ECONOMICS OF RUBBER CULTIVATION BY SMALL HOLDERS IN KOTTAYAM DISTRICT

BY

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THESIS

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DECLARATION

I, hereby declare that this thesis entitled "Economics of rubber cultivation by small holders in Kottayam district" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

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Vellanikkara,
5th August, 1981.

CERTIFICATE

Certified that this thesis entitled "Economics of rubber cultivation by small holders in Kottayam district" is a record of research work done independently by Kum. Elsamma Job, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

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INTRODUCTION

INTRODUCTION

Rubber, one of the versatile natural products, is obtained from the tree Hevea brasiliensis. This is a tropical tree crop grown over the region between 10°S and 8°N latitudes. The optimum ecological requirements for the crop are a fairly well distributed annual rainfall of not less than 200 cm, a warm humid climate (21° to 35°C) and a well drained loamy soil. It can be grown upto altitudes of 450 to 600 meters from the sea level.

Rubber plantations exert a profound influence on the economic and social life of the people in the regions where the crop is grown. Rubber finds a number of uses. Rubber manufacturing industries produce a variety of specialised goods required for automobiles, aircrafts, railways, textile industries, pharmaceutical industries, sports goods, engineering goods, building materials and even for making roads. Rubber cultivation is also considered as an important source of employment.

As a result of the multifarious uses to which rubber can be put to, the consumption of rubber in the world has been increasing steadily. It increased from 2990 thousand tonnes in 1970 to 3885 thousand tonnes in 1979 - an increase of 29.6 per cent. Consumption of synthetic rubber also

increased by 59.7 per cent during the same period. The details on production and consumption of rubber for the decade from 1970 is shown in Table 1.1.

Table 1.1. World production and consumption of natural and synthetic rubber (in thousand metric tonnes)

Year	Natural		Synthetic	
	Production	Consumption	Production	Consumption
1970	3125	2990	5893	5635
1971	3103	3092	6215	6165
1972	3168	3230	6765	6730
1973	3570	3403	7758	7575
1974	3520	3518	7575	7450
1975	3330	3368	6855	7028
1976	3580	3505	8030	7915
1977	3605	3710	8500	8450
1978	3715	3725	8720	8690
1979 (p)	3850	3885	NA	NA

(p) - Provisional

Source: Indian Rubber Statistics (1980), pp. 102.

In the total consumption, the share of natural rubber has been declining. The share was 52 per cent for U.S.A. and 71 per cent for world during 1964-68 (Anon, 1970). The corresponding figures for 1978 were 23.9 per cent and 30 per cent (RAI, 1980).

The major producers of natural rubber in the world are Malaysia, Indonesia, Thailand, Sri Lanka, India and Liberia. Production of natural rubber in the main producing countries is shown in Table 1.2.

India is the fifth largest producer of natural rubber in the world. Rubber cultivation on a commercial scale is practised mainly in Kerala, Tamil Nadu, Karnataka and Andamans. It is also grown in Tripura, Goa, Andhra Pradesh and Maharashtra. The total area under rubber in India during 1978-79 was 246870 hectares. The bulk of this area was in Kerala, which contributed 91.07 per cent followed by Tamil Nadu (4.89 per cent) and Karnataka (3.20 per cent). Tappable area under rubber in India was estimated to be 190300 hectares in 1978-79 and production was 133300 metric tonnes. Kerala accounted for 91.4 per cent of the total rubber production (Fig.I) followed by Tamil Nadu--6.7 per cent (RRII, 1980).

Although rubber cultivation started in India on a commercial scale in 1902, rubber produced during the early period was exported due to the absence of rubber goods manufacturing industries. As the consumption of rubber increased, India became a net importer. The details of production, consumption, imports and exports of natural and synthetic rubber in India is given in Table 1.3. Total consumption of rubber in India during 1978-79 was estimated

Table 1.2. Production of natural rubber in main producing countries (in Thousand Metric Tonnes)

Countries	1970	1971	1972	1973	1974	1975	1976	1977	1978
Malaysia	1269.90	1318.50	1304.10	1542.30	1524.70	1459.30	1612.40	1613.20	1606.50
Indonesia	815.20	819.30	773.70	885.80	855.00	822.50	847.50	835.00	900.00
Thailand	289.70	318.80	336.90	389.00	379.50	355.00	411.90	430.90	467.00
Sri Lanka	159.20	141.40	140.40	154.70	132.00	148.80	152.10	146.20	155.70
India	89.90	96.90	109.10	123.20	128.40	136.00	147.80	151.60	133.00
Liberia	83.40	74.20	83.30	85.50	86.20	82.80	82.40	80.00	78.50
Nigeria	65.30	61.80	57.20	66.30	78.00	67.80	52.50	59.30	57.50
Vietnam	28.50	34.50	20.30	20.60	28.00	20.00	32.50	35.00	40.00
Brazil	25.00	24.20	25.80	23.40	18.60	19.30	20.30	22.60	23.70
Campodia	12.80	1.10	15.30	20.00	27.50	10.00	20.00	15.00	18.00
Others	110.00	123.00	135.00	150.00	155.00	175.00	189.00	203.00	209.00

Source: Indian Rubber Statistics (1980), pp. 94.

FIG. 1

SHARE OF KERALA IN THE PRODUCTION OF NATURAL RUBBER IN INDIA DURING 1978-'79

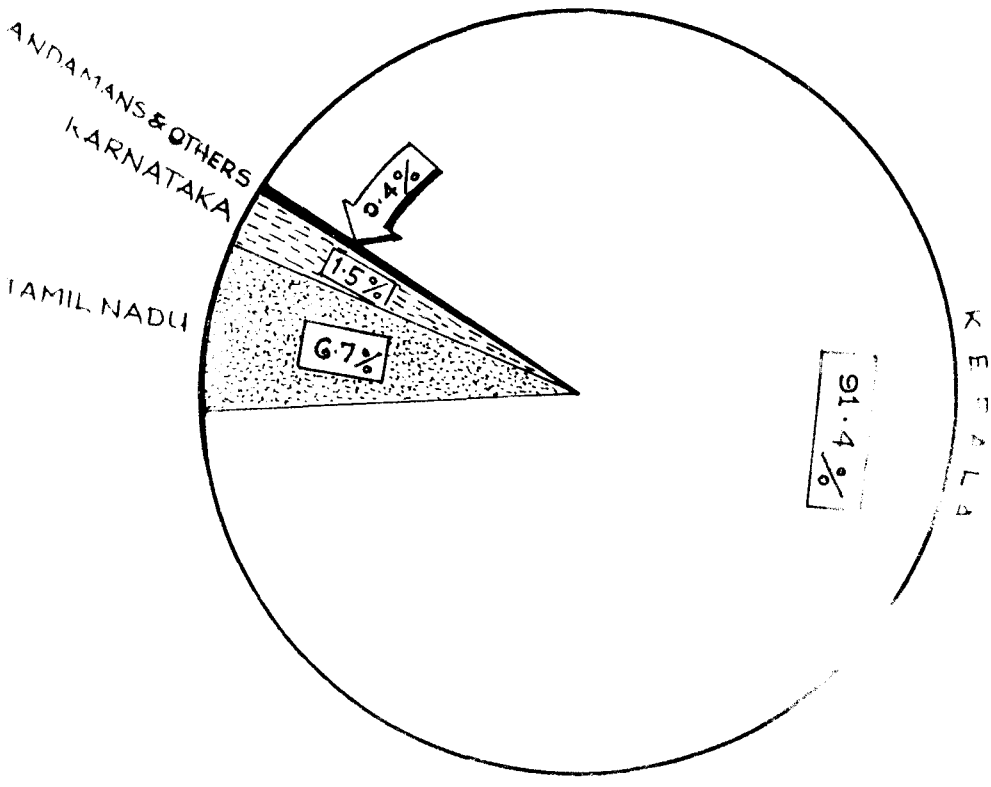


Table 1.3. Production, consumption, imports and exports of natural and synthetic rubber in India (in Metric Tonnes)

Year	Production			Consumption			Import			Export
	Natural	Synthetic	Total	Natural	Synthetic	Total	Natural	Synthetic	Total	Natural
1970-71	92,171	29,791	121,962	87,237	33,160	120,397	2,469	5,014	7,483	-
1971-72	101,210	32,911	134,121	96,454	37,209	133,663	437	5,627	6,064	-
1972-73	112,364	21,832	134,196	104,028	33,913	137,941	356	6,044	6,400	-
1973-74	125,153	23,542	148,695	130,302	23,921	154,223	52	5,607	5,661	2,700
1974-75	130,143	17,712	147,855	132,604	24,375	156,980	-	6,937	6,939	350
1975-76	137,750	25,119	162,869	125,692	37,452	158,144	-	5,928	5,928	-
1976-77	149,632	23,212	172,844	137,623	33,701	171,324	-	7,716	7,716	12,298
1977-78	146,987	27,288	174,275	144,967	34,751	179,718	-	8,816	8,816	11,078
1978-79	135,297	28,054	163,351	164,524	37,600	202,124	14,750	10,655	25,405	-
1979-80	148,470	29,524	177,994	165,245	40,588	205,833	32,200	15,755	47,955	-

Source: Indian Rubber Statistics (1980), pp. 48.

at 226454 metric tonnes, which included 164524 metric tonnes of natural rubber--72.65 per cent, 37600 metric tonnes of synthetic rubber--16.60 per cent and 24330 metric tonnes of reclaimed rubber--10.75 per cent (A.H, 1980). Increasing quantities of rubber is being imported in recent years. In 1979-80 the country had to spend foreign exchange worth Rs.25 crores on the import of rubber (Indian Economic Diary, 1981).

Initially, rubber cultivation was concentrated in extensive areas--the estates. Gradually, people with small holdings also took to rubber cultivation. The rate of planting slowed down after a while due to the low price of raw rubber. Planting by small growers showed a consistent increase from 1951 onwards because of the increase in price. The increase in the number of cultivators and area in India from 1951-52 to 1978-79 is presented in Table 1.4. Area under rubber in 1978-79 was 240.5 per cent more than that in 1951-52. It is observed that during the later years, area planted were relatively more under small holdings, whereas, the area under estates increased only marginally. In 1951-52, 68.1 per cent of the total area was shared by estates and only 31.9 per cent by small growers, while in 1978-79 the figures changed to 28.9 per cent and 71.1 per cent respectively. The increase in small holdings is not peculiar to India alone. Almost all major rubber producing countries

Table 1.4. Increase in the area and number of cultivators from 1951-52 to 1978-79

Year	Petty small holdings(upto 4 ha)		Holdings (above 4 and including 20 ha)		Estates (above 20 ha)		Total	
	Number of units	Area	Number of units	Area	Number of units	Area	Number of units	Area
1951-52	12,228 (87.30)	11,911 (17.20)	1,321 (9.40)	10,169 (14.70)	458 (3.30)	47,199 (68.10)	14,007 (100)	69,279 (100)
1961-62	59,705 (94.10)	57,934 (41.10)	3,162 (5.00)	26,953 (19.10)	580 (0.90)	55,993 (39.80)	53,447 (100)	140,880 (100)
1971-72	108,732 (94.45)	98,697 (47.27)	5,729 (4.97)	42,650 (20.42)	650 (0.56)	67,439 (32.30)	11,511 (100)	208,781 (100)
1978-79	137,744 (95.26)	121,278 (51.40)	6,720 (4.65)	46,492 (19.70)	580 (0.40)	68,140 (28.91)	144,594 (100)	235,910 (100)

(Figures in parentheses show percentages to total)

Source: Indian Rubber Statistics (1980), pp. 12 (Data reproduced from the table - classification of holdings and estates according to size at the end of each year)

now have a considerable percentage of small growers who contribute appreciably towards the total production. The share of small growers in the total area was estimated at 67 per cent in Malaya, 76 per cent in Indonesia, 95 per cent in Thailand and 55 per cent in Sri Lanka (Zeiher, 1977).

Rubber has many attractions as a small farmers crop. Under optimum climatic conditions rubber will grow almost in all soil types. The crop is not prone to serious diseases and pest attacks. The plant starts yielding by eighth year of planting. The yield is stabilized by 12th year and continues till the 25th year. Economic return can be expected till 32nd year. Tapping is possible throughout the year, except during the periods of intense rainfall and leaf fall. Thus, the output is fairly well spread throughout the year with the result that inflow of cash is also well distributed. Therefore, the small farmer can rely on rubber production for his day-to-day cash requirements--an advantage not available with most of the competing crops.

Production of synthetic rubber is costly and is dependent on non-renewable resources which are rapidly getting depleted. Therefore, every effort has to be made to promote natural rubber production. As already stated, substantial proportion of the area of rubber in India is under small holdings. Since, very little work has been done on the

economics of rubber cultivation in the small holding sector in India, a study in this direction is attempted here. This study would give information on the economics of cultivation and problems if any, facing small rubber growers. The results obtained in the study would be useful in locating the weaknesses if any, in the management and suggestions can be made for better utilisation of the resources. The specific objectives of the study are as indicated below.

1. To evaluate cost and returns.
2. To evaluate the resource use efficiency of yielding plantations.
3. To study the problems of rubber growers.

A study to fulfil these objectives requires data on various items of costs, inputs and their costs as they occur at different stages. This type of data were not readily available from the secondary sources and hence there was no alternative but to tap the primary source, viz., the growers of natural rubber, for the purpose of the study.

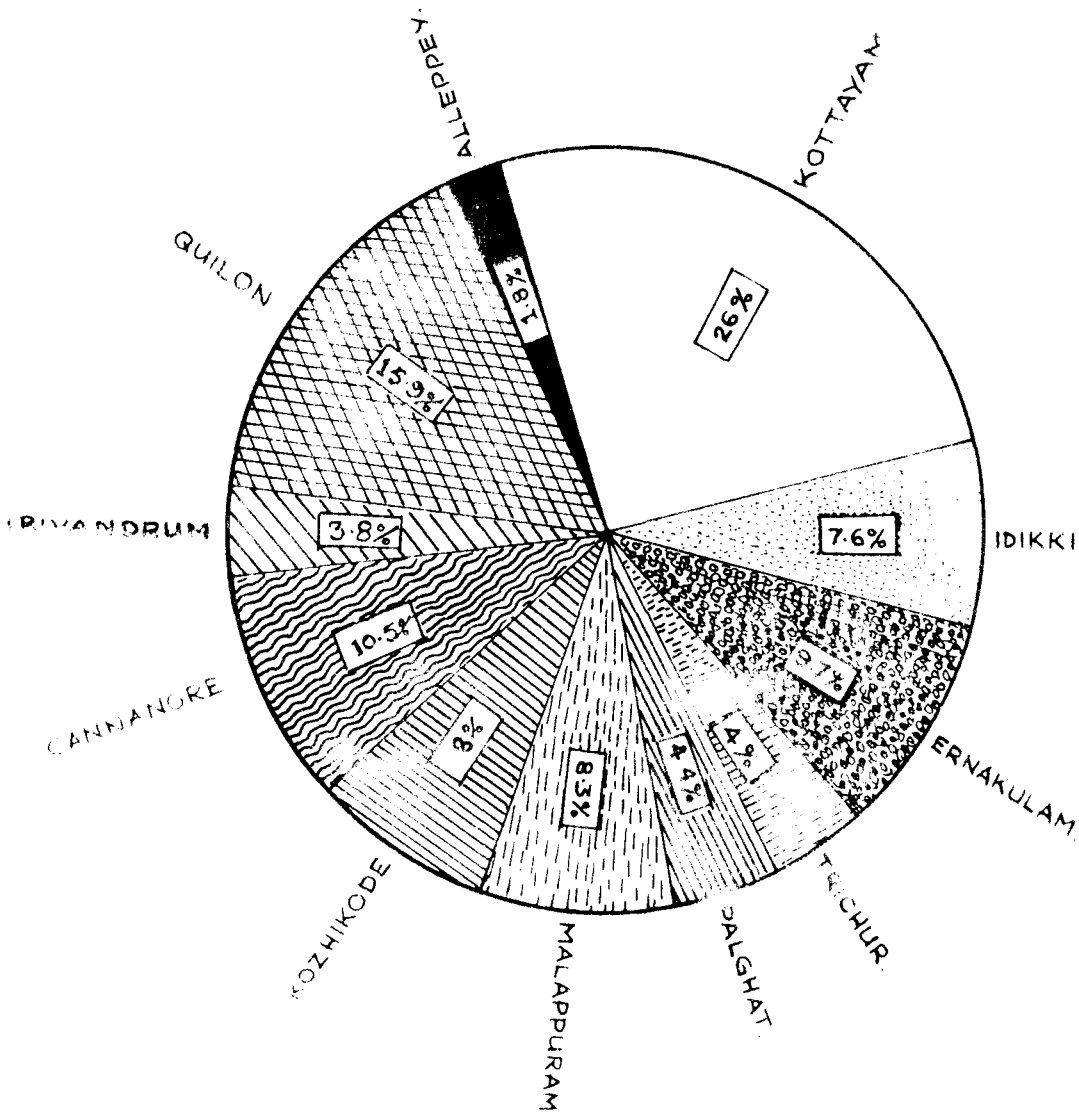
As mentioned earlier, the bulk of the area under natural rubber in India as well as the production is concentrated in Kerala. Rubber is grown in all the districts in the state. However, the distribution of area under

rubber here is very uneven and more than one fourth of the area under rubber and production is concentrated in Kottayam district (Fig. 2). Moreover, 41.73 per cent of the small holdings under rubber in the state is also located in this district. Small holdings accounted for 86.25 per cent of the total area under rubber in Kottayam district. It was therefore, decided that it would be quite appropriate to direct the present investigation on the economics of rubber cultivation in small holdings to Kottayam district.

This thesis is divided into 10 chapters including the present one. A brief account of the agricultural economy of Kottayam district is given in the chapter 2. A review of the relevant literature is given in chapter 3. Chapter 4 deals with the methodology used in this study. The chapters that follow deals with the results of the study. In chapter 5 the general socio-economic conditions of the surveyed farmers are given, while chapter 6 deals with estimated cost of cultivation of rubber per hectare, chapter 7 is on the economics of production. Capital productivity and resource use efficiency in rubber cultivation are discussed in chapter 8. The problems faced by rubber growers are enumerated in chapter 9. The final chapter deals with the summary of the major findings of the study.

FIG. 2

DISTRICT WISE AREA UNDER RUBBER IN KERALA AT THE END OF 1978-'79



A BRIEF ACCOUNT OF THE AGRICULTURAL ECONOMY OF KOTTAYAM DISTRICT

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The district, Kottayam is situated between north latitudes $9^{o}15'$ and $10^{o}12'$ and east longitudes $76^{o}22'$ and $77^{o}25'$. It is surrounded on the north by the Ernakulam district, east by the Idikky district, south by the Quilon and the Alleppey districts and west by the Vembanattu Kayal.

Total area of Kottayam district is 2196 km^2, with five Taluks and 72 villages.

The district has a humid tropical climate. The average annual rainfall is 2887 mm. Heavy rainfall is received during the southwest monsoon from May to June-July. North-east monsoon starts by September and continues till November. The distribution of monthly rainfall for the district is given in Table 2.1. The lowest minimum temperature is recorded during January ($20^{o}C$) and highest minimum temperature during May ($24^{o}C$). The lowest maximum temperature is recorded during August ($29^{o}C$) and highest maximum in March ($34^{o}C$).

The most important river in the district is Meenachil river. Other rivers viz., Periyar, Muvattupuzha, Manimala and Pampa are also passing through the district.

Table 2.1. Distribution of monthly rainfall in Kottayam district

Months	Total rainfall (mm)
July	652.9
August	429.5
September	273.2
October	330.6
November	212.8
December	71.7
January	30.3
February	26.3
March	59.8
April	141.3
May	244.9
June	609.3
Total	3082.5

Source: Farm Guide (1981), pp. 32.

Laterite is the major soil type. Red and loamy soils are also found in certain regions.

Main crops grown are rubber, cocoonut, tea, coffee, pepper, ginger, rice, tapioca and oil seeds. Cropping pattern and land use pattern for the district is given in Tables 2.2 and 2.3 respectively. The main food crop grown in the area is rice, covering an area of 37449 hectares

Table 2.2. Cropping pattern in Kottayam district for the year 1978-79

Crop	Area (in hectares)	Percentage to total cropped area
Rice	37449	15.90
Tapioca	26957	11.46
Pulses	1821	0.77
Sugarcane	178	0.07
Palmyrah	601	0.25
Pepper	13620	5.79
Ginger	3331	1.42
Turmeric	1043	0.44
Arecanut	2629	1.11
Tamirind	390	0.17
Other condiments & spices	910	0.39
Fruits	18498	7.86
Vegetable	6756	2.87
Oil seeds	54294	23.08
Betel leaves	59	0.03
Tea	2315	0.98
Coffee	1252	0.53
Rubber	55931	23.77
Cocoa	3913	1.66
Fodder crops	465	0.19
Green manure crops	328	0.14
Other non-food crops	2532	1.08
Total cropped area	235272	100.00

Source : Farm Guide (1981), pp. 9-16.

Table 2.3. Land utilisation in Kottayam district for the year 1978-79

Description	Area (in hectares)
Total geographical area	219550
Under forest	8141
Land put to non-agricultural uses	17537
Barren and uncultivable waste	1518
Permanent pastures and grazing lands	128
Land under miscellaneous tree crops	370
Cultivable waste land	1109
Fallow other than current fallow	2327
Current fallow	3665
Net area sown	184755
Area sown more than once	50517
Total cropped area	235272

Source: Farm Guide (1981), pp. 8.

followed by tapioca covering an area of 26957 hectares. Among the cash crops area under rubber is the highest with 55931 hectares followed by coocoa and tea having 3913 nectares and 2315 nectares respectively.

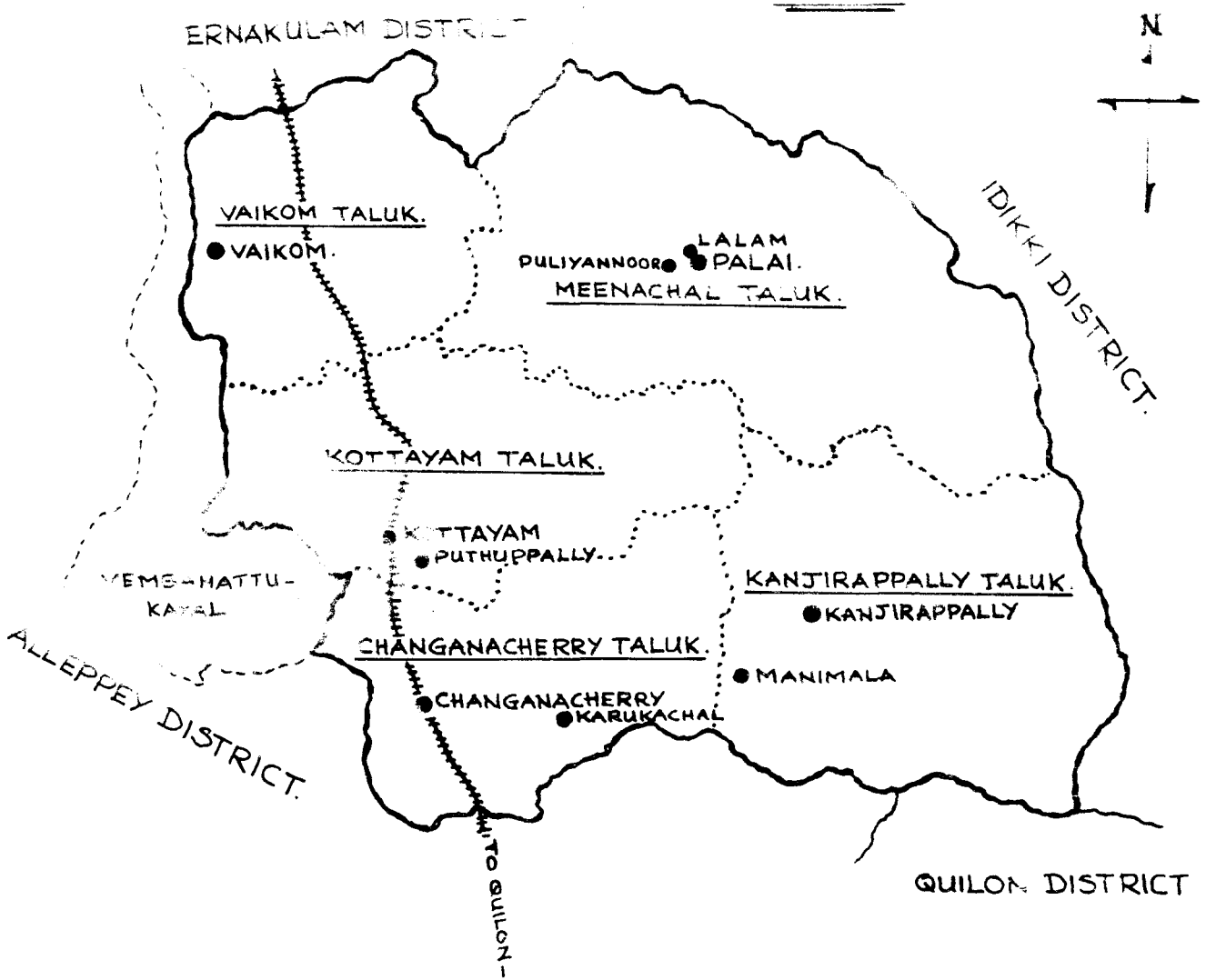
Rubber and tea are the main plantation crops in the district. The district has also developed industrially.

Rubber, tea, tile, plywood and cement industries are located here. There are two industrial estates situated at Ettumannoor and Changanacherry. Kottayam contributes a major share in the export of plantation products like tea, pepper, dry ginger and cardamom. The Rubber Research Institute of India, Kerala Plantation Corporation and Kerala Forest Development Corporation are also situated here.

Kottayam is well connected by roads. Quilon-Ernakulam railway line passes through Vaikom, Kottayam and Changanacherry Taluks of the district. Kottayam is also connected by waterways to Ernakulam, Alleppey and Quilon.

Total population of the district as per 1971 census was 15.39 lakhs with a literacy rate of 67.72 per cent. Density of population was 701 per km^2. The total workers in the district was 619613 of which 150655 were cultivators, 161214 were agricultural workers and 307744 were employed in other sectors. A map of Kottayam district indicating the villages selected for the study is shown as Fig. 3.

FIG 3



KOTTAYAM DISTRICT

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Studies on the economics of cultivation of tree crops, particularly of rubber are very limited. Review of studies on economics of rubber cultivation and on perennial crops relevant to the present study was presented in this chapter.

Westgarth and Narayana (1964) studied the effect of price and yield on production cost of Rubber in Malaya. They found that increased yield per acre tended to reduce the cost per pound of upkeep and general charges and markedly reduced tapping cost per pound. Low yielding estates had the highest revenue, cost and highest cost for tapping, upkeep and general charges, when these were measured in terms of cost per pound. But when these charges were expressed as cost per acre, their relationship with yield per acre were curvilinear, low yielding estates tended to have the lowest costs per acre, and the heaviest charges per acre occurred on estates with yield in the regions of 300 pounds to 1000 pounds per acre per annum.

RRIM (1965) reported that yields were strongly correlated with the amounts of fertilizer applied per hectare. Mean yields of fields receiving no fertilizers were 883 kg per hectare for trees upto 9 years old. The

corresponding figure for fields receiving 400 kg annually were 1398 kg per hectare. Data for trees 15 to 19 years old indicated an erratic increase due to fertilizer on account of lesser number of holding per class. The general standard of husbandry was likely to be nigh on holdings receiving large amounts of fertilizer. Profits were found to increase with the highest fertilizer levels, although these may be in excess of requirements for some nutrients to the plantation.

Bhatnagar (1966) studied the economic problems of tea farming in Kangra Valley and suggested how they should be tackled. The analysis had revealed that the small size of tea plantations, low yield per acre, ill-equipped processing units and the substandard quality of tea produced which fetches low prices, resulted in tea cultivation in Kangra being no better than subsistence farming. The study stressed the need for replanting in the existing vacancies or complete replanting. Conducting experiments for evolving a suitable variety of tea for new plantings, modernising processing, were also suggested. It was observed that returns from small plantations by and large were of the marginal nature while some of them actually uneconomic. It was suggested that provision for suitable incentives by way of subsidy, development finance, and

supply of tea samples free of cost could help to make cultivation economic.

Amschel (1967) analysed the problems and prospects of the Nigerian rubber industry. Data of cost and returns collected from small holdings rubber growers in mid east region of Nigeria indicated that rubber growing was only as profitable as the exploitation of wild oil palm. He found that the main obstacle to rising the farm incomes was the bad marketing situation. There were no price differentiation to the quality of the product and prices paid to farmers by the traders are based on the market price of the brown crepe.

Ngchoong Sool (1967) analysed the data on cost of establishment and bringing into production of 70 replanted and 12 new planted rubber fields and estates in Malaya. All fields selected were planted with clones in 1956-59. For replanting, higher costs were found to be involved for the preparatory operations and also during the earlier years. It was found to increase with the increase in unproductive period. New planting was generally more expensive than replanting mainly because of cost incurred for levelling and terracing. Costs were found to increase with increase in the slope of land.

Rubber Small Holdings Economic Enquiry Committee (1968) narrated some of the problems faced by small growers in India. They were (1) uneconomic size of holdings (2) subdivision and fragmentation of holdings due to partition, sale and other causes (3) old and low yielding areas with reduced yield on a large scale (4) scarcity and high cost of high yielding materials (5) lack of scientific knowledge of cultivation practices (6) defects in tapping, lack of processing facilities and (7) absence of strong organisations to meet their common problems.

Barlow and Chan (1969) found that the proportion of high yielding material and the yield per acre were shown to be of overriding significance in determining profitability.

Studying the West Malayan region, Lim (1969) concluded that the main problem of the individual small holder was lower productivity. Small holdings in Malaysia contributed only about 43 per cent of the total production while accounting for 56 per cent of the estimated area under rubber in West Malaysia.

In an analysis of the cost of production of coffee in India, Madappa (1970) observed that, there is high percentage of labour and material costs in the total cost of cultivation. Labour cost accounted for 40 per cent and material costs 20 per cent.

Pee (1970) observed that tapping and collection charges represent about 60 per cent of the total production costs in normal estate operations. Cost reduction could be envisaged with increasing task sizes. The study also investigated the economics of the latex collection on estates to provide some general guidelines on collection methods.

George and Joseph (1973) estimated cost, revenues and margins of coconut, Rubber and Oil palm in Kerala, and concluded that oil palm had the greatest return over cost with internal rate of return 18 per cent and benefit-cost ratio 2.71. The corresponding figures for rubber and coconut were 10 per cent and 1.2 and 9.5 per cent and 1.07 respectively.

Jones (1973) discussed the economics of a coffee project of 75 acres in eastern districts of Rhodesia, assessed over a period of 40 years. The return on total capital invested was estimated at about 10 per cent.

RRIM (1973) reported that a reduction in the non-yielding period from six to four years would result in a substantial rise in internal rate of return. This could be achieved through judicious use of superior planting materials, horticultural manipulation techniques and

improved management. The maximum additional expenditure which could be permitted in employing these techniques had been worked out to range from $ 972 to $ 1752 per hectare, which highlighted the great extent to which extra expenditure could be economically justified.

Wimalaratne (1973) reported that tapping was the biggest single item in the total cost of production of natural rubber.

Palanisamy and Kandasamy (1974) made an attempt to estimate the cost of grape production and resource use efficiency. They found that the level of irrigation, manures and fertilizers had more influence on the production of grapes than other items.

Artina-Sudhardi (1975) observed that tapping and transportation costs account for about 25 per cent of the total expenditure on a rubber estate.

RRIM (1975) reported that tapping and collection costs continued to be the biggest item, accounting for about 40 per cent of total mature area cost per kilogram of rubber produced.

Goswami and Singh (1976) in an analysis of different indicators of investment efficiency revealed that among the

three tree species, sisso, bamboo and teak planted at soil conservation centre, Gujarat, Sisso appeared to provide more favourable returns to capital, followed by bamboo. Internal rate of returns for Sisso and bamboo were 20 per cent and 12.45 per cent respectively and benefit-cost ratios 2.9 and 1.06 respectively. For teak internal rate of return was less than 12 per cent and benefit-cost ratio 0.69.

ARIM (1977) reported the efficiency of Malaysian investment on rubber research by bringing together the benefit and cost streams through the use of three investment criteria, benefit-cost ratio, net present value and internal rate of return. The computations indicated that the overall direct primary returns to producers and consumers from investment on rubber research were high, with internal rate of return of 24 to 25 per cent. When benefits received by producers in Malaysia alone were considered in the computation, the internal rate of return of about 12 per cent were still higher than the 10 per cent opportunity cost of capital in Malaysia.

Outlining the handicaps of small farm sector in rubber cultivation, Sekhar (1977) indicated that the expenditure during the non-yielding phase retarded movement towards replanting and modernisation. Also, that the

non-availability of finance or easy credits inhibited the use of modern crop management practices, which further reduced productivity. Scattered nature of holdings and their small sizes, lack of adoption of modern processing technology, etc. also reduced the returns for products. Lack of group or central marketing activities, dependence on the daily income from the produce for livelihood, and the production and sale of unsmoked sheets by small holders resulting in unilateral decrease of weight and downgrading of product by dealers were stated to be some of the problems faced by small holding sector.

RRIM (1978) reported the economic and social justifications of the Felda type land development approach as a means of alleviating the standard of living of the selected 'landless' rural population. This study compared technical and allocative efficiencies of 149 small holders having average 3.0 hectares holdings selected from the three Felda land settlement schemes with 165 unassisted independent rubber small holders with farms of approximately 1.0 hectares in Malacca. Felda small holders were found to be more technically efficient, in that, they obtained more yield, even when adjustments were made for different levels of measurable inputs. This was mainly due to their better rubber clones and crop management. Higher prices of output,

more fertilizer use and much larger holding size resulted in Felda farmers having very much higher incomes and profits than the independent small holdings.

METHODOLOGY

M E T H O D O L O G Y

The present study on Economics of Rubber Cultivation by Small Holders is based on data collected from a sample of cultivators in Kottayam district. The term small holder is used here to refer to an owner whose holding does not exceed 50 acres ie., 20 hectares (Government of India, Ministry of Commerce, 1968). In this chapter, the procedure adopted in sampling and method of analysis used are explained.

Sampling procedure

Stratified two stage random sampling was adopted for the selection of rubber growers who were the chief source of data for the study. As there is good deal of variation in agro-climatic conditions in Kottayam district, it was necessary to take that fact into account while selecting the sample villages. On the basis of agro-climatic zones the villages in the district were grouped into two zones. The recommendation of the expert committee constituted for formulation of cropping patterns were taken as a guideline for stratification (Government of Kerala, 1974). The areas under the high-land is regarded as Zone I and the mid land as Zone II. Zone I has an

estimated area of 41490 hectares under rubber and Zone II, 11128 hectares (RRII, 1980).

Three villages from among those in Zone I and two villages from among the villages of Zone II were selected at random. A list of selected villages is given below.

Zone I - Manimala
Puliyannoor
Lalam

Zone II - Karukachal
Puthuppally

Sampling frame in each village was prepared from the Directory of Rubber Estates and Holdings in India published by the Rubber Board. Twenty holdings were selected at random from each village. Since rubber plantation takes eight years to start yielding and 12 years for the yield to get stabilized, sample was drawn from farmers who initiated rubber cultivation sufficiently early. Data were collected from the holdings selected.

Manimala is in Kanjirappally Taluk, with an area of 37.42 km^2. The village is about 14 km away from Kanjirappally township. The Manimala river passes through this village. Puliyannoor and Lalam villages belong to Meenachil Taluk with an area of 14.63 km^2 and 19.34 km^2 respectively. These villages are drained by Meenachil river.

The distance of Puliyannoor and Lalam from Palai is 3 km and 1 km respectively. Both these villages lie in highland zone.

Karukachal is in Changanacherry Taluk with an area of 21.25 km^2. It is 16 km away from Changanacherry proper. Puthuppally belongs to Kottayam Taluk and is having an area of 22.40 km^2. It is at about 12 km away from Kottayam town. Both these villages represent the midland zone.

Collection of data

Data were collected by personally interviewing the respondent farmers aided by a well structured schedule, which was pre tested. A specimen of the schedule is given as Appendix I. The information collected includedarea under rubber, expenditure incurred in various aspects of cultivation, processing and marketing of produce, sheet and scrap rubber produced, their price and the problems faced by the cultivators. The survey was conducted during 1980-81.

Method of analysis

The tabular method, analysis of capital productivity and production function were used for analysing and interpreting the data.

Cost of cultivation

Cost of cultivation refers the total expenses involved in the cultivating of one hectare of rubber. Cost of cultivation is calculated yearwise from 1st to 12th year of planting because from 12th year onwards costs and returns were expected to be the same.

Cost of production

Cost of production is the cost for producing one quintal of sheet rubber. Economic life span of rubber tree is taken as 32 years (George and Joseph, 1973). Tapping starts from the eighth year. Expenditure for the first seven years were compounded and distributed among 25 years from eighth to 32nd, in proportion to the yield obtained in each year. For calculating cost of production per quintal, returns from scrap rubber is substracted from the total cost of cultivation in each year.

Capital productivity analysis

Various methods are available to measure the capital productivity (Gittinger, 1976). The four methods used in this study are (1) pay-back period, (2) Benefit-cost ratio, (3) Net present worth and (4) Internal rate of return.

1. Payback period

The payback period is a measure of the length of time from the beginning of a project to the time net benefits return the cost of the capital investment.

2. Benefit-cost ratio

The benefit-cost ratio is defined as the ratio between the present worth of benefits and that of costs.

$$\text{Benefit-cost ratio} = \frac{\text{Present worth of benefits}}{\text{Present worth of costs}}$$

Symbolically,

$$\text{Benefit-cost ratio} = \frac{\sum_{t=1}^{n} \frac{Bt}{(1+I)^t}}{\sum_{t=1}^{n} \frac{Ct}{(1+I)^t}}$$

3. Net present worth

The most straightforward discounted cash flow measure of project worth is net present worth. This is simply the present worth of the cash flow stream. Discounting was done by adopting the following formula.

$$\text{Net present worth (NPW)} = \sum_{t=1}^{n} \frac{Bt-Ct}{(1+I)^t}$$

where,

Bt = benefits in t^{th} year

Ct = costs in t^{th} year

n = total number of years of the project

I = rate of interest (discount rate)

The rate of interest used is 10 per cent which is the market rate of interest on long term loans.

4. Internal rate of return

Another method of using discounted cash flow for measuring the worth of a project is to find out the discount rate which just makes the net present worth of the cash flow equal to zero. This discount rate is termed as internal rate of return and it represents the average earning power of the money used in the project over the project life.

Symbolically, Internal rate of return is that discount rate 'I' such that

$$\sum_{t=1}^{n} \frac{Bt-Ct}{(1+I)^t} = 0$$

The value of I is determined by trial and error method.

Resource use efficiency

A linear production function was worked out to evaluate the influence of the following factors on yield. The factors considered were age of the plantation, labour days, quantity of fertilizer, cost of plant protection

and holding size. It can be represented as:

$$Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5$$

Where,

Y = Gross income (Rs) per year

x_1 = Age of the plants (years)

x_2 = Labour (Man days) per year

x_3 = Fertilizer (kg) per year

x_4 = Plant protection (Rs) per year

x_5 = Area (acres)

b_1, b_2, b_3, b_4 and b_5 are regression coefficients.

GENERAL ECONOMIC AND SOCIAL CONDITIONS OF THE SAMPLE

GENERAL ECONOMIC AND SOCIAL CONDITIONS OF THE SAMPLE

To obtain a background information about rubber growers, family details of the sample cultivators were studied.

Education

Illiterate farmers were totally absent among the selected sample families. Of the total, 49 per cent of the respondents were educated in colleges, 28 per cent upto high school and 14 per cent were educated upto middle school. A distribution of the respondents according to their educational status is given in Table 5.1. A break up among the villages showed that 55 per cent of the respondents in Puliyannoor were college educated followed by Lalam and Karukachal having 50 per cent each.

An analysis of the educational status of the respondents family showed that, out of the total of 589 individuals, 12.73 per cent were aged below five years. Those educated to the primary school were 25.13 per cent while 22.58 per cent were educated to the high school. Only 20.87 per cent of the total were found to have been in college. The detailed break up of the educational status of the families is given in Table 5.2.

Table 5.1. Distribution of the farmers according to education

Name of village	Illiterate	Primary School	Middle School	High School	College education	Total
Manimala	-	1 (5.00)	4 (20.00)	6 (30.00)	9 (45.00)	20 (100)
Puliyannoor	-	1 (5.00)	3 (15.00)	5 (25.00)	11 (55.00)	20 (100)
Lalam	-	2 (10.00)	2 (10.00)	6 (30.00)	10 (50.00)	20 (100)
Karukachal	-	3 (15.00)	2 (10.00)	5 (25.00)	10 (50.00)	20 (100)
Puthuppally	-	2 (10.00)	3 (15.00)	6 (30.00)	9 (45.00)	20 (100)
Total	-	9 (9.00)	14 (14.00)	28 (28.00)	49 (49.00)	100 (100)

(Figures in parentheses show percentages to total)

Table 5.2. Distribution of the respondents family according to education

Name of village	0-5 (age group)	Primary	Middle school	High school	Under-graduate	Graduate	Total
Manimala	15 (13.16)	29 (25.44)	22 (19.30)	27 (23.68)	17 (14.91)	4 (3.50)	114 (100)
Puliyannoor	14 (11.11)	31 (24.60)	25 (19.84)	27 (21.43)	22 (17.46)	7 (5.56)	126 (100)
Lalam	16 (13.79)	28 (24.14)	23 (19.83)	25 (21.55)	19 (16.38)	5 (4.31)	116 (100)
Karukachal	16 (12.90)	32 (25.81)	22 (17.74)	28 (22.58)	20 (16.13)	6 (4.84)	124 (100)
Puthuppally	14 (12.84)	28 (25.69)	21 (19.27)	26 (23.85)	16 (14.68)	4 (3.67)	109 (100)
Total	75 (12.73)	148 (25.13)	113 (19.19)	133 (22.58)	94 (15.96)	26 (4.91)	589 (100)

(Figures in parentheses show percentages to total)

Occupation

Most of the farmers in the sample had more than one occupation. Classification of the respondents based on the number of occupation is given in Table 5.3. It was observed that only 16 per cent of the total respondents depended on agriculture alone, while 51 per cent found employment elsewhere along with agriculture and

25 per cent engaged in business and eight per cent were engaged in all the three occupations.

Table 5.3. Classification of the respondents according to occupation

Name of village	Agriculture alone	Agriculture + service	Agriculture + business	Agriculture + service+ business	Total
Manimala	4 (20.00)	9 (45.00)	6 (30.00)	1 (5.00)	20 (100)
Puliyannoor	2 (10.00)	11 (55.00)	5 (25.00)	2 (10.00)	20 (100)
Lalam	2 (10.00)	12 (60.00)	4 (20.00)	2 (10.00)	20 (100)
Karukachal	3 (15.00)	10 (50.00)	6 (30.00)	1 (5.00)	20 (100)
Puthuppally	5 (25.00)	9 (45.00)	4 (20.00)	2 (10.00)	20 (100)
Total	16 (16.00)	51 (51.00)	25 (25.00)	8 (8.00)	100 (100)

(Figures in parentheses show percentages to total)

A classification of the respondents considering their major sources of income was also made. The distribution is given in Table 5.4. It was observed that 47 per cent of the total respondents have agriculture as

their primary occupation. Employment was the primary occupation of 38 per cent and business for 15 per cent of the total respondents.

Table 5.4. Classification of respondents according to their major sources of income

Name of village	Agriculture	Service	Business	Total
Manimala	9 (45.00)	7 (35.00)	4 (20.00)	20 (100)
Puliyannoor	9 (45.00)	9 (45.00)	2 (10.00)	20 (100)
Lelam	9 (45.00)	8 (40.00)	3 (15.00)	20 (100)
Karukachal	10 (50.00)	6 (30.00)	4 (20.00)	20 (100)
Puthuppally	10 (50.00)	8 (40.00)	2 (10.00)	20 (100)
Total	47 (47.00)	38 (38.00)	15 (15.00)	100 (100)

(Figures in parentheses show percentages to total)

Family size

An analysis of family size of respondents showed that 51 per cent of the total families come under the size group having 3 to 6 members. The families having 6 to 9 members were 34 per cent of the total. Classification of respondents family according to different size group is shown in Table 5.5.

Table 5.5. Distribution of the respondents according to the size of family

Name of village	1 to 3 members	3 to 6 members	6 to 9 members	above 9 members	Total house-holds	Average size of family
Manimala	3 (15.00)	11 (55.00)	4 (20.00)	2 (10.00)	20 (100)	5.70
Puliyannoor	1 (5.00)	9 (45.00)	8 (40.00)	2 (10.00)	20 (100)	6.30
Lalam	2 (10.00)	11 (55.00)	6 (30.00)	1 (5.00)	20 (100)	5.80
Karukachal	2 (10.00)	8 (40.00)	9 (45.00)	1 (5.00)	20 (100)	6.20
Puthuppally	1 (5.00)	12 (60.00)	7 (35.00)	-	20 (100)	5.45
Total	9 (9.00)	51 (51.00)	34 (34.00)	6 (6.00)	100 (100)	5.89

(Figures in parentheses show percentages to total)

In all villages, the highest proportion of the families come under the size group with 3 to 6 members. Puthuppally has 60 per cent, followed by Manimala and Lalam with 55 per cent each. Puthuppally has no family having more than nine members. The respondents had a mean family size of 5.89.

Age and sex

The distribution of the sample families according to age showed that 53.80 per cent of the members were below

14 years of age and 9.85 per cent in the age group of 50 and above. According to the 1971 census, the percentage of population in the age group 14 to 59 was 53.51. If this can be considered as the work force, the percentage of dependents were 46.49 (Government of Kerala, 1977). Similar comparison to the sameple farmers indicates that the proportion of dependents (ie., in the age group 0 to 14 and 60 and above) were found to be higher. The proportion of male and female among total members were 61.63 and 38.37 per cent respectively. The distribution of family members of respondents according to age and sex is given in Table 5.6.

Area under rubber

Distribution of the selected farmers according to area under rubber is given in Table 5.7. Among the total respondents 35 per cent had an area under rubber between 0.5 to 1.0 hectares and 24 per cent between 1.0 to 1.5 hectares. Holdings above 3 hectares were only 4 per cent of the total.

Table 5.6. Classification of respondents' family according to age and sex

Name of Village	Age group (years)								Total members
	0 to 14		14 to 59		60 and above		Total		
	Male	Female	Male	Female	Male	Female	Male	Female	
Manimala	39 (34.20)	22 (19.23)	25 (21.93)	17 (14.91)	8 (7.02)	3 (2.60)	72 (63.16)	42 (36.84)	114 (100)
Puliyannoor	42 (33.30)	27 (21.43)	25 (19.84)	18 (14.29)	9 (7.14)	5 (3.97)	76 (60.32)	50 (39.68)	126 (100)
Lalam	38 (32.76)	24 (20.69)	26 (22.41)	18 (15.52)	7 (6.03)	3 (2.59)	71 (61.21)	45 (38.79)	116 (100)
Karukachal	40 (32.26)	26 (20.97)	27 (21.76)	18 (14.52)	8 (6.45)	5 (4.03)	75 (60.48)	49 (39.52)	124 (100)
Puthuppally	38 (34.86)	21 (19.27)	24 (22.02)	16 (14.68)	7 (6.42)	3 (2.75)	69 (63.36)	40 (36.67)	109 (100)
Total	197 (33.45)	120 (20.35)	127 (21.58)	87 (14.77)	39 (6.62)	19 (3.23)	363 (61.63)	226 (38.37)	589 (100)

(Figures in parentheses show percentages to total)

Table 5.7. Distribution of the selected farmers according to area under rubber

Name of village	Below 0.50 (ha)	0.50 to 1.00 (ha)	1.00 to 1.50 (ha)	1.50 to 2.00 (ha)	2.00 to 2.50 (ha)	2.50 to 3.00 (ha)	above 3.00 (ha)	Total
Manimala	1 (5.00)	8 (40.00)	6 (30.00)	1 (5.00)	3 (15.00)	-	1 (5.00)	20 (100)
Puliyanmoor	2 (10.00)	7 (35.00)	4 (20.00)	4 (20.00)	1 (5.00)	2 (10.00)	-	20 (100)
Lalam	3 (15.00)	8 (40.00)	4 (20.00)	-	2 (10.00)	1 (5.00)	2 (10.00)	20 (100)
Karukachal	2 (10.00)	6 (30.00)	5 (25.00)	3 (15.00)	2 (10.00)	1 (5.00)	1 (5.00)	20 (100)
Puthuppally	1 (5.00)	6 (30.00)	5 (25.00)	5 (25.00)	2 (10.00)	1 (5.00)	-	20 (100)
Total	9 (9.00)	35 (35.00)	24 (24.00)	13 (13.00)	10 (10.00)	5 (5.00)	4 (4.00)	100 (100)

(Figures in parentheses show percentages to total)

COST OF CULTIVATION

COST OF CULTIVATION

Being a perennial crop, the costs for rubber cultivation are incurred over a period of time. A practical difficulty is noticed in obtaining the correct informations on the spendings made much earlier to the data collection for this study. Moreover, it is also observed that the costs of inputs have increased to a considerable proportion. Often the increase in costs are more than the normal discount rate. Hence, an attempt is made to present the cost of cultivation as it would have been incurred in 1980-81. For this, information were gathered on the quantities of the various inputs applied by the sample cultivators during the different years from planting till date, ie., for 12 years. The inputs used were tabulated and the per hectare requirement of the different inputs for the various years of cultivation have been worked out. The inputs were valuated at the rates existing in the concerned zone during 1980-81. Interest on working capital has not been included in these calculations. This exercise would present an idea of the cost for undertaking cultivation of one hectare of rubber and the cost that a farmer would incur at the present cost of inputs for 12 years. The cost figures for the district have been arrived at, after allowing weightage for the area. Total cost of cultivating one hectare of

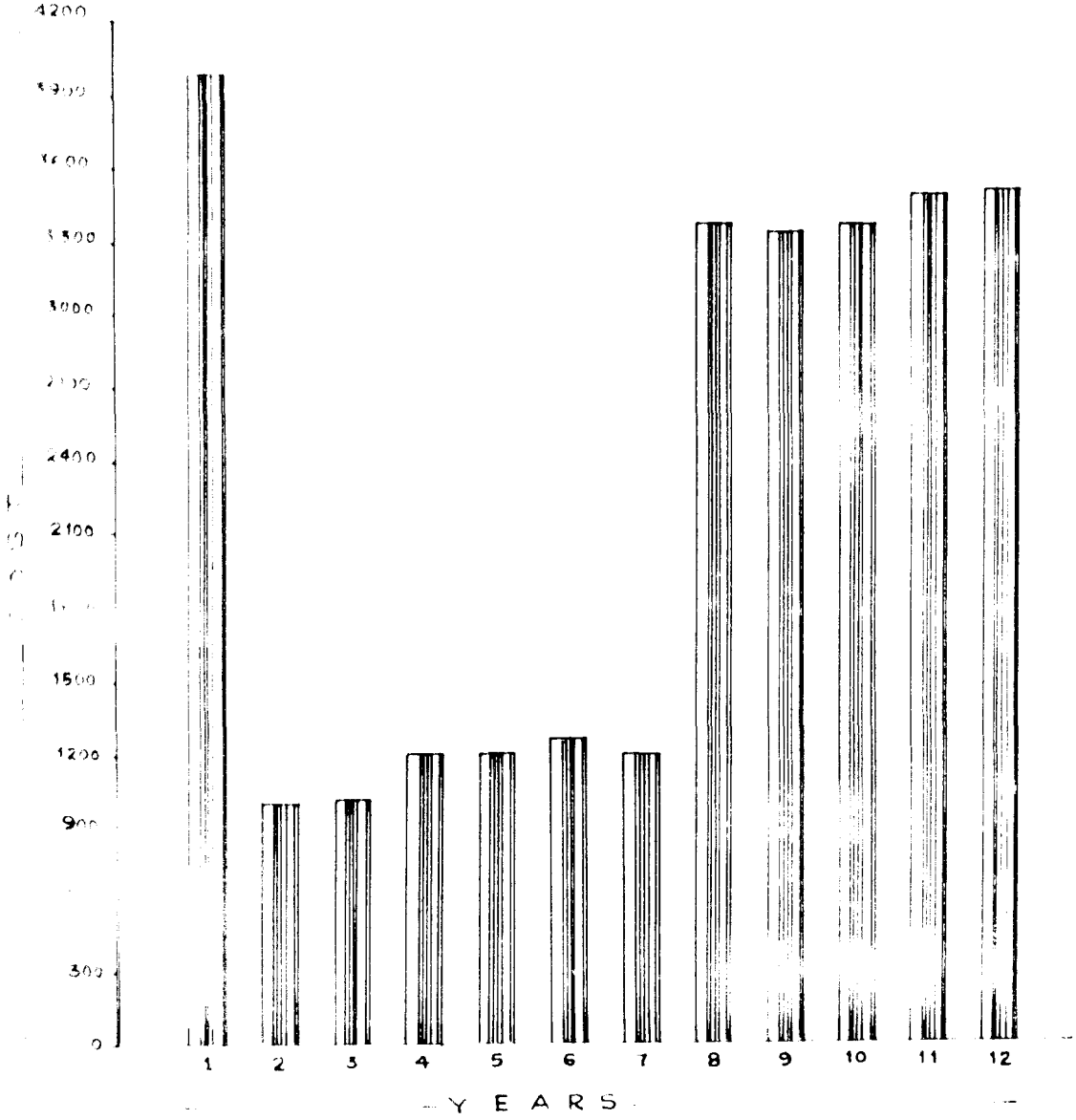
rubber for 12 years is presented in Table 6.1. (Fig.4). The itemwise distribution of the costs for the various years for Zone I, Zone II and the district have been shown in the Appendix II.

Table 6.1. Cost of cultivation of rubber for 12 years per hectare (in Rs)

Year	Zone I	Zone II	District
1	4139 (14.52)	3882 (14.04)	4087 (14.43)
2	1017 (3.57)	1102 (3.98)	1034 (3.65)
3	1076 (3.76)	994 (3.59)	1058 (3.73)
4	1239 (4.35)	1114 (4.02)	1210 (4.27)
5	1227 (4.31)	1191 (4.30)	1218 (4.31)
6	1270 (4.46)	1172 (4.23)	1249 (4.40)
7	1204 (4.22)	1172 (4.23)	1198 (4.23)
8	3486 (12.23)	3355 (12.12)	3450 (12.18)
9	3383 (11.87)	3343 (12.07)	3387 (11.95)
10	3429 (12.03)	3379 (12.20)	3418 (12.06)
11	3498 (12.27)	3466 (12.52)	3493 (12.33)
12	3533 (12.40)	3514 (12.69)	3530 (12.46)
Total	28501 (100)	27691 (100)	28332 (100)

(Figures in parentheses show percentages to total)

FIG. 4 - YEARWISE DISTRIBUTION OF THE COST OF CULTIVATION PER HECTARE OF RUBBER FOR THE DISTRICT (IN Rs)



Expenditure was the highest during the first year of planting being 14.52, 14.04 and 14.43 percentages respectively for Zone I, Zone II and the district of the total for 12 years. The high cost during the first year of cultivation was because of preparatory cultivation, cost of seedlings and planting. There was only a marginal difference in the proportion of the distribution of costs in different years between the zones and the district. Total expenditure for Zone I was estimated to be Rs.28501, which was 2.9 per cent higher than that of Zone II. The same for the district was Rs.28332.

A comparison of the expenditure for the different items for various years has been made separately. Table 6.2 shows the expenditure on human labour for 12 years per hectare. Expenditure on human labour was the highest in first year of establishment of the crop (first to seventh year). This was due to the high use of labour for clearing the field, terracing, making pits and planting. Labour cost for the first year was about 1.4 per cent higher in Zone I than that of Zone II. From the 2nd year onwards upto seventh year labour was utilized for weeding and fertilizer application alone. Labour cost per hectare was found to be more or less same during that period in the two zones. From the eighth year onwards cost of labour was more since it was utilized for tapping. The proportion of labour cost in

different years from eighth to 12th year did not differ much in zones and between the two zones. Total expenditure on labour for Zone I was 5.41 per cent higher than that of Zone II. This is because of the higher wage rate prevalent in the former zone.

Table 6.2. Expenditure on human labour per hectare (in Rs)

Year	Zone I	Zone II	District
1	2142 (14.67)	1883 (13.59)	2088 (14.44)
2	280 (1.92)	255 (1.84)	275 (1.90)
3	249 (1.71)	221 (1.59)	243 (1.68)
4	237 (1.62)	222 (1.60)	232 (1.61)
5	232 (1.59)	209 (1.51)	227 (1.58)
6	231 (1.58)	201 (1.45)	225 (1.55)
7	233 (1.60)	207 (1.99)	228 (1.58)
8	2205 (15.10)	2108 (15.22)	2185 (15.11)
9	2210 (15.14)	2128 (15.38)	2205 (15.29)
10	2183 (14.95)	2133 (15.40)	2173 (15.03)
11	2198 (15.05)	2141 (15.49)	2186 (15.12)
12	2201 (15.07)	2143 (15.47)	2189 (15.14)
Total	14601 (100)	13851 (100)	14456 (100)

(Figures in parentheses show percentages to total)

Purchase of seedlings was during the first year. The cost per hectare was Rs.775, Rs.754 and Rs.771 respectively for Zone I, Zone II and the district. This included the expenditure on transporting the seedlings also. Cost of seedlings for gap filling has been included under miscellaneous expenses for the second year.

Expenditure on fertilizer from the year of planting to the 12th year is shown in Table 6.3. Expenditure on fertilizer included the cost involved in transporting it from the dealer. Total expenditure on fertilizer for Zone I was 2.39 per cent higher than that of Zone II. This may be due to the higher transportation cost. There was not much difference in the proportion to the total expenditure for the item for the different years in Zone I, Zone II and the district.

Expenditure on plant protection per hectare from first year of planting upto 12th year is presented in Table 6.4. Expenditure on plant protection included the cost of chemicals, application, hire charges of equipment, expenses on watering the young seedlings, shading and painting the seedlings with lime and copper sulphate. The expenditure on plant protection was found to be the highest in the first year for the zones and the district which was around 13 per cent of the total expenditure on this item. The high

Table 6.3. Expenditure on fertilizer per hectare (in Rs)

Year	Zone I	Zone II	District
1	434 (7.24)	451 (7.71)	437 (7.33)
2	291 (4.85)	358 (6.12)	305 (5.12)
3	480 (8.01)	409 (6.99)	465 (7.80)
4	599 (10.00)	466 (7.96)	571 (9.58)
5	585 (9.76)	507 (8.67)	560 (9.53)
6	570 (9.51)	513 (8.77)	558 (9.36)
7	532 (8.88)	562 (9.61)	539 (9.04)
8	511 (8.53)	523 (8.94)	514 (8.62)
9	487 (8.13)	518 (8.85)	494 (8.29)
10	493 (8.23)	511 (8.73)	497 (8.34)
11	508 (8.48)	521 (8.90)	511 (8.57)
12	501 (8.36)	512 (8.75)	503 (8.44)
Total	5991 (100)	5851 (100)	5962 (100)

(Figures in parentheses show percentages to total)

Table 6.4. Expenditure on plant protection per hectare (in Rs)

Year	Zone I	Zone II	District
1	506 (13.29)	514 (13.02)	508 (13.19)
2	185 (4.83)	220 (5.59)	192 (4.99)
3	213 (5.56)	231 (5.87)	217 (5.63)
4	206 (5.38)	293 (7.46)	224 (5.82)
5	284 (7.41)	342 (8.70)	296 (7.69)
6	345 (9.00)	332 (8.45)	342 (8.89)
7	320 (8.36)	283 (7.20)	312 (8.10)
8	319 (8.33)	271 (6.90)	309 (8.02)
9	310 (8.09)	320 (8.14)	312 (8.10)
10	345 (9.00)	331 (8.42)	342 (8.89)
11	380 (9.92)	377 (9.60)	380 (9.87)
12	418 (10.91)	416 (10.59)	417 (10.83)
Total	3831 (100)	3930 (100)	3851 (100)

(Figures in parentheses show percentages to total)

expenditure in the first year for this item was due to shading and watering the seedlings in addition to chemical spraying. The expenditure was about five per cent in the second year and was found to increase during the subsequent years due to the increased requirement of chemical and labour. Total expenditure on plant protection for 12 years has been 2.58 per cent higher in Zone II than Zone I.

Expenditure on certain items were incurred only from the eighth year onwards, like the expenditure on tapping and processing materials and expenses on rolling to squeeze out water. Cost of tapping and processing materials are of two types - recurring costs for the cup, hanger, acid and tapping knives and non-recurring costs on dishes and buckets. Recurring cost for the different years are presented in Table 6.5. It was found to be increasing every year for the zones and the district. This was due to the increase in the use of acid. Total expenditure was 3.62 per cent more for Zone II than that of Zone I, since more of these materials were required as the latex production in Zone II was more. Buckets and dishes are needed for collecting the latex and processing. Expenditure on these items were estimated to be Rs.101, Rs.124 and Rs.106 respectively for both the zones and the district.

Table 6.5. Expenditure on the tapping and processing materials (recurring expenses) per hectare (in Rs)

Year	Zone I	Zone II	District
8	143 (17.06)	139 (15.98)	143 (16.92)
9	159 (18.97)	161 (18.51)	159 (18.82)
10	175 (20.88)	175 (20.11)	175 (20.71)
11	180 (21.48)	187 (21.49)	182 (21.54)
12	181 (21.60)	208 (23.91)	186 (22.01)
Total	838 (100)	870 (100)	845 (100)

(Figures in parentheses show percentages to total)

Rolling charges per hectare for the zones and the district are presented in Table 6.6. The same has been found to increase every year as was expected. The payment for converting the latex into sheets was made in kind. Two days production of latex per year was paid annually for the entire produce.

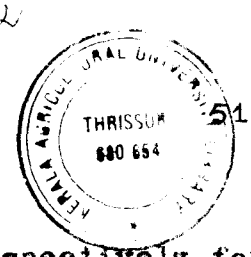
Table 6.6. Expenditure for rolling latex from a hectare (in Rs)

Year	Zone I	Zone II	District
8	74 (14.61)	71 (14.12)	73 (14.46)
9	97 (19.17)	97 (19.28)	97 (19.21)
10	109 (21.54)	109 (21.67)	109 (21.58)
11	113 (22.33)	113 (22.47)	113 (22.38)
12	113 (22.33)	114 (22.47)	114 (22.38)
Total	506 (100)	504 (100)	506 (100)

(Figures in parentheses show percentages to total)

The cost for tools and implements for land preparation occurredin the first year. Expenditure on this item was found to be Rs.164 in all the cases. Replacement and maintenance of the existing ones were found to incur Rs.46 for Zone I, Rs.53 for Zone II and Rs.47 for the district in each year from the second.

Tax includes both the land revenue at the rate of two rupees per acre and plantation tax at the rate of Rs.20 per acre for holdings in excess of one hectare .



Tax was found to be Rs.19, Rs.18 and Rs.19 respectively for both the zones and the district.

All other expenditures were taken as miscellaneous expenditure and is presented in Table 6.7. Miscellaneous expenditure was found to be the highest in second year, since it included expenditure on gap filling, establishment of covercrop, etc.

Table 6.7. Expenditure on miscellaneous items per hectare (in Rs)

Year	Zone I	Zone II	District
1	99 (10.31)	105 (12.47)	100 (10.80)
2	196 (20.42)	198 (23.53)	196 (21.17)
3	69 (7.19)	62 (7.36)	67 (7.24)
4	132 (13.75)	62 (7.36)	117 (12.63)
5	61 (6.35)	62 (7.36)	61 (6.59)
6	59 (6.15)	55 (6.53)	58 (6.26)
7	54 (5.63)	49 (5.82)	53 (5.72)
8	68 (7.08)	48 (5.70)	54 (5.83)
9	55 (5.73)	48 (5.70)	54 (5.83)
10	59 (6.15)	49 (5.82)	56 (6.05)
11	54 (5.63)	53 (6.29)	55 (5.94)
12	54 (5.63)	51 (6.06)	55 (5.94)
Total	960 (100)	842 (100)	926 (100)

(Figures in parentheses show percentages to total)

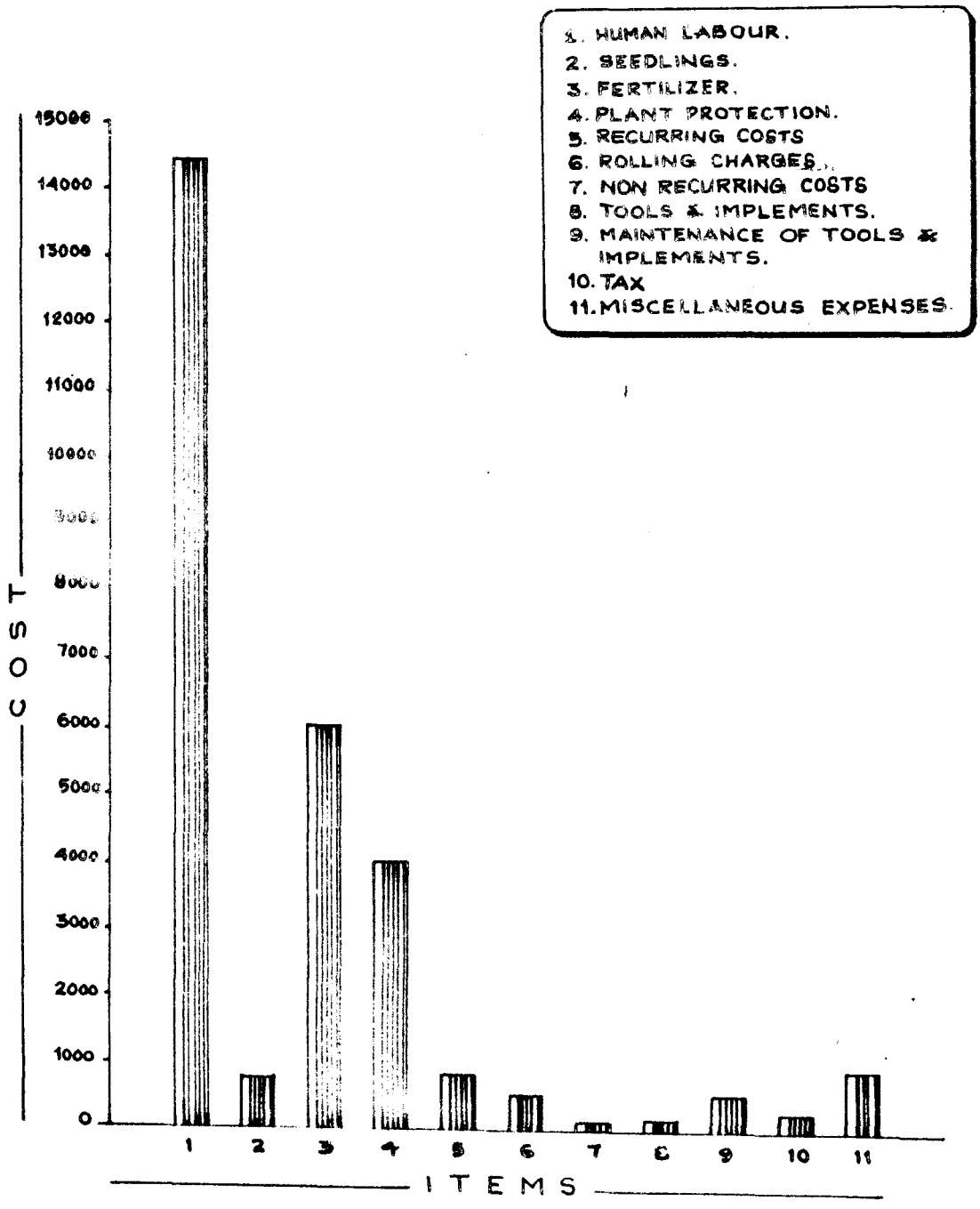
Itemwise break up of the total cost of cultivation till the period of yield stabilization is shown in Table 6.8 (Fig.5). It may be seen from the table that the largest claiment of the total cost for 12 years in all the cases was human labour accounting for about 51 per cent.

Table 6.8. Itemwise break up of the total cost of cultivation for 12 years (in Rs)

Items	Zone I	Zone II	District
Human labour	14601 (51.23)	13851 (50.03)	14456 (51.02)
Seedlings	775 (2.72)	754 (2.72)	771 (2.72)
Fertilizer	5991 (21.02)	5851 (21.13)	5962 (21.05)
Plant protection	3831 (13.44)	3930 (14.20)	3851 (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 (3.27)
Total	28501 (100)	27688 (100)	28332 (100)

(Figures in parentheses show percentages to total)

FIG. 5 - ITEMWISE TOTAL COST OF CULTIVATION PER HECTARE OF RUBBER FOR 12 YEARS FOR THE DISTRICT (IN Rs)



Expenditure on fertilizer accounted for little over 21 per cent while plant protection around 14 per cent. For all the other items the expenditure was found to be below five per cent.

Rubber starts yielding from eighth year and the yield stabilizes from 12th year. It would be of interest to understand the nature of expenditure at these two years. The expenditure for the eighth year and the 12th year are presented in Tables 6.9a and 6.9b respectively. The cost of establishment shown in the table refers to the portion attributed for that particular year from the total cost incurred upto the eighth year. It has been aportioned in proportion to the total return for 25 years (8 to 32).

It may be observed from the tables that the cost of establishment was higher for the 12th year than for the eighth in absolute terms as well as a proportion to total expenditure for that particular year. All the other items of expenditure recorded similar pattern of cost for both the years. Returns for the 12th year in all the cases both in terms of quantity and value were more than that for the eighth year.

Table 6.9a. Cost and returns for 6th year (in Rs)

Items	Cost per hectare		
	Zone I	Zone II	District
A. Cost of establishment	297 (7.40)	283 (7.34)	291 (7.34)
B. Itemwise expenditure during the year:			
Human labour	2205 (55.00)	2108 (54.68)	2185 (55.12)
Fertilizer	511 (12.75)	523 (13.57)	514 (12.97)
Plant protection	319 (7.95)	271 (7.03)	309 (7.80)
Maintenance of tools and implements	46 (1.15)	53 (1.37)	47 (1.19)
Tax	19 (0.47)	18 (0.47)	19 (0.47)
C. Tapping and processing costs:			
*Recurring costs	143 (3.57)	139 (3.60)	143 (3.61)
**Non-recurring costs	101 (2.52)	124 (3.22)	106 (3.67)
Rolling charge	74 (1.85)	71 (1.84)	73 (1.84)
Miscellaneous	68 (1.70)	48 (1.25)	54 (1.36)
Interest	226 (5.64)	217 (5.63)	223 (5.63)
Total	4009 (100)	3855 (100)	3964 (100)

(Figures in parentheses show percentages to total)

* Recurring costs includes the cost of chemical, cups, hangers and tapping knives.

** Non-recurring costs includes the cost of buckets and dishes.

	Returns					
	Zone I		Zone II		District	
	Quantity (kg)	Value (Rs)	Quantity (kg)	Value (Rs)	Quantity (kg)	Value (Rs)
Sheet	536	6429	518	6211	532	6383
Scrap	124	805	131	852	125	815
Total value		7234		7063		7198

Table 6.9b. Cost and returns for 12th year (in Rs)

Items	Cost per hectare		
	Zone I	Zone II	District
A. Cost of establishment	476 (11.21)	453 (10.78)	466 (11.00)
B. Itemwise expenditure for the year:			
Human labour	2201 (51.81)	2143 (50.98)	2189 (51.69)
Fertilizer	501 (11.79)	512 (12.18)	503 (11.88)
Plant protection	418 (9.84)	416 (9.90)	417 (9.86)
Maintenance of tools and implements	46 (1.08)	53 (1.26)	47 (1.11)
Tax	19 (0.45)	18 (0.43)	19 (0.45)
C. Tapping and processing costs:			
*Recurring costs	181 (4.26)	208 (4.95)	186 (4.39)
Rolling charges	113 (2.66)	114 (2.70)	114 (2.69)
Miscellaneous	54 (1.27)	50 (1.19)	55 (1.30)
Interest	239 (5.63)	237 (5.63)	239 (5.63)
Total	4248 (100)	4204 (100)	4235 (100)

(Figures in parentheses show percentages to total)

*Recurring costs includes the cost of chemical, cups, hangers and tapping knives.

	Returns					
	Zone I		Zone II		District	
	Quantity (kg)	Value (Rs)	Quantity (kg)	Value (Rs)	Quantity (kg)	Value (Rs)
Sheet	807	9691	918	11012	852	10224
Scrap	177	1147	218	1417	165	1204
Total value		10838		12429		11428

Considering the cropcycle of rubber as 32 years, the cost and returns per hectare for the zones and the district for the entire period has been worked out and presented in Table 6.10. It has been assumed that the cost from the 13th year to the 32nd as being the same. It has been observed that the yield of rubber would decline from the 29th year to the 32nd in the reverse order of its improvement from eighth to the 12th year.

Table 6.10. Cost and returns per hectare for a crop cycle of rubber (in Rs)

Year	Cost			Returns								
				Zone I			Zone II			District		
	Zone I	Zone II	District	Sheet	Scrap	Total	Sheet	Scrap	Total	Sheet	Scrap	Total
1	4139	3889	4087	-	-	-	-	-	-	-	-	-
2	1017	1102	1034	-	-	-	-	-	-	-	-	-
3	1076	994	1058	-	-	-	-	-	-	-	-	-
4	1239	1114	1210	-	-	-	-	-	-	-	-	-
5	1227	1191	1218	-	-	-	-	-	-	-	-	-
6	1270	1172	1149	-	-	-	-	-	-	-	-	-
7	1204	1172	1198	-	-	-	-	-	-	-	-	-
8	3486	3355	3450	6429	805	7234	6211	852	7063	6383	815	7198
9	3383	3343	3387	7808	940	8742	8049	976	9025	7859	944	8803
10	3429	3379	3418	9138	1062	10200	9294	1199	10493	9171	1091	10262
11	3498	3466	3493	9577	1138	10715	9981	1214	11195	9660	1100	10760
12 to 28	3533	3514	3530	9691	1147	10838	11012	1447	12459	10224	1204	11428
29	3533	3514	3530	9577	1138	10715	9981	1214	11195	9660	1100	10760
30	3533	3514	3530	9138	1062	10200	9294	1199	10493	9171	1091	10262
31	3533	3514	3530	7808	940	8748	8049	976	9025	7859	944	8803
32	3533	3514	3530	6429	805	7234	6211	852	7063	6383	815	7198
32	-	-	-	-	-	24000(a)	-	-	24000(a)	-	-	24000(a)

(a) - Salvage value

COST OF PRODUCTION

COST OF PRODUCTION

The cost of production of rubber has been worked out as the cost involved in producing one quintal of sheet rubber. In the computations the actual expenditure incurred by the sample cultivators were considered. The economic life of rubber has been taken as 32 years (George and Joseph, 1973) with a period of 25 years available for tapping. The total cost of establishment (for seven years) has been compounded to the eighth year. Proportional allocation of this amount has been made to the cost for the succeeding years in proportion to the yield obtained in the respective years. Since a stabilized yield is expected from the 12th year to the 28th, it has not been repeated in the table. A decrease in the yield is observed from the 28th year to the 32nd. Hence, the cost of production per quintal for these years are shown separate. Table 7.1 represents the cost of production per quintal of sheet rubber from the eighth to the 32nd year. The table also includes the cost of cultivation and the quantity of sheet rubber produced.

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 total cost.

Table 7.1. Cost of production per quintal of sheet rubber (in 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	2262	2334	2277	5.36	5.18	5.32	422	451	428
9	2129	2284	2140	6.51	6.71	6.55	327	340	327
10	2363	2034	2272	7.62	7.74	7.64	310	263	297
11	2383	2122	2306	7.98	8.32	8.05	299	255	286
12 to 28	2552	2083	2432	8.07	9.18	8.31	316	227	293
29	2633	2242	2529	7.98	8.32	8.05	330	269	314
30	2768	2344	2657	7.62	7.74	7.64	363	303	348
31	2839	2627	2773	6.51	6.71	6.55	436	392	423
32	2993	2725	2936	5.36	5.18	5.32	559	526	552

A marginal change in the cost has been recorded from eighth to the 12th year. The higher cost noticed for the years 29th to 32nd is a result of the decrease in returns from scrap rubber. The cost per quintal of rubber for the period from eighth to 12th shows that it is highest for the eighth year (Rs.422, Rs.451 and Rs.428 respectively for Zone I, Zone II and the district). The same was found to decrease for the subsequent years till the 12th and remained more or less the same for the rest of the period, till the 28th year (Rs.316, Rs.227 and Rs.293 respectively for Zone I, Zone II and the district). The cost per quintal showed an increasing trend for the period from 29th to 32nd year.

CAPITAL PRODUCTIVITY AND RESOURCE USE EFFICIENCY

CAPITAL PRODUCTIVITY AND RESOURCE USE EFFICIENCY

Rubber has a long gestation period and considerable investments are made for 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 to capital. Four measures of capital productivity are considered. They are (1) payback period, (2) Benefit-cost ratio, (3) Net present worth and (4) Internal rate of return. Capital productivity analysis brings out a measure of the efficiency of returns obtained.

1. Payback period

Payback period is an undiscounted measure of the worthiness of an endeavour. It measures the efficiency of cultivation by indicating the period within which the returns would offset the investments. The two drawbacks attributed to this measure are (1) it fails to consider earnings after the payback period, (2) it fails to take into consideration differences in the timing of proceeds. The payback period for the two zones and the district are shown below.

Zone I - 9.53 years
Zone II - 9.43 years
District - 9.51 years

The other three methods, viz., Benefit-cost ratio, Net present worth and Internal rate of return are discounted measures of investment worth. Using a suitable discount rate, the investment is reduced to the present value. The returns are also similarly discounted. The stream of costs and benefits are then compared.

2. Benefit-cost ratio

The benefit-cost ratio indicates the returns on a rupee of investment. All costs have been discounted to the present value and compared with discounted value of benefits. A project with cost-benefit ratio greater than unity is considered worthwhile. The benefit-cost ratio for the zones and the district is shown below.

Zone I	- 1.96
Zone II	- 2.21
District	- 2.04

As these ratios are greater than unity, the investments are economically justified. The benefit-cost ratio in Zone II is 12.75 per cent more than that of Zone I. This can be attributed both to the low cost of cultivation as well as the higher yield in this zone.

3. Net present worth

Net present worth tries to project an idea of the feasibility of cultivation. Here, both the cost and the benefits were discounted at an opportunity cost and these two were compared. A positive net present worth is considered as a worthwhile investment. The present worth of a hectare of rubber cultivation for the two zones and the district were found to be as follows.

Zone I - Rs.23747

Zone II - Rs.29255

District - Rs.25597

The net present worth was positive in both the zones. It was Rs.5508 (i.e., 23.19 per cent) more in Zone II than that of Zone I. The advantage of net present worth measure as compared with benefit-cost ratio is that, computation process for netting out the amounts shall be started at any point of time.

4. Internal rate of return

Internal rate of return is another method of using discounted cash flow for measuring the worth of investments. The internal rate of return for the investment is that discount rate which nullifies the present worth of cash outflows and inflows. It represents the average earning power of money used in

cultivation over its projected economic life. Since the internal rate of return method involves complicated trial and error calculations, the net present worth method is usually preferred to. However, the internal rate of return has an advantage over the other, that the returns on investments are expressed as a percentage. The internal rate of return for the two zones and the district are as follows.

Zone I	- 23.70
Zone II	- 25.35
District	- 24.20

The computation of the measures of capital productivity is shown in Appendixes III, IV and V.

A comparison can be made between the two zones, Zone I which is predominantly highland and Zone II, predominantly midland. Rubber cultivation was initiated in highlands and was introduced to midlands later. All the four measures of capital productivity discussed above indicated that the cultivation of rubber in the midland (Zone II) was advantageous to the highland (Zone I). It is also observed that the cost of cultivation in the midlands per hectare has been lesser than that in the highlands, probably due to high intensity of work resultant of the undulating nature

of land in the highlands. The yield per hectare in Zone II has also been recorded to be higher than that of Zone I. This may be due to the better utilisation of inputs in the midland, while possibility do exist for a greater wastage of inputs added due to heavy soil run off, water percolation and other conditions prompted by the undulating terrain of the highlands.

Resource use efficiency

Linear and loglinear production functions were tried for the data and found that loglinear function was not better than the linear function. The inputs taken into consideration were age of the plantation (x_1), human labour (x_2), quantity of fertilizer (x_3), cost of plant protection (x_4) and area (x_5) in that order. The partial regression coefficients and their standard errors, multiple correlation coefficient (R), coefficient of determination (R^2) and the F ratios, for the two zones were determined and are presented in Table 8.1.

The coefficient of determination R^2 explains the proportion of variation of the dependent variable (Y), explained by the independent variables. Eighty three per cent in Zone I and 71 per cent in Zone II of the variations in yield were explained by the independent variables.

Table 8.1. Partial regression coefficients, standard errors, multiple correlation coefficients, coefficient of determination and F ratios (absolute values)

	Constant	x_1	x_2	x_3	x_4	x_5	R	R^2	F
Zone I	204.90	-1.31 (243.08)	6.15 (50.72)	0.116 (2.03)	1.14 (3.41)	16.60 (588.89)	0.91	0.83	53.67**
Zone II	-1215.68	68.92 (1034.64)	-10.28 (72.96)	-1.97 (7.72)	3.90 (7.17)	145.36 (1668.09)	0.84	0.71	16.93**

(Figures in parentheses show standard errors)

** Significant at 1% level

Though the F ratios were found to be significant in both the zones, none of the regression coefficients were significant. This could be because of the presence of multicollinearity. The simple correlation coefficient between yield and area was 0.89 in Zone I and 0.76 in Zone II, implying that 79 per cent and 58 per cent respectively of the variation in yield in Zone I and Zone II were explained by the area alone. In other words, only 4 per cent of the variation in Zone I and 13 per cent of the variation in Zone II of the yield were explained by the other four components considered in addition to the contribution of the area. Such a major contribution by area could be explained as 'yield increases in proportion to the area, if other factors remain constant'.

In these circumstances it is worthwhile to consider the regression of yield on the five inputs on per hectare basis. The corresponding partial regression coefficients, standard errors, multiple correlation coefficients, coefficient of determination and F ratios were determined and presented in Table 8.2.

Here influence of other factors through area is eliminated. In Zone I and Zone II only 55.9 per cent and 17.6 per cent respectively of the variations in yield were explained by the independent variables. Though F ratio was

Table 8.2. Partial regression coefficients, standard errors, multiple correlation coefficient, coefficient of determination and F ratios (per hectare values)

	Constant	x_1	x_2	x_3	x_4	x_5	R	R^2	F
Zone I	137.008	-3.22 (70.43)	8.82 (38.76)	0.541 (1.89)	0.934 (1.65)	-12.04 (38.89)	0.75	0.559	13.70**
Zone II	285.05	-14.26 (200.75)	9.12 (64.93)	-0.696 (5.57)	1.380 (4.34)	11.12 (69.10)	0.42	0.176	1.45

(Figures in parentheses show standard errors)

**Significant at 1% level

significant for Zone I, the regression coefficients were not significant. This may, perhaps, be due to the presence of multicollinearity. Age, fertilizer and plant protection showed much variation in Zone I, compared to Zone II. This could be the reason for the more explanation of the variation in yield in Zone I compared to Zone II. In Zone II, F was not significant. This may be because, there may not be much variation in the inputs among themselves and there could not be much variation in yield caused by those inputs. The variation in yield could also be attributed to many other factors not considered here such as texture, structure and reaction of soil, microclimate, type of planting material, etc.

PROBLEMS OF SMALL GROWERS

PROBLEMS OF SMALL GROWERS

The study was also aimed at understanding the problems of small growers engaged in the cultivation of rubber. No serious problems were reported by the respondents.

Non-availability of trained tappers was one of the problems suggested by the farmers. Proper tapping has got a direct bearing on the yield and bark regeneration. The trained tappers have been noticed to seek employment in estates where the wages are higher.

Marketing of produce was found to be another problem faced by the small growers. Absence of good roads and high cost of transportation affect the marketing. Eventhough rubber marketing societies were functioning, only a very few farmers were found to be utilising the facility. Certain amount of partiality shown by these society authorities, delay in making payments etc. prevented the small growers from utilising the facilities.

Moreover, there seems to be no strong organisation among the small growers. They also opined that the facility of availing subsidy would not benefit them since the cultivation was in a sort of interplanted nature.

SUMMARY

S U M M A R Y

The present investigation on the economics of rubber cultivation by small holders in Kottayam district was undertaken during the year 1980-81. A sample of 100 small holders was used for this purpose, in two agro-climatic zones found within the district. Zone I was highland and Zone II was midland.

The salient findings of the investigation are summarised below.

It was observed that all of the sample farmers were literate. Almost all of them had taken up more than one occupation. Only 16 per cent of the total farmers was pure agriculturists. The highest proportion (51 per cent) of the sample families had 3 to 6 members with average family size of 5.89. Majority of the holdings came under the size group of 0.5 to 1.0 hectare (35 per cent).

Data were collected for a period of 12 years from the year of planting and cost of cultivation per hectare was calculated based on 1980 prices.

Total cost of cultivation for 12 years was found to be Rs.28501 and Rs.27683 for the Zone I and Zone II respectively and the average for the district was Rs.28332.

The major item in the cost of cultivation was labour constituting about 51.23 per cent (Rs.14601), 50.03 per cent (Rs.13851), 51.02 per cent (Rs.14456) of the total respectively for Zone I, Zone II and the district. During the pre-yielding period, labour cost was the highest in the first year of planting and was 14.52 per cent of the total labour cost for first 12 years for Zone I, 14.04 per cent for Zone II and 14.43 per cent for the district. From the second year, labour cost remained more or less steady upto eighth year. From eighth year onwards labour cost increased and was about 15 per cent of the total labour cost for the Zones and for the district.

The expenditure on seedlings was Rs.775, Rs.754 and Rs.771 respectively for Zones I and II and the district. It was only 2.72 per cent of the total cost of cultivation.

Expenditure on fertilizer accounted for 21.02 per cent (Rs.5991), 21.13 per cent (Rs.5851) and 21.05 per cent (Rs.5962) for Zone I, Zone II and for the district respectively. Plant protection accounted for 13.44 per cent (Rs.3831) of the total cost for Zone I, 14.20 per cent (Rs.3930) for Zone II and 13.59 per cent (Rs.3851) for the district.

Recurring costs on tapping and processing materials were involved from the eighth year onwards and these were

2.92 per cent (Rs.838), 3.14 per cent (Rs.870), 2.98 per cent (Rs.845) of the total for Zone I, Zone II and the district, respectively. The cost for the various tools and implements for clearing the land and planting was incurred only during the first year. Similarly, cost of utensils used for collection of latex and processing was incurred only during the eighth year. These two put together have recorded 0.93 per cent (Rs.265), 1.04 per cent (Rs.288) and 0.95 per cent (Rs.270) of the total cost for Zone I, Zone II and the district, respectively. Maintenance of tools and implements accounted for Rs.506 for Zone I, Rs.583 for Zone II and Rs.517 for the district. The corresponding percentage were 1.78, 2.11 and 1.84.

Rolling charges were 1.78 per cent of the total cost for Zone I, 1.82 per cent for Zone II and 1.78 per cent for the district. It was Rs.506, Rs.504 and Rs.506 respectively for the Zones I and II and the district.

Tax was 0.80 per cent (Rs.228) for Zone I, 0.78 per cent (Rs.216) for Zone II and 0.79 per cent (Rs.228) for the district. Miscellaneous expenditure was 3.37 per cent (Rs.960), 3.04 per cent (Rs.842) and 3.27 per cent (Rs.926) respectively for the zones I and II and for the district.

Tapping starts by the eighth year and the yield is observed to increase till the 12th year. Then it stabilizes.

The stabilized yield is obtained until the 28th year. Hence the returns were assumed to be the same for the period of 13th to 28th year as was obtained during the 12th year. Thus returns for the years 12th to 28th were at Rs.10838 for Zone I, Rs.12459 for Zone II and the average for the district worked out Rs.11428. The returns for the period 29th to 32nd years were calculated assuming that yield declines in the reverse order of its increase during eighth to 12th year.

Cost of production per quintal of sheet rubber showed a steady decrease from eighth year to 12th year. Cost of production for stable production period was estimated at Rs.324, Rs.242 and Rs.305 respectively for the Zone I, Zone II and the district.

Payback period for both the zones was found to be between nineth and 10th year of planting. Benefit-cost ratios were 1.96, 2.21 and 2.04 respectively for Zone I, Zone II and the district. As against the total investment upto the yielding stage of Rs.11172, Rs.10634 and Rs.11054 for Zone I, Zone II and the district, respectively, the net present worth was estimated at Rs.23747, Rs.29237 and Rs.25597 respectively for Zone I, Zone II and the district. Internal rate of returns were 23.70 per cent, 25.35 per cent and 24.20 per cent respectively for Zone I, Zone II and for the district.

Age of the plantation, labour days utilised, the quantity of fertilizer, cost of plant protection and the area were the independent variables considered for regression analysis. Eighty three and 71 per cent of the variations in the yield for Zone I and Zone II were found to be explained by the variables used in absolute quantities. Further analysis was made considering the inputs used per hectare. While 55.9 per cent of the variation on productivity was explained by the independent variables in Zone I, the same variables explained only 17.6 per cent of the variation for Zone II. The regression coefficients in both the cases were found to be insignificant.

The problems of the farmers in the area under study were the absence of trained tappers, improper functioning of the rubber marketing societies and the absence of a strong organisation among cultivators.

Indications are that cultivation of rubber was more rewarding in Zone II, the midland compared to Zone I, the highland.

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APPENDICES

APPENDIX I

Copy of the Schedule

ECONOMICS OF RUBBER CULTIVATION BY SMALL HOLDERS IN KOTTAYAM DISTRICT

I. IDENTIFICATION:

1. Name and address of the owner:

2. Family details

No.	Name	Sex Male/Female	Age	Relation-ship	Education	Occupation

3. Name and register No. of the holding :

4. Location of the owner's residence (distance from the nearest rubber dealer :

II. AREA UNDER RUBBER

	Area	No. of trees
a. Actual registered area under rubber :		
b. Topography		

III. COST OF PRODUCTION

1st year	Men	Women	Rs. Ps.
1. Clearing the field			
2. Terracing			

1st year	men	Women	Rs. Ps.

3. Cost of making pits (at the rate of Rs. ..../pit)

4. Filling and planting

5. Cost of planting materials (at the rate of Rs...../ material)

6. Cost of shade basket (at the rate of Rs. .... for ..... Nos.)

7. Fixing shade baskets

8. Pruning and thinning out

9. Weeding and mulching

10. Other cultivation operations, if any (Soil conservation, Fencing etc.)

2. Manuring Expenditure

a. Cost of manure/Fertilizer

b. Other expenses like transport

c. Cost of Application

3. Plant protection

a. Cost of chemicals

b. Cost of application

c. Hire charges of equipments, if any

d. Cost of Rocker sprayer, if owned

e. Expenses of other plant protection measures

	Men	Women	Rs.Ps.
4. Covercrop establishment			
a. Labour cost			
b. Cost of seeds (Material)			
5. Miscellaneous Expenditure			
6. Total for the first year			
2nd Year - I Maintenance			
a. Weeding and mulching			
b. Terracing			
2. Manuring expenditure			
a. Cost of manure/fertilizer			
b. Other expenses like transport			
c. Cost of application			
3. Plant protection			
a. Cost of chemicals			
b. Cost of application			
c. Hire charges of equipments, if any			
d. Expenses of other plant protection measures			
4. Cover crop establishment			
a. Cost of fertilizer			
b. Cost of application			
5. Miscellaneous expenditure			
6. Total for the 2nd year			
3rd year			
1. Maintenance			
a. Weeding and mulching			

	Men	Women	Rs.Ps.

2. Manuring Expenditure

   a. Cost of Manure/Fertilizer

   b. Other expenses like transport

   c. Cost of application

3. Plant protection

   a. Cost of chemicals

   b. Cost of application

   c. Hire charges of equipments, if any

   d. Expenses of other plant protection measures

4. Miscellaneous Expenditure

5. Total for the 3rd year

   4th year

1. Maintenance

   a. Weeding and mulching

2. Manuring Expenditure

   a. Cost of Manure/Fertilizer

   b. Other expenses like transport

   c. Cost of Application

3. Plant protection

   a. Cost of chemicals

   b. Cost of application

   c. Hire charges of equipments, if any

   d. Expenses of other plant protection measures

4. Miscellaneous expenditure

	Men	Women	Rs.Ps.
5. Total for the 4th year			
5th year			
1. Maintenance			
a. Weeding			
2. Manuring Expenditure			
a. Cost of Manure/fertilizer			
b. Other expenses like transport			
c. Cost of application			
3. Plant protection			
a. Cost of chemicals			
b. Cost of application			
c. Hire charges of equipments, if any			
d. Expenses of other plant protection measures			
4. Miscellaneous expenditure			
5. Total for the 5th year			
6th year			
1. Maintenance			
a. Weeding			
2. Manuring Expenses			
a. Cost of Manure/Fertilizer			
b. Other expenses like transport			
c. Cost of application			
3. Plant Protection			
a. Cost of chemicals			
b. Cost of application			
c. Hire charges of equipments, if any			

	Men	Women	Rs.Ps.
d. Expenses of other plant protection measures			
4. Miscellaneous expenses			
5. Total for the 6th year			

7th year

1. Maintenance			
a. Weeding			
2. Manuring expenses			
a. Cost of manure/fertilizer			
b. Other expenses like transport			
c. Cost of application			
3. Plant protection			
a. Cost of chemicals			
b. Cost of application			
c. Hire charges of equipments, if any			
d. Expenses of other plant protection measures			
4. Miscellaneous expenses			
5. Total for the 7th year			

8th year

1. Maintenance			
a. Weeding			
2. Manuring expenditure			
a. Cost of manure/fertilizer			
b. Other expenses like transport			
c. Cost of application			

	Men	Women	Rs.Ps.
3. Plant protection			
a. Cost of chemicals			
b. Cost of application			
c. Hire charges of equipments, if any			
d. Expenses of other plant protection measures			
4. Miscellaneous expenditure			
5. Tapping charges (at the rate of Rs.....)			
6. Total for the 8th year			

		Kg	Price/kg	Total
Yield	1. Sheet rubber			
	2. Scrap rubber			

	Men	Women	Rs.Ps.
9th year			
1. Maintenance			
a. Weeding			
2. Manuring Expenditure			
a. Cost of manure/fertilizer			
b. Other expenses like transport			
c. Cost of application			
3. Plant protection			
a. Cost of chemicals			
b. Cost of application			
c. Hire charges of equipments, if any			
d. Expenses of other plant protection measures			
4. Miscellaneous expenditure			

5. Tapping charges (at the rate of Rs. ...../noon)

	Kg	Price/kg	Total
Yield - Sheet rubber			
Scrap rubber			

10th year	Men	Women	Rs.Ps.
1. Maintenance			
a. Weeding			
2. Manuring expenditure			
a. Cost of manure/fertilizer			
b. Other expenses like transport			
c. Cost of application			
3. Plant protection			
a. Cost of chemicals			
b. Cost of application			
c. Hire charges of equipment, if any			
d. Expenses of other plant protection measures			
4. Miscellaneous expenditure			
5. Tapping charges			
6. Total for the 10th year			

	Kg	Price/kg	Total
Yield - sheet rubber			
scrap rubber			

11th year	Men	Women	Rs.Ps.
1. Maintenance			
a. Weeding			

	Men	Women	Rs.Ps.
2. Manuring expenditure			
a. Cost of manure/fertilizer			
b. Other expenses like transport			
c. Cost of application			
3. Plant protection			
a. Cost of chemicals			
b. Cost of application			
c. Hire charges of equipments, if any			
d. Expenses of other plant protection measures			
4. Miscellaneous expenditure			
5. Tapping charges			
6. Total for 11th year			

	Kg	Price/kg	Total
Yield - Sheet rubber			
Scrap rubber			

12th year

1. Maintenance			
a. Weeding			
2. Manuring Expenditure			
a. Cost of manure/fertilizer			
b. Other expenses like transport			
c. Cost of application			

	Men	Women	Rs.Ps.
3. Plant protection			
a. Cost of chemicals			
b. Cost of application			
c. Hire charges of equipments, if any			
d. Expenses of other plant protection measures			
4. Miscellaneous expenditure			
5. Tapping charges			
6. Total for the 12th year			

	Kg	Price/kg	Total
Yield - Sheet rubber			
Scrap rubber			

IV. Expenditure on tools & implements

a. Cost of small tools & implements (like mammetties etc. used for field work)

b. Sprayer, Duster, etc.

c. Repairs and maintenance of tools

V. Tapping and collection of latex

Stores	Cost
a. Cup, hanger, etc.	
b. Yield stimulents, if any used	
c. Rain guard	
d. Tapping knives	
e. Buckets	

VI. Processing, sheeting, smoking

1. Stores

a. Acid

b. Firewood

c. Cost of Rubber roller, if owned

d. Cost of smoke house if owned

e. Repair and maintenance of rollers, smoke house

f. Charges paid for sheeting rubber, if outside labour is utilised

VII. Packing

a. Packing charge

b. Transportation charges upto selling point

VIII. Taxes

Plantation tax

Other taxes

PROBLEMS OF RUBBER GROWERS

1. Is your rubber area a compact block or fragmented

2. Is the rubber area intercropped/interplanted - Yes/No
   If 'Yes' reason for interplanting/intercropping

   a. Trees existed before planting rubber

   b. Scarcity of land

   c. Price flutuation of crops

   d. Employment potential of the family throughout the year

   e. Other reasons

3. Are you cultivating superior planting material - Yes/No
If 'No' Why?

a. Price is high (b) Not obtained in time.

c. Scarcity of planting material

d. Viability rate low

e. Other reasons

4. Are you adopting proper spacing? Yes/No

If 'no' why?

a. Ignorance of recommended spacing

b. It is labour intensive

c. Scarcity of land

d. Other reasons

5. Are you applying the recommended fertilizers - Yes/No.
If 'no' why?

a. Ignorance of recommendations

b. Cost of fertilizer high

c. High labour charges

d. Other reasons

If 'yes' what are the common fertilizers using?

6. Are you adopting regular plant protection measures?
Yes/No

If 'no' why?

a. Ignorance of plant protection

b. Labour charges high

c. High cost of chemicals

d. Other reasons

7. Are you adopting soil conservation measures - Yes/No
   If 'No' why?

   a. No need (b) Cost is very high

   c. Other reasons

8. Whether cover crops are established - Yes/No
   If 'No' why?

9. Whether regular weeding is adopted - Yes/No
   If 'No' why?

10. Who taps your rubber trees?

    a) Family (b) Labourers (c) Family & Labourers

11. Have you got trained tappers? Yes/No
    If 'No' why?

12. Have you got enough processing conveniences - Yes/No

13. Are you taking loan from any credit institutions?
    Yes/No

    If 'yes' from which institution and the amount taken?

    If 'no' why?

    a. Lack of credit institutions nearby

    b. Procedural complications

    c. Loan amount meagre

    d. High interest rate

    e. Other reasons

14. Is there any good market place nearby - Yes/No

15. Is there enough transportation facilities - Yes/No

16. Are you selling through rubber marketing societies?
    Yes/No

    If 'No' Why?

a. Delay in getting money

b. Not purchased in time

c. Grading is not impartial

d. Low price when compared to open markets

e. Other reasons

17. Is there any organisation for small growers to meet their common problems? Yes/No

18. Are you using any stimulents - Yes/No

If 'yes' what are the stimulents you are using?

If 'No' why?

19. Do you have any other problems regarding rubber cultivation?

APPENDIX IIa

Itemwise cost of cultivation per nectare for 12 years in Zone I (in Rs)

Year	Human labour	Seed-lings	Ferti-lizer	Plant protec-tion	Recu-rring cost	Rolling charge	Non-recu-rring cost	Tools and imple-ments	Mainte-nance of tools & imple-ments	Tax	Misce-llane-ous	Total
1	2142 (51.75)	775 (18.72)	434 (10.49)	506 (12.23)	-	-	-	164 (3.96)	-	19 (0.46)	99 (2.39)	4139 (100)
2	280 (27.53)	-	291 (28.61)	185 (18.19)	-	-	-	-	46 (4.52)	19 (1.87)	196 (19.27)	1017 (100)
3	249 (23.14)	-	480 (44.61)	213 (19.80)	-	-	-	-	46 (4.28)	19 (1.77)	69 (6.41)	1076 (100)
4	237 (19.13)	-	599 (48.35)	206 (16.63)	-	-	-	-	46 (3.71)	19 (1.83)	132 (10.65)	1239 (100)
5	232 (18.85)	-	585 (47.68)	284 (23.15)	-	-	-	-	46 (3.75)	19 (1.55)	61 (4.98)	1227 (100)
6	231 (18.19)	-	570 (44.88)	345 (27.17)	-	-	-	-	46 (3.62)	19 (1.50)	59 (4.65)	1270 (100)
7	233 (19.35)	-	532 (44.19)	320 (26.58)	-	-	-	-	46 (3.82)	19 (1.58)	54 (4.49)	1204 (100)
8	2205 (63.25)	-	511 (14.66)	319 (9.15)	143 (4.10)	74 (2.12)	101 (2.90)	-	46 (1.32)	19 (0.55)	68 (1.95)	3486 (100)
9	2210 (65.33)	-	487 (14.40)	310 (9.16)	159 (4.70)	97 (2.87)	-	-	46 (1.36)	19 (0.56)	55 (0.63)	3383 (100)
10	2183 (63.66)	-	493 (14.38)	345 (10.06)	175 (5.10)	109 (3.18)	-	-	46 (1.34)	19 (0.55)	59 (1.72)	3429 (100)
11	2198 (62.84)	-	508 (14.52)	380 (10.86)	180 (5.15)	113 (3.23)	-	-	46 (1.32)	19 (0.54)	54 (1.54)	3498 (100)
12	2201 (62.30)	-	501 (14.18)	418 (11.83)	181 (5.12)	113 (3.20)	-	-	46 (1.30)	19 (0.54)	54 (1.53)	3533 (100)

(Figures in parentheses show percentages to total)

APPENDIX IIb

Itemwise cost of cultivation per hectare for 12 years in Zone II (in Rs)

Year	Human labour	Seed-lings	Ferti-lizer	Plant protec-tion	Recu-rring cost	Rolling charge	Non-recu-rring cost	Tools and imple-ments	Mainte-nance of tools & imple-ments	Tax	Misce-llane-ous	Total
1	1883 (48.42)	754 (19.39)	451 (11.60)	514 (13.23)	-	-	-	164 (4.22)	-	18 (0.46)	105 (2.70)	3889 (100)
2	255 (23.14)	-	358 (32.49)	220 (19.96)	-	-	-	-	53 (4.81)	18 (1.63)	198 (17.97)	1102 (100)
3	221 (22.23)	-	409 (41.15)	231 (23.24)	-	-	-	-	53 (5.33)	18 (1.81)	62 (6.24)	994 (100)
4	222 (19.93)	-	466 (41.83)	293 (26.30)	-	-	-	-	53 (4.76)	18 (1.62)	62 (5.56)	1114 (100)
5	209 (17.55)	-	507 (42.57)	342 (28.72)	-	-	-	-	53 (4.45)	18 (1.51)	62 (5.21)	1191 (100)
6	201 (17.15)	-	513 (43.77)	332 (28.33)	-	-	-	-	53 (4.52)	18 (1.54)	55 (4.69)	1172 (100)
7	207 (17.66)	-	562 (47.95)	283 (24.15)	-	-	-	-	53 (4.52)	18 (1.54)	49 (4.18)	1172 (100)
8	2108 (62.83)	-	523 (15.59)	271 (8.08)	139 (4.14)	71 (2.17)	124 (3.70)	-	53 (1.58)	18 (0.54)	48 (1.43)	3355 (100)
9	2128 (63.66)	-	518 (15.50)	320 (9.57)	161 (4.82)	97 (2.90)	-	-	53 (1.59)	18 (0.54)	48 (1.44)	3343 (100)
10	2133 (63.13)	-	511 (15.12)	331 (9.80)	175 (5.18)	109 (3.23)	-	-	53 (1.57)	18 (0.53)	49 (1.45)	3379 (100)
11	2141 (61.77)	-	521 (15.03)	377 (10.88)	187 (5.39)	113 (3.35)	-	-	53 (1.53)	18 (0.52)	53 (1.53)	3466 (100)
12	2143 (60.86)	-	512 (14.59)	416 (11.81)	208 (5.94)	114 (3.34)	-	-	53 (1.50)	18 (0.51)	50 (1.45)	3514 (100)

(Figures in parentheses show percentages to total)

APPENDIX IIc

Itemwise cost of cultivation per hectare for 12 years in the district (in Rs)

Year	Human labour	Seed-lings	Ferti-lizer	Plant protec-tion	Recu-rring cost	Rolling charge	Non-recu-rring cost	Tools and imple-ments	Main-tenance of tools & imple-ments	Tax	Misce-llane-ous	Total
1	2088 (51.10)	771 (18.87)	437 (10.70)	508 (12.43)	-	-	-	164 (3.99)	-	19 (0.47)	100 (2.45)	4087 (100)
2	275 (26.60)	-	305 (29.50)	192 (18.57)	-	-	-	-	47 (4.55)	19 (1.84)	196 (18.96)	1034 (100)
3	243 (22.97)	-	465 (43.95)	217 (20.51)	-	-	-	-	47 (4.443)	19 (1.80)	67 (6.33)	1058 (100)
4	232 (19.17)	-	571 (47.19)	224 (18.51)	-	-	-	-	47 (3.88)	19 (1.57)	117 (9,68)	1210 (100)
5	227 (18.76)	-	568 (47.19)	296 (24.46)	-	-	-	-	47 (3.88)	19 (1.57)	61 (5.04)	1218 (100)
6	225 (18.01)	-	558 (44.68)	342 (27.38)	-	-	-	-	47 (3.76)	19 (1.52)	58 (4.64)	1249 (100)
7	228 (19.03)	-	539 (44.99)	312 (26.04)	-	-	-	-	47 (3.92)	19 (1.59)	53 (4.42)	1198 (100)
8	2185 (63.33)	-	514 (14.90)	309 (8.96)	143 (4.14)	73 (2.12)	106 (3.07)	-	47 (1.36)	19 (0.55)	54 (1.57)	3450 (100)
9	2205 (65.14)	-	494 (14.59)	312 (9.22)	159 (4.70)	97 (2.81)	-	-	47 (1.39)	19 (0.56)	54 (1.60)	3387 (100)
10	2173 (63.59)	-	497 (14.54)	342 (10.00)	175 (5.12)	109, (3.16)	-	-	47 (1.38)	19 (0.56)	56 (1.64)	3418 (100)
11	2186 (62.60)	-	511 (14.63)	380 (10.88)	182 (5.21)	114 (3.24)	-	-	47 (1.35)	19 (0.54)	55 (1.55)	3493 (100)
12	2189 (62.03)	-	503 (14.25)	417 (11.82)	186 (5.30)	114 (3.20)	-	-	47 (1.33)	19 (0.54)	55 (1.53)	3530 (100)

(Figures in parentheses show percentages to total)

APPENDIX IIIa

Computation of pay back period for Zone I

Year	Estimated cost of cultivation	Progressive total of cost	Returns	Progressive total of returns	Net returns on progressive total
1	4139	4139	-	-	-4139
2	1017	5156	-	-	-5156
3	1076	6232	-	-	-6232
4	1239	7471	-	-	-7471
5	1227	8698	-	-	-8698
6	1270	9968	-	-	-9968
7	1204	11172	-	-	-11172
8	3486	14658	7234	7234	-7424
9	3383	18041	8748	15982	-2059
10	3429	21470	10200	26182	4712
11	3498	24968	10715	36897	11929
12 to 28	3533	60061	184246	221143	161082
29	3533	63594	10715	231858	168264
30	3533	67127	10200	242058	174931
31	3533	70660	8748	250806	180146
32	3533	74193	7234	258040	183847

Payback period - 9.53 years

APPENDIX IIIb

Computation of payback period for Zone II

Year	Estimated cost of cultivation	Progressive total of cost	Returns	Progressive total of returns	Net returns on progressive total
1	3889	3889	-	-	-3889
2	1102	4991	-	-	-4991
3	994	5985	-	-	-5985
4	1114	7099	-	-	-7099
5	1191	8290	-	-	-8290
6	1172	9462	-	-	-9462
7	1172	10634	-	-	-10634
8	3355	13989	7063	7063	-6926
9	3343	17332	9025	16088	-1244
10	3379	20711	10493	26581	5870
11	3466	24177	11195	37776	13599
12 to 28	59738	83915	211803	249579	165664
29	3514	87429	11195	260774	173345
30	3514	90943	10493	271267	180324
31	3514	94457	9025	280292	185835
32	3514	97971	7063	287355	189384

Payback period - 9.43 years

APPENDIX IIIe

Computation of payback period for the district

Year	Estimated cost of cultivation	Progressive total of costs	Returns	Progressive total of returns	Net returns on progressive total
1	4087	4087	-	-	-4087
2	1034	5121	-	-	-5121
3	1058	6179	-	-	-6179
4	1210	7389	-	-	-7389
5	1218	8607	-	-	-8607
6	1249	9856	-	-	-9856
7	1198	11054	-	-	-11054
8	3450	14504	7198	7198	-7306
9	3387	17891	8803	16001	-1890
10	3418	21309	10262	26263	4954
11	3493	24802	10760	37023	12221
12 to 28	3530	84812	194276	231299	146487
29	3530	88342	10760	242059	153717
30	3530	91872	10262	252321	160449
31	3530	95402	8803	261124	165722
32	3530	98932	7198	268322	169390

Payback period - 9.51 years

APPENDIX IVa

Computation of benefit-cost ratio and net present worth for Zone I

Year	Estimated cost of cultivation (Rs)	Benefit (Rs)	D.F. (10%)	Present worth of cost (Rs)	Present worth of benefit (Rs)
1	4139	-	0.9091	3763	-
2	1017	-	0.8264	840	-
3	1076	-	0.7513	808	-
4	1239	-	0.6830	864	-
5	1227	-	0.6209	762	-
6	1270	-	0.5645	717	-
7	1204	-	0.5132	618	-
8	3486	7234	0.4665	1626	3375
9	3383	8748	0.4241	1435	3710
10	3429	10200	0.3855	1322	3932
11	3498	10715	0.3505	1226	3756
12	3533	10838	0.3186	1126	3453
13	3533	10838	0.2897	1024	3140
14	3533	10838	0.2633	930	2854
15	3533	10838	0.2394	846	2595
16	3533	10838	0.2176	769	2358
17	3533	10838	0.1978	699	2144
18	3533	10838	0.1799	636	1950
19	3533	10838	0.1635	578	1772
20	3533	10838	0.1486	525	1611
21	3533	10838	0.1351	477	1464
22	3533	10838	0.1228	434	1331
23	3533	10838	0.1117	395	1211
24	3533	10838	0.1015	359	1100
25	3533	10838	0.0923	326	1000
26	3533	10838	0.0839	296	909
27	3533	10838	0.0763	270	827
28	3533	10838	0.0693	245	751
29	3533	10715	0.0630	223	675
30	3533	10200	0.0573	202	584
31	3533	8748	0.0521	184	456
32	3533	7234	0.0474	167	343
		24000(a)	0.0474		1136
				24692	48439

(a) - Salvage value
Benefit-cost ratio - 1.96
Net present worth - 23747

APPENDIX IVb

Computation of benefit-cost ratio and net present worth for Zone II

Year	Estimated cost of cultivation (Rs)	Benefit (Rs)	D.F. (10%)	Present worth of cost (Rs)	Present worth of benefit (Rs)
1	3889	-	0.9091	3533	-
2	1102	-	0.8264	911	-
3	994	-	0.7513	747	-
4	1114	-	0.6830	761	-
5	1191	-	0.6209	739	-
6	1172	-	0.5645	662	-
7	1172	-	0.5132	601	-
8	3355	7063	0.4665	1565	3295
9	3343	9025	0.4241	1418	3828
10	3379	10493	0.3855	1303	4045
11	3466	11195	0.3505	1215	3924
12	3514	12459	0.3186	1120	3969
13	3514	12459	0.2897	1018	3609
14	3514	12459	0.2633	925	3280
15	3514	12459	0.2394	841	2983
16	3514	12459	0.2176	765	2711
17	3514	12459	0.1978	695	2464
18	3514	12459	0.1799	632	2241
19	3514	12459	0.1635	575	2037
20	3514	12459	0.1486	522	1851
21	3514	12459	0.1351	475	1683
22	3514	12459	0.1228	431	1530
23	3514	12459	0.1117	392	1392
24	3514	12459	0.1015	357	1265
25	3514	12459	0.0923	325	1150
26	3514	12459	0.0839	295	1045
27	3514	12459	0.0763	268	951
28	3514	12459	0.0693	244	863
29	3514	11195	0.0630	221	705
30	3514	10493	0.0573	201	601
31	3514	9025	0.0521	183	470
32	3514	7063	0.0474	167	335
		24000(a)	0.0474		1138
				24110	53365

(a) - Salvage value
Benefit-cost ratio - 2.21
Net present worth - 29255

APPENDIX IVc

Computation of benefit-cost ratio and net present worth for the district

Year	Estimated cost of cultivation (Rs)	Benefit (Rs)	D.F. (10%)	Present worth of cost (Rs)	Present worth of benefit (Rs)
1	4087	-	0.9091	3715	-
2	1034	-	0.8264	855	-
3	1088	-	0.7513	795	-
4	1210	-	0.6830	826	-
5	1218	-	0.6209	756	-
6	1250	-	0.5645	706	-
7	1198	-	0.5132	615	-
8	3450	7198	0.4665	1609	3358
9	3387	8802	0.4241	1436	3733
10	3418	10262	0.3855	1318	3956
11	3493	10760	0.3505	1224	3721
12	3530	11428	0.3186	1125	3641
13	3530	11428	0.2897	1023	3311
14	3530	11428	0.2633	929	3009
15	3530	11428	0.2394	845	2736
16	3530	11428	0.2176	768	2487
17	3530	11428	0.1978	698	2260
18	3530	11428	0.1799	635	2056
19	3530	11428	0.1635	577	1868
20	3530	11428	0.1486	525	1698
21	3530	11428	0.1351	477	1544
22	3530	11428	0.1228	433	1403
23	3530	11428	0.1117	394	1277
24	3530	11428	0.1015	358	1160
25	3530	11428	0.0923	326	1055
26	3530	11428	0.0839	296	959
27	3530	11428	0.0763	269	872
28	3530	11428	0.0693	245	792
29	3530	10760	0.0630	222	678
30	3530	10262	0.0573	202	588
31	3530	8803	0.0521	184	459
32	3530	7198	0.0474	167	341
		24000(a)	0.0474		1138
				24553	50150

(a) - Salvage value

Benefit-cost ratio - 2.04

Net present worth - 25597

APPENDIX Va

Computation of internal rate of return for Zone I

Year	Estimated cost of cultivation (Rs)	Annual benefit (Rs)	Incremental benefit (Rs)	D.F. (20%)	Present worth (20%) (Rs)	D.F. (25%)	Present worth (25%) (Rs)
1	4139	-	-4139	0.8333	-3449	0.8000	-3311
2	1017	-	-1017	0.6944	- 706	0.6400	- 651
3	1076	-	-1076	0.5787	- 623	0.5120	- 551
4	1239	-	-1239	0.4823	- 598	0.4096	- 507
5	1227	-	-1227	0.4019	- 493	0.3277	- 402
6	1270	-	-1270	0.3349	- 425	0.2621	- 333
7	1204	-	-1204	0.2791	- 336	0.2097	- 252
8	3586	7234	3748	0.2326	872	0.1678	629
9	3383	8748	5365	0.1938	1040	0.1342	720
10	3429	10200	6771	0.1615	1094	0.1074	727
11	3498	10715	7217	0.1346	971	0.0859	620
12	3533	10838	7305	0.1122	820	0.0687	496
13	3533	10838	7305	0.0935	683	0.0550	402
14	3533	10838	7305	0.0779	569	0.0440	321
15	3533	10838	7305	0.0649	474	0.0352	257
16	3533	10838	7305	0.0541	395	0.0281	205
17	3533	10838	7305	0.0451	329	0.0224	164
18	3533	10838	7305	0.0376	275	0.0180	131
19	3533	10838	7305	0.0313	229	0.0144	105
20	3533	10838	7305	0.0261	191	0.0115	110
21	3533	10838	7305	0.0217	159	0.0092	67
22	3533	10838	7305	0.0181	132	0.0074	54
23	3533	10838	7305	0.0151	110	0.0059	43
24	3533	10838	7305	0.0126	92	0.0047	34
25	3533	10838	7305	0.0105	77	0.0038	28
26	3533	10838	7305	0.0087	64	0.0030	22
27	3533	10838	7305	0.0073	53	0.0024	18
28	3533	10838	7305	0.0061	45	0.0019	14
29	3533	10715	7182	0.0051	37	0.0015	11
30	3533	10290	6667	0.0042	28	0.0012	8
31	3533	8748	5215	0.0035	18	0.0010	5
32	3533	7234	3701	0.0029	11	0.0008	3
		24000(a)	24000	0.0029	70	0.0008	19
					2208		-782

(a) Salvage value

Internal rate of return = 23.70%

APPENDIX Vb

Computation of internal rate of return for Zone II

Year	Estimated cost of cultivation (Rs)	Annual benefit (Rs)	Incremental benefit (Rs)	D.F. (25%)	Present worth (25%) (Rs)	D.F. (30%)	Present worth (30%) (Rs)
1	3889	-	-3887	0.8000	-3110	0.7692	-2990
2	1102	-	-1102	0.6400	- 705	0.5917	- 652
3	994	-	- 994	0.5120	- 509	0.4552	- 452
4	1114	-	-1114	0.4096	- 456	0.3501	- 390
5	1191	-	-1191	0.3277	- 390	0.2693	- 321
6	1172	-	-1172	0.2621	- 307	0.2072	- 243
7	1172	-	-1172	0.2097	- 246	0.1595	- 227
8	3355	7063	3708	0.1678	622	0.1226	455
9	8343	9025	5682	0.1342	763	0.0943	536
10	3379	10493	7114	0.1074	764	0.0725	516
11	3466	11195	7729	0.0859	664	0.0558	431
12	3514	12459	8945	0.0687	590	0.0429	384
13	3514	12459	8945	0.0550	492	0.0330	295
14	3514	12459	8945	0.0440	394	0.0254	227
15	3514	12459	8945	0.0352	315	0.0195	174
16	3514	12459	8945	0.0281	251	0.0150	134
17	3514	12459	8945	0.0225	201	0.0116	104
18	3514	12459	8945	0.0180	161	0.0089	80
19	3514	12459	8945	0.0144	129	0.0068	61
20	3514	12459	8945	0.0115	103	0.0053	47
21	3514	12459	8945	0.0092	82	0.0040	36
22	3514	12459	8945	0.0074	66	0.0031	28
23	3514	12459	8945	0.0059	53	0.0024	21
24	3514	12459	8945	0.0047	42	0.0018	16
25	3514	12459	8945	0.0038	34	0.0014	13
26	3514	12459	8945	0.0030	27	0.0011	9
27	3514	12459	8945	0.0024	21	0.0008	7
28	3514	12459	8945	0.0019	17	0.0006	5
29	3514	11195	7681	0.0015	12	0.0005	4
30	3514	10493	6979	0.0012	8	0.0004	4
31	3514	9025	5511	0.0010	6	0.0003	2
32	3514	7063	3549	0.0008	3	0.0002	1
		24000(a)	24000	0.0008	19	0.0002	5
					118		-1676

(a) - Salvage value

Internal rate of return - 25.35%

APPENDIX Vc

Computation of internal rate of return for the district

Year	Estimated cost of cultivation (Rs)	Annual benefit (Rs)	Incremental benefit (Rs)	D.F. (20%)	Present worth (20%) (Rs)	D.F. (25%)	Present worth (25%) (Rs)
1	4087	-	-4087	0.8333	-3406	0.8000	-3270
2	1034	-	-1034	0.6944	- 718	0.6400	- 662
3	1058	-	-1058	0.5787	- 612	0.5120	- 542
4	1210	-	-1210	0.4823	- 587	0.4096	- 496
5	1218	-	-1218	0.4019	- 490	0.3277	- 399
6	1249	-	-1249	0.3349	- 418	0.2621	- 327
7	1198	-	-1198	0.2791	- 334	0.2097	- 251
8	3450	7198	3748	0.2326	872	0.1678	629
9	3387	8803	5416	0.1938	1050	0.1342	727
10	3418	10262	6844	0.1615	1105	0.1074	735
11	3493	10760	7267	0.1346	978	0.0859	624
12	3530	11428	7898	0.1122	886	0.0687	543
13	3530	11428	7898	0.0935	738	0.0550	434
14	3530	11428	7898	0.0779	615	0.0440	348
15	3530	11428	7898	0.0649	513	0.0352	280
16	3530	11428	7898	0.0541	427	0.0281	222
17	3530	11428	7898	0.0451	356	0.0225	178
18	3530	11428	7898	0.0376	297	0.0180	142
19	3530	11428	7898	0.0313	247	0.0144	113
20	3530	11428	7898	0.0261	206	0.0115	91
21	3530	11428	7898	0.0217	171	0.0092	73
22	3530	11428	7898	0.0181	143	0.0074	58
23	3530	11428	7898	0.0151	119	0.0059	47
24	3530	11428	7898	0.0126	100	0.0047	37
25	3530	11428	7898	0.0105	83	0.0038	30
26	3530	11428	7898	0.0087	69	0.0030	24
27	3530	11428	7898	0.0073	58	0.0024	19
28	3530	11428	7898	0.0061	48	0.0019	15
29	3530	10760	7230	0.0051	37	0.0015	11
30	3530	10262	6732	0.0042	28	0.0012	8
31	3530	8803	5273	0.0035	18	0.0010	5
32	3530	7198	3668	0.0029	11	0.0008	3
		24000(a)	24000	0.0029	70	0.0008	19
					2682		-517

(a) - Salvage value

Internal rate of return - 24.20%

ECONOMICS OF RUBBER CULTIVATION BY SMALL HOLDERS IN KOTTAYAM DISTRICT

BY

ELSAMMA JOB

ABSTRACT OF A THESIS

Submitted in partial fulfilment of the

requirement for the degree of

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COLLEGE OF HORTICULTURE

Vellanikkara - Trichur

KERALA - INDIA

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A B S T R A C T

An investigation on economics of rubber cultivation by small holders was conducted in Kottayam district during the period 1980-81, to evaluate the cost and returns, capital productivity, the resource efficiency of yielding plantations and to study the problems of small growers.

Stratified two stage sampling was adopted for the study and data were collected from a sample of 100 cultivators selected randomly.

Average size of family for the sample was found to be 5.89. Majority of the sample holdings were under the size group of 0.50 to 1.00 hectare .

Total cost of cultivation per hectare for establishing rubber i.e., for seven years was estimated at Rs.11054 in terms of 1980-81 prices. More than one half of this was accounted for by labour. Net returns per hectare was Rs.3234 during the eighth year and Rs.7193 during the 12th year - the year of yield stabilization. Cost of production per quintal of sheet rubber was estimated at Rs.305 during stabilized yield period. Payback period was 9.51 years. Benefit-cost ratio was 2.04 and internal rate of return 24.20 per cent. No serious problems were seen to be faced by the small growers.