

Growth Rates of Agricultural Production and its Decomposition Analysis in Odisha

Paper Submission: 08/04/2021, Date of Acceptance: 14/04/2021, Date of Publication: 25/04/2021

Abstract

Agriculture is the predominant sector in Odisha. It contributes a higher share to State GSDP and provides livelihood to a greater share of rural population. Hence a study on the growth of agricultural crops and contributing factors for output growth has much importance. Therefore, an attempt has been made to examine the trends in area, production and yield of foodgrain and also the non-foodgrain crops along with the decomposition of their growth into area and yield during both pre-reforms and post-reforms period in Odisha. The compound annual growth rate of area, production and yields were computed by using log-linear model and decomposition of output growth of the crops was made by using decomposition analysis model. The performance of agricultural sector was slightly better during pre-reforms period than that of the post-reforms period. Mostly in case of the foodgrain crops; the yield effect contributes more towards output growth. But, among the cash crops there is diversity in performance. The decomposition analysis has some policy implications. The area expansion in favour of cash crops which is possible through crop diversification needs attention of Government and policy formulations.

Keywords: Growth, Area, Production, Yield, Trend, Decomposition, Foodgrain Crops, Cash Crops.

Introduction

Agriculture is the prime activity that humans accepted since the days from which the process of collection of food through hunting and gathering changed to the activity of settled agriculture. Since then, it has been the basic activity of the human civilisation and plays the role of primary sector in each region of human existence in the Globe. So also; agriculture sector has been the backbone of the Indian economy.

In the post-independence era during 1950s, agriculture sector had the highest share of about 55 % in National Income of India. Of course, it has come down to about 15 % in recent times. But its importance has not declined significantly since about 80 % of its population depend upon it directly or indirectly (GOI, 2013). It has been a source of livelihood and food security for a large majority of its population. In addition, the performance of this sector determines the growth of other sectors in the economy. Besides, this sector has helped the Nation in achieving the status of 2nd largest producer of agricultural output accounting for 7.39 % of the total agricultural output of the world (Statisticstimes.com, 2016).

Odisha, one of the eastern States of India has an agrarian economy. Its agriculture sector is predominant having a share of 18.9% of its Gross Value Added (GVA) in 2018-19 (GOO, Economic Survey, 2018-19). It is also the major source of employment for 56% of total workers in rural sector. Apart from its contribution as a source of livelihood, it provides inputs to agro-based industries which contribute 8.5% of the total output of the manufacturing sector.

Government of India adopted various economic reform measures and structural adjustment in all the sectors of the economy including agriculture. Hence, the structural changes like reduction in food subsidies, fertilizer subsidies, liberalization of agricultural trade and rise in minimum support prices for various agricultural products have been observed. Of course, the farmers are confronted with the dual challenges with higher production cost and lower price of their agricultural produce. In the State of Odisha also, such measures have been undertaken. Hence, necessity

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arises for the study of the impact of the economic reforms on the growth of agricultural production and productivity of the state.

Review of Literature

Agricultural diversification is an important benchmark for economic growth (GOI 1951; Sen et al, 2017; Biswas, 2016; Bhat et al, 2016; Singh et al, 2018). But it is not that significant in the state of Odisha. Besides, the productivity of land shows large disparities over the years (Patra 2014). Singh (2017) in her study concludes that the agricultural productivity of almost all the crops in recent years has been stagnated. Hence, some researchers suggest maintaining a sustainable agricultural growth even if there is fast growth in non-agricultural sector. Many economists also agree that agricultural growth is a pre-condition for sustainable economic growth. Thus, an assessment of the factors responsible for the agricultural growth, more particularly the area and yield are more important (Singh, 1981; Ranade, 1980). Therefore, growth decomposition in agriculture output has been an important issue for which the breakdown of growth output into various components like area, yield and cropping pattern has much importance (Rehman et al, 2011; Shadmehri, 2008; Alamian et al, 2013). Therefore, in the present study an attempt has been made to analyze the growth of agriculture and the contribution of various components to overall growth of output in pre as well as post reforms period in the state of Odisha.

Objectives of the Study

The objectives of the present study are as follows: -

1. To examine in trends (CAGR) in production of the group of crops like rice, cereals, pulses, food grains, oilseeds, fibres, spices, vegetables and sugarcane grown in Odisha in pre and post reforms period.
2. To examine the sources of growth of output of the major crops grown in Odisha using decomposition analysis model during pre as well as post reform periods.

Data and Methodology

The data relating area, yield and production of agricultural growth in Odisha have been collected from various issues of Odisha agricultural statistics and economic survey published by Government of Odisha.

The compound annual growth rate (CAGR) of area, yield and production for pre, post reform periods and the overall period is done by using Log Linear function in the following forms: -

$\log Y = a + b.t$ where 'Y' represents the time series data, 't' is time,

'a' is the constant coefficient and 'b' is the slope coefficient.

The CAGR is computed by using the equation

$$\text{CAGR} = (\text{Anti log } b - 1) \times 100$$

This equation presumes that a change in agriculture output each year would depend upon the

output in the preceding year (Deosthali and Chandrashekhar, 2004).

The Decomposition Analysis model is used to measure the relative contribution of area, yield or their interaction in the change in production of individual crops/ group of crops. Several researchers have used this model to study the effect of area and yield component on the growth performance of the crops (Bastine and Palanisami, 1994, Bhatnagar and Nandal, 1994, and Siju and Kombairaju, 2001). The equation for this model is used as:

$$\Delta P = \Delta A \times Y_0 + \Delta Y \times A_0 + \Delta A \times \Delta Y \quad \text{where}$$

ΔP = Change in production ($P_n - P_0$),

ΔA = Change in area ($A_n - A_0$) and

ΔY = Change in yield ($Y_n - Y_0$).

The subscripts 0 and n represents the initial year and last year of the period. In this study, the triennium average (TA) has been chosen both for the initial as well as the last year of the periods. The computation of CAGR and decomposition analysis has been done for each period starting from 1951-52 to 1990-91 (Pre-Reforms period), from 1991-92 to 2018-19 (Post-Reforms period) and from 1951-52 to 2018-19 (Overall period).

Results and Discussion 1. Analysis on Trend and Growth Pattern of Agricultural crops Pre-Reform Period (1951-52 to 1990-91)

The trend and CAGR in production of main crops in Pre-reform period in Odisha is presented in Table-1. It is observed that the overall production of foodgrains increased by 5288 thousand tonnes as the production level reached triennium average of 7759 thousand tonnes in 1990-91 from triennium average of 2471 thousand tonnes in 1951-52 with a growth rate of 2.65 % per year. Among the foodgrains, rice is the main crop constituting 68.78 % of its production.

The production of rice has recorded a growth of 1.86 % while cereals as a whole and pulses maintain 2.33 and 4.71 % per year respectively during the period. Among the cash crops, spices recorded the highest growth rate of 10.66 % followed by oilseeds at 8.14 %, vegetables 7.15%, sugarcane 3.99 % and fibres 3.04 % per year in this period in Odisha. The production of all the crops in Odisha shows an increasing trend in this period.

The growth in yield is the important source of growth in production of agricultural crops. The levels of yield and the CAGR of yield of agricultural crops in pre-reforms period in Odisha is shown in Table-2. It is noticed that the growth rate in yield of each crop is less than the growth rate in its production during this period. The highest growth rate at 3.04 % is found in case of spices among all the crops during this period. But in case of foodgrains, the yield rate has grown at 1.16 % per annum while the yields of its constituents such as cereals have grown at the rate of 1.62 % and pulses has been stagnated. The yield level of rice has also increased at a margin of 1.62 % per year during the pre-reforms period in Odisha.

Table-1 Trend and CAGR of Production of Agricultural Crops in Pre-Reforms Period in Odisha (In thousand tonnes)

Year	Rice	Cereals	Pulses	Food grains	Oil seeds	Fibres [#]	Spices	Vege tables	Sugarcane
1951-52	2127	2147	225	2471	65	297	--	--	1040
1961-62	3719	3805	324	4028	87	349	--	--	1022
1971-72	3901	4244	449	4693	241	546	95	2072	1848
1981-82	3715	4445	956	5401	562	619	158	4469	3150
1990-91	6073	6202	1142	7759	891	705	346	6766	3492
CAGR	1.86 (6.98)*	2.33 (8.93)	4.71 (18.18)	2.65 (0.01) ^{NS}	8.14 (29.98)	3.04 (10.77)	10.66 (9.12)	7.15 (13.78)	3.99 (12.73)

- thousand bales, 1 bale=180 kg, * - significant at 5 %level, NS- not significant.

Among the cash crops, the yield level of oilseeds has grown by 2.80 % per annum followed by vegetables at 1.86% per cent, the sugarcane and fibres both at 1.16 % per year in this period. The performance of the changes in yield level of agricultural crops in Odisha shows that the rise in

production of the crops except pulses has been influenced although not by large margin, by their yield level in this period. It is obvious that the growth of the yield of the crops except pulses is statistically significant in pre-reforms period.

Table-2 (in Kg/ hectare) Trend and CAGR of Yield of Agricultural Crops in Pre-Reforms Period in Odisha

Year	Rice	Cereals	Pulses	Food grains	Oil seeds	Fibres	Spices	Vege tables	Sugarcane
1951-52	553	545	524	558	312	848	--	--	41795
1961-62	926	912	463	829	385	1002	--	--	36043
1971-72	862	852	508	800	691	1206	905	6667	60562
1981-82	896	896	551	806	697	1078	1090	7843	62904
1990-91	1364	1257	545	1092	778	1433	1275	8502	71234
CAGR	1.62 (6.63)	1.62 (6.82)	0.0001 (0.337) ^{NS}	1.16 (5.56)	2.80 (12.62)	1.16 (7.81)	3.04 (4.28)	1.86 (4.98)	1.16 (9.51)

NS-not significant

The production of any crop very much depends upon the area under the crops. Hence there is necessity of analysing the growth in area under the crops in Odisha. Table-3 presents the trends in area under cultivation of the main crops as well as their growth rates during prereforms period in Odisha. It is observed that the growth of area under rice and cereals recorded at only 0.46 and 0.69 % respectively per year during this period in Odisha. The growth in area under pulses recorded the highest rate at 4.71

%among foodgrain crops while the growth rate of area under foodgrains is only 1.39 %in the period.

Among the cash crops, growth of area under spices is highest at 5.68 %per year followed by both vegetables and oilseeds at 5.20 %, sugarcane 2.33 %and fibresat 1.86 %per year during the period in Odisha. It can be noticed that the growth rates of area under cash crops are more than that of the growth rates of yield during the period in the State of Odisha. The CAGR of area under each crop except foodgrains are found to be statistically significant.

Table-3 Trend and CAGR of Area under Agricultural Crops in Pre-Reforms Period in Odisha (in Thousand Tonnes)

Year	Rice	Cereals	Pulses	Food grains	Oil seeds	Fibres	Spices	Vege tables	Sugarcane
1951-52	3847	4001	431	4431	210	63	--	--	25
1961-62	4035	4190	694	4884	224	59	--	--	24
1971-72	4531	4987	882	5869	349	82	61	312	31
1981-82	4136	4950	1738	6688	805	104	146	572	50
1990-91	4448	4930	2096	7104	1146	89	167	794	49
CAGR	0.46 (5.46)	0.69 (9.15)	4.71 (22.87)	1.39 (1.40) ^{NS}	5.20 (23.85)	1.86 (8.97)	5.68 (10.37)	5.20 (15.28)	2.33 (11.94)

NS-not significant

If analysis is made basing upon crops, it can be observed that the rise in production of rice and cereals on the whole can be accounted for the rise in yield since the rise in area is marginal in this pre-reforms period in Odisha. In case of pulses production, the increase in area contributes significantly because there is no change in yield level during this period, but growth in area is higher.

In case of cash crops, the level of production is influenced more by the changes in area than the changes in yield in this period. The higher growth in area under cash crops than that of the area under foodgrains might be due to low profitability caused by low minimum support price in case of foodgrains in Odisha.

Post-Reforms Period (1991-92 to 2018-19)

The trend and the CAGR of production of important crops grown in the State of Odisha in Post-reforms period (1991-92 to 2018-19) and for the overall period (1951-52 to 2018-19) is presented in Table-4. The production of foodgrains increased by 2545 thousand tonnes during this period in Odisha since the level of production reached triennium average of 9946 thousand tonnes in 2018-19 from triennium average of 7401 thousand tonnes in 1990-91 maintaining the growth rate of 1.48 % per annum. It is observed that the CAGR of foodgrains production

in this period is less than that of the pre-reforms period. Among the constituents of foodgrains, cereals production recorded a growth rate of 1.62 % per year while pulses production has increased at the rate of 0.69 % per year in this period in Odisha. The rice being major component of cereals has only 1.39 % per annum growth rate of production in this period. It can be noticed that the growth rate of production in case of rice, cereals, pulses and foodgrains in post-reforms period is less than that of the pre-reforms period in the State of Odisha.

Table-4**Trend and CAGR of Production of Agricultural Crops in Post-Reforms & Overall Period in Odisha (in thousand tonnes)**

Year	Rice	Cereals	Pulses	Food grains	Oil seeds	Fibres*	Spices	Vegetables	Sugarcane
1991-92	5774	6279	1121	7401	856	690	343	7091	3270
2001-02	5002	5383	554	5938	412	294	185	5970	1836
2011-12	7441	8084	986	9262	664	492	476	8336	2767
2018-19	8026	8903	1043	9946	540	525	557	8948	1937
CAGR (Postreform period)	1.39 (2.998)	1.62 (3.51)	0.69 (1.23) ^{NS}	1.48 (3.17)	-0.46 (0.91) ^{NS}	0.46 (0.77) ^{NS}	4.95 (7.31)	2.33 (3.86)	- 1.16* (2.28)
CAGR (Whole Period)	1.86 (14.13)	1.86 (15.52)	2.33 (10.86)	1.91 (0.01) ^{NS}	3.75 (12.06)	0.46 (2.54)	4.47 (11.49)	3.04 (11.14)	1.39 (6.07)

- thousand bales, 1 bale=180 kg, * - significant at 5 % level, NS- not significant

In case of cash crops cultivated in Odisha, the production of fibres, spices and vegetables recorded the growth rate of 0.46, 4.95 and 2.33 % per year respectively during this period. The reverse performance is noticed in case of production of oilseeds and sugarcane production in this period since the growth rates are negative at 0.46 and 1.16 % per year respectively. It shows that the production performance of cash crops is worse than that of the foodgrain crops in this period. It can be evidenced that overall performance of the State in agricultural production was better in pre-reforms period while it is analysed on the basis of CAGR, but if analysed on the basis of absolute rise in production level there is satisfaction as the volume of production of most of the crops has reached its highest level in this period (Table-7).

The yield level of a crop is highly responsible for influencing the rise in its production.

So, it is necessary to examine the growth of yield level of agricultural crops in the State of Odisha in the post-reforms period. Table-5 presents the trend and CAGR of yield of agricultural crops in Odisha during post-reforms as well as in overall period. The yield of rice has increased from triennium average of 1292 kg/ha in 1991-92 to triennium average of 2072 kg/ha in 2018-19 recording a growth rate of 2.33 % per year. The growth in yield of cereals is equal to that of the growth rate of rice. In case of pulses, the yield level was 537 kg/ha (triennium average) in 1991-92, which changed to 523 kg/ha in 2018-19 (triennium average) in 2018-19 with a very less growth of 0.23 % per year. But the growth in yield of foodgrains being influenced by the cereals is 1.86 % per year in this period. It possesses an increasing trend as the triennium average yield level increases from 1042 kg/ha in 1991-92 to 1584 kg/ha in 2018-19.

Table-5**Trend and CAGR of Yield of Agricultural Crops in Post-Reforms & Overall Period in Odisha (in Kg/hectare)**

Year	Rice	Cereals	Pulses	Food grains	Oil seeds	Fibres	Spices	Vegetables	Sugarcane
1991-92	1292	1252	537	1042	754	1475	1259	8733	69696
2001-02	1130	1108	371	930	572	541	1370	10785	63610
2011-12	1824	1825	483	1402	871	689	3068	13488	69897
2018-19	2072	2076	523	1584	888	584	3480	13788	73351
CAGR (Postreform period)	2.33 (2.80)	2.33 (4.93)	0.23 (0.45) ^{NS}	1.86 (4.78)	1.39 (4.50)	- 2.56 (4.92)	5.19 (9.51)	2.33 (12.73)	0.46 (0.53) ^{NS}
CAGR (Whole Period)	2.33 (13.32)	1.62 (15.42)	- 0.23* (1.88)	1.39 (13.45)	1.39 (11.15)	- 0.69 (4.43)	3.28 (12.92)	2.09 (22.34)	1.16 (6.18)

* - significant at 5 % level, NS – not significant

Among the cash crops cultivated in Odisha, there is an increasing trend in yield growth in case of all the crops excepting the fibres during this period in Odisha. The growth of yield recorded the highest level at 5.19 %per year in case of spices and the lowest level at 0.46 %per year in case of sugarcane. There is sharp decline in Triennium average yield of fibres from 1475 kg/ha in 1991-92 to 584 kg/ha in 2018-19 with a negative growth rate of 2.56 %per year in this period in Odisha. Thus, it can be inferred that there is better yield growth among foodgrain crops in this period than the pre-reforms period while in case of cash crops it is diversified.

Table-6 explains the trend and CAGR of area under main agricultural crops in post-reforms period as well as for the overall period in Odisha. It is observed that the area under rice in this period has a triennium average of 4465 thousand hectares in

1991-92, which reached the triennium average of 3863 thousand hectares in 2018-19 indicating decline over the period. But its growth rate is 0.69 %in this period. Similar performance is noticed in area growth in case of cereals as well as pulses and foodgrains with growth rates of 0.69, 0.46 and – 0.26 %per year in this period in Odisha

In case of cash crops, area growth performance is worse than that of the foodgrain crops in Odisha. It is because the growth rate of area under spices and vegetables is very negligible and in case of oilseeds and sugarcane there is decline of area under the crops. Only in case of area under fibres there is growth in area of 3.04 %per year in this period. Thus, it can be inferred that there is no significant rise in the growth of area under agricultural crops in Odisha in post-reforms period, rather there is either decline or stagnation in case of some crops.

Table-6
Trend and CAGR of Area under Agricultural Crops in Post-Reforms & Overall Period in Odisha
(In thousand hectares)

Year	Rice	Cereals	Pulses	Food grains	Oil seeds	Fibres	Spices	Vege tables	Sugarcane
1991-92	4465	5009	2086	7096	1135	84	167	811	47
2001-02	4403	4830	1483	6313	713	94	135	542	29
2011-12	4085	4462	2042	6609	762	130	155	693	40
2018-19	3863	4273	1995	6273	608	162	160	649	26
CAGR (Postreform period)	0.69 (7.63)	0.69 (7.62)	0.46 (1.27) ^{NS}	- 0.26 (2.63)	- 2.09 (7.67)	3.04 (9.52)	0.0001 (0.28) ^{NS}	- 0.0005 (0.02) ^{NS}	- 1.62 (4.03)
CAGR (Whole Period)	0.0002 (1.74)	0.23 (3.07)	2.33 (14.06)	0.69 (0.60) ^{NS}	2.33 (10.9)	1.16 (10.58)	1.16 (5.12)	0.92 (4.17)	0.46 (2.45)

*- significant at 5 %level, NS- not significant

Overall Period (1951-52 to 2018-19)

An analysis of the overall period from 1951-52 to 2018-19 shows that there is four-fold increase in production of foodgrains in Odisha from the triennium average of 2471 thousand tonnes in 1951-52 to triennium average of 9946 thousand tonnes in 2018-19. But the highest level of foodgrains production has been recorded at 11824 thousand tonnes in 2014-15 (Table-7). The pulses production reached highest at 1194 thousand tonnes in 1994-95. So also the record level of production of rice, cereals and spices have been reached at 9845, 10767 and 669 thousand tonnes respectively in 2014-15. But the vegetable production reached its peak level at 9515 thousand tonnes in 2011-12 while the production of oilseeds and fibres reached peak level at 858 thousand tonnes and 747 thousand bales respectively in 1991-92. It shows that the production of oilseeds and fibres is not encouraging during post reforms period in Odisha. Similar situation is noticed in case of sugarcane production as its highest production was achieved in 1992-93 at 3603 thousand tonnes in Odisha. Since then, its production level has not crossed the level until 2018-19. It can further be observed that the emphasis on production of rice and other cereals, foodgrains, spices and vegetables might have been given for which their peak level has been reached in 2010s while in case of other crops including pulses, oilseeds, fibres and sugarcane the record production during 1990s

stands even now. The reason behind such a situation might be due to the structural changes through economic reforms such as liberalisation of agricultural trade etc.. To extend advantages of the liberalised trade, Government might have preferred to emphasise the crops which has a greater share in total agricultural output and has greater potential in Odisha.

The growth potential of agricultural production in Odisha may be accounted for the growth of area under the crops and the yield potential of the crops. It is observed that growth rate of the yield level had been higher than that of the area under rice and cereals which are the major components of foodgrains while the growth rate of area was much greater than the yield rate in case of pulses. Thus it can be inferred that the increase in production of rice, cereals and foodgrains on the whole might be due to rise in yield level while in case of pulses, increase in production might be due to growth of area only since its growth in yield is stagnant throughout the period.

Among cash crops also, growth in area is more than the growth in yield level in case of oilseeds and fibres while the performance in case of spices, vegetables and sugarcane is reverse in nature. It means that the change in production of spices, vegetables and sugarcane is more due to expansion of yield level than that of expansion of area in the State of Odisha.

Table-7 Highest Level of Production of Agricultural Crops in Odisha
(In Thousand Tonnes)

Crop	Pre-Reforms Period		Post-Reforms Period		Whole Period	
	Amount (Thousand Tonnes)	Year	Amount (Thousand Tonnes)	Year	Amount (Thousand Tonnes)	Year
Rice	6284	1989-90	9845	2014-15	9845	2014-15
Cereals	6857	1989-90	10767	2014-15	10767	2014-15
Pulses	1175	1990-91	1194	1995-96	1194	1995-96
Foodgrains	7974	1989-90	11824	2014-15	11824	2014-15
Oilseeds	950	1990-91	855	1991-92	950	1990-91
Fibres	782	1990-91	747	1991-92	782	1990-91
Spices	619	1990-91	669	2014-15	669	2014-15
Vegetables	6468	1990-91	9515	2011-12	9515	2011-12
Sugarcane	3560	1983-84	3603	1992-93	3603	1992-93

Decomposition of Agricultural Growth

The analysis of growth of production, yield and area under the crops indicates the general pattern of growth and direction of changes in area and yield. It indicates the influence of change in area and yield on production of the crops to some extent. But to corroborate the same it is necessary to examine the sources of output growth. Therefore, the growth of the output of the crops was apportioned to the various sources by breaking the change in production into three effects such as area effect, yield effect and interaction effect. It has been done with the help of decomposition analysis model. The relative contribution of area, yield and their interaction to change in production of the crops is presented in Table-8.

Pre-Reforms Period

The decomposition analysis of growth of the crops in Odisha during the pre-reforms period reveals that the growth of output of rice, cereals and foodgrains on the whole was mainly on account of

changes in yield as the share of yield effect was 78.06, 69.15 and 45.54 % respectively. In case of pulses, its share is only 0.66 % and the share of area effect is 96.78 %. Hence, growth of pulses production is caused mainly by growth in area. In case of the non foodgrains crops, the yield effect varies from 4.59 % in case of oilseeds to 56.01 % in case of fibres in this period while the area effect varies from 25.32 % of fibres to 66.49 % in case of vegetables. It is evidenced that the area effect is dominant in case of growth of output among oilseeds, spices, vegetables and sugarcane while yield effect is dominant in case of growth of fibres.

Above all, the output growth during pre-reforms period is accounted for yield effect among rice, cereals, foodgrains and fibres and for area effect in case of pulses, spices, vegetables and sugarcane. In case of oilseeds, there is an exception in the sense that the interaction of both area and yield effect is dominant. So, growth of oilseeds production is influenced by both areas as well as yield expansion.

Table-8 Decomposition of Growth in Production of Principal Crops in Odisha
(Percentage)

Crops	Effect	Pre-Reforms Period	Post-Reforms Period	Whole Period
Rice	Area	9.39	- 34.81	0.15
	Yield	78.06	155.83	99.44
	Interaction	12.55	- 21.02	0.41
Cereals	Area	13.42	- 35.16	2.25
	Yield	69.15	158.29	91.43
	Interaction	17.43	- 23.13	6.32
Pulses	Area	96.78	- 62.03	100.20
	Yield	0.66	- 39.70	- 0.04
	Interaction	2.56	1.73	- 0.16
Foodgrains	Area	29.14	- 24.99	13.76
	Yield	45.54	112.00	60.92
	Interaction	25.32	12.99	25.32
Oilseeds	Area	39.48	143.30	32.26
	Yield	4.59	- 68.77	8.17
	Interaction	55.93	25.47	59.57
Fibres	Area	25.32	- 296.14	266.29
	Yield	56.01	205.41	- 64.67
	Interaction	18.67	190.73	- 101.62
Spices	Area	61.87	- 2.54	17.80
	Yield	13.93	107.03	31.34
	Interaction	24.20	- 4.49	50.86

Vegetables	Area	66.49	- 0.43	32.71
	Yield	12.89	125.50	32.35
	Interaction	20.62	- 25.07	34.94
Sugarcane	Area	41.22	-106.94	4.85
	Yield	31.27	12.55	91.49
	Interaction	27.51	- 5.61	3.66

Post-Reforms Period

During post reforms period, it is observed that the yield effect is highly dominant to the extent of 155.83, 158.29 and 112.00 % in case of growth of production of rice, cereals and foodgrains. But in case pulses production, the area effect was dominant. Therefore, it can be deduced that yield effect was the major force of output growth of foodgrain crops except the pulses in which area effect was the major force.

Among the cash crops, there is decline in oilseeds production, but the major force of the decline is the area effect (decline in area). In case of fibres, spices and vegetables production the major force is the growth of yield since yield effect is dominant. In case sugarcane production, it has declined, the major force behind the decline is decline in area. Thus, the change in output due to area effect is in case of pulses, oilseeds and sugarcane while the major force of yield in changes in output growth is found among rice, cereals, foodgrains, fibres, spices and vegetables during this period.

Overall Period

The analysis of decomposition of output growth over the overall period from 1951-52 to 2018-19 can provide some insights on the major forces behind output growth of the crops cultivated in Odisha. It can be noticed that the yield effect is more dominant in case of rice, cereals, foodgrains and sugarcane while the area effect is dominant in case of pulses and fibres and the interaction effect is dominant in case of oilseeds, spices and vegetables. Thus, yield effect turned out to be the most powerful factor for increasing production of rice, cereals and foodgrains as well as sugarcane among cash crops while area expansion was responsible for output growth in case of pulses and fibres. But in case of output growth of oilseeds, spices and vegetables both area and yield expansion is the major forces responsible for expansion of production in Odisha.

Conclusions and Policy Implications

From the foregoing analysis, it can be concluded that main source of growth in production of main crops, especially total foodgrains during the overall study period has been the growth in yield. But, among the cash crops there is diversity in performance. In case of sugarcane the output growth is due to yield growth while in case of pulses and fibres the main source of growth was in area effect. In case of oilseeds, spices and vegetables both the yield and area growth contribute towards the output growth. It seems that the supply of HYV seeds, expansion of irrigation facilities, fertilisers with subsidy, credit supply facilities, minimum support price policy etc. are the most important factor for promotion of production of agricultural crops. Since mostly the measures favour the foodgrain crops, the

yield effect contributes more towards growth of total foodgrains.

It is obvious that the performance of agricultural sector was better during pre-reforms period than that of the post-reforms period. The main source of growth in production of total foodgrains has been the increase in yield and non-foodgrains has been the increase in area in this period. During post-reforms period also, the major force behind output growth of total foodgrains is yield growth while among cash crops the output growth of spices and vegetables is due to yield effect and that of pulses, oilseeds and sugarcane is due to area effect.

The decomposition analysis has some policy implications. The area expansion in favour of cash crops which is possible through crop diversification needs attention of Government and policy formulations. The diversion of labour from agriculture to non-agricultural activities which again becomes a difficult task if the yield of agricultural crops does not rise further so as to achieve the target of National Agricultural Policy 2000 of achieving agricultural growth of 4 % per annum. Therefore, there is urgent need to raise productivity of foodgrains further which will encourage the surplus labour in the sector to non-agricultural sector and crop diversification in favour of cash crops.

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