CHAPTER I

INTRODUCTORY

Rubber, tea, coffee and cardamom are the major plantation crops cultivated in Kerala. Kerala had a long tradition in the cultivation of plantation crops. Now, the state accounts for 45 percent (6,26,000 hectares) of the total area under plantation crops in the country. Among these plantation crops, rubber is the most important as far as the area under cultivation is concerned. At present, out of the total area under plantation crops in Kerala, the percentage share of rubber is estimated as 73.99(4,63,000 hectares), while the respective shares of other plantation crops, tea, coffee and cardamom are 5.88 percent (36,821 hectares), 13.24 percent (82,878 hectares) and 6.88 percent (43,054 hectares). Again, Kerala has more than 86 percent of the area under rubber and nearly 90 percent of the production of natural rubber in India. Thus Kerala holds a dominant position both in the area as well as in the production of natural rubber in the country.

Between 1980-81 and 1996-97, area under rubber rose from 2.38 lakh hectares to 4.13 lakh hectares showing an aggregate increase of 73.53 percent and an average annual growth rate of 3.30 percent. Meanwhile, the production of natural rubber recorded a more than three fold increase and its annual growth rate in production, which is found to be 7.81 percent, is the highest among all the major crops cultivated in Kerala. Along with this, the per hectare productivity of natural rubber in the state increased from 780 Kg. in 1980-81 to 1529 Kg. in 1996-97, registering a nearly two fold increase. As an import substitute also Kerala’s rubber is significant for the national economy.
1.1 Importance of the study

An important feature of Kerala’s rubber economy is that it is over-whelmingly small holder oriented. Between 1960-61 and 1996-97, the number of small growers in Kerala has increased from 0.58 to 9 lakhs. During the period, area under rubber of small growers increased from 0.80 to 3.50 lakh hectares. At present, 90 percent of the area under rubber in Kerala is held by small growers. Thus, during the last 36 years, the percentage share of area and production of small growers have increased at the rate of 4.38 and 9.98 percent respectively.

In contrast to area under small holders, during the years from 1960-61 to 1996-97, the area under estates declined from 47,493 to 45,000 hectares, showing an average negative growth rate of 0.15 percent. However, in the case of production, there is an increase from 7,000 to 70,000 tonnes, showing an increase at the rate of 6.60 percent per year.

Along with the increase in area and production, the per hectare yield of small holding sector and estates has also increased. The per hectare yield of small growers has increased from 215 Kg. in 1960-61 to 1510 Kg. in 1996-97, i.e., the productivity has increased at the rate of 5.60 percent. Even with low percentage share in area and production, the per hectare yield of estates has exceeded that of small growers. It has increased from 481 Kg. in 1960-61 to 1545 Kg. in 1996-97, i.e., the productivity has increased at the annual rate of 3.30 percent.

All these developments made by estates and small growers are mainly the result of the positive role played by many factors of which technology is the most important one. In the case of small growers, even though the productivity has been increasing continuously, there are many problems which are currently affecting adversely the progress of the rubber economy of the state.
Technology may be defined as the body of existing knowledge concerning the production of a particular commodity from the appropriate inputs or resources\(^1\). The development of technology here mainly refers to the improvements in various stages of production from the use of planting material to that of the production of raw-industrial product rubber and the structure of marketing and pricing. The important techniques used in the package of technology among small growers are the use of high yielding planting materials, correct spacing and density of planting, the use of manures and fertilizers, plant protection measures, stimulation process and different types of tapping and processing systems.

For implementing the changes in technology, a basic force is needed, i.e., a combination of technological innovations with the institutional innovation is required. The rate of adoption of improved technology in the cultivation of rubber thus shows the changing attitude of growers to the technology and the role played by institutions, i.e., technology is always under the control of the attitudinal or cultural institutional aspect\(^2\). So basically, the generation, diffusion and adoption of better technology is necessary for increasing productivity of crops with the given resources. Hence the importance of the study.

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\(^1\) Yujiro Hayami defined technology as "the determinant on the value of a product to be produced from a given combination of production factors called production function". Product here means an economic value newly added to the society by the inputs of labour, capital and natural resources within a period. Change in technology in natural rubber production mainly consists of the use of high yielding planting material, improved agronomic practices, protection from plant diseases, improving the quality of rubber, etc. All these factors are considered as production factors. According to Hayami, this increase in economic resources and progress in technology are not independent.


\(^2\) Culture means- The value systems of people and institutions of various types and nature like organizations, social actions, rules, collective actions, etc.
1.2 Review of Literature

The development of the rubber economy of Kerala is an important step towards the advancement of the agricultural sector in the state. The one major factor behind this spectacular development of the rubber economy is the diffusion and adoption of improved technology in the cultivation and production of natural rubber. Many of the studies relating to this subject have been under reference. For the preparation of the present study, more than 100 research articles, nearly 10 books relating to the cultivation technology of rubber, some of the published and non-published theses and various government reports have been referred. Among these, the materials that have given more importance to better technologies are reviewed here.

This section is divided into four parts. In the first part, the studies relating to the evolution and dissemination of technology in the development of Kerala’s rubber economy is presented. Second part deals with the impact of technology in production and productivity of natural rubber in Kerala and the rest of the world. Role of institutions in developing advanced technology is reviewed in the third part. The future of natural rubber in India and Kerala is reviewed in fourth part.

1.2.1 Evolution and dissemination of technology in developing the rubber cultivation

As rubber is now considered as a small grower’s crop, an ideal clone for them is essential. But in rubber cultivation, the longevity of one clone or planting material is questionable. The diffusion of various clones from the past to the recent times shows the need for changing the planting material mainly on the basis of the yield of the tree. Many studies are available on this subject. On the basis of cost benefit analysis, C.M. George\(^3\) has

revealed that as compared to the present high yielding clone RRII 105 with the Malaysian clone PB 217 it is the latter, which is now considered as a good substitute for RRII 105. According to CET Mann⁴, the invention of improved high yielding clones are helpful in reducing the immaturity period of the crop. Similar conclusion is given by M. R Sethuraj⁵ in one of his studies.

After selecting the planting material, the important cultural practices followed in the rubber cultivation are weed control and application of fertilizers. The two methods of weed control are the application of herbicides and manual weeding. To compare the effectiveness and economy of the herbicide application in rubber plantation with manual weed control, M. Mathew and others⁶ have conducted a study at Erumeli in Pathanamthitta. The observation was conducted on young rubber plantations having applied various herbicides and manual weeding in contour terraces. After the 4 year experience from 1981 to 1984, they revealed that in terms of cost, manual weeding is costlier than herbicide treatment. So the dissemination of this improved method among rubber growers is essential for reducing the cost of rubber cultivation.

For the healthy growth of rubber trees, systematic and scientific application of fertilizers is essential. K.G. Mohanan⁷ and Sivanadyan⁸ have discussed this aspect in one of their studies. They emphasized the need for proper manuring during the period of immaturity for the improvement in growth and girdling rates of rubber trees. Finally it

enables a reduction in the immaturity period of rubber trees and thereby increases the production of natural rubber.

Harvesting of the crop is the final stage of the cultivation of rubber. Now, the use of rainguard is considered as one of the important techniques in the system of tapping. Rainguard is usually suggested for enhancing rubber production by increasing the number of tapping days. Tapping shade rainguarding and polythene sheet rainguarding are the two methods of rainguarding used in the state. To compare the cost advantages of these two types of rainguards, Tom Joseph, Haridasan and Joy Cyriac\(^9\) had conducted a study in Thodupuzha by taking 50 samples. While discussing about the benefit of the use of rainguarding, their study firmly established that the cost of tapping shade rain guarding is 84 percent higher than that of polythene sheet rainguarding.

By using the Discounted Cash Flow Analysis, Kahlon A.S. and Singh\(^{10}\) also come to the same conclusion. At 11 percent discount rate, they estimated that a rainguarded plot should have an average yield of 810 Kg. per hectare. On the assumption of 20 percent increase in yield from rainguarding, the study shows that, to adopt rainguarding, an average yield of 675 Kg. per hectare per year should be available.

One important problem now facing the rubber economy in Kerala and elsewhere is the non-availability of skilled labourers. According to Tillekeratne and Nugawela\(^{11}\), the use of rainguarding enables to maximise natural rubber production and helps to reduce the problem of seasonal unemployment of rubber tappers. They emphasized the need for a deviation among small growers from traditional technology practices to modern technology for increasing the production of natural rubber. In the case of Sri-Lanka they concluded


that, if small growers and estates are ready to adopt the use of rainguard, they can easily increase their rubber production by not less than 15 to 20 percent and thereby the problem of surviving will not be questionable.

Rubber trees in Kerala are widely affected by various diseases like the Brown bast, Pink disease, various types of Leaf diseases, Abnormal leaf fall, etc. According to L. Thankamma\textsuperscript{12} this may be mainly due to the incorrect system of tapping. For reducing the diseases of rubber trees and to increase the average yield, she had introduced and experimented a new tapping system, Inclined Upward Tapping (IUT). She had conducted the study at Ambady Estate in Kulasekharam in 1993. The study strongly advocates the adoption of the new tapping system IUT instead of the traditional Downward Vertical Tapping (DVT). Her study empirically shows 45 to 74 percent increase in yield and 1.16 to 2.08 percent rate of decline in the incidence of plant diseases due to the adoption of Inclined Upward Tapping.

The evolution of technology in the rubber economy of Kerala, India and the world as a whole and its development in various stages of rubber cultivation and production are widely discussed and analyzed in the Hand Book of Natural Rubber\textsuperscript{13}, published by the Rubber Research Institute in Kottayam. Along with this, the market structure and changes in the price of natural rubber in terms of historical background are also examined here. Recently Collin Barlow, Jayasurya and others\textsuperscript{14} have published another book relating to the various aspects of technology. Here, they examined the adoption and diffusion of the development of technology in the world rubber economy. They analyzed and stated the fact that for improving the production of natural rubber, a gradual change in technology relating to the cultivation of rubber and its adoption is essential. The development of natural rubber then is partly a study of technological change in which methods of production and processing are progressively improved.


\textsuperscript{13} The Rubber Board, 1980, \textit{Hand Book of Natural Rubber Production in India}, The Rubber Research Institute of India, Kottayam.

1.2.2 Impact of technology in production and productivity

Increase in production and productivity is the final result of the adoption of improved technology. Jacob Mani Mannothra\textsuperscript{15} in one of his articles states that a time bound action programme is needed for onfarm research and the implementation of appropriate techniques that will lead to higher yield even within a short period. He points out that the highest productivity (1.70 tonnes per hectare) attained by Ivory Coast in West Africa is mainly due to the adoption of scientific tapping system coupled with latex diagnosis among other things.

To assess the extent of the adoption of new technology by small growers, P. Rajasekharan and V. Haridasan\textsuperscript{16} conducted a study in 1990 covering 480 small growers in Kottayam District. The study throws light on the various problems relating to technology adoption and concludes that in Kerala, the promotion of technological dualism among small holding sector is characterized by the existence of traditional and modern technology side by side. The full impact of the adoption of technology is possible only by inducing all the growers to adopt modern technology.

Most of the statistically based studies relating to this aspect are available internationally. The one important study was conducted by T.A. Chew\textsuperscript{17} among Chinese small holding sector. He has conducted two field surveys in 1963/64 and 1978 covering around 355 small holders in various regions of China. By fitting the Cobb-Douglas Production Function in two sets of cross-sectional data collected at different points of time,

the study concluded that the rate of technology progress in small holding sector is capital augmenting type.

Yee Yuen Loh\textsuperscript{18} in one of his studies relating to the progress of Malaysian Block Rubber Processing facilities, statistically proved that even with the progress of technology these facilities were grossly under utilized. This was mainly due to the result of highly capital intensive investing nature of the processing plants. The study observes an insignificant relation between return and capital investment. He also examined the efficiency of old and new processing plants and showed that there is no significant difference in efficiency between the two types of plants.

1.2.3 Role of institutions in developing modern technology

The role of institutions relating to rubber research is very crucial in improving and imparting technology. Recognising this fact, The Rubber Research Institute\textsuperscript{19} was established in India in the year 1955 and at present it is the premier Rubber Research Institution in the whole world. Several research oriented studies have already been undertaken in this institute in various aspects related to rubber cultivation. However it is often alleged that the Rubber Research Institute of India has just adopted what the Malaysians have done. One major criticism levelled against this institute is that even more than 30 years of research has not introduced any worthwhile result to protect the physiological disorder of rubber trees like the brown bast.


Obeysekere,\textsuperscript{20} in one of his articles discussed the impressive achievements made by the Sri-Lankan Rubber Research Institute. The main aim of the institute is to improve rubber production by developing the high yielding clones, fertilizers and modern techniques. He opined that the country is hopeful of achieving the production target of 1.25 lakh tonnes by 2000, if the ongoing trend continues.

While discussing these impressive achievements, Barlow and Peries\textsuperscript{21} through their several years' experience in the Rubber Research Institute of Sri-Lanka believe that a better adoption of improved techniques and technology to the situation of small rubber holding can produce substantial economic benefits. They highlighted some major issues relating to the planting methods, harvesting and processing of natural rubber in Rubber Research and pointed out that a difference has always occurred between the application of technology in Research Institutes and its practical result. So a bias is generated between these two results.

Pushparajah\textsuperscript{22} in one of his articles, compared the Malaysian Rubber Research Institute to other institutes elsewhere. He points out that Malaysia has given more importance to the protection of environment and the innovations in labour-saving techniques in rubber cultivation. He states that future of Malaysian Rubber Industry will brighten up only by making rubber cultivation a less labour-intensive system particularly in tapping. The study predicts that in the near future, the approach to rubber as a monocrop solely for latex will slowly phase out. Then rubber will be planted for the timber as a primary product and latex will be an important by-product.

According to S. Viswanath,23 Thailand gained its position as the top producer of natural rubber in the world mainly due to the responsible programmes implemented by the Thai Rubber Research Institute. The basic problem facing this industry is the unawareness of growers about new technology and processes in rubber cultivation and production. To mitigate this problem, the Rubber Research Institute is planning to set up an international rubber training centre to develop qualified human resources.

The positive role played by the Indian Government in terms of various incentives and subsidy schemes are very widely discussed by Tharian George, Haridasan and Sreekumar24 in one of their studies. For the dynamic growth of rubber industry, the government has given more importance to modern scientific processing of raw rubber by establishing group centres in the co-operative and public sector. The government also introduced various control measures on rubber prices. According to the authors, the major consequence of these policies was the occurrence of structural changes in the industry and the growth of small holding sector.

Tharian George25 has conducted a field study for estimating the impact of input subsidy among smallholdings in Kottayam district. The study observed that there exists a wide inter-regional variation between subsidy and employment generation and showed the increasing scope for popularising potential benefits from individual inputs. For analysing the result, he followed a multi-stage random sampling method covering 5 regions and 207 member growers attached to 25 Rubber Producers Societies (RPSs.). Similar studies were conducted by various other experts like Sunil Mani, Toms Joseph, M.R.Sethuraj, etc.

On the enlightened development of the Thai Rubber Industry, Sanit Samosorn\textsuperscript{26} is of the opinion that this achievement is mainly due to the dynamic production policy of the Thai government. The government is making all out efforts to set up research centres, improve the quality of rubber based products and to develop a good marketing system.

One critical appraisal of the policies followed by the government for encouraging rubber cultivation is made by Mathew Anithottam\textsuperscript{27}. He criticises that small growers in India are always facing the problem of short term fluctuations in the price of natural rubber due to the defective policies of the government. He also suggested to dissolve the Rubber Board by retaining only the Research Institute. Ban on import of natural rubber and increase in the duty of polyurethene are the other important suggestions made by him to improve the situation. At the end, he warns that in the absence of long term farmer friendly policies of the government, the destruction of rubber cultivation in the country is imminent.

1.2.4 Future of natural rubber in India

The historical experience of the rubber economy of India/Kerala shows that a speculation about the future of natural rubber is not an easy task as it depends on many factors like the performance of small holdings sector, the availability of area under cultivation, etc. Lack of availability of skilled tappers, lack of processing facilities and non-availability of inputs required for production are the important problems now facing both the small holding and estate sector in Kerala. Even after recognising these limitations, C.M. George\textsuperscript{28} reasonably assumes that the future of natural rubber economy will be bright and it can continue as a fully viable and profitable agro-business for a long time.

\textsuperscript{26} Sanit Samit, 1996, “Great Efforts to Develop Small Holding Sector”, Rubber Asia, Dhanam Publications, Cochin, November – December, pp:77-79.
K.J. Mathew is of the opinion that many long term and short term measures are needed for the bright future of the rubber economy of Kerala. In this regard, he suggested the expansion of rubber cultivation to non-traditional areas, replanting of existing areas and the productivity enhancement of mature holdings. He concluded that all these can be possible only through the adoption of scientific tapping and improved agro-management practices.

1.3 Objectives of the Study

The basic objective of this study is to examine the promotion and adoption of technology in the cultivation and primary processing of natural rubber in Kerala. The specific objectives of the study are:

1. to examine and evaluate the historical development of Kerala’s rubber economy and the role of technology in it.
2. to ascertain specifically, the impact of institutional and organizational arrangements in the promotion, diffusion and adoption of technology in rubber production.
3. to examine to what extent the marketing and pricing of natural rubber are instrumental in sustaining technology, and
4. to analyze the current crisis phase of Kerala’s rubber economy and its impact on technology adoption on the basis of the response of small growers.

1.4 Methodology and Source of Data

The present study covers the period from the beginning of rubber cultivation in Kerala i.e., from 1902 to the end of 1990's. This is an all Kerala study. The findings of the present study are primarily based on the results of field investigation conducted in 5 districts of Kerala, viz: Kottayam, Pathanamthitta, Thiruvananthapuram, Kozhikode and Kannur. Here Kottayam and Pathanamthitta are included in the Central Zone, Thiruvananthapuram in the South Zone and Kozhikode and Kannur in the North Zone.

A total of 300 sample small growers, 8 selected plantation estates and 8 estates under private individuals were selected from 5 districts. The sample small growers are selected by using the method of quota sampling i.e., by dividing the growers into a quota of 50 from 6 different taluks in three regions. They are Meenachil and Kanjirappally in Kottayam district, Pathanamthitta Taluk, Nedumangadu in Thiruvananthapuram district, Kozhikode Taluk and Thaliparampu in Kannur district. By using the random sampling technique, we have selected the growers from each quota.

Plantations and private individual estates were selected on the basis of purposive sampling. Along with the sample survey, the study adopted some other methods like, group discussions, observation and personal interview. In the case of sample survey, selected growers were interviewed with a structural questionnaire. The field survey was conducted from June 1997 to November 1997.

To understand the problem of price crisis from June 1996 in the rubber economy, we have conducted discussions with selected Rubber Board Officials, managers of various Marketing Societies, Presidents of Rubber Producers Societies (RPSs), various Rubber Dealers and Economic Experts. For that we have followed an interview schedule. Observation at the time of survey helped to some extent to generate some aspects relating to
technology which are not quantified. Besides, some group discussions in various places were conducted to understand the problems faced by small rubber growers during these periods.

The sample study includes the data relating to the various aspects of technology which are related to the selection of planting material to the marketing of natural rubber. Average age of the rubber cultivators, their educational status, owned land area, cropping pattern followed, the diffusion and the rate of adoption of cultivation practices, processing facilities, marketing of rubber, etc among small and large holders are estimated from the sample data.

On the basis of these data, the production and productivity analysis, cost needed by holders for producing one kilogram of natural rubber and the profit earned by them are estimated. To analyze the rate of progress in the adoption of technology among small growers and large holders, we have used popular statistical tools such as correlation, regression, various statistical inferences as F and Z tests. To analyze the improvement in production of natural rubber and the changing nature of the natural rubber, we have used the compound and semi-log growth rates.

**Compound growth rate = \left[ \log \left( \frac{Y_n - Y_{o1}}{n} \right) - 1 \right] \times 100**

where \(n\)-number of years

**Semi-log growth rate, log y = a + bt.** where,

\[ b \text{- growth rate} \]

\[ t \text{- time} \]

The present study includes both primary and secondary data. Important sources of the secondary data are the various publications of the Rubber Board, Kottayam (Rubber Board Bulletin, Indian Journal of Natural Rubber Research, Rubber Reporter, Planters’ Chronicle, etc), Rubber Research Institute of India, Puthupally, various Rubber Board Regional offices, and related institutions. Various issues of Government Reports, Journals, Periodicals, etc. were referred for the study.
1.5  **Scheme of the Study**

The study consists of seven chapters. In the **first chapter** we have discussed the significance of the rubber economy of Kerala and the role played by technology in developing it. The **second chapter** explains, to what extent the technology has been instrumental in the promotion of Kerala's rubber economy. The role of institutions in developing and diffusing technology especially among small rubber growers is reviewed in the **third chapter**. The emergence of institutions, its various structural arrangements, developmental activities and policies followed by government are briefly explained here. The **fourth chapter** presents the findings of primary investigations conducted among small growers and estates all over Kerala. This chapter tries to examine the positive relation between technology adoption and production of natural rubber. The **fifth chapter** examines the effect of technology adoption in cost, yield and profit. The **sixth chapter** tries to analyze the interrelation of technology on marketing and pricing of natural rubber. The **seventh chapter** gives the summary and conclusions of the study.