Assessing Socio-economic and Modernization Status of Rubber (*Hevea brasiliensis*) Growers: Evidence from Nagaland, North Eastern Himalayan Region, India

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Paper Received on February 19, 2020, Accepted on March 01, 2020 and Published Online on May 20, 2020

ABSTRACT

This paper is an attempt to assess the current socio-economic and modernization status of rubber growers in the Mokokchung district, Nagaland, NEHR, India, which will pave the way for accelerating further modernisation. Various socio-economic variables were included to analyse the socio-economic status of rubber growers. Modernization index was calculated, and respondents were sorted accordingly. The mean annual income from rubber cultivation was Rs. 1,86,303, mean income from agriculture was Rs. 1,89,408 and mean annual income was Rs. 2,13,638. It has also emerged that income from rubber cultivation had contributed around 98 per cent on annual income from agriculture and about 87 per cent on total annual income. The majority (89%) of the respondents were under medium modernization index category and the remaining (11%) were under high modernization index category. Further, variables, namely, 'education', 'total size of landholding', 'size of operational land holding', 'land under Rubber cultivation', 'possession of the number of rubber trees', 'material possession', 'annual income', 'income from agricultural sector' and 'income from rubber cultivation' had a positive and significant association with the modernization level of rubber cultivation. Further, the null hypothesis was accepted in respect of five socio-economic variables and rejected in respect of nine socio-economic aspects.

Key words: *Rubber; Socio-economic status; Modernization; Modernization index; Correlation;*

Modernization of agriculture is a process of transforming agriculture from conventional labour-based agriculture to technology-based agriculture (*Wu, 2011*). It is a continuing process, and it is the essence of advancement in agriculture and rural areas (*Kusz, 2014*). Modernization of agriculture is important for acquiring desired changes in developing countries like India. Modernization in the existing agricultural scenario is a diverse and complex process (*Patra et al., 2019*). Modernization yield not only on higher production and better quality; it can simultaneously breed on ecological and environmental issues (*Patra et al., 2004*).

Rubber tree (*Hevea brasiliensis)* belongs to the family *Euphorbiaceae* and is the most economically important member of the genus *Hevea*. Only three species of the genus viz., *Hevea brasiliensis, Hevea guianensis, Hevea benthamiana* yield usable rubber. But *Hevea brasiliensis*is the only species used to grow commercially and has major economic importance because of its sap-like extract (latex), which is the primary source of natural rubber. However, natural rubber has been found in the latex of over 2,000 species of plants belonging to 311 genera of 79 families. *Heveabrasiliensis* is a quick growing tall tree and is adaptable to a wide range of agro-climatic conditions. It grows on many types of soil, provided they are deep and well-drained. It can grow well in areas receiving an annual rainfall of 2,000-4,000 mm, RH of 80 per cent and temperature between 21 to 35°C (Govt. of India).

Rubber is primarily utilized for making tires and inner tubes for automobiles and other vehicles. Besides these, some of the industries are using the largest amounts of rubber each year to produce rubber gloves, balloons, matting, flooring, hoses, belts, adhesives, rubber bands and pencil erasers.

*Hevea brasiliensis*is native to Brazil (parts of the

Amazon basin and Matio Grosso) and the Guianas (*www.wikipedia.com*). It was introduced to tropical Asia in 1876 through Kew garden in the UK with the seeds brought from Brazil by Sir Henry Wickham. Wild rubber from Brazil and Africa gave way to plantation rubber in East- Asia. These changes in the mode and geographical location of natural rubber production led to vast improvements and productivity (*www. wikipedia.com*).

In India, commercial cultivation of natural rubber was introduced by the British planters. They started the experimental efforts to grow rubber on a commercial scale in India during 1873 at the Botanical Garden, Kolkata. The first *Hevea* plantations in India were established at Thattekandu, Kerala in 1902 (*www. wikipedia.org*).

The total area under rubber in India is of around 8, 822,000 ha. India is currently the sixth largest producer of Natural Rubber (NR) in the world with one of the highest productivity (694,000 tonnes in 2017-18). The capacity of production in India is around 900,000 tonnes, of which about 75 per cent is tapped. It is the second-largest consumer of Natural Rubber where the consumption is approximately 1.1 million tonnes. Traditional rubber-growing states comprising Kerala and Tamil Nadu account for 81 per cent of production. Major non-traditional rubber growing regions are the North-Eastern states of Tripura, Assam and Meghalaya, Odisha, Karnataka, Maharashtra and West Bengal. (*National Rubber Policy, 2019*).

In the North-Eastern region of India, Rubber is cultivated in the states of Assam, Tripura, Meghalaya, Manipur, Mizoram and Nagaland. The total production of Natural rubber in northeast India is *94430* tonnes during 2018-19 (*Press Information Bureau, 2019*). Rubber plantation was started in Nagaland under the aegis of the Land Resources Department and Rubber Board. Nagaland has a potential of 3.80 lakh hectares of rubber plantation (*Patton and Ezung, 2019*) with a total production of 4,390 tonnes in 2018-2019 (*Press Information Bureau, 2019*).

There are 11 districts in Nagaland, among which Dimapur, Mokokchung and Wokha have recently started the cultivation of Rubber. In Nagaland, cultivation of rubber is emerging as a new enterprise and small / medium scale cultivation is going on, but the State has the potential to produce in large scale. Farmers of some ranges of the district have opted/considered rubber cultivation as a profitable farming/occupation, and recently, they had started rubber farming in small to medium scale.

Even though the potential and importance of rubber cultivation do not capitalise as well as large scale cultivation of rubber is yet not achieved. It is necessary to motivate the farmers to start large scale and commercial cultivation of rubber which will sustainably support their livelihood. Proper transfer of technologies and availability of database to the rubber growers is needed to encourage farmers to adopt rubber cultivation.

Keeping in view all the issues as mentioned earlier, this was an attempt to map the socio-economic characteristics of the study community and status of modernization of rubber cultivation, as well as a relationship study between socio-economic characteristics and modernization.

METHODOLOGY

The locale of the study wasthe Mokokchung district of Nagaland. In Nagaland, Mokokchung district was the first to begin rubber cultivation on a large scale and commercial basis and playing an important role in livelihood and socio-economic condition of the people. Therefore, Mokokchung was purposively selected for the study. Among 6 Rural Development blocks in the district, two blocks, namely, Changtongya and Longchem were selected. Experience of rubber cultivation and area under rubber cultivation of the farmers were taken into considerations for selection of respondents. Accordingly, a list of rubber growers was prepared from 7 villages under two selected blocks. Out of the seven villages, 15 farmers from each of the village were selected which constitute a sample size of 105 respondents. The descriptive research design was used for this study. The selected respondents were interviewed using a structured interview schedule developed for this study.

Various socio-economic factors were taken into consideration and were analysed to produce valuable results and to know the socio-economic status of rubber growers. Response against each socio-economic variable was converted into suitable numerical value/ score and interpreted accordingly. Further, the value/ score of socio-economic variables was used as independent variables in correlation analysis with the dependent variable. In this study, the dependent variable

was 'Modernization Index' of individual rubber grower to determine the modernization status. Modernization index was obtained by adding the value of the ratio of awareness level and the ratio of adoption level and divided by two and multiplied by 100. The formula employed for calculation of modernization index (MI) is:

$$MI = \frac{\text{Ratio of awareness} + \text{ratio of adoption}}{2} \times 100$$

Altogether, 15 questions from 11 selected practices/ fields related to planting material, variety, land preparation, method of planting, manures and fertiliser, plant protection measures (viz., weed management, insect control and disease control), cropping pattern and time of harvesting and processing had been asked to the respondents to calculate the ratio of awareness. For each question, a score of '1' was assigned in case of 'aware' and '0' for 'not aware'. This way maximum achievable score was 15 and the minimum was 0. Further, the total score achieved by the respondents was divided by the maximum possible score i.e. 15 to get the 'ratio of awareness' value. Similarly, the method was adopted to find out the 'ratio of adoption.' Further, with the help of Score of modernization index, farmers were distributed into three categories, viz., Farmers with high, medium and low modernization index by using the following formula; Low= <[Mean – standard deviation (sd)], Medium= between mean ± sd and High= > (Mean + sd), respectively. The null hypothesis of the study ($H_0$1) was 'there was no association between the socio-economic characteristics of rubber growers and present status of the rubber cultivation' (i.e., 'Modernization Index').

RESULTS AND DISCUSSION

Socio-economic variables viz. age, experience in rubber cultivation, accessibility of village, education, primary occupation, total land holding, operational landholdings, land under rubber plantation, possession of the number of trees, material possession, type of housing, annual income, income from agriculture, and income from rubber were included and studied to measure the socio-economic characteristics of study community.

The analysis of the age of respondents at the time of the interview revealed that the majority of the respondents (65%) belonged to old age group (51yearsor more). A similar type of observation was found by *Cortez et al. (2002)* among rubber growers of Poloni in Sao Paulo State, where a larger part of the rubber growers were 60 years and above. The remaining 33 per cent and 2 per cent belonged to the middle age group and young age group, respectively. The average age of the respondents was 54, and it ranges from 35 to 75 years. On the other hand, 60 per cent of the respondents had 13 to 17 years of experience, 30 per cent had 18 years and above experience and the remaining 10 per cent had up to 12 years of experience in rubber cultivation. Majority of the villages (71%) had poor accessibility, whereas 29 per cent of the villages had good accessibility (Table 1).

Table 1. Socio-economic characteristics of rubber growers (N=105)

Variables	Categories	No.	%
Age	Up-to 35 years	2	2
	36-50 years	35	33
	51 years and above	68	65
	Mean=54; SD=9.04		
Experience	(Low) Upto 12 years	10	10
	(Moderate) 13 to 17 years	63	60
	(High) Above 18 years	32	30
	Mean=15; SD=2.76		
Accessibility of village	Good	30	29
	Poor	75	71
Education	Illiterate	4	4
	Upto class V	48	46
	Upto class VIII	31	29
	Upto class X	15	14
	Upto class XII	3	3
	Graduate	4	4
Occupation	Farming	95	90
	Business	6	6
	Government Employee	4	4
Number of rubber trees	Upto 250	28	27
	251-500	45	43
	501 to 750	23	22
	Above 750	9	8
	Mean=449; SD=294		
Material possession	Television	79	75
	Two-wheeler	32	30
	Radio	27	25
	Light motor vehicle	10	9
	Computer	6	5
	Laptop	0	0
Type of housing	Kutcha house	37	35
	Pucca house	57	54
	RCC	11	11

The respondents were highly literate, as just 4 per cent were illiterate. Large numbers (46%) of the respondents received education up to class V, followed by 29 per cent of the respondents had education up to class VII. Similarly, 14 per cent, 3 per cent and 4 per cent of respondents had education up to class X, XII and graduation, respectively. Further, 90 per cent of the respondents were continuing farming as a primary occupation; whereas only 6 per cent and 4 per cent of the respondent's primary occupation was business and governmental job, respectively, but they were also practicing farming and rubber cultivation as their secondary occupation (Table 1).

Concerning the possession of the number of rubber trees, large numbers of respondents (i.e. 43%) had possessed 251 to 500 rubber trees, and 27 per cent of the respondents had up to 250 rubber trees in their plantation. On the other hand, 22 per cent and 8 per cent of the respondents had 501 to 750, and more than 750 rubber trees, respectively in their plantation. The average number of trees was 449 with sd value of 294 (Table 1).

Table 1 also contains information related to material possession of the respondents which includes television, 2- wheeler, radio, light motor vehicle and computer which was owned by 75 per cent, 30 per cent, 25 per cent, 9 per cent and 5 per cent of the respondents, respectively. In respect of possession of the type of house, the majority (54%) of the respondents had 'pucca house'. This type of house is characterized by cemented walls and roof with '*Corrugated Galvanized Iron'* (CGI) sheets, and 35 per cent of the respondents had 'kutcha house' (bamboo made walls and pillars, and roof made from palm leaf). Remaining 11 per cent of the respondents had RCC (*Reinforced Concrete Cement*) house.

Table 2 contains information related to the size of landholding under different land use classes. It was found that 59 per cent of the respondents had medium land holding, followed by 34 per cent had semi-medium, and the remaining 7 per cent had large landholding. The mean of total landholding was 15 acres with SD value of 6.1.

According to the operational landholding pattern of the respondents, 48 per cent of the respondents had semi-medium operational landholding, and 41 per cent of the respondents had small operational land holding, followed by medium category with 9 per cent of

Table 2. Distribution of respondents according to landholding under different sub-classes (N=105)

Category	TL		OL		LRC	
	No.	%	No.	%	No.	%
Marginal (0.025-2.5 Acre)	0	0	2	2	49	46
Small (2.51-5 Acre)	0	0	43	41	47	45
Semi-medium (5.01-10 Acre)	36	34	51	48	6	6
Medium (10.01-25 Acre)	62	59	9	9	3	3
Large (> 25 Acre)	7	7	0	0	0	0
Mean	15		6.62		3.57	
SD	6.1		3.07		2.42	

TL= Total landholding; OL=Operational landholding; LRC=Land under rubber cultivation

respondents. The study further shows that large and landless farmers (according to their operational landholding size) were not present in the study area. From Table 2, it can be concluded that 57 per cent of the respondents had possessed 5 acres or more land for agriculture and allied activities. Similarly, in respect of land under rubber cultivation, 46 per cent of respondents had marginal (0.025-2.5 Acres) area of land under rubber cultivation, followed by 45 per cent with Small (2.51-5 Acres) area of land under rubber cultivation. The remaining 10 per cent had 5 acres or more land under rubber cultivation. Land under rubber ranged from 1-16 acres with an average size of holding under rubber was 3.57 acres.

Table 3. Distribution of respondents according to income (N= 105)

Category	No.	%
Annual income		
Low (< Rs 1,08,862)	5	5
Medium (Rs 1,08,862-3,18,414)	84	80
High (> Rs 3,18,414)	16	15
Mean=213638	SD=104775	
Income from agriculture		
Low (< Rs 97,608)	1	1
Medium (Rs 97,608-2,81,207)	93	88
High (> Rs 2,81,207)	11	11
Mean=189408	SD=91799	
Income from rubber		
Low (< Rs 92,934)	3	3
Medium (Rs 92,934-2,79,672)	91	87
High (> Rs 2,79,672)	11	10
Mean=186303	SD=93369	

Table 3 contains the distribution of the study community according to their annual income, income

from agriculture and income from rubber cultivation, respectively. Majority of the rubber growers (80%) had medium annual income (from Rs. 1,08,862 to 3,18,414). Another 15 per cent of the respondents had high annual income, i.e., more than Rs. 3,18,414 and remaining 5 per cent had low annual income, i.e. less than Rs. 1,08,862. The annual income of the respondents was ranged from Rs. 1,03,950 to Rs. 5,19,415 and with an average annual income of Rs.2,13,638.

Concerning annual income from the agricultural sector, around 88 per cent of the respondents had medium (Rs..97,608- 2,81,207) level of annual income from agricultural sectors. On the other hand, 11 per cent of the respondents had a high level of annual income, i.e., more than Rs. 2,81,207 and the remaining of the respondents had low income (<Rs. 97,608). The annual income of the respondents from the agricultural sector was ranged from Rs.78,000 to Rs. 4,83,600. The average annual income from the agricultural sector was Rs.1,89,408 with sd value of 91,799. From the study, it can be concluded that around 88 per cent of the respondents had moderate earning from agricultural sectors.

On the other hand, majority of the respondents (87%) had medium (Rs. 92,934- Rs. 2,79,672) level of income from rubber cultivation, whereas, 10 per cent of the respondents had a high level of income and remaining 3 per cent of the respondents had a low level of income from rubber cultivation. The annual income of the respondents from rubber cultivation was ranged from Rs. 78,000 to Rs.4,83,600 with a mean annual income of Rs.1,86,303. It has also emerged that income from rubber cultivation had contributed around 98 per cent to annual income from agriculture and about 87 per cent to total annual income.

Table 4. Distribution of respondents based on their modernization index (N=105)

Category	Score range	Population	
		No.	%
Low	< (Mean–sd)	0	0
Medium	Mean ± sd	94	89.52
High	>(Mean + SD)	11	11.48

Status of modernization of rubber cultivation and relationship between various factors and modernization : The study also has an attempt to categorize the respondents according to their modernization index (the mean score of modernization index was 86.34) and to find out the relationship between various independent variables and modernization index.

Table 4 shows the distribution of respondents according to their modernization index. The majority (89.52%) of the study community were under medium modernization index category. Remaining 11.48 per cent of the respondents belonged to high modernization index category. There was no respondent under low modernization index category but about 90 per cent under the medium category. Therefore, regular training of beneficiaries and field level functionaries is required (*Patra et al. 2015*) to achieve the desired level of modernization in the farming sector, as field level functionaries are regarded as the interface between the client system and the extension system (*Patra and Mondal, 2007*).

Further, in the correlation study between modernization index and various independent/socio-economic variables, 171 correlations emerged out and of which 21 were negatively correlated, and 150 were positively correlated, where 89 were found to be significant. In this paper, only correlations with independent variables versus dependent variable were taken into consideration (Table 5) and hypothesis testing was carried out based on the significant and non-significant relationships.

The independent variables, namely, 'education', 'total size of landholding', 'size of operational land holding', 'land under Rubber cultivation', 'possession of the number of Rubber trees', 'material possession', 'annual income', 'income from agricultural sector' and 'income from rubber cultivation' had a positive and significant correlation with the modernization level of rubber cultivation.

The correlation value between 'experience in rubber cultivation', 'accessibility of the village', 'occupation', and 'type of house' were non-significantly correlated with the modernization level of rubber cultivation. The type of house or housing condition is an important parameter to measure the development by an intervention. *Ao and Patra (2018)* reported that IWMP has a positive and significant influence on the change in housing condition. Still, their findings are not aligned with the findings of the present study. The correlation value of 'age' was -0.3455 which was

Table 5. Relationship between various factors and modernization index of rubber cultivation

Variables	'r' Value
Age	-0.3455^{NS}
Experience in Rubber cultivation	0.1473^{NS}
Accessibility of the villages of the study area	0.1284^{NS}
Educational status of the respondents	0.4288**
Occupation of the respondents	0.1107^{NS}
Number of rubber trees	0.3804**
Material possession	0.2782**
Type of house	0.1189^{NS}
Total size of land holding	0.3276**
Size of operational land holding	0.3313**
Land under Rubber cultivation	0.3731**
Annual income	0.3093**
Income from agricultural sector	0.2638**
Income from Rubber cultivation	0.2593**

**Significant at 1 per cent level; NS – not significant

negatively correlated with the modernization level of rubber cultivation. The findings of this relationship study have a partial agreement with the results of *Patra et al. (2018).* It can be concluded from the research that the null hypothesis was accepted in respect of five variables and rejected in respect of nine aspects.

CONCLUSION

From the study, it can be concluded that the majority (65%) of the respondents belong to the old age group. Around 60 per cent had 13-17 years of experience in rubber cultivation. The educational qualification of 46 per cent of the respondents had up to class V. The primary occupation of 90 per cent of the respondents was farming. The number of rubber trees owned by 43 per cent of the respondents was 251- 500 rubber trees. The material possession of the respondents was including television, 2- wheeler, radio, light motor vehicle and computer with 75 per cent, 30 per cent, 25 per cent, 9 per cent and 5 per cent of the respondents, respectively. A majority (54%) of the respondents had 'pucca house,' followed by 35 per cent and 11 per cent with 'kutcha house' and RCC house respectively.The total landholding of 59 per cent of the respondents was under medium (10.01-25 acres) category. Operational land holding for 48 per cent of the respondents was also under medium (10.01-25 acres) category. In respect of land under rubber cultivation, large numbers of respondents (i.e., 45%) were under marginal (0.025-2.5 acres) category followed by 45 per cent with small (2.51-5 acre) area under rubber cultivation with an average size of holding under rubber was 3.57 acres. The mean annual income from rubber cultivation was 28,550. Income from rubber had contributed around 98 per cent to annual agricultural income, and about 87 per cent to total annual income.

Around 89.52 per cent of the study community had medium modernization index, and the remaining 11.48 per cent had high modernization index. Variables, namely, 'education', 'total size of landholding', 'size of operational land holding', 'land under Rubber cultivation', 'possession of the number of rubber trees', 'material possession', 'annual income', 'income from agricultural sector' and 'income from rubber cultivation' had a positive and significant association with the modernization level of rubber cultivation. The null hypothesis was accepted in respect of five socio-economic variables and rejected in respect of nine socio-economic aspects. Immediate intervention is needed to improve the accessibility of the villages, enhance knowledge of farmers on improved management practices of rubber and status of adoption of improved technologies in rubber cultivation for modernization of rubber cultivation and to achieve food, environment and higher-income security.

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