

# Growth Rates and Decomposition Analysis of Onion Production in Rajasthan State of India

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## ABSTRACT

This paper investigates the trends in area, production and yield of onion in Rajasthan state of India by using component analysis model. The study data period has been divided into three periods: period one, 1984-95, 1996-2005 and 2006-2015. The comparison of area, production and yield growth rates in all periods revealed that cotton show better performance in state as well as national level. The decomposition analysis of growth suggests that for onion yield effect is the major source of growth in period 1984-95 and 1996-2005 except for period 2006-2015 for which area effect was the major source in Rajasthan. At national level, source of output growth for onion was the yield effect. The sources of output for the overall study period revealed that in case of onion crops, the main output source was the yield effect for respective crop. The results of decomposition analysis have important policy implications because each growth component alone has a limited scope to expand overtime. For example, land's growth potential (the acreage effect) is limited due to the scarce supply of water resources in Rajasthan As such, efforts have to be directed toward further increasing the productivity of crops. The future government policy should focus on developing new high-yielding with drought resistant varieties in Rajasthan.

**Keywords:** Growth rate, decomposition analysis, onion, correlation, Rajasthan

Onion (*Allium cepa* L) is extremely important vegetable crop not only for internal consumption but also as highest foreign exchange earner among the fruits and vegetables. Onion is an important vegetable crop grown all over the world. Its demand is worldwide. Onion is carminative, melt the phlegm and oil extracted from these is volatile. Besides, onion has several medicinal uses described by various authors as remedy or cure for different ailments. Onion is the largest vegetable produced and consumed not only in India but also in the world. Onion producing and exporting countries in the world are China, India, USA, Turkey, Japan, and Spain, but, major onion importing countries are Malaysia, the United Arab Republic, Canada, Japan, Lebanon and Kuwait.

Amongst the onion producing countries in the world, India ranks second in area and production, the first being China. Onion is exported from India to 38 countries in varying quantities. It occupies an

area of 1173 thousand ha, with production of 18927 thousand tons. The export of onion during 2014-15 was 1086071.85 thousand tons with a value of ₹ 200994.53 lakhs. The total production of onion during the year 2015-16 is estimated at around 202.14 lakhs MT as per the 2<sup>nd</sup> advance estimates. Out of this, around 65% produce which comes in *rabi* season is partly used for domestic consumption as well as storage for further consumption in different parts of the country from June to November along with the fresh produce of early *kharif* and *kharif* onion. The major onion storing states are Maharashtra, Gujarat, M.P., Rajasthan and Bihar. As per the NHRDF's estimate, around 45-46 lakh MT onions have been stored in the current season by the farmers as well as traders which is around 15% more compared to last year and quality is better than last years stored. Around 12-15 lakh MT onions are required per month for consumption in the country. The quantity exported is less than ten

per cent of its production. India's contribution to the export is less than 8 per cent in the international market although its position is second in the onion production. With this background the present paper is an attempt to study the production and export scenario of onion from India. Maharashtra produces the maximum output of onion in India producing a level of 5361.96 thousand tons during 2014-15 on 441.9 thousand hectares of land as shown in table 1. The Rajasthan state has the six ranks in area and production of onion in the country. Maximum onion production takes place in Maharashtra (5361.96 thousand tons) state followed by Karnataka (3227.04 thousand tons), Madhya Pradesh (2842 thousand tons), Bihar (1247.31 thousand tons.), Gujarat (1126.55 thousand tons), Rajasthan (960.78 thousand tons) and Haryana (640.22 thousand tons). The details are given below in table.

**METHODOLOGY**

The present study is based on secondary data for the 30 years period from 1986 to 2015. The study examines growth rates of area, production and yield of onion in Rajasthan and India. The study period has been divided in three decade period 1984-95, 1996-2005 and 2006-2015. Also, analysis was conducted for the entire study period of 30 years. In order to examine the degree of relationship in area, production and yield of onion crop in Rajasthan, the statistical measures, such as correlation coefficient were worked out and to estimation of growth rate was mostly done by employing two common methods of growth rate including Linear Growth

Rate and Compound Growth Rate (CGR). The linear growth rate has inherent limitations to perform the comparison of growth rates between periods and crops. Thus, it seems more appropriate to use the compound growth rate for analyzing the growth trend of agricultural crops between two periods. The compound growth rate (CGR) is estimated by fitting a semi-log trend equation (1) of the following form:

$$\ln Y = a + bt \quad \dots(1)$$

where, Y defines the time series data of production, area and yield of major crops i.e. wheat, rice, sugar cane and cotton, 't' is the trend term and 'a' is the constant coefficient. The slope coefficient 'b' measures the relative change in Y for a given absolute change in the value of explanatory variable 't'. If we multiply the relative change in Y by 100, we will get percentage change or growth rate in Y for an absolute change in variable 't'. The slope coefficient 'b' also measures the instantaneous rate of growth. We can calculate the compound growth rate using the following equation:

$$\text{CGR} = [\text{antilog } b - 1] * 100 \quad \dots(2)$$

The equation (2) has been estimated by applying Ordinary Least Square (OLS) method. The t-test was applied to test the significance of 'b'. This equation presumes that a change in agriculture output in a given year would depend upon the output in the proceeding year (Deosthali and Chandrehekhar, 2004).

**Table 1:** State wise Percentage share of onion production during 2014-15

Sl. No.	State	Area ('000 ha)	Share (%)	Production (in '000 MT)	Share (%)
1	Maharashtra	441.9	37.66	5361.96	28.37
2	Karnataka	186.99	15.94	3227.04	17.08
3	Madhya Pradesh	117.88	10.05	2842	15.04
4	Bihar	54.3	4.63	1247.31	6.60
5	Gujarat	44.3	3.78	1126.55	5.96
6	Rajasthan	61.36	5.23	960.78	5.08
7	Haryana	28.69	2.45	640.22	3.39
8	Andhra Pradesh	38.37	3.27	575.58	3.05
9	Telangana	23.85	2.03	450.54	2.38
10	Uttar Pradesh	24.47	2.09	413.6	2.19

Source: Agriculture Statistics, Ministry of Agriculture and farmer welfare in India

To measure the relative contribution of area and yield towards the total output change with respect of individual crop, component analysis model has used. In the literature, several researchers have used this model to study growth performance of the crops (Bastine and Palanisami, 1994; Bhatnagar and Nandal, 1994; Mundinamani *et al.*, 1995; Gupta and Saraswat, 1997; Singh and Ranjan, 1998; Siju and Kombairaju, 2001; Kakali and Basu, 2006).

$$\Delta P = A \circ \Delta Y + Y \circ \Delta A + \Delta A \Delta Y \quad \dots(3)$$

Change in production = Yield effect + Area effect + Interaction effect Thus, the total change in production is attributed due to area and yield that can be decomposed into three effects viz; yield, area and interaction effects. The selection of the study period was mainly due to availability of data for this period of time. Selected crops were high volatile in nature and important vegetable crop grown all over the world. The data has been collected from various secondary sources including directorate of Economics of Statistics, Govt. of India, National Horticultural Research and Development Foundation (NHRDF).

### RESULTS AND DISCUSSION

A commonly employed method for measuring the changing attitude of area and production of any crop is correlation (Table 2). The correlation Coefficient(r) of area and production of onion over the period i.e. 1985-86 to 2014-2015 is 0.697 in Rajasthan and 0.988 in India, which is highly significant at 1% level implying that the increment of area strongly affect the production of onion to increase.

**Table 2:** Relationship between Area and Production of Onion

Particular	Criteria	Value of Correlation@	P(T<t) two- tail
Rajasthan	Area Vs Production	0.697	0.0001
India	Area Vs Production	0.988	0.0001

### Compound Growth Rate of Area, Production and Yield in Rajasthan Vs India

Compound growth rates in area, production and productivity of onion in Rajasthan have

been presented in Table 3 Growth rate of onion production increased significantly at the rate of 9.09 per cent per annum which was largely attributable by significant growth in area by 4.13 per cent per annum with 4.76 per cent non- significant growth of productivity during period 1986-95. The growth of production of onion decreased during the during 1996-2005, which was recorded as 7.13 per cent mainly due to low productivity growth of 0.32 per cent per annum while area recorded growth of 6.79 per cent per annum. Area, only of the shown significant impact during 1996-2005. During the period 2006-2015, production growth rate was observed 9.19 per cent which is largely attributable to positive area growth of 9.03 per cent per annum while productivity growth was by 0.57 per cent. During the overall period, the production growth rate was recorded non-significantly as 9.25 per cent per annum. It was attributed by both i.e. non- significant growth in area by 6.66 per cent per annum and growth in productivity by 2.43 per cent per annum.

At national level the compound growth rates in area, production and productivity of onion also observed in same Table 2. Growth rate of onion production increased significantly at the rate of 7.13 per cent per annum which was largely attributable by significant growth in area by 4.41 per cent per annum with 2.6 per cent non- significant growth of productivity during period 1986-95. The growth of production of onion during the during 1996-2005, which was recorded as 5.84 per cent mainly due to significant productivity and area growth of 1.55 per cent and 4.25 per annum. During the period 2006-2015, production growth rate was observed 11.27 per cent which is largely attributable to positive significant productivity growth of 2.15 per cent per annum with area growth was by 8.89 per cent. During the overall period, the production growth rate was recorded non-significantly as 7.14 per cent per annum. It was attributed by both i.e. non-significant growth in area by 5.38 per cent per annum and growth in productivity by 1.66 per cent per annum.

Hence, it can be concluded from the foregoing discussion that there was positive growth in area, production and productivity of onion crop in Rajasthan and India during study period.

**Table 3:** Compound Growth Rates of Area, Production and Yield of Onion in India and Rajasthan

Particulars	1986-95		1996-2005		2006-2015		Overall period 1986-2015	
	Raj.	India	Raj.	India	Raj.	India	Raj.	India
Area	4.13** (0.005)	4.41*** (0.001)	6.79*** (0.002)	4.25* (0.01)	9.03 (0.88)	8.89 (0.13)	6.66 (7.76)	5.38 (1.1)
Production	9.09** (0.009)	7.13 (0.007)	7.13 (0.001)	5.84 (0.026)	9.19 (0.33)	11.27 (0.16)	9.25 (2.75)	7.14 (5.64)
Yield	4.76 (0.056)	2.60 (0.122)	0.32 (0.84)	1.55*** (0.001)	0.14 (0.57)	2.15** (0.09)	2.43 (6.01)	1.66 (1.2)

\*\*\*1% Significant level; \*\* 5% Significant level; \* 10% Significant level Figures in the parenthesis indicates t-value

### Decomposition and Output Growth of Onion

The growth analysis (area, production and yield) of onion revealed the general pattern of growth and direction of changes in yield and area. But this analysis does not evaluate the contribution of area and yield towards the production growth. So, it is necessary to examine the sources of output growth. To appraise the sources of output growth for major crops, the change in production is divided in to three effects i.e., area effect, yield effect and interaction effect. The relative contribution of area, yield and their interaction to changes in production of onion.

**Table 4:** Growth Decomposition in production of Onion (%)

State	Period	Area Effect	Yield Effect	Interaction Effect
Rajasthan	1986-1995	36.59	49.29	14.03
	1996-2005	7.69	84.82	7.51
	2006-2015	50.54	30.33	19.15
	1986-2015	15.44	21.06	63.51
India	1986-1995	12.05	85.37	4.18
	1996-2005	27.63	59.48	13.86
	2006-2015	15.24	60.25	24.10
	1986-2015	10.32	56.69	32.79

The decomposition analysis is employed for three periods as shown in Table 4. In Rajasthan, During the period of 1986-1995 and 1996-2005 an increase in output for onion was mainly due to increase in yield with the respective yield contribution towards productivity for these crops of 49.29 and 84.82 per

cent. The area effect was the major driving force for onion output growth in 2006-2015. About 50.54 % growth in onion was due to area effect which more than offset the yield effect of 30.33 % in onion.

In India, the main source of output growth of onion 85.37 per cent (period 1986-1995), 59.48 per cent during 1996-2005 and 60.25 per cent during 2006-2015 was due to yield effect. The decomposition analysis of the growth of onion crops over the entire study period (1986 to 2015) revealed that growth in production of onion was mainly due to yield effect 56.69 per cent.

### CONCLUSION

This paper investigates the trends in area, production and yield of onion in Rajasthan state of India by using component analysis model. The study data period has been divided into three periods: period one, 1984-95, 1996-2005 and 2006-2015. The comparison of area, production and yield growth rates in all periods revealed that onion show better performance in state as well as national level. The decomposition analysis of growth suggests that for onion yield effect is the major source of growth in period 1984-95 and 1996-2005 except for period 2006-2015 for which area effect was the major source in Rajasthan. At national level, source of output growth for onion was the yield effect. The sources of output for the overall study period revealed that in case of onion crops, the main output source was the yield effect for respective crop. The results of decomposition analysis have important policy implications because each growth component alone has a limited scope to expand overtime. For example, land's growth potential (the acreage



effect) is limited due to the scarce supply of water resources. If the current yield trends continue, the growth in crops production will decline overtime because of the limitations on land growth potential. In addition, some arable land would likely be reduced to accommodate the residential land needs of a growing population, which would likely have a negative effect on per capita production. There is an urgent need to increase crop production, which will become inevitable in view of population growth. As such, efforts have to be directed toward further increasing the productivity of crops. The future government policy should focus on developing new high-yielding with drought resistant varieties in Rajasthan. Research efforts are needed to strengthen the crop breeding programs using new efficient technologies. Further, developing and establishing the bio-technology programs should be intensified to develop high yield varieties of the crops suitable to agro-climate conditions of the regions.

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