

# Growth Rate and Instability Estimation of Plantation Crops in India

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**ABSTRACT:** Tea, coffee, rubber, cocoa, coconut, arecanut, oil palm, palmyrah, cashew, cinchona are major plantation crops in India. . Plantation crops shares 3.82 per cent of total crop land, but still its earns shares 12.72 per cent of the total export earnings of all commodities or 75 per cent of total earnings from the export of agricultural produces in India. So it is necessary to indentify growth and instability in plantation crops over time to get guideline for framing policies. The data is collected from the Indian Agricultural Statistic Research Institute on the Area, Productivity and Production of the Plantation crops from the year 1991-92 to 2011-12 on the Area, Productivity and Production of the Plantation crops in India. The results shows that the good Plantation crops production achieved in India in last 20 years. The growth in area(1.48 %), productivity(1.59%) and production(3.10 %) of the Plantation crops in India is positive and significant. Instability Index shows that the Production of Plantation crops in India was more unstable as compared to Area and Productivity of Plantation crops during the period from 1995-96 to 2011-12. The previous years' area made positive effect on next years' production of Plantation crops in overall period.

**KEYWORDS:** CGR, Instability, Plantation, Crop, India, Trend

## I. INTRODUCTION

The major commercial Plantation crops are the tea, coffee, rubber, cocoa, coconut, arecanut, oil palm, palmyrah, cashew, cinchona etc. It have good role in Indian Economy and contributes in export of the nation. Plantation crops occupy less than 2 per cent of the total cultivated area (i.e. 3.82 per cent of total crop land) but still its earns Rs. 16,000 million and shares 12.72 per cent of the total export earnings of all commodities or 75 per cent of total earnings from the export of agricultural produces.

Plantation industry provides direct as well as indirect employment to many millions of people. Tea industry generates direct employment to 10 lakhs and indirect employment to 10 lakh people, while-cashew processing alone generates employment to 3 lakhs people besides 2 lakhs farmers are employed in cashew cultivation. Plantation industry supports many by-product industries and also many rural industries. For example, coconut husk is used to produce coir fiber annually to a tune of 2,19,600 tones in India.

These crops conserve the soil and ecosystem. Tea planted across hill slopes, the plantation of cashew is in barrel and waste lands which protect the land from soil erosion during the rainy season or due to heavy winds.

The area and production is more in Kerala (1073000.7 ha and 4359000.9 MT) followed by Karnataka (679000.2 ha and 1401000.0 MT), Tamil Nadu (503000.0 ha and 3810.6 MT), Andhra Pradesh (289000.0 ha/and 1021000.2 MT).

Considering the need of the hour, the present topic entitled as 'Compound Growth Rate and Instability Index of Plantation Crops in India' Production in India' is taken to review the growth rate and instability indices in area, production and productivity as well as impact of the area and productivity on production. The objectives of the study are designed as follows

## II. OBJECTIVES

The objectives of the paper are given below

1. To study the production status of Plantation crops in India
2. To estimate the growth rates of the Area, Productivity and Production for Plantation crops in India;
3. To study the instability in the Area, Productivity and Production of Plantation crops in India;
4. To find the effect of Area and Productivity on Production of the Plantation crops in India;

### III. METHODOLOGY

This section will focus on the source of data, period of the data, crop included, methods adopted to achieve the objectives.

#### A. Source of data

The data is collected from the Indian Agricultural Statistic Research Institute on the Area, Productivity and Production of the Plantation crops.

#### B. Period of the data

The annual data is collected from the year 1991-92 to 2011-12 on the Area, Productivity and Production of the Plantation crops.

#### C. Analytical Tools:

The tools are used to estimate the growth; instability and effect of area and productivity on production are as follows;

##### C.1. Estimation of Production status

The status of the Plantation crops production in last 20 years in simply presented in over decades. The triennial averages are estimated.

##### C.2. Estimation of Growth

In the present study, the Compound Growth Rates in Area, Productivity and Production of Plantation crops are estimated as follows

The exponential equation of the following type was used.

$$Y = ab^t$$

Where

Y = Area, Productivity and Production

(Area in "00" ha, Production in "00" bales, Productivity in lint kg /ha.)

t = time period in years

b = trend value (coefficient)

a = intercept.

$$\text{Compound Growth Rate} = (b - 1) \times 100. \text{ (Chand and et al. 2012)}$$

The significance of the estimated compound growth rates was tested with the help of 't' test.

For getting normal base year, the triennial averages are taken as base year.

##### C.3. Estimation of Instability

To estimate the instability of Area, Productivity and Production of Plantation crops, the Coefficient of variation and Cuddy Della Index is used. The formula is as follows

a) Coefficient of Variation(CV) : Standard Deviation/Mean

To avoid the over estimation of CV, the following Cuddy Della Index (Ix) is used in comparison with CV.

b) Cuddy Della Index (Ix) was calculated as follows:

$$I_x = CV \sqrt{1 - \bar{R}^2}$$

Where, CV = Coefficient of Variation ( $\sigma/\bar{X}$ )

$\bar{R}^2$  = Adjusted coefficient of multiple determination

##### C.4. Method for effect of Area and Productivity on Production

To estimate the effect of Area and Productivity on Production of Plantation crops in India, the Crop Acreage Response Model is used. In this model, the effect of lagged years' area and productivity on the present production of the Plantation crops is estimated.

$$Y = a + b_1 A_{t-1} + b_2 P_{t-1} + u$$

Y = Production of selected crop (000 tons)

a = Intercept

$A_{t-1}$  = Area under selected crop (000 ha)

$P_{t-1}$  = Productivity of selected crop (ton/ha)

$b_i$  (1 to 2) = Coefficients of respective variables

IV. RESULTS AND DISCUSSION

Results regarding the trend and stability of the Plantation crops in India are presented and discussed in this section on the line of objectives mentioned.

**a. Production status of Plantation crops in India**

The table no 1 represents the area, production and productivity status of the Plantation crops in India. The table shows the area, production and productivity of Plantation crops in India over the decade since 1991-92 and the current year 2011-12.

The area of the Plantation crops in the country has increased from 2431 thousand hectares to 3508 thousand hectares i.e. net area increased by 144 per cent. The production also increased from 8710 thousand tons to 15117 thousand tons i.e. net increased by 174 per cent. The productivity of Plantation crops in India is increased from 3.57 tons per hectare to 4.29 tons per hectare. i.e. net increased by 120 per cent. The more increase in area and production in seen between year 2001-02 to 2011-12 which is increased by 144 and 174 per cent

Overall, the good Plantation crops production achieved in India in last 20 years

Table no. 1 . Production Status of Plantation crops in India				
Area: Area 000 ha, Production 000 tons, Productivity tons / ha				
S.N.	Particulars/Year	1991-92	2001-02	2011-12
1	Area	2431	2943	3508
	%	100	121	144
2	Production	8710	9617	15117
	%	100	110	174
3	Productivity	3.57	3.27	4.29
	%	100	91	120

Note : The figures area triennial averages.

**b. Growth in Plantation crops in India**

The table no 2 represents the compound growth rates of area, production and productivity of Plantation crops in India. The table shows the compound growth rates of area, production and productivity of Plantation crops in India for the decades 1995-96 to 2004-05 and for the decade 2005-06 to 2011-12 as well as for whole period of said two decades.

The growth rate of the Plantation crops’ area was 1.25 per cent significantly for first decade. While, it was 1.70 per cent significantly for second decade. For whole period it was 1.48 percent significantly. Which shows the growth in area of Plantation crops was smother and positive for whole period.

The Plantation crops’ productivity was increased by 0.02 percent in first decade non-significantly and by 3.75 percent per annum in second decade, significantly. For whole period, growth rate of productivity in Plantation crops was positive and significant and it was 1.59 percent per annum.

The production growth in Plantation crops of India was 1.27 percent, 5.51 percent and 3.10 percent for first decade, second decade and for whole period respectively. It was positive and significant at 1 per cent.

Overall, the growth in area(1.47 %), productivity(1.58%) and production(3.08 %) of the Plantation crops in India is positive and significant.

Table no. 2: Compound Growth Rate of Area, Productivity and Production of Plantation crops in India				
S.N.	Particulars	1995-96 to 2004-05 (first decade)	2005-06 to 2011-12 (second decade)	1995-96 to 2011-12 (whole period)
1	Area	1.25***	1.70***	1.48***
2	Productivity	0.02	3.75***	1.59***
3	Production	1.27	5.51***	3.10***

Note: \* = Significant at 10 percent (table T value is 1.833 for decades and 1.729 for whole period)  
 \*\* = Significant at 5 percent (table T value is 2.262 for decades and 2.093 for whole period)  
 \*\*\* = Significant at 1 percent (table T value is 3.250 for decades and 2.861 for whole period)

**c. Instability in Plantation crops of India.**

The table no.3 displayed the Instability in Area, Productivity and Production of Plantation crops in India for the decades 1995-96 to 2004-05, for the decade 2005-06 to 2011-12 and for whole period of said two decades. Coefficient of Variation and Cuddy- Della Index are showing instability in Area, Productivity and Production.

The instability indicates the variation in the selected indicator over the period of the study. The Cuddy Della Index indicates instability at controlled level.

The Coefficient of Variation in area of Plantation crops was 4.30, 5.86 and 9.09 per cent in first decade, second decade and for whole period respectively, while the CD index for area in Plantation crops was 2.01, 2.83 and 2.72 per cent in first decade, second decade and for whole period respectively.

In case of Productivity of Plantation crops in India, the Coefficient of Variation was 9.64, 13.37 and 14.13 per cent in first decade, second decade and for whole period respectively, while the CD index for productivity in Plantation crops was 9.63, 6.96 and 10.14 per cent in first decade, second decade and for whole period respectively.

The Plantation crops production was also varying over the selected period. The Coefficient of Variation was 11.71, 19.08 and 22.74 per cent in first decade, second decade and for whole period respectively, while the CD index for productivity in Plantation crops was 10.91, 9.33 and 12.55 per cent in first decade, second decade and for whole period respectively.

The Coefficient of Variation shows that variation of the almost all parameters is higher than the variation showed by Cuddy Della Index.

Overall, Instability Index shows that the Production of Plantation crops in India was more unstable as compared to Area and Productivity of Plantation crops during the selected period.

S.N.	Indices	Area			Productivity			Production		
		1995-2004	2005-12	1995-2012	1995-2004	2005-12	1995-2012	1995-2004	2005-12	1995-2012
		I	II	Whole	I	II	Whole	I	II	Whole
1	CV	4.30	5.86	9.09	9.64	13.37	14.13	11.71	19.08	22.74
2	Cuddy-Della index	2.01	2.83	2.72	9.63	6.96	10.14	10.91	9.33	12.55

**d. Effect of Area and Productivity on Production of Plantation crops in India**

The table.4 depicts the effect of previous years’ Area and Productivity of Plantation crops on next years’ Plantation crops Production in India for the decades 1995-96 to 2004-05 and for the decade 2005-06 to 2011-12 as well as for whole period of the two decades.

The results show that the lagged value of the area has given positive effect on next years’ production significantly. The regression coefficient of area was 1.21 percent, 0.99 per cent and 0.59 percent non-significantly for first decade, second decade and whole period. While the lagged productivity of Plantation crops has contributed negatively on production non-significantly in overall period.

The effect of past productivity was not significant. The previous years’ area made positive effect on next years’ production of Plantation crops in overall period.

S.N.	Year	1995-2004	2004-12	1995-2012
	Particulars	Coefficient	Coefficient	Coefficient
1	Productivity	-125.25	-59.07	-88.01
2	Area	1.21***	0.99	1.06
3	Intercept	-129.44	292.85	158.29

Note: \* = Significant at 10 percent (table T value is 1.833 for decades and 1.729 for whole period)  
 \*\* = Significant at 5 percent (table T value is 2.262 for decades and 2.093 for whole period)  
 \*\*\* = Significant at 1 percent (table T value is 3.250 for decades and 2.861 for whole period)

**V. CONCLUSION**

It is concluded from the results that the good Plantation crops production achieved in India in last 20 years. The growth in area(1.48 %), productivity(1.59%) and production(3.10 %) of the Plantation crops in India is positive and significant. Instability Index shows that the Production of Plantation crops in India was more unstable as compared to Area and

Productivity of Plantation crops during the period from 1995-96 to 2011-12. The previous years' area made positive effect on next years' production of Plantation crops in overall period.

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