to note that, share of vegetable production to total production in Odisha is appreciable, although the share of area used varies between 5 to 8 per cent. Production share of oilseeds as compared to the area used has remained low. Production share of fibers and condiments and spices in the State has also remained unappealing over the study period.

Table 3: Share of Production of Major Crops in Odisha (Percentage of Total Production)

Year	Cereals	Pulses	Foodgrains	Oilseeds	Fibers	Vegetables	Condiments & Spices
TE 2009-11	41.45	5.29	46.74	3.52	2.20	45.64	1.90
TE 2006-08	43.26	4.79	48.05	3.40	2.12	45.32	1.11
TE 2003-05	38.21	3.78	41.99	2.95	1.84	51.76	1.31
TE 2000-02	49.15	5.09	54.24	4.07	2.64	37.35	1.70
TE 1997-99	48.98	5.41	54.39	4.30	3.04	36.58	1.68
TE 1994-96	41.60	6.92	48.58	5.15	2.86	42.21	1.25

Source: Odisha Agriculture Statistics, Directorate of Agriculture and Food Production, Odisha.

While analysing the share of production, it is observed that there is a balance distribution between foodgrain and non-food grain. However, major contribution of cereals

and vegetables is observed under foodgrain and non-foodgrain category, respectively. Furthermore, while analysing the share of yield of major crop groups it is observed that,

vegetables account for two-thirds and the rest one-third is distributed among other crop groups. It is worth noting that the share of yield of cereals, pulses and foodgrains has declined over consecutive four triennium ending periods. Yield of oilseeds and fibers has not remained attractive; on the other hand, vegetables have shown an excellent trend with respect to yield and some visibility has been marked in the yield of condiments and spices, compared to its area and production.

Temporal Changes in the Yield Share of Major Crops

Crop productivity, or crop yield, is one of the essential indicators for agricultural development and is normally expressed as kilograms (kg) of product per hectare (ha). The share of yield rate of the major crop groups to the total yield rate of the agricultural output considered for study is shown in Table 4. It is

interesting to note that yield share of cereals and pulses decreased over first four triennium ending periods till TE 2003-05. However, the yield share of cereals increased by 17.9 per cent and pulses by 12.9 per cent during TE 2006-08. Same trend has been observed for foodgrains. Yield share of oilseeds varied between 3.68 and 5.63 per cent in the State during study period. However, percentage of oilseeds yield to total yield recorded maximum in triennium ending period TE 1994-96. Fibers showed a low productivity in the State throughout the study period. Yield share of fibers to total yield remained below 4 per cent in all the TE periods except TE 1997-99. Yield share of vegetables remained splendid over the years at the State level. It has more than 60 per cent through all the triennium ending periods. Although area and production of condiments and spices remained low, the share of yield remained satisfactory during the periods of analysis.

Table 4: Share of Yield of Major Crops in Odisha (Percentage of Total Yield)

Year	Cereals	Pulses	Foodgrains	Oilseeds	Fibers	Vegetables	Condiments & Spices
TE 2009-11	7.92	2.37	6.30	4.04	3.73	63.98	11.66
TE 2006-08	8.54	2.39	6.80	3.95	3.75	67.18	7.38
TE 2003-05	7.01	2.08	5.70	3.68	3.77	69.82	8.00
TE 2000-02	8.01	2.59	6.69	4.07	3.90	65.73	9.01
TE 1997-99	8.41	2.91	7.07	4.07	5.51	62.31	9.71
TE 1994-96	10.23	4.00	8.36	5.63	0.05	63.07	8.66

Source: Odisha Agriculture Statistics, Directorate of Agriculture and Food Production, Odisha.

The production and productivity of major crops in the State, is observed low and skewed towards the traditional crops (cereals and vegetables), may be due to traditional farming practices, low use of yield raising inputs like HYV seeds, fertilisers, organic manures, uneconomic size of operational holdings, low capital formation and investment in agriculture, deficient rural infrastructure and extension services, inappropriate policy environment and mostly regional diversification.

Cropping Pattern Changes in Share of Area, Production and Yield of Major Crops Across Physiographic Zones

Odisha's agriculture is known for its diversity which is mainly the result of variations in resource endowments, climate, soil type, land fertility, rainfall, temperature, water resources, topography, technology adoption, infrastructure, natural calamities, availability of inputs, marketing, irrigation facilities, farm mechanisation, cropping intensity, size of land holdings, locations, crop diversification and commercialisation of agriculture, farmers' indebtedness, migration, historical, institutional and socio-economic factors. As a result, agricultural sector has followed an uneven path and huge gaps have been there in production and productivity across different regions and districts of the State. Analysing cropping pattern with respect to area, production and yield across the physiographic zones of major crop groups will help to look into the trends at the disaggregate level and to develop

decentralised development strategies to ensure inclusive growth in the State in the long-run.

Changes in Share of Area under Major Crops Across Physiographic Zones: Analysis of distribution of area under cultivation for major crop groups to GCA over time across the physiographic zones has been presented in Tables 5_a and 5_b. In NP, relatively more percentage of area has been used for cereals in all time periods as compared to other physiographic zones and maximum 66.16 per cent recorded in this zone in TE 2000-02. Although, a decreasing trend has been observed between TE 1997-99 and TE 2009-11 for CTL, share of area to GCA remained high over the time period. The temporal behaviour of area used for the six time periods in EG reflects that area share for cereals has remained maximum at 55.76 per cent in TE 2000-02 and in rest of the time periods it has shown a valuable share at more than 50 per cent. For CP, area share has been 53.19 per cent in TE 1994-96, increased by 11 per cent in TE 1997-99 and thereafter, a continual decline is observed. Furthermore, proportion of area under pulses is observed maximum in CP over all intervening time periods and across zones. In CTL area under pulses, cultivation has been decreasing till TE 2000-02 and a substantial increase has been noticed during the remaining periods. Similar trend has been observed for EG. It is observed that less percentage of area is used for pulses in NP as compared to other zones. The area share of foodgrains seems to have occupied the centre

stage for cultivation for all the physiographic zones and not much change is observed over the time period.

Area share of oilseeds has shown little fluctuations over the years in NP, however it has been decreasing till TE 2000-02 and a marginal improvement has been recorded consequently (Table 5_a). For CTL and EG, area share of oilseeds has gone down till TE 2003-05, and then increased by 13.8 per cent for CTL and 2.8 per cent for EG. Very negligible proportion of area has been used for cultivation of fibers as

revealed by zone-wise investigation except TE 2003-05. Area share of vegetables for NP was 10.07 per cent to GCA in TE 1994-96 and it has declined till TE 2003-05, however, the share has increased after TE 2003-05. In CTL, lesser area has been used for vegetables as compared to NP. In EG, area share in various time periods has remained lower when correlated with CP. No perceptible amount of area has been utilised for condiments and spices across the physiographic zones over the time period.

Table 5_a : Changes in Share of Area under Foodgrains Across Physiographic Zones
(Percentage of GCA)

	Zones	TE2009-11	TE2006-08	TE2003-05	TE2000-02	TE1997-99	TE1994-96
Cereals	NP	58.18	60.27	63.26	66.16	63.74	57.96
	CTL	49.74	52.01	56.22	56.29	56.38	50.53
	EG	50.31	51.67	55.54	55.76	54.63	50.35
	CP	53.08	54.50	56.20	59.38	59.97	53.19
Pulses	NP	16.40	15.35	13.25	12.20	13.79	15.91
	CTL	23.76	22.51	19.28	18.28	18.97	21.75
	EG	20.87	20.38	15.76	17.51	18.29	22.51
	CP	24.52	23.42	20.34	21.21	19.27	23.81
Foodgrains	NP	74.58	75.62	76.51	78.35	77.54	73.87
	CTL	73.50	74.52	75.50	74.57	75.35	72.27
	EG	71.18	72.05	71.30	73.28	72.92	72.81
	CP	77.60	77.92	76.54	80.59	79.24	77.00

Source: Odisha Agriculture Statistics, Directorate of Agriculture and Food Production, Odisha.

Table 5_b: Changes in Share of Area under Non-foodgrains Across Physiographic Zones (Percentage of GCA)

	Zones	TE2009-11	TE2006-08	TE2003-05	TE2000-02	TE1997-99	TE1994-96
Oilseeds	NP	9.77	9.47	8.17	8.14	9.41	10.68
	CTL	11.76	12.86	11.08	11.33	12.94	14.17
	EG	11.22	11.78	11.45	12.46	14.56	15.35
	CP	6.00	6.19	6.29	6.93	6.95	8.53
Fibers	NP	0.59	0.70	3.58	0.93	0.94	0.93
	CTL	1.05	1.10	2.97	0.89	0.70	0.56
	EG	1.37	1.41	3.77	1.57	1.31	0.72
	CP	0.41	0.50	3.54	0.67	0.84	0.77
Vegetables	NP	8.34	8.43	5.97	6.53	6.57	10.07
	CTL	6.63	5.96	4.49	6.02	5.50	8.89
	EG	7.20	7.37	5.39	5.50	4.89	6.86
	CP	8.70	8.84	6.26	5.97	6.32	9.18
Condiment and Spices	NP	1.56	1.56	1.57	2.14	2.07	2.14
	CTL	1.76	1.67	1.67	2.15	2.10	2.10
	EG	2.37	2.24	2.43	2.47	2.36	2.19
	CP	1.70	1.72	1.89	1.50	1.47	1.63

Source: Odisha Agriculture Statistics, Directorate of Agriculture and Food Production, Odisha.

Changes in Share of Production of Major Crops Across Physiographic Zones: Zone-wise analysis of production share of major crop groups (foodgrains and non-foodgrains) in the State has been done to identify their relative importance in the cropping pattern and shown in Tables 6_a and 6_b. Cereal production has shown a continuous fluctuation among all the

zones over the study period. Significant improvement is observed in production share of cereals across all the zones between TE 1994-96 and 1997-99. However, it has declined marginally except NP in TE 2000-02. But there is a significant decline in production share of cereals for all the zones in the TE 2003-05. However, production share of cereals has

increased significantly in TE 2006-08 across all the zones. In TE 2009-11, production share of cereals has again declined for all the zones except EG. The production share of pulses has remained very low and it varied between 2 and 9 per cent across the physiographic zones during the study period. A continuous decline in the share of pulses production is observed for all the physiographic zones from TE 1994-96 to TE 2003-05 except in CP in TE 2000-02. However, there is an increase in the share of pulses production during the subsequent TE periods. Foodgrains consisting of cereals and pulses have shown fluctuations and similar kind of trend for all the zones.

Under non-foodgrains, the production share of oilseeds in the State is very low and it varied between 1.71 and 6.11 per cent across the physiographic zones during the study period. The share of oilseeds production has declined continuously for all the zones from TE 1994-96 to 2003-05 except CP in TE 2000-02. However, it has increased in the subsequent triennium periods except EG in 2009-11. The production share of fibers is extremely low across the physiographic zones. For NP, small increase has been observed between TE 1994-96 and TE 1997-99 and then it has declined continuously over the study period. In EG, the

share of fiber production has shown a consistency and remained at more than 2 per cent throughout the study period. However, a continual decline has been recorded till TE 2003-05 and a marginal increase has been marked in TE 2006-08 in the CP zone.

Under non-foodgrains production, share of vegetables is predominant and occupies an important place in diversification of agriculture and plays a pivotal role for food and nutritional security. Significant decline is observed in the share of vegetable production across all the zones between TE 1994-96 and 1997-99. However, the share of vegetables production has increased significantly during TE 2000-02 and TE 2003-05 across all the zones. But there is a significant decline in the share of vegetable production by more than 5 per cent for all the zones in the TE 2006-08. Furthermore, the share of vegetable production has increased in TE 2009-11 across all the zones except EG. Although condiments and spices are important cash crops in Odisha, results indicate that physical production has not been remarkable to total agricultural production. The production share of condiments and spices in the State is very low and it varied between 0.96 to 3.87 per cent across the physiographic zones during the study period.

Table 6_a : Changes in Share of Production of Foodgrains Across Physiographic Zones
(Percentage of Total Production)

	Zones	TE2009-11	TE2006-08	TE2003-05	TE2000-02	TE1997-99	TE1994-96
Cereals	NP	33.96	44.38	37.21	47.57	45.27	40.58
	CTL	43.13	49.77	43.92	46.07	48.32	41.19
	EG	40.86	40.68	35.37	46.04	47.91	41.81
	CP	38.88	39.62	35.23	46.96	50.44	42.89
Pulses	NP	4.53	3.38	2.88	3.57	5.32	5.58
	CTL	5.57	4.95	3.84	4.70	5.50	6.81
	EG	5.70	5.80	3.94	5.40	5.51	8.77
	CP	5.09	4.70	3.87	6.15	6.09	6.88
Foodgrains	NP	38.49	47.76	40.09	51.14	50.59	46.16
	CTL	48.69	54.72	47.76	50.77	53.82	48.01
	EG	46.55	46.48	39.31	51.43	53.43	50.58
	CP	43.97	44.33	39.10	53.11	56.53	50.04

Source: Odisha Agriculture Statistics, Directorate of Agriculture and Food Production, Odisha.

Table 6_b : Changes in Share of Production of Non-foodgrains Across Physiographic Zones
(Percentage of Total Production)

	Zones	TE2009-11	TE2006-08	TE2003-05	TE2000-02	TE1997-99	TE1994-96
Oilseeds	NP	3.04	2.16	1.71	2.42	3.72	3.90
	CTL	4.45	4.44	3.51	4.56	5.48	5.78
	EG	3.91	4.00	3.40	4.55	5.22	6.11
	CP	3.57	3.50	3.42	4.67	3.79	4.99
Fibers	NP	1.56	1.67	1.72	3.54	4.36	3.55
	CTL	1.80	1.99	1.74	2.15	1.43	1.55
	EG	2.52	2.43	2.35	2.46	2.89	2.21
	CP	1.55	1.73	1.30	2.48	3.36	3.42
Vegetables	NP	55.19	47.41	55.21	41.01	39.49	45.03
	CTL	43.63	37.73	45.53	40.51	37.05	43.46
	EG	43.14	45.33	52.79	38.58	35.42	38.84
	CP	49.63	49.45	54.69	38.39	35.10	40.86
Condiment and Spices	NP	1.72	1.00	1.21	1.89	1.84	1.36
	CTL	1.43	1.13	1.26	2.01	2.21	1.19
	EG	3.87	1.75	2.07	2.96	3.04	2.25
	CP	1.28	1.00	1.23	1.34	1.22	0.96

Source: Odisha Agriculture Statistics, Directorate of Agriculture and Food Production, Odisha.

Changes in Share of Yield of Major Crops

Across Physiographic Zones: Study regarding agricultural yield is essential to understand the pace of changes in output per hectare and changes in the cropping pattern. Tables 7_a and 7_b indicate zone-wise yield share of foodgrains and non-foodgrains to the total yield. Continuous decline in yield share of cereals is observed from TE 1994-96 to 2003-05 across all the zones. However, yield share of cereals has increased significantly in the TE 2006-08 for all the zones and further it has declined except EG in TE 2009-11. The yield share of pulses has not been impressive at the State level as well as at the zonal level. It varied between 1.97 to 5.61 per cent across the zones during the study period. The yield share of pulses has remained highest in the first triennium ending period (TE 1994-96) in all the zones, except NP, where, 5.61 per cent of yield share has been observed in TE 1997-99. A marginal increase has been seen in TE 2006-08 as compared to previous TE period across the zones. Again, a marginal increase has been recorded in NP and CTL in the last period (TE 2009-11). Similar trend has been observed for foodgrains across the zones. In TE 1994-96, yield share of foodgrains has remained highest as compared to other TE periods across the zones. Continuous decline in the share of yield of foodgrains is observed from TE 1994-96 to 2003-05 across all the zones, except in TE 2000-02 for EG. In TE 2009-11, a substantial decline in yield has been observed in NP and CTL and for EG and CP a moderate decline has been witnessed.

Under non-foodgrains, continuous decline in yield share of oilseeds is observed from TE 1994-96 to 2003-05 across all the zones. However, yield share of oilseeds has increased in the TE 2006-08 and TE 2009-11 for all the zones, but not significantly. Zone-wise, yield shares of fibers indicate that, share of yield of fibers in the CP and NP has remained higher as compared to other two zones during the study period. Yield share of fibers was negligible in TE 1994-96 for all the zones. However, a sudden rise in the share of yield has been observed in TE 1997-99 for all the zones among which NP reported maximum 7.34 per cent. The yield share of vegetables remained splendid over the years across the physiographic zones. In TE 2003-05, the share of yield of vegetables has been observed maximum for all the physiographic zones as compared to other TE periods. During this TE period in EG, the share reported maximum 71.61 per cent followed by 70.05 per cent in NP. There is a decline in the share of yield of vegetables observed during TE 2006-08 across all the zones. During TE 2009-11, share of yield of vegetables has increased marginally except EG and CP. A noticeable improvement has been observed in the yield share of condiments and spices between TE 1994-96 and 1997-99 across all the zones. On the other hand, a continuous decline in the share of yield of condiments and spices is observed from TE 2000-02 to TE 2006-08 for all the zones. However, significant increment is noticed in the recent TE 2009-11 for all zones where in EG the share reported maximum 11.56 per cent followed by 10.46 per cent in NP.

Table 7_a : Changes in Share of Yield of Foodgrains Across Physiographic Zones
(Percentage of Total Yield)

	Zones	TE2009-11	TE2006-08	TE2003-05	TE2000-02	TE1997-99	TE1994-96
Cereals	NP	5.89	8.30	6.49	7.20	7.17	9.78
	CTL	8.45	9.79	7.66	8.24	8.55	10.61
	EG	8.08	8.08	6.52	7.89	8.14	9.44
	CP	7.94	8.28	7.13	7.65	9.00	11.06
Pulses	NP	2.69	2.51	2.34	2.75	5.61	4.73
	CTL	2.33	2.27	1.97	2.40	2.86	3.92
	EG	2.54	2.67	2.35	2.69	2.60	4.32
	CP	2.26	2.30	2.14	2.57	3.16	4.05
Foodgrains	NP	5.19	7.10	5.76	6.48	6.57	9.10
	CTL	6.60	7.60	6.23	6.81	7.14	8.67
	EG	6.52	6.62	5.60	6.68	6.60	8.09
	CP	6.14	6.45	5.81	6.31	7.49	8.54

Source: Odisha Agriculture Statistics, Directorate of Agriculture and Food Production, Odisha.

Table 7_b : Changes in Share of Yield of Non-foodgrains Across Physiographic Zones
(Percentage of Total Yield)

	Zones	TE2009-11	TE2006-08	TE2003-05	TE2000-02	TE1997-99	TE1994-96
Oilseeds	NP	2.75	2.45	2.27	3.03	3.95	4.92
	CTL	4.01	3.71	3.36	3.83	4.26	5.29
	EG	3.19	3.24	2.73	3.35	3.14	4.61
	CP	6.05	6.09	5.41	5.99	5.54	7.88
Fibers	NP	4.66	4.93	4.71	6.13	7.34	0.05
	CTL	3.79	3.89	4.02	3.65	3.84	0.04
	EG	3.86	3.75	3.31	2.92	3.63	0.03
	CP	6.39	6.05	5.01	5.26	6.32	0.06
Vegetables	NP	68.37	67.25	70.05	65.42	60.02	62.32
	CTL	67.21	66.03	69.49	67.08	63.63	64.39
	EG	64.26	68.13	71.61	67.83	66.33	64.54
	CP	63.11	64.39	67.45	63.97	59.96	60.14
Condiment and Spices	NP	10.46	7.46	8.37	8.99	9.33	9.10
	CTL	7.61	6.71	7.27	7.98	9.73	7.08
	EG	11.56	7.50	7.89	8.64	9.56	8.97
	CP	8.11	6.43	7.05	8.26	8.53	8.28

Source: Odisha Agriculture Statistics, Directorate of Agriculture and Food Production, Odisha.

Determinants of Agricultural Production in Odisha

As it is observed from the above analysis, agriculture in the State has shown a high degree of disparity across the physiographic zones, therefore, it is, in this context, pertinent to examine the major determining factors of agricultural production and draw implications thereon. The study examines the impact of the factors considering foodgrains and non-foodgrains over the period 1993-94, 2001-02 and 2010-11. Detailed data on area, production and productivity is given in annexure (Table A1 to A8) for the respective time periods. Besides, an attempt is made to find out the impact of such determinants on total agricultural production (considering both foodgrains and non-foodgrains together) over the same periods.

Hypotheses and Variables

Changes in the crop sector are influenced by several factors such as the use of physical inputs, weather conditions, irrigation, credit availability, market, and government policies. This study examines the determinants of crop production at the State level through the neo-classical growth model, which is described as follows:

The aggregate production function can be specified as

$$Y = f(R, GCA, CI, GIA, FC, LR)$$

Where Y is the aggregate crop productivity (foodgrains, non-foodgrains, total

(foodgrains + non-foodgrains); R is rainfall; GCA gross cropped area; CI is cropping intensity; GIA is the gross irrigated area; FC is fertiliser consumption; and LR is literacy rate.

Level of production generally determines the overall performance of an agrarian economy and treated as dependent variable in a broad analytical framework (Bhattacharya and Bhattacharya 2007). Consumption of fertilisers and cropping intensity are taken as the main technological variables. The rationale for including rainfall in the production function is that a significant proportion of cultivated area depends on rainfall and its variation affects the crop output substantially. Similarly, the gross cultivated area has shown very little fluctuations over time and it is taken as proxy for available land for cultivation. The gross irrigated area represents use of water from all sources of irrigation for crop production. Education has a significant impact upon agricultural productivity, which may boost farm productivity through refining the quality of labour, by increasing access to information and awareness programmes on agricultural practices. Thus, literacy rate is considered as an important variable in the study. Notwithstanding the limitations, the selected variables do have a good capacity to present the true picture of overall agricultural performance of the State.

On the basis of preceding discussion, the following hypotheses are thus formulated:

- H (a): Stable rainfall causes increase in agricultural productivity;
- H (b): Greater the share of cultivable area to the total geographical area, the higher would be the overall agricultural productivity;
- H (c): Cropping intensity is directly related to agricultural productivity;
- H (d): Improved irrigational facilities lead to higher agricultural productivity;
- H (e): Fertiliser consumption affects agricultural productivity;
- H (f): Higher the literacy rate, higher is the agricultural productivity

The following section, accordingly, presents all the variables, dependent and independent, and indicates the methods of their measurement.

Variables	Method of Measurement	Notations
Agricultural Production (Foodgrains, Non-Food Grains, Total)	Level of production in foodgrains, Non-foodgrains Total (Foodgrains + Non-foodgrains)	Y
Rainfall (R)	Actual rainfall as the ratio to normal rainfall	X_1
Gross Cultivable Area (GCA)	Gross cultivable area as a ratio to the total geographical area	X_2
Cropping Intensity (CI)	The ratio of gross cultivable area to net cropped area	X_3
Irrigation (I)	The gross irrigated area as a ratio to the gross cropped area	X_4
Fertiliser Consumption (FC)	Total fertilisers consumed for crop production as a ratio to the gross cropped area	X_5
Literacy Rate (LR)	Literacy rate	X_6

Model Specification

With a view to examining the impact of macroeconomic factors on agricultural productivity in Odisha, the study is carried out with ordinary least squares (OLS) estimation of the multiple regression model with k explanatory variables and specified.

$$Y_t = \hat{a} + \hat{a}_1 X_{1t} + \hat{a}_2 X_{2t} + \hat{a}_3 X_{3t} + \dots + \hat{a}_k X_{kt} + e_t \quad (5)$$

Where X_{it} is the t^{th} observation on the first explanatory variable (for $t = 1 \dots N$ observations)

All the variables are in logarithmic form and the model is estimated through the ordinary least squares (OLS) method. Empirical models are designed to ensure that the potential econometric problems—specification bias and simultaneity—are taken into account. In order to test the robustness of the results, the regression analysis has been done for foodgrains, non-foodgrains and for total, taking both foodgrains and non-food grains into consideration for the year 2010-11, 2001-02 and 1993-94 at three different time periods and taking district as unit of study.

Results and Discussion

For present data set, F test result suggests that OLS model is efficient. Thus, economic interpretation of the results is based on OLS model. Table 8 presents the results at the aggregate level considering both food grains and non-foodgrains and also

independently foodgrains and non-foodgrains for the year 2010-11, 2001-02 and 1993-94. The key variables of interest of this study are agricultural productivity and macroeconomic factors affecting agricultural production. The results regarding the effect of macroeconomic factors on foodgrains productivity are presented in column 2 of Table 8 for the year 2010-11. The coefficient of the macroeconomic factors i.e. rainfall, gross cropped area, gross irrigated area, fertiliser consumption, and literacy rate are positive and significant, except cropping intensity. For the year 2010-11 column 3 of Table 8 presents results regarding the effect of macroeconomic factors on levels of productivity of non-foodgrain crops and the coefficient of the macroeconomic factors i.e. rainfall, gross cropped area, cropping intensity, gross irrigated area, fertiliser consumption and literacy rate are positive and significant. Furthermore, the results regarding the effect of macroeconomic factors on aggregate agricultural productivity taking both food grains and non-foodgrains, are presented in column 4 of Table 8 for the year 2010-11. The coefficient of the macroeconomic factors i.e. rainfall, gross cropped area, cropping intensity, gross irrigated area, fertiliser consumption and literacy rate are positive and significant. Similar kind of results have been observed for the year 2001-02 and 1993-94.

Table 8: Estimation of Relationship between Agricultural Productivity (Foodgrains and Non-Foodgrains) and Selected Macroeconomic Variables

Variables	Estimated Coefficients (2010-11)			Estimated Coefficients (2001-02)			Estimated Coefficients (1993-94)		
	1	2	3	4	5	6	7	8	9
	Food-grains	Non-foodgrains	Total	Food-grains	Non-foodgrains	Total	Food-grains	Non-foodgrains	Total
<i>R</i>	0.32*** (4.78)	0.35*** (4.81)	0.30*** (4.75)	0.28*** (3.78)	0.29*** (3.81)	0.27*** (3.76)	0.31*** (4.58)	0.28*** (4.12)	0.30*** (4.48)
<i>GCA</i>	0.035* (2.21)	0.032* (2.21)	0.030* (2.19)	0.031* (2.20)	0.021* (1.89)	0.019* (1.81)	0.019* (1.81)	0.016* (1.78)	0.018* (1.80)
<i>CI</i>	0.01 (0.76)	0.21** (2.76)	0.11* (2.56)	0.02 (0.76)	0.12** (2.71)	0.09** (1.78)	0.01 (0.71)	0.13** (2.74)	0.11** (2.71)
<i>GIA</i>	0.73*** (2.04)	0.63*** (1.94)	0.68*** (1.84)	0.71*** (2.03)	0.66*** (1.93)	0.69*** (1.99)	0.62*** (1.91)	0.73*** (1.94)	0.70*** (1.97)
<i>FC</i>	0.31*** (2.39)	0.30*** (2.38)	0.30*** (2.39)	0.21*** (2.19)	0.20*** (2.09)	0.20*** (2.10)	0.27*** (2.11)	0.47*** (2.91)	0.39*** (2.81)
<i>LR</i>	0.21*** (2.49)	0.29*** (2.43)	0.26*** (2.45)	0.18*** (2.39)	0.21*** (2.40)	0.20*** (2.39)	0.15*** (2.12)	0.18*** (2.21)	0.19*** (2.22)
Constant	0.55*** (11.6)	0.53*** (11.5)	0.51*** (11.2)	0.49*** (10.40)	0.44*** (9.34)	0.46*** (9.84)	0.49*** (9.54)	0.54*** (9.78)	0.52*** (9.64)
F-stat	8.57***	8.41***	8.39***	8.23***	8.12***	8.06***	9.11***	9.19***	9.17***
R-squared	0.76	0.74	0.72	0.69	0.56	0.62	0.70	0.67	0.69
Adj. R-squared	0.71	0.63	0.69	0.54	0.51	0.59	0.67	0.64	0.65
Nobs	30	30	30	30	30	30	30	30	30

Note: (a) Numbers in the parentheses are the values of t-statistics***indicates parametres are significant at 1per cent probability level; ** indicates parametres are significant at 5 per cent probability level;and * indicates parametres are significant at 10 per cent probability level.

(b) *R* is rainfall; *GCA* is gross cropped area; *CI* is cropping intensity; *GIA* is the gross irrigated area; *FC* is fertiliser consumption and *LR* is literacy rate.

Conclusion and Policy Implications

Changes in the cropping pattern are intended to give a wider choice in the production of a variety of crops in a given area so as to expand production of various crops and also to lessen risk. Area shifts and crop pattern changes can lead either to crop specialisation or to crop diversification. It is evident from the analysis that more than 75 per cent of GCA has been used for foodgrain cultivation in the State and cereal centred specialisation. A skewed distribution of area has been observed for cereal cultivation and a less proportion of area is used for other crops. Even though larger amount of land is used production and productivity of foodgrains are not satisfactory. Under non-foodgrains category vegetable production and productivity in the State is quite remarkable, though area used has remained low. Odisha ranks 4th position as far as production of vegetables is concerned at national level (Government of Odisha, 2014). The per capita consumption of vegetables in the State is

highest in the country. There is potentiality for growing all types of tropical, sub-tropical and temperate vegetables. Lack of awareness, poor rural infrastructure and poor marketing facilities are the major hindrances to expand the area under vegetables in Odisha. It is observed that there are variations in the share of area, production and productivity of major crop groups over the time period at the State level as well as across the physiographic zones.

As discussed earlier, the cropping pattern changes, however, are the outcomes of the interactive effect of many factors like resource related factors (irrigation, rainfall and soil fertility), technology related factors (seed, fertiliser, storage and processing), institutional and infrastructure related factors (farm size, extension, marketing systems, investment, output and input prices, government regulatory policies and research). Odisha agriculture has experienced the change in the relative importance of these factors over time (Table 9).

Table 9 : Changes in the Growth of Major Key Indicators of Odisha Agriculture (in percentage)

Net Area Sown	Gross Cropped Area	NAS as a % of GCA	Cropping Intensity	Net Irrigated Area	NIA as a % of GCA	Gross Irrigated Area	GIA as a % of GCA	Fertiliser Consumption (Kgs.ha)	Power Consumption for Agriculture Purpose	No. of Small and Marginal Farmers
1993/94-2010/11										
-13.65	-6.31	-7.84	12.08	26.88	35.42	26.46	34.97	207.18	-75.00	9.61
2001-2011										

Source: From various reports of Odisha Agriculture Statistics, Directorate of Agriculture and Food Production, Government of Odisha.

Agriculture in Odisha is increasingly getting influenced more and more by economic factors i.e., irrigation, fertilisers consumption, technology adoption and infrastructure. It is observed that both gross cropped area and net area sown have declined by 6.31 and 13.65 per cent, respectively, during 1993/94-2010/11. Increasing diversion of agricultural land to non-agricultural uses due to industrialisation and urbanisation and rising trend of barren land appear alarming that led to decline in area under cultivation. The role played by the adverse weather conditions and the slow pace of expansion of irrigation cannot be ignored in this perspective. Furthermore, number of small and marginal farmers has also increased by a significant percentage (9.61) during 2001-2011, which led to low levels of risk taking capacity, technology adoption, farm mechanisation and fertiliser application, resulting in low levels of investment as also the low farm productivity. Along with these, growth of intensive cultivation is very slow in the State.

The slow growth of two important agricultural output diversifying inputs like irrigation and fertilisers are considered to be the most immediate and important determining factors responsible for slow change in the cropping pattern. Though fertiliser consumption has increased by 207 per cent the absolute amount of consumption per hectare is much lower than the national figure. Although net irrigated area and gross irrigated area has increased by 26.88 and 26.46 per cent respectively, a large part of the cultivated land depends on monsoon. The low level of

consumption of power which is critical for mechanisation of agriculture indicates the lack of modernisation of the agriculture sector in the State. Percentage of power consumption for agricultural purposes declined by 75 over the time period. There has been a consistent drop in the share of agriculture sector to total power consumed in the State. The main reason ascribed for this decline is the lack of dedicated electric feeder ensuring consistent power supply for agricultural purpose especially to mega lift points. On the contrary, there has been a sharp rise in the use of power by industrial sector leading to an apparent drop in the share of power consumed by agriculture sector (Government of Odisha, 2014). As multiple demands for land increase, less land is devoted to agricultural sector. Therefore, intensive cultivation of available land seems to be a viable strategy for increasing the gross cropped area along with mechanisation and modernisation of agriculture. This is required for augmenting agricultural production in the State.

What is more, the reform initiatives undertaken in the context of ongoing agricultural liberalisation and globalisation policies are also going to further determine the crop composition both at the micro and macro levels. The policies, since the beginning of the 1990s, have had direct and indirect effects on farmers' welfare. The economic reforms did not include any specific package designed for agriculture. Rather, the presumption was that freeing agricultural markets and liberalising external trade in agricultural commodities

would provide price incentives leading to enhanced investment and output in that sector, while broader trade liberalisation would shift inter-sectoral terms of trade in favour of agriculture. However, there are changes in patterns of government spending and financial measures which also necessarily affected the conditions of agriculture.

For a holistic development of agriculture and allied sectors, the State has initiated all round development of agriculture sector with a focus on increasing the production and productivity of different crops despite the aberrant weather conditions and limited resources. Some of the important schemes that are being implemented in the State such as National Food Security Mission (NFSM), Rashtriya Krishi Vikas Yojana (RKVY), Sustainable Development of Sugarcane based Cropping Systems, Agriculture Mechanisation under Work Plan, Integrated Schemes for Oilseeds, Pulses, Oilpalm & Maize (ISOPOM), System of Rice Intensification (SRI), Technology Mission on Cotton, Technology Mission on Sugarcane, Jute Technology Mission, National Project on Management of Soil Health and

Fertility, e-Pest Surveillance, National Horticulture Mission, etc., which play vital role in making farming sustainable and obtain maximum return per rupee invested in the farm land. Besides, schemes on 'Capacity Building and Extension Reforms', 'Post-harvest Management of Agri-produce' and 'Establishment of Commercial Agri-enterprises' are also being implemented to supplement the development agenda. However, the neo-liberal economic reform strategy which involves fiscal policies of reducing expenditure on certain areas especially rural spending, trade liberalisation, financial liberalisation and privatisation of important areas of economic activity and service provision have adverse impact on agriculture and rural living conditions. To conclude, it may be stated that Odisha's agriculture has to go a long way to achieve crop diversification and balance in the inter-crop allocation of existing and additional areas to be brought under cultivation. To sustain and operationalise crop diversification in the State, institutional support, research and developmental support, and technological support are required.

References

- 1 Alexandratos, N and Bruinsma, J (2012), "World Agriculture towards 2030/2050: The 2012 Revision", ESA Working paper No. 12-03, Rome, FAO.
- 2 Bhalla, G. S and Singh, G (2009), "Economic Liberalisation and Indian Agriculture: A State-wise Analysis", *Economic and Political Weekly*, 54 (52): pp. 34-44.
- 3 Chand, R. (2001), "Emerging Trends and Issues in Public and Private Investments in Indian Agriculture: A State-wise Analysis", *Indian Journal of Agricultural Economics*, 56 (2): pp. 161-184.
- 4 Chand, R (2003), "Government Intervention in Food Grain Markets in the Changing Context", Policy Paper No. 19, National Centre for Agricultural Economics and Policy Research, New Delhi.
- 5 Government of Odisha (2012), "Economic Survey 2011-12", Department of Economics and Statistics, Bhubaneswar, Odisha.
- 6 Government of Odisha (2014), "Agricultural Statistics Odisha, 2013-14", Department of Economics and Statistics, Bhubaneswar, Odisha.
- 7 Hazra, C.R (2001), "Crop Diversification in India", in "*Crop Diversification in the Asia-Pacific Region*", Edited by Minas K. Papademetriou and Frank J. Dent, Food and Agriculture Organisation of the United Nations.
- 8 Joshi, P K, Pratap Singh Birthal and Nicholas Minot (2006), "Sources of Agricultural Growth in India: Role of Diversification towards High Value Crops", MTID Discussion Paper No. 98. Washington, D.C.: International Food Policy Research Institute.
- 9 Malthus, T.R (1798), "An Essay on the Principle of Population and A Summary View of the Principle of Population", Reprinted by Penguin Press, Harmondsworth.
- 10 Mishra, S (2009), "Poverty and Agrarian Distress in Odisha", Working Paper No. WP-2009-006, Indira Gandhi Institute of Development Research, Mumbai, <http://www.igidr.ac.in/pdf/publication/WP-2009-006.pdf>.
- 11 Mishra, S. N and Chand, R (1995), "Private and Public Capital Formation in Indian Agriculture: Comments on Complementarity Hypothesis and Others", *Economic and Political Weekly*, 30 (24): pp. A 64-79.
- 12 Mohanty, S. Pattanaik, F. and Patra. R N (2013), "Agricultural Diversification in Odisha During Post Reform Period", *Agricultural Situation in India*, 70 (6): p. 5-14
- 13 Rahman, S (2009), "Whether Crop Diversification is a Desired Strategy for Agricultural Growth in Bangladesh?" *Food Policy*, 34 (4): pp. 340-349.
- 14 Rao, V.M (1996), "Agricultural Development with a Human Face", *Economic and Political Weekly*, 31(26): pp. A52 -62.
- 15 Ruthenberg, H (1980), "Farming Systems in the Tropics", Clarendon Press, Oxford.
- 16 Vyas, V S (2001), "Agriculture: Second Round of Economic Reforms", *Economic and Political Weekly*, 36 (14): pp. 829-36.
- 17 Vyas, V. S (1996), "Diversification in Agriculture: Concept, Rationale and Approaches", *Indian Journal of Agricultural Economics*, 51 (4): pp. 636-643.
- 18 Weinberger, K. and Lumpkin, T (2007), "Diversification into Horticulture and Poverty Reduction: A Research Agenda", *World Development*, 35(8): pp.1464-1480.

ANNEXURE

Table A1: District-wise Area, Yield Rate & Production of All Crop Groups during 1993-94 in Odisha

S. No.	DISTRICT	A	Y	P
1	Balasore	433.95	2185.00	1124.30
2	Bhadrak	265.61	2181.15	524.08
3	Bolangir	472.22	1831.39	729.91
4	Sonepur	184.73	1966.51	341.41
5	Cuttack	371.21	2290.05	925.25
6	Jagatsinghpur	225.25	2086.16	463.42
7	Jajpur	316.11	2159.37	597.86
8	Kendrapara	293.36	2135.75	589.81
9	Dhenkanal	336.44	2284.30	605.12
10	Angul	331.55	2247.99	570.41
11	Ganjam	755.29	1858.51	1247.83
12	Gajapati	121.97	1767.74	175.21
13	Kalahandi	568.71	1745.83	700.01
14	Nuapara	246.64	1744.07	297.99
15	Keonjhar	412.24	1664.57	642.20
16	Koraput	415.11	1971.68	671.73
17	Malkangiri	194.43	1898.09	274.81
18	Nawarangpur	267.28	1803.01	428.87
19	Rayagada	268.35	1592.36	321.57
20	Mayurbhanj	544.36	2216.81	1118.33
21	Kandhamal	227.74	2027.36	310.51
22	Boudh	124.79	1974.19	163.07
23	Puri	296.78	1659.71	541.41
24	Khurda	225.15	2312.41	470.32
25	Nayagarh	209.27	2397.67	336.34
26	Sambalpur	266.13	2633.66	583.68
27	Bargarh	487.39	1981.80	986.46
28	Deogarh	92.80	2196.14	172.37
29	Jharsuguda	103.49	2590.50	254.54
30	Sundargarh	404.23	1650.61	596.01

Note: 1:- A= Area in '000 hect.; Y=Yield in Kgs/hects. ; P=Production in '000MTs.

Note: 2:- All Crop Group includes; Cereals, Pulses, Oilseeds, Fibers, Vegetables, Condiments and Spices.

Source: Odisha Agriculture Statistics published by Directorate of Agriculture and Food Production, Government of Odisha.

Table A2: District-wise Area, Yield Rate & Production of Major Crop Groups during 1993-94 in Odisha

S. No.	District	Cereals			Pulses			Oilseeds			Fibres			Vegetables			Condiments & Spices		
		A	Y	P	A	Y	P	A	Y	P	A	Y	P	A	Y	P	A	Y	P
1	Balasore	258.36	1380	356.43	59.46	475	28.25	26.67	649	17.32	5.59	10.01	55.95	70.09	9252	648.44	13.33	1344	17.91
2	Bhadrak	189.98	1537	291.99	41.81	458	19.14	6.75	732	4.94	1.78	11.90	21.18	19.79	9199	182.04	4.17	1149	4.79
3	Bolangir	227.79	1205	274.55	120.20	448	53.86	63.81	693	44.21	3.79	5.36	20.33	43.00	7647	328.80	8.24	990	8.16
4	Sonepur	116.14	1764	204.86	34.22	501	17.14	17.01	739	12.57	0.44	5.07	2.23	13.28	7602	100.95	3.08	1188	3.66
5	Cuttack	161.83	1807	292.36	111.72	570	63.64	28.45	1228	34.93	4.22	11.27	47.58	53.46	8935	477.69	7.61	1189	9.05
6	Jagatsinghpur	115.32	1465	168.96	48.91	521	25.47	28.40	1217	34.55	0.51	11.94	6.09	27.07	8245	223.19	4.88	1057	5.16
7	Jajpur	162.95	1410	229.72	78.12	568	44.35	39.72	1825	72.49	1.76	10.20	17.96	28.09	8120	228.10	5.12	1023	5.24
8	Kendrapara	163.12	1639	267.35	65.33	558	36.45	31.97	1401	44.79	2.42	12.50	30.25	25.06	8238	206.44	4.69	966	4.53
9	Dhenkanal	132.17	1462	193.25	99.60	581	57.85	66.06	714	47.19	1.54	5.80	8.93	29.96	9706	290.79	5.75	1237	7.11
10	Angul	120.78	1256	151.75	101.29	548	55.53	68.58	599	41.05	1.57	5.96	9.35	30.66	9947	304.99	6.84	1132	7.74
11	Ganjam	358.29	1766	632.84	251.46	472	118.70	71.40	824	58.80	5.89	5.05	29.74	55.98	7148	400.17	8.10	936	7.58
12	Gajapati	63.12	1457	91.97	27.07	516	13.98	20.81	618	12.86	1.00	5.44	5.44	7.02	6879	48.29	2.36	1131	2.67
13	Kalahandi	242.80	1075	261.10	203.73	475	96.68	69.07	559	38.64	2.85	3.00	8.55	39.19	7360	288.42	6.60	1003	6.62
14	Nuapara	116.53	892	103.91	79.80	487	38.90	28.55	946	27.02	1.38	5.44	7.51	16.40	7176	117.69	3.09	958	2.96
15	Keonjhar	245.41	1155	283.54	68.35	616	42.09	50.73	659	33.43	5.81	7.43	43.14	36.56	6406	234.19	5.08	1144	5.81
16	Koraput	250.63	1142	286.31	50.19	525	26.37	64.25	508	32.63	1.70	7.09	12.05	36.42	8332	303.45	8.30	1316	10.92
17	Malkangiri	120.62	1235	149.00	28.79	512	14.74	28.07	575	16.15	2.74	8.55	23.44	8.50	7935	67.45	3.59	1123	4.03
18	Nawarangpur	182.49	1211	221.05	31.90	582	18.56	21.53	789	16.99	2.49	5.03	12.52	22.08	7131	157.45	2.09	1100	2.30
19	Rayagada	115.07	1124	129.30	73.09	553	40.43	53.94	468	25.26	0.96	5.15	4.94	18.64	6259	116.67	4.34	1145	4.97
20	Mayurbhanj	350.33	1299	454.98	73.11	534	43.45	46.98	596	27.98	7.26	6.87	49.84	54.64	9681	528.96	11.08	1184	13.12
21	Phulbani	81.98	1098	90.02	36.25	351	12.74	74.28	416	30.93	0.45	4.18	1.88	16.81	8413	141.42	17.81	1882	33.52
22	Boudh	63.67	1201	76.47	41.90	381	16.08	9.99	248	2.48	0.62	7.13	4.42	6.72	9283	62.38	1.71	725	1.24

(Contd....)

Table A2 (Contd.....)

S.No.	District	Cereals		Pulses		Oilseeds		Fibres		Vegetables		Condiments & Spices							
		A	Y	P	A	Y	P	A	Y	P	A	Y	P						
23	Puri	191.51	1592	304.89	52.59	572	30.09	18.02	1200	21.63	0.08	8.25	0.66	31.94	5697	181.97	2.44	889	2.17
24	Khordha	131.88	1623	214.10	59.84	515	30.84	7.61	1046	7.96	0.42	6.48	2.72	22.26	9513	211.75	2.52	1171	2.95
25	Nayagarh	104.73	1904	199.40	73.71	557	11.05	12.05	585	7.05	1.04	5.04	5.24	11.25	9832	110.61	1.99	1503	2.99
26	Sambalpur	147.91	1406	207.92	51.39	595	30.57	31.64	610	19.29	2.48	4.98	12.34	25.24	12113	305.74	7.29	1073	7.82
27	Bargarh	311.48	1889	588.32	62.53	545	34.06	66.89	1263	84.45	2.20	4.78	10.52	36.42	7229	263.28	6.07	960	5.83
28	Deogarh	51.98	1242	64.55	15.81	553	8.74	12.37	652	8.07	0.51	4.82	2.46	9.05	9401	85.08	2.62	1324	3.47
29	Jharsuguda	58.22	1426	83.01	17.90	570	10.20	11.18	725	8.11	0.49	5.00	2.45	12.53	11796	147.80	2.91	1021	2.97
30	Sundargarh	241.24	951	229.47	69.26	615	42.58	39.02	626	24.42	2.32	4.63	10.74	43.30	6407	277.41	8.76	1300	11.39
TOTAL		5078.33	1399	7103.37	2129.33	522	1082.53	1115.80	769	858.19	66.31	7.09	470.45	851.41	8271	7041.61	172.46	1210	208.68

Note: 1:- A= Area in '000 hect.; Y=Yield in Kgs/hect.; P=Production in '000MTs.

Note: 2:- All Crop Group includes: Cereals, Pulses, Oil Seeds, Fibres, Vegetables, Condiments and Spices.

Source: Odisha Agriculture Statistics published by Directorate of Agriculture and Food Production, Government of Odisha.

Table A3: District-wise Area, Yield Rate & Production of All Crop Groups during 2001-02 in Odisha

S. No.	DISTRICT	A	Y	P
1	Balasore	330.00	2894.33	810.30
2	Bhadrak	202.00	3055.67	522.16
3	Bolangir	421.00	2542.83	669.30
4	Sonepur	172.00	2702.83	481.64
5	Cuttack	290.00	2872.33	546.05
6	Jagatsinghpur	178.00	3132.67	365.71
7	Jajpur	258.00	3187.67	532.31
8	Kendrapara	230.00	2865.33	509.21
9	Dhenkanal	255.00	2675.67	556.65
10	Angul	292.00	2580.33	477.72
11	Ganjam	692.00	2811.33	1328.30
12	Gajapati	122.00	2814.17	310.08
13	Kalahandi	520.00	2655.33	753.73
14	Nuapara	255.00	2406.67	398.62
15	Keonjhar	409.00	2734.17	880.83
16	Koraput	368.00	2393.00	599.02
17	Malkangiri	215.00	2579.17	390.97
18	Nawarangpur	279.00	2430.67	510.55
19	Rayagada	237.00	2436.00	400.76
20	Mayurbhanj	488.00	2862.33	1063.55
21	Kandhamal	160.00	2568.83	346.89
22	Boudh	120.00	2556.83	272.38
23	Puri	232.00	2817.00	553.43
24	Khurda	212.00	2645.17	444.23
25	Nayagarh	215.00	2864.67	314.08
26	Sambalpur	263.00	2719.17	589.95
27	Bargarh	440.00	2768.50	879.46
28	Deogarh	106.00	2738.67	245.16
29	Jharsuguda	115.00	2701.50	302.23
30	Sundargarh	364.00	2801.50	599.43

Note: 1:- A= Area in '000 hect.; Y=Yield in Kgs/hects. ; P=Production in '000MTs.

Note: 2:- All Crop Group includes; Cereals, Pulses, Oilseeds, Fibers, Vegetables, Condiments and Spices.

Source: Odisha Agriculture Statistics published by Directorate of Agriculture and Food Production, Government of Odisha.

Table A4: District-wise Area, Yield Rate & Production of Major Crop Groups during 2001-02 in Odisha

S. No.	District	Cereals			Pulses			Oilseeds			Fibres			Vegetables			Condiments & Spices		
		A	Y	P	A	Y	P	A	Y	P	A	Y	P	A	Y	P	A	Y	P
1	Balasore	247.93	1755	435.21	26.66	399	10.64	17.29	1160	20.06	4.58	1122	28.54	26.18	11754	307.71	6.92	1176	8.14
2	Bhadrak	156.24	1925	300.76	21.87	534	11.68	3.28	994	3.26	0.83	1498	6.91	16.04	12250	196.49	2.70	1133	3.06
3	Bolangir	219.60	1481	325.19	110.04	344	37.84	42.84	465	19.93	20.33	228	25.72	21.72	11803	256.37	4.54	936	4.25
4	Sonepur	117.39	1877	220.29	24.33	389	9.47	7.28	521	3.79	0.61	341	1.15	20.59	11903	245.09	1.56	1186	1.85
5	Cuttack	144.46	1657	239.36	102.85	470	48.36	13.82	624	8.62	1.88	702	7.33	19.22	12275	235.92	4.29	1506	6.46
6	Jagatsinghpur	93.86	1701	159.69	53.36	327	17.45	16.19	964	15.61	0.08	1053	0.47	12.81	13320	170.63	1.30	1431	1.86
7	Jajpur	121.88	1579	192.41	71.75	421	30.21	41.03	1696	69.58	4.17	1431	33.14	16.09	12635	203.30	2.69	1364	3.67
8	Kendrapara	124.94	1431	178.85	63.33	404	25.61	14.88	1362	20.27	1.91	600	6.37	22.50	12231	275.20	2.50	1164	2.91
9	Dhenkanal	128.28	1831	234.82	64.71	275	17.77	33.51	869	29.12	0.00	0	0.00	22.72	11804	268.18	5.30	1275	6.76
10	Angul	117.56	1601	188.20	79.76	234	18.64	68.05	465	31.64	0.00	0	0.00	19.48	11836	230.56	6.45	1346	8.68
11	Ganjam	352.91	1939	684.23	219.14	467	102.38	60.32	720	43.42	8.31	455	21.01	39.25	11878	466.21	7.84	1409	11.05
12	Gajapati	61.03	1588	96.89	25.23	581	14.66	14.88	596	8.87	1.02	559	3.17	15.05	11841	178.20	4.82	1720	8.29
13	Kalahandi	276.81	1361	376.70	144.01	554	79.72	47.10	684	32.23	25.34	119	16.80	20.30	12016	243.92	3.64	1198	4.36
14	Nuapara	122.43	1184	144.93	67.52	206	13.89	39.55	373	14.74	3.76	279	5.83	19.52	11128	217.21	1.59	1270	2.02
15	Keonjhar	239.11	1257	300.55	64.78	351	22.74	51.23	236	12.07	5.56	1113	34.39	42.14	11942	503.25	5.20	1506	7.83
16	Koraput	240.27	1171	281.42	35.66	283	10.09	50.64	232	11.74	1.94	795	8.57	26.15	10579	276.65	8.13	1298	10.55
17	Malkangiri	124.47	1017	126.53	22.07	280	6.19	43.34	947	41.05	3.10	1012	17.43	17.60	11154	196.31	3.25	1065	3.46
18	Nawarangpur	199.47	1269	253.03	28.56	501	14.32	18.22	413	7.52	5.56	226	6.98	20.37	11090	225.90	2.58	1085	2.80
19	Rayagada	111.69	1266	141.44	48.57	492	23.88	42.86	318	13.63	10.67	323	19.17	17.66	11221	198.16	4.50	996	4.48
20	Mayurbhanj	365.92	1513	553.52	42.24	454	19.18	31.01	414	12.83	5.49	696	21.24	35.10	12678	444.99	8.31	1419	11.79
21	Phulbani	76.99	1417	109.09	22.09	359	7.93	27.43	211	5.80	0.49	343	0.93	17.30	10864	187.94	15.86	2219	35.20
22	Boudh	71.68	1240	88.87	27.57	353	9.72	4.45	463	2.06	0.41	233	0.53	14.14	11998	169.65	1.47	1054	1.55

(Contd....)

Table A4 (Contd.....)

S. No.	District	Cereals			Pulses			Oil Seeds			Fibres			Vegetables			Condiments & Spices		
		A	Y	P	A	Y	P	A	Y	P	A	Y	P	A	Y	P	A	Y	P
23	Puri	139.27	1660	231.13	53.52	303	16.21	13.05	1270	16.57	0.10	540	0.30	24.21	11916	288.48	0.61	1213	0.74
24	Khordha	132.79	1483	196.98	51.62	228	11.75	5.99	978	5.86	0.47	604	1.58	19.70	11531	227.16	0.86	1047	0.90
25	Nayagarh	109.78	1600	175.69	80.47	322	25.95	12.68	651	8.25	0.74	749	3.08	8.26	11996	99.09	1.08	1870	2.02
26	Sambalpur	147.95	1822	269.53	45.14	480	21.67	38.55	456	17.58	2.06	647	7.40	22.79	11631	265.06	6.81	1279	8.71
27	Bargarh	308.53	1956	603.56	63.20	524	33.11	41.60	888	36.93	2.28	616	7.80	16.52	11579	191.29	6.46	1048	6.77
28	Deogarh	53.49	1302	69.63	17.22	455	7.83	18.96	506	9.59	0.58	605	1.95	12.37	12354	152.82	2.76	1210	3.34
29	Jharsuguda	66.77	1491	99.56	15.94	476	7.59	12.68	494	6.26	0.54	577	1.73	15.38	11917	183.29	3.03	1254	3.80
30	Sundargarh	265.58	970	257.71	50.39	403	20.30	16.67	641	10.69	1.85	921	9.47	23.71	12392	293.82	5.02	1482	7.44
TOTAL		4939.08	1526	7535.77	1743.60	400	696.78	849.38	635	539.57	114.66	469	298.99	624.87	11841	7398.85	132.07	1399	184.74

Note: 1:- A= Area in '000 hect.; Y=Yield in Kgs/hects.; P=Production in '000MTs.

Note: 2:- All Crop Group includes: Cereals, Pulses, Oilseeds, Fibres, Vegetables, Condiments and Spices.

Source: Odisha Agriculture Statistics published by Directorate of Agriculture and Food Production, Government of Odisha.

Table A5: District-wise Area, Yield Rate & Production of All Crop Groups during 2010-11 in Odisha

S. No.	DISTRICT	A	Y	P
1	Balasore	320.95	3003.17	846.87
2	Bhadrak	208.99	3379.00	638.63
3	Bolangir	470.59	3058.17	1147.96
4	Sonepur	206.48	2896.83	608.79
5	Cuttack	305.76	3695.67	745.45
6	Jagatsinghpur	179.60	3594.50	469.45
7	Jajpur	260.65	3206.83	585.24
8	Kendrapara	256.75	3627.33	592.54
9	Dhenkanal	234.44	3253.83	582.51
10	Angul	283.44	3058.33	500.05
11	Ganjam	689.83	2598.33	1130.02
12	Gajapati	137.11	2915.00	374.69
13	Kalahandi	590.17	3414.17	1314.42
14	Nuapara	262.90	2779.17	434.34
15	Keonjhar	391.43	3266.67	1082.11
16	Koraput	372.78	3569.67	820.17
17	Malkangiri	216.17	3072.00	513.50
18	Nawarangpur	271.62	3003.83	794.10
19	Rayagada	237.51	3187.50	562.87
20	Mayurbhanj	424.16	3138.67	807.46
21	Kandhamal	171.33	4286.50	604.22
22	Boudh	130.94	3167.33	348.13
23	Puri	256.65	3188.33	524.78
24	Khurda	192.61	3487.67	546.47
25	Nayagarh	216.37	3595.50	442.82
26	Sambalpur	264.50	2675.00	476.15
27	Bargarh	441.67	2894.83	931.20
28	Deogarh	96.48	2736.67	172.37
29	Jharsuguda	94.75	2822.50	129.79
30	Sundargarh	371.03	2884.33	640.21

Note: 1:- A= Area in '000 hect.; Y=Yield in Kgs/hects. ; P=Production in '000MTs.

Note: 2:- All Crop Group includes; Cereals, Pulses, Oilseeds, Fibers, Vegetables, Condiments and Spices.

Source: Odisha Agriculture Statistics published by Directorate of Agriculture and Food Production, Government of Odisha.

Table A6: District-wise Area, Yield Rate & Production of Major Crop Groups during 2010-11 in Odisha

S. No.	District	Cereals			Pulses			Oilseeds			Fibres			Vegetables			Condiments & Spices		
		A	Y	P	A	Y	P	A	Y	P	A	Y	P	A	Y	P	A	Y	P
1	Balasore	240.71	1849	445.06	22.12	529	11.70	19.51	885	17.27	2.20	1137	13.90	29.18	11903	347.32	6.77	1716	11.62
2	Bhadrak	159.18	1852	294.85	15.42	545	8.40	6.10	1080	6.59	0.44	1962	4.80	23.42	13650	319.69	3.63	1185	4.30
3	Bolangir	222.10	1891	420.07	145.99	468	68.29	25.57	1116	28.54	31.69	678	119.28	38.97	13030	507.77	3.44	1166	4.01
4	Sonepur	128.86	2443	314.82	41.70	514	21.45	10.77	1045	11.26	0.90	460	2.30	22.16	11575	256.50	1.83	1344	2.46
5	Cuttack	137.99	1825	251.78	114.36	458	52.33	15.57	1520	23.67	1.52	2349	19.84	26.83	14412	386.67	6.93	1610	11.16
6	Jagatsinghpur	88.30	1578	139.36	54.85	423	23.22	10.23	1852	18.95	0.06	2028	0.68	19.45	14407	280.22	5.49	1279	7.02
7	Jajpur	128.94	1397	180.17	62.83	324	20.36	36.29	1447	52.50	2.03	1855	20.92	23.58	12883	303.79	5.62	1335	7.50
8	Kendrapara	135.77	1256	170.55	77.28	391	30.21	11.72	1493	17.50	2.46	3062	41.85	22.63	14340	324.51	6.48	1222	7.92
9	Dhenkanal	95.41	1398	133.38	69.40	428	29.67	34.52	769	26.56	1.20	930	6.20	26.77	13959	373.67	6.39	2039	13.03
10	Angul	88.82	709	62.93	101.93	482	49.15	58.49	579	33.85	0.85	923	4.36	23.91	13989	334.48	9.16	1668	15.28
11	Ganjam	334.56	1501	502.30	253.58	506	128.34	47.45	987	46.81	4.16	604	13.95	41.09	10474	430.36	5.44	1518	8.26
12	Gajapati	66.99	1630	109.22	33.81	602	20.37	12.43	701	8.71	0.71	649	2.56	19.90	11335	225.57	3.21	2573	8.26
13	Kalahandi	300.48	2343	703.92	185.34	666	123.37	45.33	1011	45.81	27.84	597	92.36	24.24	13998	339.31	5.16	1870	9.65
14	Nuapara	116.49	1795	209.13	98.94	366	36.19	28.01	826	23.13	3.22	565	10.10	12.97	11643	151.01	3.23	1480	4.78
15	Keonjhar	211.32	1161	245.41	77.82	537	41.78	36.34	354	12.88	4.30	1389	33.19	52.24	13937	728.05	9.36	2222	20.80
16	Koraput	234.97	1600	375.99	40.97	412	16.89	45.83	444	20.35	0.47	1436	3.75	28.53	12006	342.53	10.99	5520	60.66
17	Malkangiri	115.64	2027	234.38	30.94	491	15.20	48.90	955	46.70	0.55	870	2.66	17.19	12154	208.93	2.91	1935	5.63
18	Nawarangpur	213.06	2549	543.04	26.05	539	14.04	6.84	632	4.32	0.48	694	1.85	18.51	12287	227.44	2.58	1322	3.41
19	Rayagada	103.91	1895	196.94	63.35	721	45.65	30.00	496	14.88	14.95	578	48.00	19.73	12402	244.69	4.19	3033	12.71
20	Mayurbhanj	299.98	951	285.41	55.46	563	31.25	26.33	643	16.92	3.56	734	14.52	34.58	12954	447.95	3.82	2987	11.41
21	Phulbani	73.47	1387	101.93	28.00	443	12.41	29.06	333	9.67	0.19	388	0.41	21.83	14795	322.98	18.73	8373	156.82
22	Boudh	66.29	1228	81.40	37.43	504	18.85	7.45	577	4.30	0.29	1049	1.69	17.15	13883	238.10	2.15	1763	3.79

(Contd....)

Table A6 (Contd.....)

S. No.	District	Cereals			Pulses			Oilseeds			Fibres			Vegetables			Condiments & Spices		
		A	Y	P	A	Y	P	A	Y	P	A	Y	P	A	Y	P	A	Y	P
23	Puri	153.91	1710	263.13	66.40	288	19.13	18.72	1646	30.81	0.05	1140	0.32	16.22	12952	210.08	0.94	1394	1.31
24	Khordha	101.62	1705	173.29	56.94	465	26.49	7.55	1747	13.19	0.14	706	0.55	23.27	14160	329.50	1.61	2143	3.45
25	Nayagarh	100.69	1659	167.01	80.26	315	25.26	8.04	372	2.99	0.65	546	1.97	16.96	13280	225.23	3.77	5401	20.36
26	Sambalpur	154.88	1475	228.41	52.53	470	24.68	32.66	458	14.97	0.24	685	0.91	17.52	11136	195.11	6.61	1826	12.07
27	Bargarh	305.34	2328	710.96	79.18	405	32.07	38.47	1201	46.20	1.27	679	4.79	12.07	10642	128.45	4.13	2114	8.73
28	Deogarh	43.65	751	32.79	23.19	356	8.25	17.33	510	8.83	0.28	701	1.09	9.44	12405	117.10	2.54	1697	4.31
29	Jharsuguda	54.71	651	35.64	18.69	401	7.49	13.46	568	7.65	0.47	1436	3.75	5.87	12593	73.92	1.87	2722	5.09
30	Sundargarh	225.32	698	157.22	64.92	568	36.89	41.71	532	22.20	1.15	953	6.09	32.42	12548	406.81	5.48	2007	11.00
TOTAL		4703.36	1652	7770.49	2079.68	481	999.38	770.68	828	638.01	107.85	793	474.89	698.63	12922	9027.74	154.46	2957	456.80

Note: 1:- A= Area in '000 hect.; Y=Yield in Kgs/hect.; P=Production in '000MTs.

Note: 2:- All Crop Group includes: Cereals, Pulses, Oilseeds, Fibres, Vegetables, Condiments and Spices.

Source: Odisha Agriculture Statistics published by Directorate of Agriculture and Food Production, Government of Odisha.

Table A7: Performance of Major Key Indicators of Odisha Agriculture during 1993/94-2010/11 (Area in '000 hectare)

S. No.	DISTRICT	A	Y	P
1	Balasore	320.95	3003.17	846.87
2	Bhadrak	208.99	3379.00	638.63
3	Bolangir	470.59	3058.17	1147.96
4	Sonepur	206.48	2896.83	608.79
5	Cuttack	305.76	3695.67	745.45
6	Jagatsinghpur	179.60	3594.50	469.45
7	Jajpur	260.65	3206.83	585.24
8	Kendrapara	256.75	3627.33	592.54
9	Dhenkanal	234.44	3253.83	582.51
10	Angul	283.44	3058.33	500.05
11	Ganjam	689.83	2598.33	1130.02
12	Gajapati	137.11	2915.00	374.69
13	Kalahandi	590.17	3414.17	1314.42
14	Nuapara	262.90	2779.17	434.34
15	Keonjhar	391.43	3266.67	1082.11
16	Koraput	372.78	3569.67	820.17
17	Malkangiri	216.17	3072.00	513.50
18	Nawarangpur	271.62	3003.83	794.10
19	Rayagada	237.51	3187.50	562.87
20	Mayurbhanj	424.16	3138.67	807.46
21	Kandhamal	171.33	4286.50	604.22
22	Boudh	130.94	3167.33	348.13
23	Puri	256.65	3188.33	524.78
24	Khurda	192.61	3487.67	546.47
25	Nayagarh	216.37	3595.50	442.82
26	Sambalpur	264.50	2675.00	476.15
27	Bargarh	441.67	2894.83	931.20
28	Deogarh	96.48	2736.67	172.37
29	Jharsuguda	94.75	2822.50	129.79
30	Sundargarh	371.03	2884.33	640.21

Note: 1:- A= Area in '000 hect.; Y=Yield in Kgs/hects. ; P=Production in '000MTs.

Note: 2:- All Crop Group includes; Cereals, Pulses, Oilseeds, Fibers, Vegetables, Condiments and Spices.

Source: Odisha Agriculture Statistics published by Directorate of Agriculture and Food Production, Government of Odisha.

Table A8: Performance of Major Key Indicators of Odisha Agriculture during 1993/94-2010/11 (Area in '000 hectare)

Year	% of Deviation in Rainfall	NSA	GCA	NSA % of GCA	CI	NIA	NIA % of GCA	GCA	GIA % of GCA	FC (Kgs.ha)	% of Power Consumption for Agri. Purpose
1993-94	-5.39	6278	9691	64.78	149	1643	16.96	2456	25.34	20	5.6
1994-95	13.16	6279	9691	64.79	155	1627	16.79	2467	25.46	23	6.6
1995-96	7.04	6210	9668	64.23	158	1690	17.48	2629	27.20	25	6.5
1996-97	-34.11	5968	8216	72.64	154	2263	27.55	3357	40.86	39	2.8
1997-98	-0.42	6122	8644	70.82	141	1599	18.49	2318	26.82	35	3.6
1998-99	-23.40	6048	8428	71.76	139	1650	19.57	2358	27.98	36	4.8
1999-00	-4.45	6071	8558	70.94	140	1662	19.42	2506	29.28	42	3.9
2000-01	-31.11	5845	7942	73.60	135	1596	20.10	2156	27.15	41	3.1
2001-02	9.04	5845	8802	66.41	151	1752	19.91	2546	28.92	41	2.8
2002-03	-32.01	5680	7853	72.33	138	1247	15.88	1712	21.80	39	2.1
2003-04	12.23	5795	8638	67.09	149	1737	20.11	2518	29.15	39	1.8
2004-05	16.38	5739	8718	65.83	152	1846	21.17	2691	30.86	43	1.9
2005-06	4.71	5691	8928	63.74	157	1923	21.53	2965	33.21	46	1.7
2006-07	15.96	5654	8960	63.10	158	2002	22.34	3149	35.15	47	1.4
2007-08	9.67	5624	9016	62.38	160	2027	22.48	3308	36.70	52	1.2
2008-09	4.99	5604	9071	61.78	162	2081	22.94	3177	35.03	62	1.3
2009-10	-6.11	5574	9074	61.43	163	2059	22.69	3039	33.49	60	1.3
2010-11	-10.90	5421	9080	59.70	167	2085	22.97	3106	34.21	63	1.4

Source: From various reports of Odisha Agriculture Statistics, Directorate of Agriculture and Food Production, Government of Odisha.

Note: (a) NSA is net sown area; GCA is gross cropped area; CI is cropping intensity; GIA is the gross irrigated area; NIA is net irrigated area and FC is fertiliser consumption.