

TO STUDY GROWTH RATE OF AREA, PRODUCTION AND PRODUCTIVITY OF FRUIT CROPS IN JHARKHAND

R.P.Singh* and Nimmy Rani**

Present Paper estimates growth rate of area, production and productivity of fruit crops in Jharkhand. The study revealed positive growth rate in all selected fruits (litchi, mango, guava and banana) except citrus. It has also been observed that among periods, IVth period (2005-10) was found to be favorable for litchi, mango and guava particularly, while negative growth rate was found in banana and citrus. The productivity growth rate was also observed to be positive nearly 2.56 percent, 2.56 percent, 1.50 percent, 5.21 percent respectively in litchi, mango, guava and banana. This trend resulted in positive growth in volume of these fruits in the state. The study further revealed that variability in area was highest in litchi (71 percent) due to shifting in area from other fruit crops in the litchi area followed by mango and banana respectively. Similarly variability in productivity was observed to be high in banana and there was no considerable variation in the yield of other fruit crops.

Keywords: Fruits, Litchi, Citrus

INTRODUCTION

The coverage under fruits in Jharkhand during 2000-01 was about 0.30 lakh hectare which increased to above 0.36 lakh hectare in 2006-07. During this period, area increased at the annual average growth rate of 3.46 percent. Production increased from 2.65 lakh to 4.37 lakh tones i.e. @ 10.78 percent per annum. Yield rate increased from 8.86 tones per hectare to 12.09 tones per hectare and per annum growth rate was 3.65 percent. This indicated that production of fruit increased mainly on account of increase in area and yield during the period. Fruits and vegetables are protective foods and each adult individual should have 175 grams of the same in his daily diet of which 250 grams. (recommended by the Indian Council of Medical Research (ICMR) . Among fruit crops Mango, Guava, Citrus, Banana, Litchi, and papaya are popular in the state. These crops not only promote health of the population and better environment but have also high potential to generate economic betterment and employment too. An attempt has been made under this paper to estimate growth rate of area, production and productivity of important fruit crops of the state. Besides instability/ variability was measured in respect to area, production and yield of these crops in the state.

METHODOLOGY

The study was based on secondary data collected from various sources (various issues like Planning for Agriculture Development of Chotanagpur and Santhal Pargana, Development Strategies and Action Programme, Agricultural development of Jharkhand At a Glance through Figures: 2006, Agricultural Statistics of Jharkhand At a Glance: 2004, Jharkhand Journal of Social Development, Towards Food Secure Jharkhand Vision- 2020). To estimate growth rate of area production and productivity of fruits under study, the periods were grouped into four:

Period I : Represents from 1990-91 to 1995-96.

Period II : Represents from 1995-96 to 1999-2000.

*Director, Centre for Agribusiness Management **student of M-sc. (Ag.) Agricultural Economics, RAC, Birsa Agricultural University, Kanke, Ranchi.

- Period III** : Represents from 2000-01 to 2004-05.
Period IV : Represents from 2005-06 to 2009-2010.
Period V : Represents from 1990-91 to 2009-2010. (Pooled data)

Estimation of Growth Rates

For estimating the growth rates of major fruits crops with respect to [w.r.t] area, production and productivity, compound growth rate model was selected for further analysis.

Compound growth rates of area, production and productivity of fruits between different periods were calculated using the following formula:

$$\frac{P_t}{P_0} = \left[1 + \frac{r}{100} \right]^t$$

Where,

P_t = Area, production and productivity in t^{th} time period

P_0 = Area, production and productivity in the base year

r = Compound growth rate

t = Time in year

Estimation of Co-Efficient of Variation

To examine the stability with respect to area, production and yield of the crops, mean, standard deviation and coefficient of variation were worked out for the four different periods of fruit crops .

$$\text{Coefficient of variation} = \frac{s}{\bar{X}} \times 100$$

Where,

s = standard deviation

\bar{X} = mean of the sample data

$$\text{Standard deviation } [s] = \frac{\sum x}{n-1}$$

Where,

$X = [X_i - \bar{X}]$

N = Number of observation

RESULTS AND DISCUSSION

Growth Rates of Area, Production and Yield

The estimated compound growth rate of litchi, mango, guava, banana and citrus in respect to area, production and yield of the state of the following four periods i.e. period I – 1990-91 to

1995-96, Period II –1995-96 to 2000-01, Period III – 2000-01 to 2005-06, period - 2005-06 to 2009-2010 have been presented in the table no.1.

The overall growth rate in area of different fruit crops revealed that the maximum growth rate per annum was observed in case of litchi and mango being nearly 6.1 percent per and 5.3 percent per annum as compound rate followed by banana 3.48 percent per annum, guava, 2.3 percent per annum respectively. The period wise analysis further revealed that the maximum growth rate of area for all crops, except banana and citrus was observed during period IV in comparison to other periods. The crop wise analysis shows that the growth rate in area of litchi was observed to be high in period IV and it increased at the rate of 23 percent per annum as compound rate. The increase may be attributed to the emergence of National Horticulture Mission in 2004-05 in the state. Against this, area under same crop during period III declined as a rate being -1 percent per annum. In case of mango, the growth rate of area was observed to be high in period IV in comparison to period I, II and period III. The growth rate of area in case of guava was observed to be high in period IV (6.07 percent) and minimum in period II (0.44 percent). In case of banana, the growth rate in area was about 11.67 percent per annum in period III which declined at annual rate of 1.57 percent per annum in period IV. The period I was also favorable for this crop and area under this crop increased at the rate of 2 percent per annum, while the declining growth rate in area of this crop was observed during period II. In case of citrus, the growth rate in area was 2.35 percent per annum in period I, while the declining growth rate in area of this crop was observed during period II, period III and period IV. The decline in area may be due to shifting of area under other fruits and vegetable crops and other climatic factors.

The overall growth rate in production of different fruit crops shows that maximum growth has been exhibited by banana which was 9.09 percent per annum as compound growth rate followed by litchi (8.83 percent), mango (8.08 percent), guava (3.81 percent) and citrus (0.60 percent). Now, the period- wise analysis shows that maximum growth in production was observed during period IV in litchi as well as mango. The crop wise analysis shows the maximum growth was found in litchi throughout the study periods. The other crops showed fluctuating rate in growth of production. The growth was negative for citrus and banana during period IV. The growth was negative for citrus during period II, while during I, the growth for citrus and banana showed positive being 2.37 percent and 21.1 percent as compound growth rate.

The overall compound growth rate in case of yield was observed to be high in banana (5.21 percent) followed by litchi (2.56 percent), mango (2.56 percent) and guava (1.49 percent) and while negative compound growth rate was observed in citrus. The period wise analysis further indicates that growth rate of yield of litchi was negative in period IV. For mango, it was high in period IV and for guava period IV was also favorable from yield point of view. The crop wise analysis indicates that maximum growth in yield of banana occurred in period III while in citrus, it was maximum in period I.

Mean of Area

ha. in period IV. Mean of the area of selected fruits crops is shown in table 2. The average area under mango was estimated to be nearly 7.8 thousand hectare, which was maximum than other fruit crops. The fluctuating trend was observed in the area of mango crop during study period. During period III (2000-01 to 2005-06), the area under this crop was about 7.61 thousand hectare which increased to 11.38 thousand hectare during period IV.

Table 1
Annual Compound Growth in Area, Production
and Productivity of Fruit Crops

(In %)

	PERIOD-I	PERIOD-II	PERIOD-III LITCHI	PERIOD-IV	OVERALL
AREA	2.35	2.1	-1.19	22.73	6.10
PRODUCTION	11.4	4.54	0.38	20.29	8.83
PRODUCTIVITY	8.6	2.38	1.59	-2.02	2.56
			MANGO		
AREA	2.34	4.9	0.24	14.54	5.36
PRODUCTION	3.76	6.84	0.35	22.68	8.08
PRODUCTIVITY	1.38	1.85	-1.1	8.37	2.56
			GUAVA		
AREA	2.41	0.44	0.57	6.07	2.35
PRODUCTION	3.95	5.6	0.64	5.35	3.81
PRODUCTIVITY	1.5	5.22	0.06	-0.69	1.49
			BANANA		
AREA	2.4	1.9	11.67	-1.57	3.48
PRODUCTION	21.1	4.53	13.73	-1.61	9.09
PRODUCTIVITY	17.38	2.57	1.8	0	5.21
			CITRUS		
AREA	2.35	0.88	0.17	-4.98	-0.43
PRODUCTION	2.37	0.76	0.17	-0.86	0.60
PRODUCTIVITY	0.02	-0.12	0	-13.8	-3.66
			OTHERS		
AREA	2.52	28.94	11.88	18.94	4.63
PRODUCTION	4.22	22.28	14.19	-8.2	7.50
PRODUCTIVITY	0.6	-4.23	2.13	13.24	2.74

The table further revealed that the area under litchi was nearly 1.5 thousand hectare in period II which remained constant in period III and increased sharply in period IV as 5.8 thousand hectare. The area under the crop mango in period I was 5.6 thousand hectare which increased to 6.7 thousand hectare in period II, 7.6 thousand in period III and further increased sharply up to 11.3 thousand in period IV. In case of guava, it was found to be nearly 5.2 thousand hectare in period III which increased to 6.1 thousand hectare in period IV. Moreover the ever increasing growth was observed in banana during the study period. In the case of citrus, area decreased from higher level (5.54 thousand ha) to lower level 4.4 thousand.

Table 2
Mean of The Area of Different Fruit Crops

('000' ha)

CROPS	PERIOD I	PERIOD II	PERIOD III	PERIOD IV	OVERALL
LITCHI	1.38	1.54	1.57	5.77	2.6
MANGO	5.63	6.76	7.61	11.38	7.8
GUAVA	4.7	5.03	5.16	6.31	5.3
BANANA	1.43	1.59	2.28	2.79	2.0
CITRUS	4.99	5.39	5.53	4.93	5.0
OTHERS	1.77	4.29	9.2	7.9	5.8

Mean of Production

Mean of the production per year of selected fruit crops has been exhibited in table 3. A perusal of table shows that the overall production of litchi was 21.6 thousand metric tonnes during 1990-91 to 2005-10. The increasing trend was observed throughout the periods in the production of litchi. The average production during period I was recorded to 12.67 thousand metric tonnes, which registered increasing trend in period II and period III and reached to a level of 35.67 thousand metric tonnes during period IV.

Incase of mango, the increasing trend was also observed throughout the periods. The highest production under this crop was recorded during period IV (2004-05 to 2009-10), while minimum production under this crop was observed during period I (1990-91 to 1994-95) and this was probably due to less in area and unfavorable condition. The overall production was recorded to be 100.00 thousand metric tonnes per year in the state.

The increasing trend was observed in the case of guava in all periods. The average production increased from 43.61 thousand metric tonnes to 74.72 thousand metric tonnes in period IV (2004-05 to 2009-10). The average annual production was recorded to be 59.4 thousand metric tonnes. In case of banana, the average production per year was reported to be 36.2 thousand metric tonnes in the state. Under this crop, increasing trend was observed. During period I, the average production was recorded 17.1 thousand metric tonnes which increased to 27.67 thousand metric tonnes and further maintained increasing trend and reached to a maximum level of 55.85 thousand metric tonnes in period IV. It was mainly due to increase in area during the period.

Mean of Yield

The mean yield of the selected fruits crops is presented in table no. 4. The average yield per hectare of litchi was recorded to be 11.5 tonnes per hectare between 1990-91 to 2009-10. The yield was recorded to be highest during period III (12.80 tone/ h.) in the state. In case of mango, the average productivity was recorded to be (11.9 tonnes per hectare). An increasing trend was observed in this crop through out the period .

The average yield of guava was found to be 11.2 tonnes per hectare. In this crop, the average yield in period III was 12.4 which marginally decreased to 12.21 tonnes in period IV. Similarly, the average productivity of banana shows increasing trend during study periods. The average productivity was 17 tonnes per hectare. The decreasing trend was observed in citrus crop. The

average productivity in period III was 10 tonnes which declined to 7.38 tonnes per hectare. The overall average productivity was 9.4 tonnes per hectare.

Table 3
Mean of the Production of Different Fruit Crops

('000' mt. tonnes)

CROPS	PERIOD I	PERIOD II	PERIOD III	PERIOD IV	OVERALL
LITCHI	12.67	17.92	20.09	35.67	21.6
MANGO	59.165	77.27	90.72	172.91	100.0
GUAVA	43.61	55.41	64.02	74.72	59.4
BANANA	17.1	27.67	44.33	55.85	36.2
CITRUS	50.18	54.14	55.39	54.44	53.5
OTHERS	20.06	41.31	88.97	97	61.8

Table 4
Mean of the Yield of Different Fruits

(In tonnes)

CROPS	PERIOD I	PERIOD II	PERIOD III	PERIOD IV	OVERALL
LITCHI	9.07	11.6	12.80	12.60	11.5
MANGO	10.48	11.36	11.56	14.02	11.9
GUAVA	9.25	10.99	12.4	12.21	11.2
BANANA	11.67	17.2	19.14	20.00	17
CITRUS	10.05	10.03	10.00	7.38	9.4
OTHERS	11	10.08	9.5	14.31	11.2

Variability in Area

An analysis of variability in area of major fruit crops is presented in the table no. 5.

Table 5
Standard Deviation and Coefficient of Variation of Area of Different Fruits in Different Period

Crops	Period I		Period II		Period III		Period IV		Overall	
	SD	CV	SD	CV	SD	CV	SD	CV	SD	CV
Litchi	0.08	5.79	0.08	5.19	0.04	2.98	1.36	47.16	1.84	71.33
Mango	0.32	5.76	0.8	11.89	0.04	0.61	3.72	32.68	2.15	27.66
Guava	0.28	5.95	0.05	1.09	0.07	1.43	0.89	14.63	0.60	11.48
Banana	0.08	5.92	0.07	4.7	0.61	26.91	0.11	3.94	0.54	27.33
Citrus	0.29	5.81	0.11	2.18	0.02	0.42	0.62	12.71	0.33	6.73
Others	0.11	6.21	2.41	56.17	2.52	27.35	3.81	48.14	2.93	50.62

S.D. = Standard Deviation (thousand h)

C.V. = Coefficient of variation (percentage)

The two statistical methods are used i.e the standard deviation, which gives absolute measure of variability, and coefficient of variation, which indicates the percentage change in variability. The entire period of study was split into four parts period I (1990-91 to 1995-96), period II (1995-96 to 2000-01), period III (2000-01 to 2005-06), period IV (2005-06 to 2009-10) and overall period (1990-2010). The deviation of total time divided into four periods for measuring variability in area of fruit crops like litchi, mango, guava, banana and citrus.

It is evident from the table no. 05 that the period wise analysis among fruit crops under study, the variability in area was observed to be maximum in mango (3.72 thousand hectares) followed by litchi (1.36 thousand hectare) and citrus (0.62 thousand hectares) during period IV. It was further observed that during period II, the maximum variability was observed in case of mango followed by citrus crop. The maximum variability was observed in case of banana in period III. The overall variability shows that the maximum variability was found in case of mango followed by litchi, guava, banana and citrus, respectively.

The coefficient of variability period wise further indicates that the variability was observed to be high in guava during period I followed by banana. In case of banana, the maximum variability was found in period III, being nearly 27 percent, while in case of litchi and mango, period IV registered maximum percentage. The overall variability analysis indicates that the maximum variability was registered in case of litchi followed by mango and minimum in citrus. The high variability in area of crop especially in litchi and mango may be due to emergence of National Horticulture Mission which focused more on the production of mango and litchi.

Variability in Production

The analysis of variability in production of selected fruit crops is presented in table no.6. The table reveals that the overall variability in terms of quantity was recorded to be high in mango followed by banana and guava and minimum in citrus crop. The period-wise analysis further indicates that in case of litchi the maximum variability (15.4 thousand tonnes) was found in period IV and minimum (0.19 thousand tonnes) in period III. The same trend was also seen in mango and guava. While in case of banana, minimum variability was recorded in period IV and maximum in period III. In case of citrus crop, maximum variability was observed in period I and minimum in period III.

In terms of percentage, the maximum variability was observed in case of mango (43.54%) followed by banana (41.20%), Litchi (39.65%), Guava (19.21%) and citrus (3.72%), respectively. The period-wise analysis further indicates that in case of litchi, the maximum variability was recorded during period IV and minimum in period III. The similar trend was found in mango. While in case of guava, the maximum variability was recorded in period II. In case of banana, maximum variability was recorded in period IV. The analysis further shows that the least variability was recorded in citrus production in period III.

it was found that the overall variability in terms of quantity in case of litchi, mango, guava, banana and citrus was recorded to be nearly 1.12 tonnes, 0.38 tonnes, 0.49 tonnes, 2.16 tonnes and 0.1 tonnes per hectare respectively. The period-wise analysis further revealed that the maximum variability was observed during period I and minimum during period IV in case of litchi, while in case of mango the maximum variability was observed in period IV and minimum in period III. Similarly, the maximum variability was recorded during period II for guava. The yield variability analysis in terms of percentages was observed to be high in case of banana (19.06%) followed by citrus (12.48%), mango (11.05%), litchi (11.70%) and guava (11.21%) during overall period.

The period-wise analysis further reveals that maximum variability in terms of percentage was observed to be high in period IV and minimum in period III in case of citrus. For mango, the minimum variability was found in period III and maximum in period IV (19.82 %). In case of litchi maximum variation was seen in period I (20.30%) and minimum in period III (3.94 %). Similar result was obtain in case of banana. While period II was not favorable for guava.

Table 6
Standard Deviation and Coefficient of Variation of
Production of Different Fruits in Different Period

Crops	Period I		Period II		Period III		Period IV		Overall	
	SD	CV	SD	CV	SD	CV	SD	CV	SD	CV
Litchi	3.27	25.8	1.98	11.04	0.19	0.95	15.4	43.15	8.56	39.65
Mango	5.44	9.2	12.66	16.38	0.79	0.87	81.39	47.06	43.54	43.54
Guava	3.94	8.98	7.58	13.68	1.02	1.6	9.67	12.94	11.41	19.21
Banana	7.54	44.51	3.03	11.03	13.79	31.09	2.26	4.04	14.91	41.20
Citrus	2.94	5.85	1.02	1.88	0.23	0.41	1.18	2.16	1.99	3.72
Others	2.06	10.29	19.19	46.44	28.47	31.99	20.45	21.07	32.16	52.05

S.D. = Standard Deviation (thousand tones)

C.V. = Coefficient of variation (percentage)

Variability in Yield

The yield variability of selected fruit crops is presented in table no. 7.

Table 7
Standard Deviation and Coefficient of Variation
of Productivity of Different Fruits in Different Period

Crops	Period I		Period II		Period III		Period IV		Overall	
	SD	CV	SD	CV	SD	CV	SD	CV	SD	CV
Litchi	1.84	20.33	0.68	5.86	0.5	3.94	0.64	5.1	1.12	11.20
Mango	0.36	3.43	0.52	4.57	0.32	2.76	2.78	19.82	0.38	11.05
Guava	0.34	3.72	1.39	12.64	0.02	0.16	0.21	1.71	0.49	11.21
Banana	4.44	38.04	1.09	6.33	0.85	4.46	0	0	2.16	19.06
Citrus	0.005	0.049	0.03	0.29	0	0	2.62	35.5	0.21	12.19
Others	0.16	1.49	1.08	10.75	0.5	5.26	4.31	30.11	0.76	16.61

S.D. = Standard Deviation

C.V. = Coefficient of variation

CONCLUSION

The study reveals that a positive growth rate in area of all fruit crops has been observed in the state; however growth rate is higher in litchi and low in citrus. The yield growth rate further reveals that there has been a substantial change in the yield of all fruit crops. However, variability in area and yield are quite high in all fruit crops, which affects the volume of production. There is an urgent need to evolve such varieties of fruits which sustained in the farmers fields and maintain sustainable yield.

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