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## GROWTH AND PERFORMANCE OF AREA, PRODUCTION AND PRODUCTIVITY OF NATURAL RUBBER IN INDIA

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### ABSTRACT

*India's share in the production has increased over the years and the country is now one of the largest producers of natural rubber in the world market. Hence, the present study explores the growth performance of natural rubber in India as well as major producing states in India (from 1981-82 to 2010-11), using by compound growth rate and co-efficient of variation. The study reveals that the growth and co-efficient of variation in tapped area, area, production and yield of natural rubber in India registered a significant and positive signs. While the growth in area and production in major producing states have been declining, the productivity has increased from 891 kg. per ha. to 1327 kg. per ha. during the study period. It is recommended that there should be forming a separate board for rubber at state level, through which, it may initiate the modernized strategies, introduce High Yield Varieties (HYV) of seedlings and sapling, creates awareness regarding technologies & marketing knowledge etc., among the planters.*

### KEYWORDS

Compound Growth Rate (CGR), Co-efficient of Variation (CV), Area, Tapped Area, Production, Productivity and Yield, High Yield Variety (HYV).

### INTRODUCTION

India is predominantly an agrarian economy contributing about 14.5 per cent of Gross Domestic and 52 per cent of the countries work force in 2010-11 depends on agricultural and allied sector for their livelihood (Economic Survey, 2011-12). Though the share of Indian agriculture in the Gross Domestic Product has steadily declined, it is still the single largest contributor to the Gross Domestic Product and plays a vital role in the overall socio-economic development of India (State of Indian Agriculture Report 2011-12). India, with its favorable agro-climatic conditions and rich natural resource base, has become the world's largest producer across a range of commodities.

India is the fourth largest natural rubber producing country after Thailand, Indonesia and Malaysia. India's share in the production has increased over the years and the country is now one of the largest producers of natural rubber in the world market. South Indian regions, especially Kerala, Tamil Nadu and Karnataka contribute heavily to India's rubber production. In fact, 90 per cent of the total production comes from the state of Kerala. According to the figures recently released by the Rubber Board in India, the consumption pattern in the months of November – December 2011 exceeded the production pattern. In November the consumption rate was around 7 per cent compared to a production of 4.3 per cent (March 2012 Articles, Tyres & Wheels, India Transport News & Analysis). Production of natural rubber in India fluctuated around 6-7 lakhs tonnes annually which amounts Rs. 3000 crores. Kerala accounts for 72 per cent of the total rubber production is in the form of Ribbed Smoked Sheets (RSS) alone, which is also imported by India accounting for 45 percent of the total rubber imports. India has imported 213785 tonnes of natural rubber during 2011-12 against the import of 177637 tonnes during 2010-11, exported 27145 tonnes of natural rubber during 2011-12 compared to 29851 tonnes exported during previous year. India is one among the top ten rubber producing countries. An estimated around 4.8 lakh hectares of land is now under rubber cultivation, and in the next five years, the area under the "liquid gold" cultivation would be doubled. India's north east has the potential to transform itself into the world's largest natural rubber producing region, and the country's second rubber based industrial park is being set up in Tripura to boost the industry. The rubber plantation can be considered as significant contributions towards reducing global warming through carbon sequestration (Indian Rubber Board Statistics 2011-12).

### SCOPE OF THE STUDY

According to Indian Rubber Board, the demand for natural rubber has been consistently exceeding supply. During 2011-12, the production of natural rubber in the country stood at 903700 tonnes, while its consumption was at 964415 tonnes (India had to import 60715 tonnes of natural rubber). The widening gap between supply and demand in the local market was the main reason for the sharp rise in prices and imports. The shortage of natural rubber is estimated at about 75000 tonnes this year against an estimated consumption of over 10 lakh tones (Business Line, 23-June -2012). Another concern among experts is the lower productivity of Indian rubber farms, largely due to the smaller size of holdings. This trend indicates clearly, how the natural rubber is an essential commodity in the present era and hence, the study therefore aims to analyze the growth of the natural rubber in India with the following specific objectives:

- i) To study the growth and performance of area, tapped area, production and productivity of natural rubber in India.
- ii) To study the growth and performance of tapped area, production and productivity of natural rubber in major producing states in India.

### REVIEW OF LITERATURE

**Ashalatha (2000)** analysed the growth rate of area, production, productivity and export of cashew kernal, cashewnut shell liquid, imports of raw cashewnuts and unit value of exports of cashew. The study covered the period of 1956-57 to 1998-99. The growth rate was studied in two periods period-I, covering 1956-57 to 1970-71 and period-II, covering 1971-72 to 1998-99. It was observed that the growth rate of area, production, productivity kernal export, raw cashew import, cashewnut shell liquid value and cashewnut shell liquid-unit value of export were showing positive trend but the cashew nut shell liquid quantity exported showed negative growth and non-significant.

**Sujatha et al., (2003)** estimated the compound growth rates of mango exports from India before and after WTO by using secondary data from 1989-90 to 2001-02 collected from APEDA. The total period was divided into two parts, i.e., 1989-90 to 1994-95 (pre-WTO) and 1995-96 to 2001-02 (post-WTO). The compound growth rate analysis indicated that the rate of growth in quantity and value of exports was more during post-WTO period in case of fresh mangoes. However, the growth rates of mango pulp decreased during post – WTO period compared to pre-WTO period. **Kumar et al., (2008)** studied the performance of cucumber and gherkin export from India has been studied. It has been observed that India has made tremendous progress in the export of cucumber and gherkin products during the past 15 years (1990-2005). The export has increased by 128.5 times with an impressive annual compound growth rate of 37.46 per cent, as against only 4.38 per cent in the world market.

**Deepa et al., (2009)** evaluated the performance of karnataka State Agricultural Produce Processing and Export Corporation, Limited. Secondary data were used for the study for the period 1997 to 2007. The growth rate of Onion export (69.40) was found to be positive and significant whereas, growth rate of Potato (-12.70), Mango (-4.39) and Niger seeds (-66.08) was found to be negative and non-significant. Apart from this compound growth rates of domestic market, import markets in terms of quantity and value showed a negative growth rate. But export markets growth rate was positive in terms of quantity (31.18 per cent) and value (32.06 per cent) which indicated an increasing trend over the years. **Goudra et al., (2011)** studied the scenario of chilli production in North Karnataka and the result revealed that the Northern Karnataka as a whole registered positive compound growth rate for area (13.76), production (13.88), productivity (12.20). These registered values were non-significant both at ten and five percent level of significance.

The above reviews revealed that many researchers had investigated various aspects of the growth of the area, production and productivity related aspects in various crops by using the compound growth rate and the trend. In the present study the Compound Growth Rate (CGR) and Co-efficient of Variation (CV) were worked out for the area, tapped area, production and yield, of the natural rubber in India.

## METHODOLOGY

The data collected were analyzed to draw meaning full interpretations and to assess the situation in the rubber economy in India. For the present study, the following statistical tools were employed to assess the growth performance of natural rubber are compound growth rate and coefficient of variation. The secondary data have been used for the study purpose. In order to analyze the growth rate and coefficient of variation, the time series data of tapped area, area, production, and yield or productivity of natural rubber were collected from various publications, official records and web sources such as Hand Book of Statistics on the Indian Economy, International Rubber Study Group, Indiatat, Kerala Rubber Board statistical News, Food and Agricultural Organization (FAO) of the United Nations etc., have been referred for the collection of data from 1981-82 to 2010-11.

### COMPOUND GROWTH RATE

To arrive at normal years, a simple average of estimates for thirty years from 1981-82 to 2010-11 have been taken. The normal year was considered as base year for estimating growth rates. By taking time as the independent variables and the area, tapped area, production and productivity of the natural rubber as the dependent variables, the compound growth rates were estimated by using the formula.

$$Y = A(1+r)^t$$

Where,

Y = Dependent Variables like tapped area, area, production and productivity in the year 't' for which growth rate is estimated.

A = Constant

r = rate of annual increment

t = time element which takes the value of 1, 2, 3, ----- n

After transforming the model into a linear form by taking logarithms to base 'e'

$$\ln Y = \ln A + t \ln(1+r)$$

Let,  $\ln A = a$

$\ln(1+r) = b$

So,  $\ln Y = a + bt$

$(1+r) = \text{Anti } \ln \text{ of } b$

$R = (\text{Anti } \ln \text{ of } b) - 1$

The semi log function is linear in parameters (linear relationship between Y and t), and hence, it could be fitted in the OLS Technique.

The compound growth rate (r) is obtained by the following formula and is generally expressed in terms of percentage.

$$r = \{(\text{Anti } \ln \text{ of } b) - 1\} \times 100$$

The significance of growth rate was tested by applying student 't' test statistic (Laxmanan *et al.* 2005).

$$t = r / S.E.(r) \text{ with } (n-2) \text{ df}$$

where,

$$S.E.(r) = 100 \text{ bx } S.E.(\log b) / \log 10^e$$

r = the compound growth rate

n = number of year

S.E.(r) = Standard error

df = degrees of freedom

t =  $r / S.E.(r)$  follows student 't' distribution with n - 2 degrees of freedom.

According to log base rule,  $\ln_e 10$  is worked out to be 2.3025 which follows 't' distribution with (n - 2) degree of freedom, 'n' is number of year considered under study. Pattern of growth rate over the years was identified using the 'b' co-efficient.

If co-efficient is statistically significant and positive, then growth of the estimated parameters over the years is accelerating. If it is negative, it implied that the growth is decelerating over the years. If it is around zero, it implies that the growth is stagnant, over the years. In the present study the compound growth rates and coefficient of variation have been computed from 1981-82 to 2010-2011 for the all variables such as area, tapped area, production and productivity of natural rubber.

## RESULTS AND DISCUSSIONS

### CGR AND CV ESTIMATION ON TAPPED AREA, AREA, PRODUCTION AND YIELD OF NATURAL RUBBER IN INDIA

The results of growth and co-efficient of variation in tapped area, total area, production and productivity of natural rubber in India during reference period is discussed below. In order to identify the significant role and the economical status of natural rubber in the Indian economy, an attempt has been made at decadal wise analysis of growth and co-efficient of variation during the study period.

The growth and co-efficient of variation is worked out for the period of 1981-82 to 2010-11 and the decadal performance is also studied and the results are presented in table 1 for tapped area, area, production and yield of natural rubber. The growth of tapped area in India recorded significantly a higher growth of 5.27 per cent during the first decade (1981-82 to 1990-91) of the study as against second (1991-92 to 2000-01) and third (2001-02 to 2010-11) decades at the estimated rate of 2.50 per cent and 1.89 per cent respectively. The total tapped area grew at an average growth rate of 3.22 per cent which was comparatively higher than the growth rate estimated for the second and third decades. During the overall reference period for 30 years of the study, the coefficient of variation in tapped area under natural rubber was estimated at 26.21 per cent level.

It could be seen from the table 1, that the area of natural rubber in India grew at a rate of 2.46 per cent which was below the CGR estimated for the first (5.22 per cent) and third decades (2.66 per cent) of the study period. Similarly, a lesser growth rate was observed in the area of natural rubber during the second (1.62 per cent) decadal period, compare to overall growth rate. During the reference period, the overall coefficient of variation in area under Natural rubber was estimated at 20.75 per cent level.



TABLE 1: GROWTH AND COEFFICIENT OF VARIATION IN TAPPED AREA, AREA, PRODUCTION AND YIELD OF NATURAL RUBBER IN INDIA

Period	Description	Tapped Area	Area	Production	Yield
1981-82 to 1990-91	CGR (%)	5.27***	5.22***	8.69***	3.25***
	t Stat	15.54	32.80	22.39	18.76
	CV (%)	16.26	15.18	26.27	9.81
	Mean	238205	390791	222172	920
1991-92 to 2000-01	CGR (%)	2.50***	1.62***	6.54***	3.94***
	t Stat	40.81	29.55	13.92	8.89
	CV (%)	7.48	4.88	18.69	11.79
	Mean	362066	528801	516509	1416
2001-02 to 2010-11	CGR (%)	1.89***	2.66***	3.61***	1.83***
	t Stat	10.91	12.40	6.39	4.70
	CV (%)	5.77	8.31	11.26	6.30
	Mean	444518	620456	778087	1750
1981-82 to 2010-11	CGR (%)	3.22***	2.46***	6.56***	3.25***
	t Stat	21.16	18.42	23.55	23.30
	CV (%)	26.21	20.75	48.32	27.01
	Mean	348263	513349	505589	1362

\*\*\* denotes significant at 1 per cent level.

The compound growth rate for production of natural rubber was estimated at 6.56 per cent for whole period of study, which was lower than the CGR (8.69 per cent) estimated for the first decade. Comparatively the estimated production of CGR for the second (6.54 per cent) and third (3.61) decades were lesser to the overall growth rate estimated. The overall estimated compound growth rate of production in India registered at 6.56 per cent per annum, which means the production increased annually by 6.56 per cent. The coefficient of variation in production under natural rubber was estimated at 48.32 per cent over the study period (table 1).

Further the decadal growth analysis for yield of natural rubber in India is inferred in the table 1. The yield grew at an average annual rate of 3.25 per cent for the entire period of study, in the same way a similar growth rate (3.25 per cent) was estimated during the first decade (1981-82 to 1990-91) of the study, when compared to lower rate of growth (3.94 per cent) for second decade (1991-92 to 2000-01). The CGR of yield was much lower (1.83 per cent) during third decadal (2001-02 to 2010-11) period compared to overall period growth rate (3.25 per cent) estimation. It is found from the table that the overall estimated compound growth rate of yield in India registered at 3.25 per cent per annum, which was greater than the CGR estimated for the area at the rate of 2.46 per cent during the same. The co-efficient of variation in yield of natural rubber was estimated at 27.01 per cent over the period under study.

It is concluded that the results revealed, during the period 1981-82 to 1990-91 the tapped area, area, production and yield have registered a positive and significant growth for the selected period. The co-efficient of variation was found to be less in case of taped area, area and yield compared to the production, which indicates that there was no much variation in the parameters under study. The positive growth rate has been recorded for the tapped area, area, production and yield of natural rubber during the period under study.

#### CGR and CV Estimation on Tapped Area, Production and Productivity under Natural Rubber in Major Producing States in India

The tapped area of natural rubber is concentrated only in few states such as Kerala, Tamil Nadu, Karnataka and some North Eastern states in India. Hence, the study is an attempt to assess the real growth on tapped area under natural rubber at different states in India and is presented in the table 2.

TABLE 2: GROWTH AND COEFFICIENT OF VARIATION ON TAPPED AREA UNDER NATURAL RUBBER IN MAJOR PRODUCING STATES IN INDIA (area in ha.)

Year	Parameters	Kerala	Tamil Nadu	Karnataka	Others	Total
1981- 82 to 1990-91	CGR (%)	4.58***	2.26***	5.66***	12.70***	4.53***
	t Stat	10.43	13.40	11.82	10.24	11.46
	CV (%)	14.61	6.91	16.43	34.40	14.33
	Mean	209635	10746	5372	1235	226988
1991-92 to 2000-01	CGR (%)	2.44***	1.29***	5.33***	21.21***	2.72***
	t Stat	10.12	12.08	18.02	17.19	29.50
	CV (%)	7.51	4.00	15.45	59.91	8.13
	Mean	325590	12567	9110	7350	352717
2001-02 to 2010-11	CGR (%)	1.48***	1.20***	2.99***	10.14***	1.97***
	t Stat	7.32	19.22	8.05	42.92	12.16
	CV (%)	4.70	3.64	9.80	28.93	5.99
	Mean	385883	14401	12174	24311	436770
1981-82 to 2010-11	CGR (%)	3.11***	1.49***	4.27***	16.01***	3.33***
	t Stat	17.78	38.54	26.64	40.20	22.79
	CV (%)	25.46	12.92	34.33	99.90	27.18
	Mean	307036	12571	8886	10965	338825

Note: \*\*\* denotes significant at 1 percent level, \*\* significant at 5 percent level.

It is found from the table that the CGR of other states was estimated around 16.01 per cent, which was comparatively very high to the listed states viz., Kerala, Karnataka, and Tamil Nadu during the overall decades of the period under study. The estimated CGR of tapped area of Tamil Nadu was registered at 2.26 per cent, 1.29 per cent, and 1.20 per cent which was very low rate to all specified states and other states in India during first, second, and third decadal period of study. The overall CGR of tapped area at different states in India during 1981-82 to 2010 -11 was estimated around 3.33 per cent, which means the area was increased annually by 3.33 per cent over the study period, this was mainly because of favorable climatic conditions and attained affordable producer's price for natural rubber. It came to understood from the analytical table, even though there was a positive and significant growth in tapped area in all major producing states in India over the past 30 years, the decadal wise growth rates shows a declining trend in the same. The coefficient of variation in tapped area was calculated at 27.18 per cent during the entire period of the study.

The results of growth and coefficient of variation on production under natural rubber in major producing states in India is presented in the table 3 for the period of 30 years from 1981-82 to 2010-11.

TABLE 3: GROWTH AND COEFFICIENT OF VARIATION ON PRODUCTION UNDER NATURAL RUBBER IN MAJOR PRODUCING STATES IN INDIA

Year	Parameters	Kerala	Tamil Nadu	Karnataka	Others	Total
1981- 82 to 1990-91	CGR (%)	7.74***	3.84***	13.39***	20.83***	7.65***
	t Stat	17.38	5.44	13.55	12.37	17.28
	CV (%)	23.74	13.24	38.48	51.15	23.49
	Mean	188379	11368	4058	716	204520
1991-92 to 2000-01	CGR (%)	7.35***	5.51***	8.13***	27.61***	7.52***
	t Stat	17.06	13.47	24.11	22.04	19.66
	CV (%)	20.81	16.76	23.03	73.57	21.32
	Mean	453158	16807	9941	6524	486430
2001-02 to 2010-11	CGR (%)	3.79***	1.59***	5.00***	11.94***	4.02***
	t Stat	6.64	15.24	7.33	24.62	7.92
	CV (%)	11.94	4.84	16.98	34.65	12.37
	Mean	690487	23115	15702	25628	754932
1981-82 to 2010-11	CGR (%)	6.75***	3.64***	7.46***	20.08***	6.79***
	t Stat	24.38	27.36	20.86	38.10	26.37
	CV (%)	49.86	30.61	53.42	111.35	50.40
	Mean	444008	17097	9900	10956	481961

Note: \*\*\* denotes

significant at 1 percent level, \*\* significant at 5 percent level.

It is found from the analytical table, the CGR of production under natural rubber in other states in India was highly estimated at 20.08 per cent which is comparatively far higher to the listed states like, Kerala, Tamil Nadu and Karnataka during overall study period. The estimated CGR of production in Tamil Nadu registered at 3.84 per cent, 5.51 per cent and 1.59 per cent respectively during first, second and third decadal periods of study, which was a very lower rate to all specified and other states in India. The overall CGR of production under Natural rubber in different states of India during 1981-82 to 2010 -11 was estimated at 6.79 per cent which means the production increased annually by 6.79 per cent over the study period, this was mainly because of adoption of modern technology, introduction of modern implements in the plantation works and expected market price for natural rubber was goes on rising trend. The coefficient of variation in production during the overall study period was estimated at 50.40 per cent level.

The growth and coefficient of variation on productivity under natural rubber in major producing states in India is presented in table 4.

TABLE 4: GROWTH AND COEFFICIENT OF VARIATION ON PRODUCTIVITY UNDER NATURAL RUBBER IN MAJOR PRODUCING STATES IN INDIA

Year	Parameters	Kerala	Tamil Nadu	Karnataka	Others	Total
1981- 82 to 1990-91	CGR (%)	3.02***	1.55**	7.33***	7.22***	2.99***
	t Stat	14.57	2.13	5.62	7.87	18.22
	CV (%)	9.12	7.70	24.08	21.66	9.01
	Mean	889	1055	734	547	891
1991-92 to 2000-01	CGR (%)	4.08***	4.17***	2.65***	5.28***	4.67***
	t Stat	14.66	9.86	18.70	11.89	13.23
	CV (%)	12.07	12.93	8.01	15.92	13.71
	Mean	1411	1332	1079	822	1366
2001-02 to 2010-11	CGR (%)	2.28***	0.39***	1.95***	1.63***	2.01***
	t Stat	5.66	4.02	5.88	3.76	5.34
	CV (%)	7.56	1.44	6.72	6.26	6.79
	Mean	1784	1605	1282	1040	1723
1981-82 to 2010-11	CGR (%)	3.50***	2.12***	3.06***	3.51***	3.34***
	t Stat	25.44	16.03	12.72	16.28	25.73
	CV (%)	29.03	18.94	25.15	28.68	27.92
	Mean	1361	1330	1032	803	1327

Note: \*\*\* denotes significant at 1 percent level, \*\* significant at 5 percent level.

It is found from the analytical table, Karnataka (7.33 per cent), other states (5.28 per cent) and Kerala (2.28 per cent) have been registered the highest CGR values compared to other listed states in India during first, second and third decadal study respectively. The overall CGR of productivity under natural rubber at different states in India during 1981-82 to 2010 -11 was estimated at 3.34 per cent, which means the productivity increased annually by 3.34 per cent over the entire study period, this was mainly because of adoption of modern technology, introducing of HYV of seedlings and saplings in the field of rubber plantations. The coefficient of variation in productivity was calculated at 27.92 per cent during the overall period under study. It could be concluded that the overall performance in productivity of natural rubber is quite encouraging, which was increased from 891 kg. per ha. to 1327 kg. per ha. during the past 30 years. Even though, there were some fluctuations in the intervening years, the overall productivity shows gradual increasing trend but the overall growth rate was almost stable.

## CONCLUSION

The overall performance of decadal growth in tapped area, area, production and yield in India has been satisfactory during the past thirty years and the progress was slow during the recent time i.e., 2001-02 to 2010-11. Further, it could be concluded that the growth and coefficient of variation in tapped area, area, production and yield of natural rubber in India is registered a significant and positive signs during the reference period. The growth in area and production of natural rubber in major rubber producing states has been declining. The productivity of rubber in rubber producing states has increased from 891 kg per hector to 1327 kg per hector during the past thirty years. Even though there are some ups and downs, the overall productivity shows increasing trend, but the total growth shows declining trend. Appropriate policy measures have to be undertaken by the concern states in order to sustain the production of rubber in the states.

## SUGGESTIONS AND RECOMMENDATIONS

The overall growth and performance of tapped area, production and productivity under natural rubber in Tamil Nadu state is quite low compared to other listed producing states in India. Therefore, it is suggested that necessary action should be taken by the Government of Tamil Nadu, by the way of forming a separate board for rubber at state level, through which, it may initiate modernized strategies, introduce High Yield Varieties (HYV) of seedlings and sapling, creates awareness regarding technologies & marketing knowledge etc., among the planters.

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