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Growth Analysis of lac Production During XII Plan *VIS*-A-*VIS* XI Plan Period in Jharkhand, India

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ABSTRACT

The study is based on secondary data on lac production during XI and XII Plan. Several econometric factors, including minimum, maximum, mean production, growth rate, % changes in mean value during the XII plan over the XI plan era and its instability were evaluated. Jharkhand state which contributed 38.82% in national production during the XI plan period increased its share to 54.75% during the XII plan. There is a 15.93% increase in % share during the XII plan. The state registered a positive growth rate of 9.85% during the XI plan, declined to -6.07% during the XII plan. District wise per cent change in mean value from XI to the XII plan indicated that Ranchi-Khunti district recorded the highest increase to the extent of 134% followed by Gumla (45 %) Simdega (27%) and Singbhum (27%). However, there is a general decline in a few districts and the highest decline was recorded in Latehar (-69%) followed by Garhwa (68%) and Palamau (-3%). The state as a whole recorded a 61% increase in mean value over the XI plan.

Keywords *Butea monosperma*, Jharkhand state, Lac Production, *Schleichera oleosa*, Shellac.

INTRODUCTION

Forestry is an important sector that contributes significantly to the Indian economy. India's forest industry accounts for 1.2% of the country's GDP. According to estimates, 25% of the world's population rely on forest resources to some extent for their survival, with 350 million people living in or near dense forest areas and relying heavily on them for subsistence or livelihood. For their primary health and nutritional needs, almost 80% of people in developing nations rely on Non-Wood Forest Products (NWFPs), such as fruits and herbs. India is the world's biggest supplier of Non-Wood Forest Products (NWFPs)-based raw materials for the food, paint, varnish, cosmetics and pharmaceutical industries. In India, there are approximately 621.4 million lac host trees, but only about 5% of this vast inoculable land is used for production. Using the maximum capacity of existing host plants

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for lac cultivation with recommended technology could be a good method for reducing migration and increasing local job opportunities. As a result, the income level and as a result, the standard of living of tribal farmers may improve. Lac is an important source of income for forest and sub-forest people (Jaiswal *et al.* 2006, Borah and Garkoti 2019). Lac's demand potential is well known due to its widespread use in several industries. The principal lac host plants in India include *Schleichera oleosa*, *Ziziphus mauritiana*, and *Butea monosperma*. *Schleichera oleosa* is best suited for *Kusmi* lac, while *Butea monosperma* is best suited for *Rangeeni* lac. *Ziziphus mauritiana* is suitable for both *Rangeeni* and *Kusmi* lac but only during a specific season. Forest dwellers safeguard these trees for their long-term survival because of their economic importance. Each lac insect strains have two crop cycles per year; the *Rangeeni* summer crop begins in October-November and matures in June-July, encompassing eight months. The *Rangeeni* rainy crop begins in June-July and ends in October-November, a four-month period. Although the *Rangeeni* summer crop matures in June-July, producers often harvest the ari crop in April. In the same way, the *Kusmi* summer crop begins in January-February and finishes in June-July. *Kusmi*'s winter crop blooms from June to July and ripens in January and February. Several studies have been carried out on growth analysis of lac production during past years (Saha and Jaiswal, 1993; Jaiswal and Saha 1998 Jaiswal *et al.* 1999 Jaiswal *et al*. 2011a, b, 2012, Jaiswal and Singh 2014d). Jharkhand remained a forest-rich state with significant minor forest produce. Lac production is another key source of income, primarily for forest and sub-forest people. The assessment of the potential and performance of different districts in terms of lac production would aid in the development of a strategy to improve livelihood opportunities in the state. With this in mind, secondary data on lac production has been analyzed crop by crop and district by the district for the XIth and XIIth plan periods to examine the trend.

MATERIALS AND METHODS

The crop by crop and district by district secondary data on lac production, pertaining to the year 2007-08 to 2011-12 and 2012-13 to 2016-17 have been collected from published information namely Annual Lac Bulletin, Directorate of Lac Development, Ranchi; Lac Bulletin, Indian Lac Research Institute, Ranchi (Pal *et al*. 2006, 2007, 2008, 2009, 2010, 2011) and various issues of "Lac, Plant and Resins and Gums Statistics: At a glance" (Pal *et al*. 2012, 2013 Yogi *et al*. 2014, 2015, 2017, 2018, 2020). Eight major lac growing districts of Jharkhand state and a few other districts categorized as others have been covered under the study. Minimum, maximum, mean values, growth rate (simple) and instability in lac production were considered as standard parameters for each district. The compound growth rate for lac production has been calculated as per the standard procedure. The percentage change in mean value from XI plan to XII plan period was also calculated. The standard approach was used to calculate the compound growth rate for lac production. ACGR and the instability index were estimated through secondary data analysis. The Annual Compound Growth Rate (ACGR) was worked out by fitting the exponential function given below:

$Y = ab^t$

{Y = The dependent variable (export), a = Constant term, b = Regression coefficient, t = Time variable in years}.

The equation rewritten in the logarithmic form as follows

log Yti = log a + tj log bij {where, Yt = export of jth commodity in th year, ACGR in % (r) = (Antilog of log b-1) x 100 Where, r = Compound growth rate per annum (%)}.

It was also estimated the percentage change in mean value from the XI plan to the XII plan period. The coefficient of variation (CV) often contains the trend component and thus overestimates the level of instability in time series data characterized by long-term trends. To overcome this problem, the instability index given by Cuddy and Dell (1978) was applied which corrects the co-efficient of variation. The instability index was estimated by using the equation given below:

Instability index = $CV*\sqrt{(1-R^2)}$

{Where, CV = Co-efficient of variation, R^2 = Co-efficient of determination of the trend equation}

Trend equation (linear) is given as

Y = a+bt {wherein Y = NRGs export, b = Regression

coefficient and t = Time}

RESULTS AND DISCUSSION

A perusal of data indicated that during the XII plan, the average state production was 10,147 tons per annum. The minimum production was 8,630 tons and a maximum of 12,207 tons per annum during these five years. During the XI plan, however, the average production was 6,306 tons. It means the production increased to 60.91% from the XI plan. Amongst different districts, the highest production was recorded in the Ranchi district followed by Simdega, Khunti, Gumla, West Singbhum, Palamau, Latehar and Garhwa. The mean production of the state is nearly 16.9% less than the maximum value recorded during the XII plan. It means at least this much production can be achieved easily by some key interventions. Minimum production value indicated that this much production is ensured without much effort. As evident, the Ranchi district alone contributes around 28.31% of state lac production. Khunti is the newly created district during the XII plan. Before this, production data of Khunti was included in the Ranchi district. After Ranchi, Simdega contributes 22.10% followed by Gumla (17.58%), Khunti (14.77%), West Singbhum (8.61%) and others. Ranchi+Khunti districts together increased their share of in-state production during the XII plan. All eight districts reduced their share in states total production. A comparison of annual average production of both plan periods indicated a decline in Palamau, Latehar and Garhwa district but their collective share in-state production is only around 3%. In other districts, the per cent increase in production was highest for Ranchi- Khunti (134 %) followed by Gumla, Simdega and West Singhbhum. The state as a whole produced around 15.30% *Rangeeni* and 84.70% *Kusmi* lac. Palamau and Garhwa are purely *Rangeeni* lac producing districts. Whereas, in Latehar around 35.31% share is from *Rangeeni* lac. While other districts produced mainly *Kusmi*. These include Ranchi (84.44%), Khunti (79.26%), Gumla (96.46%), West Singbhum (83.75%) and Simdega districts (95.09%).

A comparison of data on the mean value for the XI and XII plan indicated that there is a 61% increase in lac production during the XII plan in the state. In respect of *Rangeeni* lac, the overall change remained stable during the XII plan *vis*-a-*vis* the XI plan. However, there was a 17, 15, 29 % increase in mean value in Ranchi-Khunti, West Sighbhum and Simdega district respectively during the XII plan. Contrary to this, Gumla, Latehar, Palamau and Garhwa recorded 24, 69, 33 and 68% reduction in mean value respectively during the XII plan. In respect of *Rangeeni* summer crop, Palamau is the only district that records higher decline during the summer season in comparison to rainy crop. This district is dry and prone to high temperatures during the summer season. Districts that witnessed increased production of *Rangeeni* summer crops include Ranchi-Khunti, West Singhbhum and Simdega. While Gumla, Latehar, Palamau and Garhwa registered decreased production during the XII *vis*-à-*vis* XI plan. The increased *Rangeeni* rainy crop was recorded in Ranchi-Khunti and Simdega districts. While decreased production was witnessed in Gumla, West Singhbum, Latehar, Palamau and Garhwa districts (Table 1).

The *Kusmi* lac production increase by 81% over the XI plan but it was an overall stable situation for *Rangeeni* lac in the state. Similarly, in respect of *Kusmi* lac crop, Ranchi-Khunti recorded the highest increase in mean value (195%) followed by Gumla, West Singbhum and Simdega. The increase in mean per cent was more for *Kusmi* winter crop in Gumla, West Singbhum and Simdega. However, in the Ranchi-Khunti district, a per cent increase was more for *kusmi* summer crop. This was possibly due to the fact that in the Ranchi and Khunti district, *kusmi* brood lac is readily available from *Z. mauritiana* for inoculation of *Kusmi* summer crop. Besides this, Ranchi and Khunti is relatively low-temperature zone during the summer season than Gumla, West Singbhum and Simdega. Hence, there is little possibility of high temperature during summer, resulting in better survival of lac crop (Table 1).

The state recorded 14.65% instability in production during these five years. Only Khunti (13.12%) and West Singbhum districts (8.73%) registered lower instability than the state figure. The rest of the districts registered higher instability. Garhwa district recorded the highest instability in production

Table 1. Mean (tons), per cent share and change in lac production during XII plan *vis*-à-*vis* XI plan periods in Jharkhand.

Districts	Plan period	Attributes	*Rangeeni* Summer	Rainy	Total	*kusmi* Summer	Winter	Total	Grand total
Whole state	XI	Mean	780	768	1548	2360	2398	4758	6306
	XII	Mean	806	747	1553	4989	3605	8594	10,147
	XII	% Share	7.94	7.36	15.30	49.17	35.53	84.70	100
	XI-XII	% Change	3	-3	0	111	50	81	61
Ranchi	XI	Mean	376	283	659	706	540	1246	1905
	XII	Mean	244	203	447	1578	848	2426	2873
	XII	% Share	8.49	7.07	15.56	54.93	29.52	84.44	100
	XI-XII	% change	-35	-28	-32	124	57	95	51
Khunti	XI*	-	-	-	-	-	-	-	-
	XII	Mean	206	121	327	824	426	1250	1577
	XII	% Share	13.06	7.67	20.74	52.25	27.01	79.26	100
Ranchi + Khunti	XI	Mean	376	283	659	706	540	1246	1905
	XII	Mean	450	324	774	2402	1274	3676	4450
	XII	% Share	10.11	7.28	17.39	53.98	28.63	82.61	100
	XI-XII	% change	20	14	17	240	136	195	134
Gumla	XI	Mean	25	38	63	837	884	1721	1784
	XII	Mean	32	51	83	700	450	1150	1233
	XII	% Share	1.40	2.14	3.54	46.91	49.55	96.46	100
	XI-XII	% change	-22	-25	-24	20	96	50	45
West Singhbhum	XI	Mean	66	58	124	338	230	568	692
	XII	Mean	108	34	142	349	383	732	874
	XII	% Share	12.36	3.89	16.25	39.93	43.82	83.75	100
	XI-XII	% change	64	-41	15	3	67	29	26
Simdega	XI	Mean	37	73	110	1114	1018	2132	2242
	XII	Mean	35	50	85	1000	684	1684	1769
	XII	% Share	1.65	3.26	4.91	49.69	45.41	95.09	100
	XI-XII	% change	6	46	29	11	49	27	27
Latehar	XI	Mean	30	50	80	-	-	-	-
	XII	Mean	11	14	25	11	34	46	71
	XII	% Share	15.54	19.77	35.31	16.10	48.59	64.69	100
	XI-XII	% change	-63	-72	-69				
Palamu	XI	Mean	127	145	272	272	272	272	272
	XII	Mean	48	133	181	0	31	31	212
	XII	% Share	22.64	62.74	85.38	0.00	14.62	14.62	100
	XI-XII	% change	-62	-8	-33	-100	-89	-89	-22
Garhwa	XI	Mean	46	79	125				
	XII	Mean	15	26	41				
	XII	% Share	37	63	100				
	XI-XII	% change	-67	-68	-68				
Others	XI	Mean	38	42	80	46	108	154	234
	XII	Mean	114	114	228	137	108	136	473
	XII	% Share	24.10	24.10	48.20	28.96	22.83	28.75	100
	XI-XII	% Change	200	171	185	198	0	-12	102

(59.01%) followed by Latehar (52.87%), Palamau (46.86%), Gumla (28.44%), Ranchi (15.35%), Simdega (14.8%), Khunti (13.12%) and West Singhbhum (8.73%).

Though the mean value from the XI plan to XII plan increased but the state registered negative growth of 6.07% per annum in lac production during the XII plan period. Except Latehar and Ranchi districts all major lac producing districts recorded negative growth during the XII plan period. Latehar district which contributes merely around 0.7% registered a 13.14% growth rate per annum, whereas Ranchi only has 1.09% growth. The highest negative growth was

Table 2. The compound annual growth rate for lac production during XII plan *vis*-a-*vis* XI plan in Jharkhand state.

Districts	Plan period	*Rangeeni* Summer	Rainy	Total	*Kusmi* Summer	Winter	Total	Grand total
Whole state	XI	-0.32	-22.08	-11.63	20.67	22.47	21.8	9.85
	XII	-21.18	-22.72	-21.81	-5.92	0.36	-3.36	-6.07
Ranchi	XI	6.52	-15.41	-3.71	60.37	14.78	35.13	17.19
	XII	-11.53	-15.98	-13.41	-0.53	13.71	4.60	1.09
Gumla	XI	2.26	-41.58	-25.18	8.2	3.8	6.52	3.29
	XII	-35.48	-27.52	-29.05	-18.12	-8.67	-13.17	-13.53
West Singhbhum	XI	1.92	-18.77	-6.7	0.41	-12.77	-7.02	-6.89
	XII	-25.28	-38.16	-27.11	-8.52	9.12	0.00	-4.50
Simdega	XI	-6.7	-37.87	-25.16	56.19	23.99	37.63	31.14
	XII	-14.52	-12.98	-13.39	-9.23	-2.92	-6.39	-6.71
Latehar	XI	-41.13	-39.02	-39.88				-39.02
	XII	-25.10	-22.00	-23.35	-36.90	54.99	29.73	13.15
Palamau	XI	-23.29	-25.1	-24.46	-	-	-	-24.46
	XII	-33.87	-41.13	-38.80	-	48.23	48.23	-18.88
Garhwa	XI	-29.58	-37.57	-34.8	-	-	-	-34.8
	XII	-27.99	-42.12	-35.58	-	-	-	-35.58
Others	XI	47.88	20.11	33.57	10.89	-10.89	-3.97	12.24
	XII	-26.75	-31.00	-28.05	7.77	10.20	8.80	-8.78

recorded in Garhwa district followed by Palamau, Gumla, Simdega and West Singbhum district in that order during the XII plan. Overall, the increasing trend in the state lac production which was very fast during the XI plan (9.85% per annum) showed a declining trend during the XII plan (-6.07% per annum). Latehar is the only district that showed a declining trend during the XI plan but recorded an upward trend during the XII plan. Conversely, districts that recorded positive trends during the XI plan but recorded negative during the XII plan include Gumla and Simdega (Table 2).

The state registered negative growth of *Rangeeni* lac production to the extent of 21.81% and 11.63% per annum during XII and XI plan period respectively. The highest negative growth rate for *Rangeeni* lac was recorded in Palamau followed by Garhwa, Gumla, West Singhbhum, Latehar, Ranchi, Simdega during the XII plan. A similar negative growth rate was recorded during the XI plan also. Considering the overall situation of the state, the rainy crop of *Rangeeni* declined faster (-22.72%) than *Rangeeni* summer (-21.18%) season crop. A comparison of trend between the XI and XII plan for *Rangeeni* summer crop revealed that during the XI Plan, the growth rate was only to the extent of -0.32% but the corresponding figure during the XII plan become -21.18%. However, for *Rangeeni* rainy crops, the trend is more or less the same during XI and XII Plan. The state registered negative growth of *Kusmi* lac production to the extent of -3.36% and 11.63% per annum during XII and XI plan period respectively. Ranchi is the only district that witnessed positive growth for *Kusmi* lac production during both plan periods. But in Gumla and Simdega positive growth recorded during the XI plan, become negative during the XII plan. West Singbhum recorded negative growth during the XI plan become stable in the XII plan. Similarly, *Kusmi* summer crop recorded a negative trend (-5.92%) but *Kusmi* winter crop remained more or less stable (0.36%) during the XII Plan. The *Kusmi* summer crop which recorded an upward trend (20.67 %) during the XI plan, showed a declining trend (-5.92%) during the XII Plan. However, for *Kusmi* winter crop, which witnessed a 22.47% increase per annum during the XI plan, registered a more or less stable situation during the XII plan (Table 2).

CONCLUSION

The study showed negative growth during the XII plan period in the state, though an increasing trend

was visible during the XI plan. The comparison of mean value between both periods indicated a substantial increase in *Kusmi* lac production from XI plan to XII plan. The highest increase was recorded in Ranchi-Khunti district followed by Gumla, Simdega and West Singbhum district. *Rangeeni* lac production declined in all districts. Jharkhand is one of the most potential states for lac production having a strength of a large number of three most important commercial host tree species, skill manpower on this aspect, presence of research institute on this intervention, marketing capital for lac in an adjacent state (Balrampur in Purulia district of West Bengal), Govt support institution like TRIFED, JASCOLAMPF, state-run livelihood programe for lac farmers. Shrinking production of *Rangeeni* lac in many districts of the state is a challenging issue as farmers protect *B. monosperma* (a *Rangeeni* lac host tree species) due to its economic importance. We can prevent the forest of *B. monosperma* by utilization for lac production. More efforts are required to reduce the cost of production and enhance productivity. Shifting of *Kusmi* lac cultivation from *Rangeeni* on *Z. mauritiana* is also one of the important reasons for the downfall of *Rangeeni* lac and the increase in *Kusmi* lac production. The possibility should be also explored for loans, subsidy and crop insurance so that sustainable lac production is achieved by the state. Action may also be initiated for intensive farming of lac by planting trees on a line of sericulture. Besides this, border planting of *Z. mauritiana* on paddy fields is also suggested, which will increase *Kusmi* broodlac production and ultimately enhance the availability of *Kusmi* broodlac for inoculation of more trees of *S. oleosa* during summer season. It is also suggested to use *Z. mauritiana* trees for lac production where *B. monosperma* species is available and for *Kusmi* broodlac production in areas where *S. oleosa* trees are available along with *Z. mauritiana*. In areas where only *Z. mauritiana* is available, this can be utilized for *Kusmi* broodlac production by transporting *Kusmi* broodlac derived from *S. oleosa*. This strategy will help to enhance the production of both varieties of lac.

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