Research Article

FARM SIZE AND PRODUCTIVITY OF RUBBER PLANTATION IN NAGALAND

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ARTICLE INFO	ABSTRACT
	Rubber farming has become one of the important aspects for sustainable livelihood in an agrarian economy and has become a driving force for economic development of a country. In the global context, India has become one of the leading producers of natural rubber product next to Malaysia. In India, states like Kerala and Tripura, rubber farming has become a major source of employment and income generation for the rural people. In Nagaland, majority of the people still depends on agriculture and allied activities for their livelihood. However, people are still dependent on jhumming which are mostly of subsistence rather than commercial. Thus, rubber farming is gaining momentum as an alternative to jumming cultivation in almost every district of the state. Therefore, this paper tries to examine the relationship between farm size and productivity of rubber by taking 60 rubber farmers as a sample from the two districts (Wokha and Mokokchung). The result of the analysis shows that there is a high correlation between farm size and rubber production in the state.

INTRODUCTION

Rubber farming is an important activity under the agrarian system of economy in India. In the year 2017-18, about 694,000 tonne of natural rubber was produced in India as compared to 691,000 tonne during 2016-17, with a marginal growth of about 0.4 percent[1]. India has about 6000 units which falls under three categories, viz, large, medium and small scale units, out of which about 93.3 percent are small units[2]. According to the Rubber Board of India, about 12.2 lakh farmers holds for less than 10 hectares which is about 90 percent of the 7.35 lakh hectares under rubber cultivation. Majority of the holding falls under small size with an average size as small as 0.55 hectare (1.4 acres)[3]. In terms of the extent of tapped area, it increased from about 445,000 ha in 2016-17 to 479,000 ha in 2017-18 while the average yield per hectare of tapped area during 2017-18, declined marginally to 1,449 kg/ha from 1,553 kg/ha in 2016-17[4]. Rubber plantation has been identified as an important cash crops and prospective agro-based industry in Nagaland. According to Department of Land Resource, there are about 11,000 hectares under rubber plantations in the state with around 45 lakh standing tress at various stages of growth[5]. Thus it is necessary to study the total production and it relationship with farm size. Productivity of rubber farming, like any other form of farming, depends on multiple factors. Farm size is one of the main factors determining the productivity in rubber farming. There have been numerous studies done to establish a relationship between farm size and productivity in India following the study by A.K. Sen around the 1960's[6], which revealed an inverse relationship between productivity and farm size.

METHODOLOGY

The study is based on a primary data collected from a sample of 60 rubber farmers with 30 farmers selected each from the districts of Wokha and Mokokchung. Personal interview and questionnaires were used to collect the data. Secondary sources such as books, journals and government websites are used in this study.

RESULTS AND DISCUSSION

Under the study area a total of 144.5 hectare are under rubber farming with an average holding of 2.4 hectare per rubber farmer. The tapping of rubber trees starts only from 8 years. Thus, the production of rubber was calculated from the 8th years till 34 years. Moreover, the production of rubber trees are divided in three blocks – 8-10 years, 11-31 years and 32-34 years, according to the number of trees tapped during each period. The production and productivity of rubber for each period under different farm size are shown in table no 1.

Farm size and productivity (8-10 Years)

The production/yield of smoked rubber sheet in terms of Kg. for the state is well explained in the table No. 1. The total area under rubber cultivation in the study area for the state is 144.5

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hectares. In this area of cultivation, a total of 832725 Kg of rubber sheet is produced for this period of three years, and the productivity or yield per hectare is 5762Kgs for the same period. The overall correlation between size of farming and production of rubber sheet for the State shows a positive relationship with r=0.99. Since the value of r is more than six times the probable error (P.Er=0.0017), the co-efficient of correlation between farm size and productivity is significant which shows that as the size of farm increases, the productivity of rubber also increases. The co-efficient of determinants on r2 value shows that 98% of the variation in employment is explained by the farm size X. The regression values of Production (Y) on farm size (X) gave us.

Y= a+bx,   Y= -186.515 + 5830.841X

The result shows that the regression co-efficient byx is 5830.841. This explains that a unit change in Farm Size will lead a change in Production by 5830.841. The p-value of 'byx' is 3.286E-50 which is less than 0.05. Therefore, the regression co-efficient is significant at 5%.

Small Farm Size

Under small size of holding for the state, the total area under rubber plantation in the study area is 30 hectares. The total production under this area for this period of three years is 230625Kgs which is converted to smoked rubber sheet and ready for delivery, and the yield per hectare is 5765.63 Kgs during the same period. The correlation between size of farming and production of rubber sheet for the State under small size of holding shows a positive relationship with r=0.86. The co-efficient of determinants on r2 value shows that 74% of the variation in Production is explained by the farm size X. The regression values of Production (Y) on farm size (X) gave us.

Y= a+bx,   Y= -4254.74 + 8961.159X

The result shows that the regression co-efficient byx is 8961.159X. This explains that a unit change in Farm Size will lead a change in Production by 8961.159. The p-value of 'byx' is 1.63E-09 which is less than 0.05. Therefore, the regression co-efficient is significant at 5%.

Medium Farm Size

Under Medium size of holding for the state, the total area under rubber plantation in the study area is 55.5hectares. The total production under this area for this period of three years is 323100 Kgs. which is converted to smoked rubber sheet and ready for delivery, and the yield per hectare is 5821.62 Kgs. The correlation between size of farming and production of rubber sheet for the State shows a positive relationship with r=0.82. The co-efficient of determinants on r2 value shows that 67% of the variation in Production is explained by the farm size X. The regression values of Production (Y) on farm size (X) gave us.

Y= a+bx,   Y= 1423.089 + 5235.191X

The result shows that the regression co-efficient byx is 5235.191X. This explains that a unit change in Farm Size will lead a change in Production by 5235.191. The p-value of 'byx' is 441E-06 which is less than 0.05. Therefore, the regression co-efficient is significant at 5%.

Large Farm Size

Under Large size of holding for the state, the total area under rubber plantation in the study area is 49hectares. The total production under this area for this period of three years is 279000 Kgs. which is converted to smoked rubber sheet and ready for delivery, and the yield per hectare for the same period is 5693.88 Kgs. The correlation between size of farming and production of rubber sheet for the State shows a positive relationship with r=0.99. The co-efficient of determinants on r2 value shows that 98% of the variation in Production is explained by the farm size X. The regression values of Production (Y) on farm size (X) gave us.

Y= a+bx,   Y= -2172.41 + 6037.931X

The result shows that the regression co-efficient byx is 6037.931X. This explains that a unit change in Farm Size will lead a change in Production by 6037.931. The p-value of 'byx' is 2.98E-06 which is less than 0.05. Therefore, the regression co-efficient is significant at 5%.

Farm size and productivity (11-31 Years)

At this stage, all the standing rubber tree starts tapping. Thus, a total of 8697150 Kg of rubber sheet is produced for this period of 21 years, and the productivity or yield per hectare for the same period is 60187 Kgs. The overall correlation between size of farming and production of rubber sheet for the State shows a positive relationship with r=0.99. Since the value of r is more than six times the probable error (P.Er=0.0017), the co-efficient of correlation between farm size and productivity is significant which shows that as the size of farm increases, the productivity of rubber also increases. The co-efficient of determinants on r2 value shows that 98% of the variation in Production is explained by the farm size X. The regression values of Production (Y) on farm size (X) gave us.

Y= a+bx,   Y= -186.515+ 5830.841X

The result shows that the regression co-efficient byx is 5830.841. This explains that a unit change in Farm Size will lead a change in Production by 5830.841. The p-value of 'byx' is 3.28E-50 which is less than 0.05. Therefore, the regression co-efficient is significant at 5%

Small Farm Size

Under Small size of holding for the state, the total area under rubber plantation in the study area is 40 hectares. The total production under this area for this period of 21 years is 2327850 Kgs. which is converted to smoked rubber sheet and ready for delivery, and the yield per hectare for the same period is 58196 Kgs. The correlation between size of farming and production of rubber sheet for the State shows a positive relationship with r=0.86. The co-efficient of determinants on r2 value shows that 74% of the variation in Production is explained by the farm size X. The regression values of Production (Y) on farm size (X) gave us.

Y= a+bx,   Y= -11442.9+ 66628.39X

The result shows that the regression co-efficient byx is 66628.39X. This explains that a unit change in Farm Size will lead a change in Production by 66628.39. The p-value of 'byx' is 1.87E-09 which is less than 0.05. Therefore, the regression co-efficient is significant at 5%.

Medium Farm Size

Under Medium size of holding for the state, the total area under rubber plantation in the study area is 55.5hectares. The total production under this area for this period of 21 years is 3403575 Kgs. which is converted to smoked rubber sheet and ready for delivery, and the yield per hectare for the same period is 61325 Kgs. The correlation between size of farming and production of rubber sheet for the State shows a positive relationship with r=0.89. The co-efficient of determinants on r2 value shows that 80% of the variation in Production is explained by the farm size X. The regression values of Production (Y) on farm size (X) gave us.

$$Y= a+bx, \qquad Y= 18007.17+ 54111.78X$$

The result shows that the regression co-efficient byx is 54111.78. This explains that a unit change in Farm Size will lead a change in Production by 54111.78. The p-value of 'byx' is 3.22E-08 which is less than 0.05. Therefore, the regression co-efficient is significant at 5%.

Large Farm Size

Under Large size of holding for the state, the total area under rubber plantation in the study area is 49hectares. The total production under this area for this period of 21 years is 2965725 Kgs. which is converted to smoked rubber sheet and ready for delivery, and the yield per hectare for the same period is 60525 Kgs. The overall correlation between size of farming per hectare and production of rubber sheet for the State shows a positive relationship with r=0.99. The co-efficient of determinants on r2 value shows that 98% of the variation in Production is explained by the farm size X. The regression values of Production (Y) on farm size (X) gave us.

$$Y= a+bx, \qquad Y= -2172.41 + 6037.931X$$

The result shows that the regression co-efficient byx is 6037.931X. This explains that a unit change in Farm Size will lead a change in Production by 6037.931. The p-value of 'byx' is 2.98E-06 which is less than 0.05. Therefore, the regression co-efficient is significant at 5%.

Farm size and productivity (32-34 Years)

At this stage, not all rubber trees will be tapped except for those trees which were planted as an extension i.e 32-34 years. The total production of smoked rubber sheet in terms of Kg was found to be 409725 Kg of rubber sheet is produced for the period, and the productivity or yield per hectare is 2835 Kgs. The overall correlation between size of farming and production of rubber sheet for the State shows a positive relationship with r=0.96. The co-efficient of determinants on r2 value shows that 93% of the variation in Production is explained by the farm size X. The regression values of Production (Y) on farm size (X) gave us.

$$Y= a+bx, \qquad Y= -4603.99+ 62051.31X$$

The result shows that the regression co-efficient byx is 62051.31X. This explains that a unit change in Farm Size will lead a change in Production by 62051.31. The p-value of 'byx' is 3.61E-57 which is less than 0.05. Therefore, the regression co-efficient is significant at 5%

Small Farm Size

Under Small size of holding for the state, the total production under this area for this period of 3 years is 101925 Kgs. which is converted to smoked rubber sheet and ready for delivery, and the yield per hectare for the same period is 2548 Kgs. The correlation co-efficient comes out to be .15 which is not significant. Therefore, we reject the hypothesis stating that higher the farm size higher is the production in case of small farm size in the State.

Medium Farm Size

Under Medium size of holding for the state, the total production under this area for this period of 3 years is 163125 Kgs. which is converted to smoked rubber sheet and ready for delivery, and the yield per hectare for the same period is 2939 Kgs. The correlation between size of farming per hectare and production of rubber sheet for the State under Medium Size of Holding shows a positive relationship with r=0.56. The co-efficient of determinants on r2 value shows that 31% of the variation in Production is explained by the farm size X. The regression values of Production (Y) on farm size (X) gave us.

$$Y= a+bx, \qquad Y= 1149.363 + 2495.064X$$

The result shows that the regression co-efficient byx is 2495.064X. This explains that a unit change in Farm Size will lead a change in Production by 2495.064. The p-value of 'byx' is 0.008183 which is less than 0.05. Therefore, the regression co-efficient is significant at 5%.

Large Farm Size

Under Large size of holding for the state, the total production under this area for this period of 3 years is 144675 Kgs. which is converted to smoked rubber sheet and ready for delivery, and the yield per hectare for the same period is 2952 Kgs. The correlation between size of farming per hectare and production of rubber sheet for the State under large size of holding shows a positive relationship with r=0.95. The co-efficient of determinants on r2 value shows that 90 percent of the variation in Production is explained by the farm size X. The regression values of Production (Y) on farm size (X) gave us.

$$Y= a+bx, \qquad Y= -411.207+ 3028.966X.$$

The result shows that the regression co-efficient byx is 3028.966X. This explains that a unit change in Farm Size will lead a change in Production by 3028.96. The p-value of 'byx' is 0.000204 which is less than 0.05. Therefore, the regression co-efficient is significant at 5%.

Table 1 Farm size and productivity (Kg wise)

YEARS	Size of holding	Household	Total Hectare	Total tree Tapping	Total Production
8-10 years	Small	30	40 (1.33)	10250	230625 (5765.63)
	Medium	22	55.5 (2.52)	14360	323100 (5821.62)
	Large	8	49 (6.12)	12400	279000 (5693.88)
	Total	60	144.5 (9.97)	37010	832725 (5762.8)
11-31 years	Small	30	40 (1.33)	14780	2327850 (58196)
	Medium	22	55.5 (2.52)	21610	3403575 (61325)
	Large	8	49 (6.12)	18830	2965725 (60525)
	Total	60	144.5 (9.97)	55220	8697150 (60187)
32-34 Years	Small	30	40 (1.33)	4530	101925 (2548)
	Medium	22	55.5 (2.52)	7250	163125 (2939)
	Large	8	49 (6.12)	6430	144675 (2952)
	Total	60	144.5 (9.97)	18210	409725 (2835)
	Grand Total	60	144.5 (9.97)	110440	9939600 (68784.8)

Source: Field Survey 2016-17

CONCLUSION

Rubber farming has been widely practice in Nagaland as it has been an important source of livelihood in the state. From the above study it can be seen that farm size and productivity has a significantly correlated. This shows that as the farm size increases, the productivity of rubber also increases. The study also shows that comparatively, the large size of holding has the highest yield per hectare per annum. For the first period (8-10 years) the correlation was found to be highest among the large farm size. The productivity was 5762 kg per hectare and it was found that medium size holding has the highest productivity. For the second period (11-31 years) the correlation was found to be highest among the large farm size. The productivity was 60187 kg per hectare and it was found that medium size holding has the highest productivity. For the third period (32-34 years) the correlation was found to be highest among the large farm size. The productivity was 2835 kg per hectare and it was found that medium size holding has the highest productivity. It is also found that the medium size of holding has the highest (38.40 percent) percentage of land under rubber cultivation while the small size of holding (27.68 per cent) has the least percentage of land under rubber cultivation. Thus, farm size has positive impact on productivity of rubber farming in Nagaland.

Reference

Government of India (2018). Annual Report (2017-18), The Rubber Board, Ministry of Commerce and Industry, GOI, Kottayam. Retrieve from www.rubberboard.org.in/rbfilereader? fileid=259

Indianmirror.com, (2019). Indian Rubber Industry, Viewed 26 Jun. 2019, from www.indianmirror.com/indian-industries/rubber.html

Firstpost.com, (2016). Firstpost Ground Report: India's 1.2 million rubber farmers fight to survive as idle plantations begin to look like forests – Firstpost, Viewed 22 Jun. 2019, from www.firstpost.com/india/firstpost-ground-report-indias-1-2-million-rubber-farmers-fight-to-survive-as-idle-plantations-begin-to-look-like-forests-2711224.html

News.webindia123.com. (2014), Nagaland rubber plantation gaining popularity. Viewed 27 Jun. 2019, from www.news.webindia123.com/news/articles/India/20140530/2400875.html

Morung Express (2015), 11000 hectares of rubber plantations developed in Nagaland, Morung Express, 05 April 2015, Viewed 15 July 2019, from www.morungexpress.com.

Sen A K (1964), Size of Holdings and Productivity, the Economic Weekly, February 1964, pp 323-326

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