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Economic Feasibility of Small-scale Rubber Plantations in Assam

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This study attempts to examine the cost structure and economic feasibility of small-scale rubber plantations in Assam. The total cost for establishing one hectare of rubber holding was estimated at US$ 1233.40. During the tapping period, maintenance cost required was US$ 390 per hectare per annum. The total cost of production of rubber was US$ 592.40 per hectare per annum. Labour, manure and fertilisers were found to be the dominant items of cost. In spite of the high cost of production, small-scale rubber cultivation in Assam is a highly remunerative enterprise with a net return of US$ 637 per hectare per annum. It was also found to be economically viable and cost effective as indicated by satisfactory values of net present worth (US$ 1101.50), benefit-cost ratio (1.71) and modified internal rate of returns (17.58%).

India, though ranking high in the world's natural rubber producing countries has by and large remained a net importer of natural rubber since independence. The production of natural rubber has never been sufficient to meet domestic demands. In 1992–1993 the gap between demand and supply was 20 000 tonnes and increased to 31 000 tonnes in 1995–1996. By 2001–2002 it is expected to increase to 60 000 tonnes. Therefore self-sufficiency in natural rubber production is one of the most desirable objectives of the Rubber Board of India/State Governments. Traditionally rubber is grown mainly in Kerala, Tamil Nadu and Karnataka states. Owing to extreme lack of land, the scope for further expansion of area under rubber cultivation is limited in these areas. Exploratory surveys conducted by the Rubber Board indicated that expansion of rubber cultivation can take place in the non- traditional areas of which the North Eastern region of India has the highest potential (500 000 hectares). The largest potential area of 200 000 hectares is in Assam. Commercial scale cultivation of rubber in Assam took place during 1974–1975. The Rubber Board has been actively engaged in propagating its Rubber Plantation Development Scheme for accelerating rubber plantations in the North Eastern Region. As such, rubber slowly gained acceptance among smallholders in Assam since 1984–1985. Thus small-scale rubber plantations are an emerging enterprise in Assam. It is therefore important to conduct a study on the cost structure and economic feasibility of small-scale rubber plantations at the present stage of development.

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METHODOLOGY

The study is exclusively based on primary data collected from three districts *viz.* Kamrup, Karbi Anglong and Goalpara district of Assam state. Multistage random sampling technique was adopted for selecting the ultimate unit of respondents. In the first stage, the three districts were selected purposively as they have a maximum area under rubber plantation. In the second stage, twelve villages having a maximum number of rubber growers were selected at the rate of four villages per district. In the third stage, 10% of the total number of small rubber growers in each district were selected randomly from each village. Thus the total sample consisted of 176 rubber growers *i.e.* 110 farmers in Goalpara district, 35 farmers in Karbi Anglong district and 31 farmers in Kamrup district. The required information pertaining to costs and returns from rubber plantations were collected from the respondents on well structured survey schedules designed for the purpose of the agricultural year 1996 – 1997. Field survey for data collection was conducted from December 1997 to February 1998.

The economic feasibility of investment in rubber plantations was examined by using four indicators *viz.* net present worth (NPW), benefit-cost ratio (BCR), modified internal rate of return (IRR*) and payback period (PBP). The modified internal rate of return has a significant advantage over the regular IRR[1]. It assumes that the cash flow from the project is reinvested at the cost of capital, whereas the regular IRR assumes that the cash flow is reinvested at the project's own IRR. Since reinvestment at 'i' is generally more correct, the modified IRR is a better indicator of a project's profitability.

IRR* is defined as follows:

Present value of costs = Present value of terminal value

$$\text{or } \sum_{t=0}^{n} \frac{COF_t}{(1+R)^t} = \sum_{t=0}^{n} \frac{CIF_t\,(1+R)^{n-t}}{(1+\text{IRR}^*)^n} \qquad \ldots 1$$

$$\text{or PV cost} = \frac{TV}{(1+\text{IRR}^*)^n} \qquad \ldots 2$$

where, COF = cash outflows of the project
CIF = cash inflow
TV = terminal value
R = discount rate.

Rubber is cultivated in 192.61 ha in the sample farms put together. The average size of the rubber holding was 1.09 ha ranging from 0.20 ha to 6.00 ha among the sample farms. About 45% of the sample farms had either two or three rubber holdings. The average tappable area was 0.90 ha per holding constituting 82.57% of the total area under rubber. Rest of the 17.43% have not reached the tapping stage. The age of rubber plantations in the study area ranged from one-year-old to 11 years' old.

RESULTS AND DISCUSSION

Cost of production of rubber comprised of cost of establishment and maintenance of rubber holdings and processing. The cost structure of rubber in the sample farms is discussed below.

Cost of Establishment

The cost of establishment was estimated by taking into account the actual physical units of inputs used and the prevailing market price. The data was collected from the selected

sample farmers having immature rubber plantations. The cost of establishment comprised of expenditure incurred during the first year and maintenance cost subsequently up to the seventh year. This cost was estimated at US$ 1233.40 per hectare (*Table 1*). Cost of establishment showed that manure and fertilisers formed the single largest component of cost accounting for 50.26% of the total establishment cost. The next important item was expenditure on intercultural operations which constitutes 21.64% in the total cost of establishment. Other components of establishment cost were plant protection (6.81%), cover crop management (1.22%), fencing (9.64%) and watch and ward (2.47%).

The breakup of establishment cost showed that the cost incurred during the first year was the highest (31.14%). This was due to the

TABLE 1. ESTABLISHMENT COST OF SMALL-SCALE RUBBER PLANTATIONS IN ASSAM (PER HECTARE)

Operations	Amount invested by years (US$) 1	2	3	4	5	6	7	Total	Percent of total
Preparatory operations	46.60	–	–	–	–	–	–	46.60	3.78
Digging pits and refilling	27.60	–	–	–	–	–	–	27.60	2.23
Planting materials and planting	24.10	–	–	–	–	–	–	24.10	1.95
Manure and manuring	85.20	115.40	120.80	89.10	69.80	69.80	69.80	619.90	50.26
Intercultural operations	34.00	48.60	51.00	42.40	40.40	30.20	20.40	266.90	21.64
Pruning and plant protection	17.40	6.60	14.60	12.20	8.60	9.40	15.10	84.00	6.81
Cover-crop management	–	–	15.10	–	–	–	–	15.10	1.22
Fencing	118.80	–	–	–	–	–	–	118.80	9.64
Watch and ward	30.40	–	–	–	–	–	–	30.40	2.47
Total	384.10	170.60	201.50	143.70	118.80	109.40	105.30	1233.40	100.00
Percentage of total establishment cost	31.14	13.83	16.33	11.65	9.64	8.87	8.54	100.00	

Note: 1 US$ = Rs. 43.65 as at 20-04-2000; *The Sentinal*, 20 April 2000

increased utilisation of labour in land clearing, preparation *etc*. The costs incurred during the rest of the years declined as the period passed on. Generally after the fourth year, weed growth in rubber plantations is not a problem as the canopy of rubber trees would have covered the area preventing weed growth. Therefore from the fourth year onwards cost of maintenance of rubber plantations started decreasing.

Maintenance Cost

The cost of maintenance was estimated based on the data collected from the sample farmers having eighth-year-old rubber plantations.

The cost of maintenance for rubber plantations remains more or less the same from the eighth year onwards. The cost of maintenance of sample rubber plantations in Assam is shown in *Table 2*. From the table it could be seen that the cost of tapping is the major item of the maintenance cost. The tapping cost formed US$ 199.70 per hectare per annum constituting 51.21% of the total maintenance cost. Expenditure on manure and fertilisers and its application was the next important cost accounting for 17.09% of the total maintenance cost, followed by pruning and plant protection operations (13.17%). The cost of processing latex into quality sheet was estimated as US$ 41.60 per hectare, forming 10.68% of the total maintenance cost.

TABLE 2. MAINTENANCE COST FROM EIGHTH YEAR ONWARDS FOR SMALL-SCALE RUBBER PLANTATIONS IN ASSAM (PER HECTARE)

Item	Amount (US$)				
	Goalpara district (110)	Karbi Anglong district (35)	Kamrup distict (31)	Pooled (176)	Percentage of total cost
Manure and fertilisers including application	61.30	71.30	67.40	66.60	17.07
Intercultural operations	16.10	17.10	18.70	17.30	4.43
Pruning and plant protection	51.90	52.90	49.30	51.40	13.18
Tapping	197.00	201.60	200.40	199.70	51.21
Processing	41.70	42.00	41.20	41.60	10.67
Miscellaneous	13.00	13.81	13.30	13.40	3.44
Total	381.00	398.70	390.30	390.00	100.00

Cost of Production and Returns from Rubber

Cost of production of small-scale rubber plantations comprised both variable and fixed costs Variable cost reflected the annual maintenance cost of the rubber plantation The total cost of production of rubber per hectare per year was US$ 592 40 (*Table 3*) The variable cost constituted 73 73% of the total cost of production while the rest formed the fixed cost of production Returns from small-scale rubber plantation was estimated at current price and details are shown in *Table 3* The average yield of rubber sheet in the study area was 1022 kg per hectare which varied from 878 kg to 1125 kg per hectare in Goalpara district and Karbi Anglong district and yield of scrab rubber was 256 kg per hectare per annum, ranging from 235 kg to 280 kg per hectare in Karbi Anglong district to Goalpara district In the study area the average price of sheet rubber was US$ 1 10 per kg and the average price of scrap rubber was US$ 0 41 per kg The gross returns was estimated at US$ 1229 40 per hectare per annum The net returns over total cost of production was US$ 637 00 per hectare per annum Returns over variable cost worked out to US$ 792 60 per hectare per year

Economic Feasibility of Small-scale Rubber Plantation

Investment analysis in agriculture assumes importance as it facilitates the most efficient use of resources In case of perennial crops like rubber, for the capital invested now the benefits are realised as a stream of income in the future It therefore becomes necessary to examine the economic feasibility of this enterprise

Rubber is a perennial crop and will start yielding latex from the eighth year onwards The economic life of rubber is 32 years and hence analysis at one point of time will not reflect the economic feasibility of the enterprise In the present study, though the data pertaining to holdings was only up to eleven years, future benefits to earlier investments in rubber plantations were estimated because of the long-term nature of this enterprise To carry out the feasibility analysis, it was assumed that cost and returns of rubber would remain the same as that of the eleventh year in the remaining years as indicated by Okorie and Ugwu[2] and Sarmah[3] Due to the long-term nature of oil palm projects, Okorie and Ugwu[2] estimated the future benefit – cost ratio of oil palm project for the year 2000 assuming that costs and returns remained same as that of 1985 A discount factor of 10% and current price were used to work out the present worth of costs and benefits Results showed that benefit-cost ratio was 0 195 indicating that cost outweighted total returns during the period under consideration

In evaluating the feasibility of investment in small-scale rubber plantations in Assam, total cost and returns computed for each year were used Since for the capital invested in rubber, the benefits are realised as a stream of future income measures like PBP, NPW, BCR and IRR* were used A discount factor of 17% was used which was the prevailing market rate for borrowing and current price were used to calculate the present worth of costs and benefits

The data presented in *Table 4* showed that the present worth of cost and returns were US$ 1540 60 and US$ 2642 10, respectively The net present worth from one hectare of rubber plantation worked out to US$ 1101 50 and the BCR was 1 71 The PBP is the time period for an investment to generate sufficient incremental cash to recover its initial capital

TABLE 3. COST AND RETURNS FROM SMALL-SCALE RUBBER PLANTATIONS IN ASSAM

Item	Amount (US$) Goalpara district	Karbi Anglong district	Kamrup distict	Pooled	Percentage of total
A. Variable Cost					
Manure and fertiliser and its application	61.30	71.30	67.40	66.60	11.25
Intercultural operations	16.10	17.10	18.70	17.30	2.92
Pruning and plant protection	51.80	52.90	49.30	51.40	8.67
Tapping	197.00	201.60	200.40	199.70	33.71
Processing charges	41.70	42.00	41.20	41.60	7.03
Miscellaneous	13.00	13.80	13.30	13.40	2.25
Interest on working capital	45.70	47.80	46.80	46.80	7.90
Total variable cost	426.60	446.50	437.10	436.80	73.73
B. Fixed Cost					
Share of establishment cost	36.40	40.20	39.10	38.50	6.51
Depreciation	19.60	24.40	28.10	24.00	4.06
Land revenue	3.40	3.30	3.90	3.60	0.60
Rental value of land	68.70	73.30	80.20	74.10	12.50
Interest on fixed capital	14.10	15.50	16.60	15.40	2.60
Total fixed cost	142.20	156.70	167.90	155.60	26.27
C. Total Cost (A+B)	568.80	603.20	605.00	592.40	100.00
D. Returns					
Output (kg.)					
(i) Sheet rubber	878	1125	1064	1022	
Value (US$)	965.50	1159.80	1267.50	1123.80	
(ii) Scrap rubber	280	235	252	256	
Value (US$)	115.50	96.90	103.90	105.60	
Gross returns (i+ii)	1081.00	1256.70	1371.40	1229.40	
Net returns over total cost	512.20	635.50	766.40	637.00	
Returns over variable cost	654.40	810.20	934.30	792.60	

TABLE 4. INVESTMENT ANALYSIS OF SMALL-SCALE RUBBER PLANTATIONS IN ASSAM

Indicators	Value
Present worth of cost	1540.60
Present worth of returns	2642.10
Net present worth	1101.50
Benefit-cost ratio	1.71
Modified internal rate of return	17.58
Pay-back period	10.58

outlay in full. The PBP of the investment in rubber cultivation was found to be 10.58 years. This indicates that the investment in small-scale rubber plantations can be realised in 10.5 years. A modified internal rate of return (IRR*) was used to measure the profitability of rubber plantation and it worked out to 17.58 percent. Since the internal rate of return was calculated to be higher than the cost of bank loan (17 per cent), the farmers can invest in rubber plantations, use the cash flow generated by the investment to pay off the principal and interest on the loan and come out higher by 0.58 per cent on transaction.

For any enterprise to be economically viable, the benefit-cost ratio must be more than one; NPW should be positive; PBP should be short and IRR should be higher than the discount rate. Hence, based on these values, it can be concluded that small-scale rubber cultivation in Assam is economically viable and cost effective.

CONCLUSION

Rubber is a perennial crop with an economic life span of about 32 years and starts yielding from the eighth year onwards. It is a highly capital intensive crop which requires US$ 1233.40 for establishing one hectare. Out of this, manure and fertilisers form the single largest cost item accounting for 50.26 per cent of the establishment cost. The total cost of production of rubber was US$592.40 per hectare per annum. Small-scale rubber plantations in Assam were found to be economically viable and highly profitable. Liberal credit facilities, improvement in the input market structure for adequate supply of inputs, development of infrastructural needs like marketing and processing on scientific lines, strengthening of extension services, promotion and setting up of agro-industries related with the rubber sector are a few measures required to be undertaken to increase the area, production of rubber and make small-scale rubber cultivation a successful venture.

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