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CONCLUSIONS AND POLICY IMPLICATIONS

The following conclusions emerge from the analysis of data presented in the preceding sections :

(*i*) Although the supply of cereals is expected to increase only marginally (by about 3.4 per cent), yet coarse grains, pulses and oilseeds are expected to increase considerably (by about 193, 208 and 245 per cent respectively) by the end of 1986-87.

(*ii*) The demand for foodgrains will continue to increase rapidly but its demand in the urban areas will increase at a substantially higher rate.

(*iii*) The demand for superior cereals, *i.e.*, rice and wheat, will increase more rapidly than the overall demand for foodgrains.

(*iv*) The supply of cereals, coarse grains, pulses and oilseeds will be in excess of their corresponding demand in the rural and urban sectors.

The important implication of the above findings is that the marketable surplus of foodgrains in general and of superior cereals in particular will increase at a substantially rapid rate in the State. Moreover, the required incentives to the farmers from the Government for mobilizing/increasing marketed surplus is of paramount importance.

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ECONOMICS OF RUBBER CULTIVATION BY SMALL HOLDERS IN KOTTAYAM DISTRICT†

Natural rubber a product of vital and commercial importance is recovered from the latex of the rubber tree *Hevea brasiliensis*. India is the fifth largest producer of natural rubber with total production of 1,35,300 metric tonnes as per 1978-79 estimates.[1] The bulk of the area and production of natural rubber in India is in Kerala State accounting for 91.07 per cent and 91.40 per cent respectively of the total. The major share of this is in the hands of thousands of small rubber growers. More than one-fourth of the area and production and about 41 per cent of the small holdings in the State is in Kottayam district. Small holdings accounted for 86.25 per cent of the total area under rubber in Kottayam. Since very little work has been done on the economics of rubber cultivation by small growers, it was decided that

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† Contribution from the Kerala Agricultural University, Vellanikkara, Kerala.

1. The Rubber Grower's Companion, Rubber Board, Kottayam, 1982.

it would be quite appropriate to undertake it in Kottayam district. In this paper an attempt is made to evaluate the cost and returns and capital productivity of rubber on small holdings.

METHODOLOGY

Stratified two-stage random sampling was adopted for the selection of sample cultivators. Kottayam district was divided into two zones—the high land (zone I) and the midland (zone II), based on the agro-climatic variations existing in the district. Three villages from zone I and two villages from zone II were selected in proportion to the area under rubber in each zone. Twenty holdings were selected at random from each village. Detailed information on various inputs used and the returns obtained was collected by personally interviewing the respondent farmers. Since rubber plantation takes eight years to start yielding and 12 years for the yield to get stabilised, the sample was drawn from farmers who initiated rubber cultivation sufficiently early. The data were collected for a period of 12 years from planting, being the year of yield stabilisation. The cost of cultivation per hectare, cost of production per quintal of sheet rubber and analysis of capital productivity to measure the worthiness of investment were determined for zone I, zone II and for the district. Being a perennial crop, a practical difficulty is noticed in obtaining correct information on the expenditure made much earlier to the data collection. Moreover, it is also observed that the costs of inputs have increased at a faster rate every year. Hence an attempt is made here to present the cost of cultivation as it would have been incurred at 1980-81 prices. For this, information was gathered on the quantities of inputs applied by the sample cultivators during different years from planting till date, *i.e.*, for 12 years and evaluated at the rates existing in the concerned zone during 1980-81. For measuring capital productivity, the costs and returns were discounted at 10 per cent rate of interest, being the rate at which long-term credit could be available. The benefit-cost ratio, net present worth and internal rate of return were calculated based on the following mathematical notations:[2]

$$\text{Benefit-cost ratio} = \frac{\sum_{t=1}^{n} \frac{B_n}{(1+i)^n}}{\sum_{t=1}^{n} \frac{C_n}{(1+i)^n}}$$

2. J. Price Gittinger: Economic Analysis of Agricultural Projects, The Economic Development Institute and International Bank for Reconstruction and Development; The Johns Hopkins University Press, Baltimore and London, 1972.

Benefit-cost ratios and net present worth could both be evaluated for their sensitivity to changes in the discount rate. Sensitivity analysis has not been done here as finance is available at 10 per cent interest for the cultivation of rubber.

$$\text{Net present worth} = \sum_{t=1}^{n} \frac{B_n - C_n}{(1+i)^n}$$

Internal rate of return is that discount rate i such that

$$\sum_{t=1}^{n} \frac{B_n - C_n}{(1+i)^n} = 0$$

where B_n = benefits in each year,
C_n = costs in each year,
n = number of years,
i = interest (discount) rate.

RESULTS AND DISCUSSION

Cost of Cultivation

The cost of cultivation of rubber plantation was calculated on per hectare basis. Even though data were collected for 12 years only, the costs and returns were projected to 32 years, the expected life span of rubber tree.[3] Rubber starts yielding from the eighth year and yield gets stabilised at the twelfth year. From thirteenth year onwards costs remain the same as that of the twelfth year, while stable returns will be obtained upto twenty-eighth year. From twenty-ninth to thirty-second year, yield is observed to decline in the reverse order of its increase from eighth to the twelfth year. The cost of cultivation and returns per hectare of rubber plantation for both the zones and the district for its life span are given in Table I.

Expenditure per hectare was the highest during the first year of planting, being Rs. 4,139, Rs. 3,883 and Rs. 4,087 respectively for zone I, zone II and the district. The high cost during the first year of cultivation was because of the preparatory cultivation expenditure, cost of seedlings and planting cost. The higher cost in zone I over zone II is due to the high expenditure for soil conservation and higher rate of labour charges. From the second year upto the eighth year the costs of various inputs and expenditure on plantation maintenance only are involved and therefore cost is much less. From eighth year onwards the cost is much higher than the previous years as labour cost on tapping and expenditure on processing are involved.

Itemwise break-up of the cost incurred for 12 years for both the zones and the district has been made and is presented in Table II. It may be seen from the table that the largest claimant of the total cost for 12 years in all the three cases was human labour accounting for about 51 per cent. Expenditure on fertilizer accounted for a little over 21 per cent, and that on plant protection for around 14 per cent. For all the other items the expenditure was found to be below 5 per cent.

3. M. V. George and P. T. Joseph, "Cost-Benefit Analysis of Investment in Tree Crops" *Indian Journal of Agricultural Economics*, Vol. XXVIII, No. 4, October-December 1973.

TABLE I—ESTIMATED COST OF CULTIVATION AND RETURNS PER HECTARE OF RUBBER

(*Rs.*)

Year	Cost			Returns								
				Zone I			Zone II			District		
	Zone I	Zone II	District	Sheet	Scrap	Total	Sheet	Scrap	Total	Sheet	Scrap	Total
1	4,139	3,882	4,087	..								
2	1,017	1,102	1,034	..								
3	1,076	994	1,058									
4	1,239	1,114	1,210	..								
5	1,227	1,191	1,218	..								
6	1,270	1,172	1,249	..								
7	1,204	1,172	1,198	..								
8	3,486	3,355	3,450	6,429	805	7,234	6,211	852	7,063	6,383	815	7,198
9	3,383	3,343	3,387	7,808	940	8,742	8,049	976	9,025	7,859	944	8,803
10	3,429	3,379	3,418	9,138	1,062	10,200	9,294	1,199	10,493	9,171	1,091	10,262
11	3,498	3,466	3,493	9,577	1,138	10,715	9,981	1,214	11,195	9,660	1,100	10,760
12 to 28	3,533	3,514	3,530	9,691	1,147	10,838	11,012	1,447	12,459	10,224	1,204	11,428
29 .	3,533	3,514	3,530	9,577	1,138	10,715	9,981	1,214	11,195	9,660	1,100	10,760
30 ..	3,533	3,514	3,530	9,138	1,062	10,200	9,294	1,199	10,493	9,171	1,091	10,262
31	3,533	3,514	3,530	7,808	940	8,742	8,049	976	9,025	7,859	944	8,803
32	3,533	3,514	3,530	6,429	805	7,234	6,211	852	7,063	6,383	815	7,193
33						24,000(*a*)			24,000(*a*)			

(*a*) Salvage value calculated at the rate of Rs. 60 per tree.

TABLE II—ITEMWISE BREAK-UP OF THE TOTAL COST OF CULTIVATION PER HECTARE FOR TWELVE YEARS

(*Rs.*)

Items	Zone I	Zone II	District
Human labour	14,601 (51·23)	13,851 (50·03)	14,456 (51·02)
Seedlings	775 (2·72)	754 (2·72)	771 (2·72)
Fertilizer	5,991 (21·02)	5,851 (21·12)	5,962 (21·05)
Plant protection	3,831 (13·44)	3,930 (14·20)	3,851 (13·59)
Recurring costs *	838 (2·92)	870 (3·14)	845 (2·98)
Non-recurring costs**	101 (0·35)	126 (0·45)	106 (0·37)
Rolling charge***	506 (1·78)	504 (1·82)	506 (1·78)
Tools and implements	164 (0·58)	164 (0·59)	164 (0·58)
Maintenance of tools and implements ..	506 (1·78)	583 (2·11)	517 (1·84)
Tax	228 (0·80)	216 (0·78)	228 (0·79)
Miscellaneous	960 (3·37)	842 (3·04)	926 (3·28)
Total	28,501 (100)	27,688 (100)	28,332 (100)

Figures in parentheses are percentages to the total.

* Cost of chemicals for processing latex to sheet, cups for collecting latex, hangers and lapping knives.

** Cost of buckets and dishes.

*** Charge paid for converting processed latex into sheet rubber.

Cost of Production

The cost of production of rubber has been worked out in terms of the cost involved in producing one quintal of sheet rubber. In the computation, the actual expenditure incurred by the sample cultivators was considered. The economic life-span of rubber tree has been taken as 32 years with a period of 25 years available for tapping. The total cost of establishment (for 7 years) has been compounded to the eighth year at 10 per cent rate being the rate at which long-term loan is available. Proportional allocation of this amount has been made to the cost for succeeding years in proportion to the yield obtained in the respective years. Along with sheet rubber some quantity of scrap rubber is also obtained. In order to estimate the total cost of sheet rubber the value of scrap rubber was deducted from the actual expenditure. The cost of production per quintal of sheet rubber is presented in Table III.

TABLE III—COST OF PRODUCTION PER QUINTAL OF SHEET RUBBER

(*Rs.*)

Year	Cost of cultivation			Production (quintals)			Cost per quintal		
	Zone I	Zone II	District	Zone I	Zone II	District	Zone I	Zone II	District
8	2,262	2,334	2,277	5·36	5·18	5·32	422	451	428
9	2,129	2,284	2,140	6·51	6·71	6·55	327	340	327
10	2,363	2,034	2,272	7·62	7·74	7·64	310	263	297
11	2,383	2,122	2,306	7·98	8·32	8·05	299	255	286
12 to 28	2,552	2,083	2,432	8·07	9·18	8·31	316	227	293
29	2,633	2,242	2,529	7·98	8·32	8·05	330	269	314
30	2,768	2,344	2,657	7·62	7·74	7·64	363	303	348
31	2,839	2,627	2,773	6·51	6·71	6·55	436	392	423
32	2,993	2,725	2,936	5·36	5·18	5·32	559	526	552

A marginal change has been recorded from the eighth to the twelfth year. The higher total cost noticed for the years from twenty-ninth to thirty-second is the result of decrease in returns from scrap rubber. The cost per quintal of rubber from eighth to twelfth year shows that it is the highest for the eighth year, being Rs. 422, Rs. 451 and Rs. 428 respectively for zone I, zone II and for the district. From twelfth to twenty-eighth year the cost remains the same. The cost showed an increasing trend for the period from twenty-ninth to thirty-second year, the reason being the reduction in yield while the cost remains the same.

Capital Productivity

Rubber has a long gestation period and considerable investments are made over several years before the crop starts to yield. The returns are spread over a long period. The worthiness of investments on such a crop has to be evaluated taking into consideration the total period the crop is in the field. An attempt is made here to measure the productivity of capital taking into consideration (1) pay-back period, (2) benefit-cost ratio, (3) net present worth and (4) internal rate of return. The estimated cost of cultivation and returns obtained were used for these computations.

1. Payback Period

Pay-back period is an undiscounted measure of worthiness of an endeavour, which measures the efficiency of cultivation by indicating the period within which the returns offset the investment. The pay-back period for the two zones and the district are: zone I: 9.53 years, zone II: 9.43 years, and district: 9.51 years.

The other three methods are discounted measures of investment worth.

2. Benefit-Cost Ratio

The benefit-cost ratio indicates the return on a rupee of investment. The benefit-cost ratios for the zones and the district are: zone I: 1.96, zone II: 2.21 and district: 2.04.

Since these ratios are greater than unity, the investments are economically justified.

3. Net Present Worth

The net present worth tries to project the feasibility of cultivation. It is the difference between the present worth of benefits and present worth of costs. The net present worth for the zones and the district are found to be as follows: zone I: Rs. 23,747, zone II: Rs. 29,255 and district: Rs. 25,597.

4. Internal Rate of Return

The internal rate of return for the investment is that discount rate which nullifies the present worth of cash inflows and outflows. It represents the average earning power of money used in cultivation over its projected economic life. The internal rate of return obtained were: zone I: 23.70 per cent, zone II: 25.35 per cent, and district: 24.20 per cent.

CONCLUSION

The paper tries to evaluate the cost and returns, cost of production and capital productivity of rubber cultivation by small holders in two zones, namely, zone I (high land) and zone II (midland) of Kottayam district in Kerala State. The total cost of cultivation till tapping stage, *i.e.*, for seven years was estimated at Rs. 11,054 per hectare (average of two zones) in terms of 1980-81 prices. More than half of this was accounted for by labour. Between the two zones, zone I incurred more expenditure. The reason for this can be attributed to the high expenditure involved in soil conservation measures and high rate of labour charges. The cost of production also showed that zone II is economically more efficient than zone I. The payback period, benefit-cost ratio, internal rate of return and net present worth for the district were 9.51 years, 2.04, 24.20 per cent and Rs. 25,597 respectively.

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