



## CASE STUDY

### ECONOMIC ANALYSIS OF RUBBER PLANTATION- A CASE STUDY OF SHIVAMOGGA DISTRICT

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#### ABSTRACT

Rubber is the minor plantation crop cultivated in Shimoga. Rubber is cultivated mostly in the southern district in Karnataka. The inputs like land, labour, capital etc., are most conspicuous in Shimoga district. Rubber predominantly rainfed crops in Shimoga. Hence, there are affected by weather fluctuation, which may have an impact on yield and return correspondingly, their supply may also be affected leading to high variability in prices. The higher cost of cultivation of rubber was primarily due to higher variable costs. It might be due to higher variable costs and to higher average plant population per acre and better adoption of recommended package of practices in rubber. The benefit cost ratio indicates the return per rupee of investing during the entire life period of an enterprise. It was less than unity implying that non-viability of investment in rubber. The capital investment in rubber was substantial. Hence, its financial impact was long term in nature.

#### INTRODUCTION

Rubber is found in the fluid of some specific plants but it can also be produced synthetically. Synthetic rubber is produced through the process of polymerization of various monomers. Naturally, rubber is produced by the process of tapping of the plant called *Hevea Brasiliensis*. The rubber tree is a native of the Amazon River basin in South America. The ideal rubber growing regions should be 8 degree North of Equator, 10 degree South of Equator, high temperature, altitude not beyond 400 m and high humidity. These plants generally have 32 years of economic life but they may live up to 100 years or even more than that. The plantation would start its yield from 6th year onwards. The natural rubber produced processed to convert into a storable and marketable form. The basic property of rubber is that it comes back of its original shape if it is twisted or stretched but if heat is applied to the rubber, it won't return to its original shape easily. The rubber industry produces wide range of products like auto tyre, auto tubes, automobile parts, footwear, belts, cables and wires, battery boxes etc. Block rubber, Preserved Latex, Crepes and sheets are some forms in which rubber is produced and used. India is the fourth largest producer of Natural Rubber, after Thailand, Indonesia and Malaysia. Thailand is the world's largest producer of natural rubber. It produced 3,090 thousand tonnes in 2008. Indonesia is the second largest producer contributing around 28 % of the world's total natural rubber production. Malaysia produced 1,078 thousand tonnes and occupies the third rank in terms production. India is the fourth largest producer of natural rubber in the world.

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In the year 2008, India produced 881 thousand tonnes of natural rubber, up from 807 thousand tonnes in the previous year. India contributes 9 % of the world natural rubber production. Rubber plantations give yield only after 6 years of being planted and are productive for about 25 years. The above chart gives us an idea about the area under rubber in the main producing countries of the world. Indonesia, the second largest producer has 3,279 thousand hectares under rubber. While, Thailand which is the largest producer has 2,133 thousand hectares planted with rubber. This implies that Thailand has greater yield than Indonesia. Rubber cultivation in India has been traditionally confined to hinterlands of southwest coast, mainly in Kanyakumari district of Tamil Nadu and Kerala. Kerala and Tamil Nadu together constitute the traditional rubber growing regions in the country. Kerala alone contributes 91 % of the total rubber produced in India and an area of 512,045 ha under rubber plantations. Tamil Nadu contributes another 3 % of the total natural rubber production. India has around 615 thousand hectares under rubber plantations. As per the Rubber Board, India now occupies the first rank in terms of productivity at 1,879 kg/ha. India is the fourth largest consumer of natural rubber at 881 thousand tonnes. Other major consuming countries include Malaysia, Korea and Thailand. Karnataka, Goa, Konkan Region of Maharashtra, hinterlands of coastal Andhra Pradesh and Orissa, the northeastern states, Andaman and Nicobar Islands etc, where rubber is now being grown. Rubber was known to the indigenous peoples of the Americas long before the arrival of European explorers. In 1525, padre d' Anghieria reported that he had seen Mexican tribes people playing with elastic balls. The first scientific study of rubber was undertaken by Charles de la Condamine, when he encountered it during his trip to Peru in 1735. A French engineer that Condamine met in

Guiana, Fresnau studied rubber on its home ground reaching the conclusion that this was nothing more than a "type of condensed resinous oil". The first use of rubber was an eraser. It was Magellan, a descendent of the famous Portuguese navigator, who suggested this use. In England, Priestley popularized it to the extent that it became known as Indian Rubber. The word for rubber in Portuguese- *borracha*- originated from one of the first applications for this product, when it was used to make jars replacing the leather *borrachas* that the Portuguese used to ship wine.

## Review of Literature

Rubber is one of the important horticulture crops produced in India as well as the state of Karnataka in general and Shivamogga district in particular. Available literature indicates that much work has been done on cultivation, cost and influence of price on production and marketing of rubber in the country as well as in the state. Indris Jajri (2009) analyze the role of small and medium scale industries (SMIs) is increasingly important for Malaysian industrial development. Malaysia has experienced a vast changing industrial process from relatively low technology to a high technology. In this process, the most affected sector is SMIs manage to cope very well with the changing needs and current market requirements. Nevertheless, some have to struggle and suffer from many problems coping with the manufacturing development process as a result of liberalization and globalization. The results from the analysis in this paper reveal the SMIs are slow to adopt technology. This may be due to several reasons such as smaller firms are less able to assess new methods. New process technologies are often based upon large firm experience, they need to believe that the technologies work in firms like their own. Girah and Adebayo (2009) the study was conducted to analyze the technical inefficiency of rubber tapping in Rubber Research Institute of Nigeria, Benin city, Edo state. Time series data of 129 tappers were analyzed using stochastic frontier simple random sampling technique. The result of the stochastic frontier production function revealed that the variance of parameters of the frontier production function were both significant at  $P < 0.01$ . There were substantial variations in estimated efficiencies ranging from 0.38 for the least participated tapper and 0.99 for the best tapper with a mean technical efficiency of 0.72.

Jefferson Fox and Jean Christophe Castern (2013) study the establishment of vibrant small holder rubber sector of the state needs to establishment and effectively implement national policies and institutional structures to support small holder rubber cultivators. National agencies need to support smallholders through integrated efforts to provide extension, credit, transport and marketing facilities such as that provided by the Offices of Rubber Replanting Aid Fund (IORRAF) in Thailand. At the local level, small holder farmer groups need to be organized and / or supported in order to strengthen rubber cultivation, tapping, processing and marketing. Krishnakumar, P.K. (2017) study the rubber tapping season, which was to end in February in Kerala has been extended as a good, spell of summer rains and increasing purchases by tyre companies are keeping sentiments high. This is despite the fact that prices have declined over the past few weeks after a rally which started at the beginning of this year. Domestic natural rubber prices have dropped 6% over the past month to Rs. 150 per kg compared to the 18% drop in international prices to Rs. 160.

Pramod and Thomas (2016) study the natural rubber production increased 15 per cent to 60000 tonnes in October and the consumption grew four per cent to 86000 tonnes according to rubber board data. Production and consumption stood at 52000 tonnes and 82650 tonnes respectively in the year-ago month. Imports of natural rubber went up three per cent to 44520 tonnes in October. During April-October period of 2016-17 production increased nearly 11 per cent in the corresponding period of the previous year says the board. Puttarudraiah, M. (1983) conducted a study on cultivation and production of natural rubber. The major insects which affect this crop are stem borer, shot hole borer, scale insects, mites and termites. Major diseases of this crop are pink and leaf blight and brown bore. These diseases will lead to the death of the tree. This will affect the yield and source of income of the farmer.

## Objectives of the study

- To evaluate the investment in rubber plantation.
- To estimate the yield and price variability of rubber production system.
- To examine the sustainability of rubber production system.

## Statement of the Problem

From the foregoing information it can be inferred that very few empirical works have been done on rubber plantation. An in-depth study covering different aspects of rubber plantation such a cost of cultivation. Production, productivity, price aspect and marketing of rubber etc., is an urgent need of the rubber economy. Therefore, a study has been undertaken to know various aspects of rubber cultivation and to provide vital information about the prospects of rubber cultivation in Shivamogga district as well as in Karnataka.

## Research Questions

- Yield and price variability of rubber production varies from small and large farmers.
- Rubber plantation is profitable in Shivamogga district.
- Large farmers are benefitted more by rubber plantation as compared to small farmers.
- Sustainability of rubber is high in Shivamogga district.

## MATERIALS AND METHODS

**Selection of Study Area:** To evaluate objectives of the study, a case study has been undertaken, selecting Shivamogga district as the study area among 30 districts of Karnataka is due to the fact that it has the highest area under rubber cultivation and productivity of the crop as compared to other districts. It has an area 871 hectares of land under rubber cultivation and has productivity for exceeding other districts.

**Sampling design:** A multistage sampling design was adopted to select talukas, villages and farmers. In the first stage, two talukas were selected, in the second stage four villages were selected and in the third stage farmers growing rubber tree shall be selected.

**Selection of sample taluaka:** The large scale cultivation of rubber is mainly concentrated in Thirthahalli taluka of

Shivamogga district occupying an area of about 203 hectares forming about 23.31 per cent of the total area under rubber.

**Selection of villages:** There are 246 villages in Thirthahalli taluka as per 2011 census. The list of villages cultivating rubber at Thirthahalli taluka during 2015-16 season is obtain from the offices of the Assistant Director of Agriculture, Thirthahalli. Village accountants of the revenue departments who have direct contact with the farmers of various villages in the talukas were also constituted to gather information about villages constituting rubber on large scale.

**Selection of sample farmers:** The farmers of the sample villages will be divided into three groups based on the size of their landholdings namely small (0-5 acres), medium (5-10 acres) and large (above 10 acres). Thus 05 from each village shall be selected at random. In all 15 farmers shall be chosen for detailed investigation on various aspects of cost of cultivation, production and productivity of rubber garden and income derived etc.

**Sources of Data:** The study based on primary data. Primary data shall be obtained from the selected farmers through personal interview method during 2017-18 with the help of pre-tested and structured schedule. The data collected from the farmers are related to preparation of land, seeds, costs incurred on purchase of various inputs, total production and its costs, price and marketing of rubber.

**Technique of Analysis:** The statistical techniques and method of analysis to address the objectives of the study are presented under the following headings.

**Economics of rubber production:** Rubber is a perennial crop which can be economically cultivated upto 29 years. The gestation period is six to seven years. From the seventh year onwards it will start yielding can be realized after 12 years.

**Establishment cost:** The cost incurred for establishing and maintaining the gardens upto the bearing age, will be considered as establishment cost, costs will be calculated at current factor prices. Establishment cost included the expenditure on material cost, irrigation cost and labour cost.

**Yield and returns:** Yield and returns were calculated on per acre basis. Prices received for rubber at the time of data collection was considered to compute the incomes from plantations.

**Benefit Cost Ratio**

$$BC = \frac{\text{Present Worth of benefits}}{\text{Present Worth of costs}} = \frac{\sum_{i=1}^n (B_i - C_i) (I+i)^{-n}}{\sum_{i=1}^n I_i (I+i)^{-n}}$$

**Net Present Value (NPV)**

$$NPV = \sum_{i=1}^n \{(B_i - C_i) (I+i)^{-n} - I_i (1+i)^{-n}\} = 0$$

**Internal Rate of Return (IRR)**

$$\text{Internal rate of Returns} = \frac{[\text{Lower Discount rate}] + [\text{Difference between LDR \& HDR}]}{[\text{present worth of incremental}]}$$

**Sustainability of the rubber plantation**

**Percentage of sustainable plantation for rubber**

X > Mean + 1 S.D. → High yield of high cost

X < Mean + 1 S.D. → Low yield or low cost

Mean – 1 S.D. < X < Mean + 1 S.D. → Medium yield and medium cost

**General Description of Sample Plantations**

The present study, the sample comprised of 40 rubber plantations. The details of the sample plantations are presented in Table 1. The sample plantations were post classified on the basis of the average size of holdings of rubber. The average size of holding for small rubber plantations was 1-06 acres and for large plantations was 3.07 above acres respectively.

**Table 1. General description of sample plantations**

Sl. No.	Particulars	Rubber	
		Small Farmers	Large Farmers
1.	Number of sample plantations	40	40
2.	Average size of rubber holding (in acres)	1.06	3.07
3.	Average plant population (No/Acre)	155.00	160.00
4.	Variety grown	RR11-105	RR11-105
5.	Productive life span of rubber Establishment period	30.00	30.00
6.		6.00	6.00

Source: Field Survey

The average plant population per acre was 155 for small farmers and 160 for large farmers. Economic life span was assumed to be 30 years for both large and small farmers. The establishment period was six years for rubber plantation.

**Economics and Investment evaluation of rubber production**

The cost and returns from rubber cultivation were determined on per acre basis. The results of the analysis pertaining to economics of production and investment evaluation of rubber production are discussed here.

**Cost of establishing one acre of rubber plantation**

As in the case of rubber, the initial capital investment on rubber comprised establishment and maintenance of rubber plantation during the gestation period (upto 6<sup>th</sup> year). A detailed account of the per acre establishment cost on rubber is given in Table 4.2. It is evident from the table that among various components of labour cost, the prime cost was that of the application of manures and fertilizers which constituted (25.62%) percent of the total establishment cost, followed by weeding (18.64%) land preparation (17.27%), digging and pit filling (17.27%) cost of insecticide application (10.68%), cost planting (2.95%) and cost of shading (2.50%). Capital investment on material inputs amounted to Rs. 18100 which formed 45.14 percent of total capital investment on rubber. Among material inputs, expenditure on manures and fertilizers worked out to Rs. 7750, which amounted for 19.33 percent of

the total initial capital investment. This was followed by cost of planting material (Rs. 6600), cost of shading material (Rs. 1750), and cost of plant protect (Rs. 2000).

establishment and maintenance cost accounted for 14.84, 10.10, 10.10, 8.35 and 7.86 percent and during second, third, fourth, fifth and sixth years, respectively.

**Table 2. Cost of establishment of one acre of rubber plantation (Rs/acre)**

Items	I year	II year	II year	IV year	V year	VI year	Total	Percentage to the total	
<b>A</b>	<b>Labour cost</b>								
1	Land preparation	3500.00	600.00				4100.00	18.64	
2	Digging and pit filling	3500.00	300.00				3800.00	17.27	
3	Planting	500.00	150.00				650.00	2.95	
4	Shading	400.00	150.00				550.00	2.50	
5	Weeding	750.00	1000.00	800.00	1250.00	600.00	500.00	4900.00	22.27
6	Manures and fertilizer application	1000.00	900.00	900.00	900.00	1000.00	950.00	5650.00	25.62
7	Insecticide and pesticide application	200.00	300.00	400.00	500.00	500.00	450.00	2350.00	10.68
	Total labour costs	9850.00	3400.00	2100.00	2650.00	2100.00	1900.00	22000.00	100.00
<b>B</b>	<b>Material cost</b>								
1	Planting material	6000.00	600.00				6600.00	16.46	
2	Shading material	1600.00	150.00				1750.00	4.36	
3	Manures and fertilizers	1900.00	1500.00				7750.00	19.33	
4	Insecticides and pesticides	200.00	300.00				2000.00	4.99	
	Total material cost	9700.00	2550.00	1950.00	1400.00	1250.00	1250.00	18100.00	45.14
	Total cost	19550.00	5950.00	4050.00	4050.00	3350.00	3150.00	40100.00	100.00
	Percentage of total cost	48.75	14.84	10.10	10.10	8.35	7.86	(100.00)	

Note: The planting rate is Rs. 6 per plant, wage rate is Rs. 125 per manday, Rs. 75 per woman day.

Source : Field Survey.

**Table 3. Summary of Cost of establishment of one acre of rubber plantation**

Year	Labour cost	Material cost	Ratio of material cost to laour cost	Total cost	Percentage to total cost
I	9850.00	9700.00	0.98	19550.00	48.75
II	3400.00	2550.00	0.75	5950.00	14.84
III	2100.00	1950.00	0.93	4050.00	10.10
IV	2650.00	1400.00	0.53	4050.00	10.10
V	2100.00	1250.00	0.59	3350.00	8.35
VII	1900.00	1250.00	0.66	3150.00	0.08
Total	22000.00	18100.00	0.82	40100.00	100.00
Percentages to total cost	54.86	45.14			

Source : Field Survey.

**Table 4. Cost of cultivation of rubber (Rs/acre)**

SI No.	Particular	Small Plantations		Large Plantations	
		Amount (in Rs)	Percent	Amount (in Rs.)	Percentages to total cost
<b>A.</b>	<b>Variable costs</b>				
1.	Manures	1512.00	5.75	1720.00	6.26
2.	Fertilizers	2680.00	10.19	2800.00	10.18
3	Plant protection chemicals	450.00	16.72	500.00	1.89
4	Rain guard	550.00	2.10	824.00	3.00
5	Processing chemical	4520.00	17.19	6110.00	22.22
6	Maintenance of implements	202.00	0.77	238.00	0.87
7	Labour costs	13280.00	50.51	12020.00	43.72
8	Interest on fixed cost assets	3098.00	11.78	3280.00	11.93
		26292.00	85.26	27492.00	84.46
<b>B</b>	<b>Fixed Cost</b>				
1	Ammortized cost of establishment	2513.70	55.28	2582.00	51.05
	Rental value of land				
2	Depreciation	1815.00	39.92	1914.00	37.84
3	Land revenue	98.00	2.16	230.00	0.40
4	Interest on fixed assets	8.00	0.18	8.00	0.16
5		112.24	2.47	324.00	6.41
	Total fixed cost	4546.24	14.74	5058.00	15.54
	Total cost	30838.24		32550.00	

Note: The wage rate is Rs. 125 per manday and Rs. 75 per woman day.

Source : Field Survey.

A summary of the establishment costs is given in table 3 the ratio of material cost to labour cost was worked out and same has been furnished in table. A perusal of the table reveals that the ratio for the six year period was less than one (0.82) which indicated that rubber production was labour intensive. The material cost formed 45.14 percent of the total initial capital investment. Out of the total establishment cost, 48.75 per cent was incurred in the first year and for remaining years the

### Cost of cultivation of rubber

The cost of cultivation comprises both fixed and variable costs cost of cultivation of rubber was worked out for small and large plantations separately and the results are presented in Table 4. Small Plantations: It is evident from the table that while variable costs accounted for 85.26 per cent (Rs. 26292) of the total cost, fixed costs constituted 14.74 per cent (Rs. 4546.24).

Components of variable costs, labour cost, is the prime cost constituting 50.51 per cent (Rs. 13280) of the total variable cost. Ammortized cost of establishment was the major item among fixed cost, constituting 55.28 per cent (Rs. 2513.70) of the total fixed cost. Ammortization was done at 14 percent interest rate. The next important cost was rental value of land, which formed 39.92 per cent (Rs.1815) of the total cost, while fixed cost accounted for 39.92 per cent (Rs. 1815) of the total cost.

### Large Plantations

In the case of large plantation, variable costs account for 84.46 percent (Rs. 27492) of the total cost, while fixed cost accounted for 15.54 per cent (Rs. 5058) of the total cost. The major item of variable cost was labour accounting for 43.72 percent (Rs.12020) of the total variable cost. The next important cost was expenditure on processing chemical which was 22.22 percent (Rs. 6110) of the total variable cost. The major constitutes among fixed cost were amortized establishment cost and rental value of land. These two costs are accounted for 51.05 percent (Rs. 2582) and 37.84 percent (Rs.1914) respectively, of the total fixed costs. Interest on fixed assets was only 6.41 percent (Rs. 324) and the lowest cost component was land revenue which was 0.16 percent (Rs.8) of the fixed cost.

purpose, the conventional measures of project appraisal, namely; (i) Net present value (ii) Benefit cost ratio and internal rate of return were computed.

The evaluation of investment for rubber plantation was shown in below Table 6. The NPV which indicates the present value of net cash benefits from perennial crop was Rs. 1321 per acre in case of rubber. 0.92 and 12.44, percent for NPV and B:C ratio respectively implying investment is not economically viable.

### Price and Yield Variability

In order to assess the risk involved in the production of rubber, price and yield variabilities were computed for calculating price variability monthly prices of rubber pertaining to particular market for the period 2010-2011 to 2016-2017 (7 years) were considered. The data were collected from the Bureau of Economics and Statistics and Rubber Board for rubber, respectively. However, for calculating yield variability, annual yield data from 2010-2011 to 2016-2017 (7 years data) was taken. These results are summarized in table. A perusal of the table reveals that price variability for rubber was Rs. 11,561 per quintal in May 2008 to Rs. 14,086 per quintal as on September 1, 2008. prices sharply declined in October 2008, due to fall in crude oil prices.

**Table 5. Comparative economics of small and large plantations of rubber (Rs/acre)**

Sl. No.	Particulars	Rubber	
		Small plantations	Large plantations
1	Average size of farm (ave)	1.06	3.67
2	Initial investment	40100.00	40100.00
3	Fixed cost	4546.24	5058.00
4	Variable cost	26292.00	27492.00
5	Total costs	30838.24	32550.00
6	Average yield of the tree	9.52	9.50
7	Average yield /acre	1528.00	1672.00
8	Average cost of production	20.71 kg	20.76 kg
9	Gross return	38200.00	41800
10	Net return	7361.76	9250.00
11	Break even price	20.71	20.70
12	Total expenses as proportion of gross income	82.83	83.06

Source : Field survey

**Table 6. Evaluation of investment in rubber plantations**

Sl No.	Particulars	Rubber
1	B:C ratio	0.92
2	NPV (Rs)	-1321.00
3	IRR (%)	12.44
4	Discount rate (%)	13.00

Source: Field survey

The average yield per acre in case of rubber it was 1528 kgs and 1672 kgs of processed rubber for small and large plantations. The average cost of cultivation per acre of rubber was Rs.30838.24 and 32550.00 respectively for small and large plantations. The average cost of production for rubber worked out to be Rs. 20.71 kg and 20.76 kg. Gross returns were computed at an average price of Rs. 25 per kg of processed rubber. Consequently return per acre worked out to be Rs. 38200 and 41800, respectively for small and large plantations of rubber. The net returns which was obtained as gross returns less total cost was Rs. 7361.76 and Rs. 9250 per acre of small and large plantations.

### Investment evaluation in rubber

The investment on rubber was evaluated for examining the profitability and economic viability of the investment. For this

### Sustainability of rubber production system

In order to examine the sustainability of production systems of rubber, appropriate indicators were developed. The results presented in Table 7. Sustainability indicators, Return to cost ratio was calculated for the economic life period of the crops. Then the co-efficient of variation was found out. The results are presented in Table 8. From the table it can be observed that C.V is percent in rubber. Percentage contribution of eco-friendly input to the total cost of cultivation of the crop was calculated as an indicator of sustainability. Incorporation of farm yard manures, green leaf, fish meal and other biomass as input is 4.98 per cent. Costs on natural inputs (labour biomass) accounted for about 49 percent of the total cost of cultivation of rubber while PPC and fertilizers constituted 26.52 percent respectively.

**Table 7. Percentages of sustainable and unsustainable farms**

Sl No.	Particulars	Rubber	
		Return to cost ratio	Percentage
1	Sustainable group	1	
	a) Low cost, high yield	1.62	5.30
	b) Medium cost, high yield	1.43	17.59
	c) Low cost, medium yield	1.49	
	Total	--	22.89
2	Unsustainable group		
	a) high cost low yield		
	b) medium cost low yield	0.98	5.30
	c) high cost medium yield	0.89	31.23
	Total	--	36.53

Source: Field survey

**Table 8. Values of sustainability indicators of rubber**

Sl No.	Particulars	Rubber
1	CV of return to cost	4.62
2	Percentage of eco friendly	4.98
3	Inputs purchased inputs	30.25
4	Ratio of purchased inputs to sown inputs	3.92
5	Price variability in percentage	29.22
6	Yield variability in percentage	1.78

Source: Field survey

**Table 9. Opinions of farmers about constraints in production and marketing of rubber (in percent)**

Particulars	Rubber	
	Small plantations	Large plantations
A) Production Constraints		
1. Non availability of labourers	82.20	88.00
2. Non availability of skilled labourers	82.20	85.00
3. Lack of awareness about and difficulty in getting improved varieties	5.00	0.00
4. Lack of awareness about plant protection measures	33.00	22.70
5. Climatic conditions	29.22	55.92
6. Loss due to improper processing, theft etc.	43.00	42.32
B) Marketing Constraints		
1. High price fluctuations	100.00	99.35
2. High marketing margins	29.00	26.00

Source : Field Survey.

Dependency of the crop on purchased inputs, such as fertilizers, rainguard, plant protection and processing chemicals to own inputs was worked out. The ratio was found to be 3.92. Therefore, fluctuations in the prices of those items would not affect the cultivation of rubber. Therefore, rubber crop can be considered as more sustainable than compare to other plantation crops. Price and yield variabilities were calculated. Reference period for price and yield varied due to non-availability of data for yield in rubber crop. Eight years data has been taken for calculating price variability while for yield variability only 6 years data was considered. Price variability was more for rubber compared to other crops. However, yield variability was slightly higher for rubber but difference was not much conspicuous. Non availability of labourers as in the case of rubber for small and large plantations as revealed by 82.20 and 88.00 percent. Similarly non availability of skilled labourers for tapping later was the next important production constraint for both small and large farmers. High price fluctuation was the major marketing problem in rubber. All farmers interviewed expressed the same opinion. Even 99.35 percent of large farmers thoroughly expressed this as major problem. High marketing problems in case of rubber.

### Summary

The rubber is the minor plantation crop cultivated in Shimoga. Rubber is cultivated mostly in the southern district in

Karnataka. The inputs like land, labour, capital etc., is most conspicuous in Shimoga district.

### The major findings of the study are summarized below:

The average size of holding was 1.06 and 3.07 acres for small and large plantations and productive life span of rubber was 29 years. Establishment cost for rubber plantation, it was Rs. 40100. About Rs. 48.75 per cent of the total establishment cost was spent during the first year itself, which declined to 14.81, 10.10 and 10.10 per cent in second, third and fourth years respectively. This indicates that for rubber the initial investment was very high, Cost of cultivation of one acre of plantation was high for large plantations (Rs. 32550) than for small plantations. Variable expenditure constituted 85.28 per cent of the total cost for small plantation and 84.46 per cent of the total cost for large plantations, Average yield of rubber plantation was 1528 kg and 1672 kg for small and large plantations and net returns received per year was 7361.76 and 9250 for small and large plantations. The net present worth on investment was -1321 for rubber, B:C ratio was 0.92 and IRR was 12.44 per cent. The co-efficient of variation (CV) of price was lower (22.64%) in rubber, yield variability was 1.78 per cent for rubber price variability was high while yield variability was low. The peak net returns were obtained during 21<sup>st</sup> year in the case of rubber. The produce started declining after reaching a peak return in the 29<sup>th</sup> year.

The results of the study revealed that rubber plantations due to relatively higher yield and lower cost in the former than those in the latter and about 82.21 per cent of the small farmers and about 88 per cent of the large farmers faced the same problem. Non availability of labourers was the major problem in Karnataka. Important marketing constraints faced by the farmers were high price fluctuations and high marketing margin in rubber respectively.

### Conclusion

- The hybrid variety RR11-105 grown in Karnataka.
- The initial capital investment was higher in rubber. Maintenance expenditure was also high for rubber. Similarly, the level of management and care needed were greater for rubber.
- Gross returns obtained from rubber was higher.
- Project evaluation indicators of B:C ratio, NPV and IRR indicated that rubber crop is economically viable.
- Price variability was higher for rubber crop.
- Rubber replacement should be effected in the 29<sup>th</sup> year to maximize returns.

In general, the rubber productivity is higher in Karnataka. Efforts should be initiated to improve the marketing efficiency. However, it is totally the other way round in the case of rubber product diversification and by-product utilization activities are picking up momentum in recent years. Hence, there is a possibility of value addition to rubber products.

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