CONSTRAINTS AND PROSPECTS OF RUBBER CULTIVATION IN UNAKOTI DISTRICT OF TRIPURA

Thesis

Submitted to the

UTTAR BANGA KRISHI VISWAVIDYALAYA

in partial fulfillment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

Agricultural Extension

by

NANTU NAMA

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APPROVAL OF EXAMINERS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE (AGRICULTURE) IN AGRICULTURAL EXTENSION

We, the undersigned, having been satisfied with the performance of Mr. Nantu Nama (Regn. No. **A-2020-012-M**), in the *Viva voce* associated with Final Evaluation of thesis, conducted today, the 19/09/2022, recommend that the thesis be accepted for the award of the degree of Master of Science (Agriculture) in Agricultural Extension.

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This is to certify that the work recorded in the thesis entitled, "**Constraints and Prospects of rubber cultivation in Unakoti district of Tripura** "submitted by **Nantu Nama (Regn. No. A-2020-012-M)** in partial fulfillment of the requirements for the **Master of Science (Agriculture)** in Agricultural Extension of **Uttar Banga Krishi Viswavidyalaya,** is a faithful and bonafide research work carried out under my personal supervision and guidance. The results of the investigation reported in the thesis have not so far been submitted for any other Degree or Diploma. The assistance and help received during the course of investigation have been duly acknowledged.

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ABSTRACT

Title of the Thesis: Constraints and Prospects of rubber cultivation in Unakoti district of Tripura
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Rubber growing system is gradually emerging as a promising sector in Tripura and being substitutive to the traditional crop production system. High return compared to other traditional crops and less risk of crop failure makes it more popular among the youth and small and marginal farmers. Limited works has been done on rubber in Unakoti district perspective. In this condition, to study the rubber growing system of Unakoti, present study was undertaken as a M.Sc. student in Kumarghat R.D. Block and Pecharthal R.D. Block as the most concentrated rubber growing blocks in Unakoti district; and selected 60 numbers of rubber growers from the target area as respondents. During the work it was observed that majority of rubber growers have shifted from *jhum* and other cash crops into cultivating rubber for their livelihood. The high profitability and prospects of setting a steady income with minimum efforts contributed to the growth of rubber growers. Youth could find a new avenue for good income in rubber cultivation which incidentally suited their fancy and status consciousness. The maximum rubber growing farmers in Unakoti are in a poor condition due to un-organized nature, low economics of scale, low bargaining strength, un-even distribution of Rubber Processing Systems, absence of specified business linkage. It is observed that productivity was high compared to the state average. This study reveals a clear picture about the employment generation scenario in rubber growing system through the labour engagement throughout the year. As a consequence of the emergence of such system, the local labourers are being engaged in different activities and so out-migration to other areas has been reduced. Unsuitable land for other crops can be transform into rubber plantation.

Keywords: Rubber, Pecharthal, Kumarghat, Unakoti, Tripura, Growers, Employment, Causes of resort, Constraints, Prospects.

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LIST OF ABBREVIATIONS

Ac	Acre
BPU-RPS	Rubber Board's Block Planting Units- Rubber Producers Societies
GAP	Good Agricultural Practice
GCA	Gross Cropped Area
GP	Gram Panchayat
Ha	Hectare
IIPM	Indian Institute of Plantation Management
Ltd	Limited
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MT	Metric Ton
NE	North East
NER	North Eastern Region
NR	Natural Rubber
PSU	Public Sector Undertaking
R&D	Research and Development
RD	Rural Development
RPD	Rubber Plantation Development
RRIM	Rubber Research Institute of Malaysia
SC	Scheduled Caste
ST	Scheduled Tribe
TFDPC	Tripura Forest Development Plantation Corporation Ltd.
TFDPCL	Tripura Forest Development and Plantation Corporation Limited
TRM	Tripura Rural Mission
TRPC	Rehabilitation Plantation Corporation Ltd.
TRPCL	Tripura Rehabilitation Plantation Corporation Limited
VC	Village Committee

INTRODUCTION

INTRODUCTION

One of the most significant items that come from the rainforest is rubber. Although South American indigenous people who live in rainforests have used rubber for generations, rubber's first useful commercial use did not occur until 1839. Charles Goodyear spilled rubber and sulphur on a hot cooktop by mistake that year, causing it to scorch like leather yet stay plastic and stretchy. The white sap from the *Hevea* tree's bark was refined through a process called vulcanization into an important industrial commodity.

Currently, rubber is mostly obtained from the rubber tree (*Hevea brasiliensis*) or other sources in the form of latex. Making incisions in the bark and collecting the fluid in vessels is a method known as "tapping" that removes the latex, a sticky, milky, and white colloid. The rubber that is produced from the refined latex is then suitable for industrial processing. Latex from significant regions is allowed to congeal in the collection cup. The coagulated lumps are gathered and transformed into dry forms for retail sales. Whether used alone or in conjunction with other materials, natural rubber is widely utilised in a variety of applications and products. It has a high stretch to strength ratio, great resilience, and is water-proof in the majority of its practical forms. By the end of the nineteenth century, industrial demand for rubber-like materials had begun to surpass natural rubber resources, prompting the chemical production of synthetic rubber in 1909.

In India commercial production was first introduced by British colonists. Although the initial efforts to cultivate rubber on a commercial basis were started as early as 1873 at the Calcutta Botanical Garden. In Kerala's Thattekadu, the first industrial *Hevea* plantations were started in 1902. Later, the crop was extended to India's Andaman and Nicobar Islands, Tamil Nadu, and Karnataka. India is now the third-largest producer and fourth-largest consumer of rubber in the world.

Natural rubber is the most significant revenue crop in Tripura. Since its introduction in 1963 by the State Forest Department, Tripura has overtaken Kerala as the second-largest producer of natural rubber in the nation, producing around 9% of all rubber produced in India. After Kerala, Tripura boasts the second-largest rubber-

growing region in the nation. The Tripura tribal population initially started a rubber plantation as a means of generating income. The state government of Tripura has two PSUs, Tripura Forest Development Plantation Corporation Ltd. (TFDPC) and Tripura Rehabilitation Plantation Corporation Ltd. (TRPC), that are dedicated to the expansion of the state's rubber plantations and rubber industry. Rubber-based businesses have been designated as Tripura's "Thrust Sector" for investment by the Industries & Commerce Department and the State Government as the priority sector for generating income (Dept. of Industries and Commerce, Govt. of Tripura, 2022).

Tripura has three different categories of ownership for rubber plants. Rubber plantations covering 7018 ha of deforested land are owned by TFDPC Ltd. The area of the estate sector is 347 ha. The remaining areas are owned by individual growers; however, TRPC Ltd. has developed 8500 ha of those, 3800 ha under the Board's Block Plantation Project and an estimated 3000 ha by the TTAADC and Tribal Development Departments. Consequently, the balance area, which is approximately 62100 ha, has been set up by individual Rubber farmers with the help of the Board's RPD Scheme. The majority of the 1.10 lakh individual rubber farmers are from rural Tripura. An estimated 82 percent of the land under rubber is owned by underprivileged groups in society (ST & SC categories). Today, local growers maintain the great bulk of Tripura's rubber plantations. A 0.70 hectare average holding size has been determined (Economic Review of Tripura, 2020-21).

Rubber trees are mostly of the RRIM 600 clone in Tripura. Less than 280 stands are found on average per ha in mature areas, which is primarily due to the nearly annual occurrence of tempests and cyclones. The state's nearly two-decade long insurgency during the 1980s and 1990s had a terrible impact on both plant health and population. The State is fortunate to have fewest disease-pest attacks. Another external limiting element is annual wintering.

Total area under rubber in Tripura as of 2021 is 86892 ha out of which 70817 ha is in yielding stage with production estimated to be 90712 MT. The state stands 2nd in terms of area and production of natural rubber. (Rubber board, GoI, 2020-21)

With 18021.80 hectares (20.74%), Sepahijala district tops the list of districts with the most land covered by rubber; Unakoti district has the least amount, at 3748.27

ha (4.31 percent). Unakoti district has the lowest production (3469.65 MT, 3.82 percent), while West Tripura district has the most (18507.39 MT, 20.40 percent). While North Tripura has the lowest productivity at 1058 kg, Gomati has the most at 1610 kg. (Rubber board, GoI, 2020-21)

1.1 Necessity of the study

Rubber growing system is gradually emerging as a promising sector and being substitute to the traditional crop production system. But till date there are limited numbers of studies conducted on rubber growers of Unakoti district and so, limited reports on rubber growers of Unakoti. Moreover, the limited number of studies which were conducted in other countries and other parts of India aroused the following research questions in mind.

1. What are the agro-economic and socio-personal characteristics of rubber growers and which types of other enterprises they affiliated besides rubber?
2. What are the main causes of resorting to rubber?
3. Whether rural youth and educated youth are earlier in resorting to rubber?
4. What is the status of rubber growers of Unakoti in respect of adoption of production technology and status of production?
5. What are the roles of different organisation like rubber board or SHGs in development of rubber sector?
6. Whether the processing units are monopolistic in marketing or rubber grower has any control on it?
7. What are the factors that influence the performance of rubber grower in respect of production?
8. What are constraints faced by rubber growers and their extent?
9. What are the factors that influence the perception of constraints?
10. What types of social and economic changes have been observed among the rubber growers after resorting to rubber cultivation?
11. What is the overall performance of rubber sector as a sustainable livelihood system?

With the above question in mind the present study was set with the following broad objectives:

1.2 Objectives of the study

1. To study the agro-economic and socio-personal characteristics of rubber growers of Unakoti district
2. To study the general perspective of rubber cultivation in Unakoti district.
3. To identify causes of resorting rubber production by the rubber growers of Unakoti district.
4. To identify the prospects and constraints faced by rubber growers of Unakoti district of Tripura**.**

The above broad objectives were broadly subdivided into more specific smaller objectives according to the specific questions raised in the previous section as follows:

(a) To explore the agro economic and socio personal characteristics of rubber growers of Unakoti district.
(b) To explore the main causes for resorting to rubber plantation.
(c) To assess the influence of agro economic and socio personal characteristics of rubber growers of Unakoti on earliness in resorting to rubber.
(d) To explore the production perspectives viz. acreage, age of the garden, land situation and technology usage in rubber sector of Unakoti.
(e) To explore and analyse the roles of different organizations like Rubber Board and SHGs in the development of rubber sector.
(f) To explore the prospects of rubber in Unakoti.
(g) To explore and analyse the constraints facing by the rubber growers of Unakoti district.
(h) To analyse the influence of agro-economic and socio-personal characteristics of rubber growers of Unakoti on extent of constraints?
(i) To explore the social and economic changes occurred after resorting rubber growing system
(j) To explore the status of women in rubber sector in Unakoti in respect of work load and decision making.

Based on the findings on the above objectives the study will find out the performance of rubber growing system in respect of its efficiency and effectiveness in

context of the livelihood of Unakoti district and will find out the factors responsible for effective performance of the system.

1.3 Limitation of the study

The study dealt with the rubber growers of Unakoti district. The information provided by the farmers in respect to yield and initial cost of establishment are mostly prediction based. They do not have proper data available about the yield records. Some of them are also reluctant to give precise information. Majority of the farmers were not aware of government scheme related to rubber, so they have very less information regarding that.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

The entire review of literature is presented in this chapter according to the objectives of study which are directly or indirectly concerned with the objectives.

The review of literature is presented in the following sections:

1. The agro-economic and socio-personal characteristics of rubber growers of Unakoti district.
2. To study perspectives of rubber cultivation.
3. Causes of resorting rubber production by the rubber growers
4. The prospects and constraints faced by rubber growers

2.1 The agro-economic and socio-personal characteristics of rubber growers

Viswanathan and Shivakoti (2008) investigates the impact of significant socioeconomic and institutional/policy level determinants on the adoption of rubber integrated farm-livelihood systems in traditional rubber growing regions of Kerala (South India) and non-traditional rubber growing regions of Assam, Meghalaya, and Tripura (Northeast India). The implementation of rubber-integrated farm-livelihood systems differs across Kerala and Northeast India. Socioeconomic factors such as shrinking land holding size, lack of family labour, and the rubber monoculture-oriented policy promotional schemes offered by the Rubber Board's institutional intervention have all played a role in the limited adoption of integrated rubber farming systems in Kerala's traditional regions. These integrated farming techniques for rubber are popular, especially among the indigenous groups, in the Northeast, which has a developing rubber economy. Northeast India's rubber plantations have grown significantly as a result of the Rubber Board's institutional support and Research and Development (R&D) involvement in the commercialization of rubber tree farming in the late 1980s. They emphasized that rubber plantations are built on marginal, waste land, and that the vast majority of would-be rubber farmers practice an integrated, diversified farming system that includes upland paddy, fisheries, poultry, cattle, annual/perennial crops, pig farming, and other activities.

Bhowmik and Chouhan (2013) the study clearly demonstrated varied factual evidence of the implementation of integrated farm-livelihood systems for rubber in Kerala and the NE states of India. According to multivariate research, region-specific features dominated by socioeconomic, institutional, and policy-level constraints best explain the various adoption scenarios of rubber-integrated agricultural systems. In general, the study's findings had a significant influence on the socioeconomic outcomes and the paradigm of institutional development that characterizes India's post-independence rubber-development programmes. The research found that rubber farming had remained a monoculture system in large part due to past institutional arrangements and policies that had emerged to support rubber area development in traditional locations (including Kerala).

Mohanakumar (2013) sought to examine the role of NR cultivation increase in Tripura and its influence on landholding, employment, and income He emphasises that in Tripura, the growth of rubber plantation area began in the 1980s, and the Gross Cropped Area (GCA) expanded from 3.05 percent in 1989-90 to 10.08 percent in 2009-10. From the 1960s through the 1980s, the Rubber Board and the Tripura government intensively pushed rubber plantation as a commercial product, and by the 1990s, rubber plantation covered a significant area and was the most profitable crop in the state. Rubber plantations are most prevalent in the state's South and West Tripura districts, accounting for more than 90% of all plantings in 2012, however, rubber plantations are more established in South Tripura district, which has an influence on the area's land market growth. He goes on to say that, according to the Rubber Board, the state's rubber plantation area is predicted to grow by 1 lakh hectares over the 12th and 13th five-year plan periods. Rubber plantation lands are developing faster than any other crop in Tripura due to increased demand for NR in national and international markets. This agricultural state has been experiencing a process of transformation from a food producing subsistence economy to a rubber plantation based commercial crop production, which is causing major worry among the economically and socially disadvantaged sectors of the community. He proposes that such negative repercussions may be mitigated in part by developing an agriculture strategy that includes land use and can maintain a balance between income, employment, and food security for diverse categories and classes of people in the state.

Debbarma (2013) the study intended to assess the influence of rubber planting on the socioeconomic situations of shifting cultivators in Tripura's Dhalai region. Using the five assets/capitals associated with sustainable livelihood, namely Natural capital, Human capital, Physical capital, Economic or financial capital, and Social capital, and measuring it with appropriate indicators representing the five assets/capitals, his findings show that the socioeconomic conditions of the beneficiaries in Dhalai district have significantly improved. Rubber-growing households have significantly increased their physical and financial assets/capitals. Their natural capital has somewhat deteriorated as their access to communal land and woods has decreased, but their human capital has slightly improved, however they are gradually leaving up traditional skills as beneficiaries gain contemporary ones. In terms of social capital, the tribal tribes in Dhalai district have an innate social capital since they are tightly linked by kinship and hence rich in social capital. He observed that many young people are currently working as wage workers in rubber plantations or as permanent latex processors in rubber processing factories. This has brought about social transformation in the area and provided chances for former jhumias and other landless households to improve their socioeconomic circumstances. He also noted that among Tripura's districts, Dhalai has the least area under rubber plantation (6.43 percent) compared to West Tripura, which has about 46.72 percent of the total area under rubber plantation and only 25.3 percent of ST population to its total population, for whose upliftment rubber plantation has been introduced.

Reang *et al*. (2014) studied determinants of small rubber growers' adoption behaviour in Dhalai district of Tripura. The major outcome of the study reveals that area under rubber cultivation is found to be the major determining factor in adopting the cultivation technologies and small area holders farmer are more prone towards adoption than the famer holding larger area. Among personal and socio-economic variables age, education, homestead land are also found to be significant. Thus, it can be suggested that those significant variables under rubber farming systems should get more emphasis and care through concerted efforts while formulating different development strategies and programmes for different categories of farmers.

Bhowmik and Viswanathan (2015) investigated the type of labour contracts existing among rubber small holdings, the structure of employment relations in rubber small holdings, and the policy imperatives for resolving the state's rising labour market challenges. the authors discovered that the employers' aim to maximising productivity was obvious in their efforts to train their workers for improved tapping quality. The authors discovered that a significant majority of the studied workers had mastered the ability of tapping through private initiatives. The authors also discovered that several smallholders who used hired labour had received training through the Rubber Board projects and then later distributed their knowledge to their plantation employees enhancing the tapping quality. The authors discovered no salary disparities based on a worker's age/experience, gender, or other qualitative criteria. There were no pay disparities between trained (skilled) and untrained (unskilled) tappers. The authors also discovered that the introduction of share cropping in Tripura's rubber plantations was probably caused by the dropping price of NR as well as a lack of tappers. The authors concluded by stating that the type of labour scarcity experienced in Kerala has yet to develop in Tripura, where population pressure is considerable but land available for agriculture and plantation is restricted.

2.2 Causes of resorting rubber production by the rubber growers

Mohanan *et al.* (2002). Under the institutional oversight of the Rubber Board, researchers looked into the expansion of rubber farming in the NE states of India. The authors discovered that several R&D and institutional support activities are included in the developmental projects. The authors discovered that the setup called for the tribal groups to begin working in the rubber plantations as wage labourers in the beginning and earn their living until the plantations started producing (say, 5-7 years). The farms were turned over to the growers for ongoing maintenance and supervision, and as the plantations began to produce in the eighth year after planting, the growers hired the indigenous tribes for daily labour.

Viswanathan and Bhowmik (2014) the appropriateness and adaptation of the Kerala model of institutional interventions for rubber development in the unique context of the North Eastern Region were critically explored (NER). The authors investigated

the trajectory of development of rubber plantations in Kerala under the institutional interventions spearheaded by the Rubber Board and discovered that the Board promoted a rubber production system that was highly oriented toward monoculture without considering crop promotion from an agricultural system perspective. The authors also noted that, given the NER's agro-ecological variety and distinct socioeconomic, ethnic, and institutional circumstances, as well as the pattern of livelihoods pursued, institutional interventions for rubber development should be integrated and comprehensive, so as to limit the harm done to the region's delicate agro-ecosystems.

Mohanakumar (2016) in his study 'Political Economy of Natural Rubber Cultivation in Tripura,' he emphasises that the growth in the price of NR in local and international markets has resulted in fast expansion of the area under rubber cultivation. Due to increasing revenue from natural rubber, the state is undergoing an agricultural transition from a rice producing subsistence state to a commercial base natural rubber producing state. Rubber plantation area has increased as a consequence of federal and state government policies favouring rubber plantation, primarily as a result of land use policy and crop-subsidy system for rubber plantation. The majority of the state's rubber plantations are located in West Tripura district (south and central sections) and South Tripura district. Rubber cultivation in Tripura's North Tripura and Dhalai districts has been limited because the majority of these districts are characterised by steep terrain with wooded regions. He finds that because NR is a commercial product, variations in its price might cause severe ups and downs in buying power as compared to rice. Rubber plantation has also shifted land distribution, favouring rural affluent people, especially tribal tribes, while non-rubber producers' living standards have plummeted. He claims that because paddy fields can be converted to rubber plantations but rubber plantation areas cannot be converted to paddy fields, the state government's preference for rubber plantations at the expense of food security can have serious consequences for the state's social and economically vulnerable groups.

Economic review of Tripura (2020-21) In Tripura, the use of rubber has caused a paradigm shift in the socioeconomic landscape. It is currently the plantation crop in the State that is both most widely used and most profitable commercially. With its social relevance, it has strengthened the economic worth of plantation industry. In addition to

its commercial worth, rubber in Tripura has proven essential for rural development. It provides such socioeconomic activities that have sparked the idea of rehabilitation programmes for formerly nomadic shifting growers. The pattern of land use was also redefined. According to reports, this harvest has contributed to a decrease in insurgency in the State.

2.3 The prospects and constraints faced by rubber growers

Bhowmik (2006) tried to identify the future prospects of rubber cultivation, he concluded the state economy is boosted by the expansion of the rubber industry, and expanding the land base will make the economy even stronger. As we've seen, even with cautious assumptions, the rubber industry can be very profitable. Naturally, the state's revenue is expected to rise more significantly if prices stay at their current high levels. The high growth rate for yield is the most encouraging statistic regarding rubber in Tripura. A higher yield will lead to more production and better revenues. By facilitating freight flow through the Chittagong port, producers who export their goods to the mainland rubber goods industry can reduce their transportation costs.

Viswanathan and Shivakoti (2008) one of the most visible positive effects of integrated farm livelihood systems and rubber growing in Northeast India is the continuous flow of income from rubber plantation, which has enabled tribal communities to avoid the situations of distress sale of paddy that they previously encountered prior to the implementation of the rubber plantation scheme. Unlike the traditional regions, Northeast India has the potential to expand rubber-integrated agricultural systems as a measure of sustainable agriculture in the globalisation age. The authors argue that a new institutional paradigm must be accompanied by particular R&D intervention in order to develop sustainable rubber-integrated agricultural livelihood systems for Northeast India without jeopardising the region's socioeconomic, ethnic, and ecological diversity

Raj *et al*. (2012) in their report 'Geospatial Technology for Natural Rubber Acreage Estimation and Identification of Potential Areas for its Cultivation in Tripura,' they attempt to estimate the spatial extent of existing natural rubber holdings in Tripura, as well as identify and map potential areas in the state for NR cultivation expansion.

They investigated the aims using satellite photos. The area under rubber plantation estimated using satellite data was 48,037 ha in March 2012; however, it did not include the young rubber plantation of 2/3 years old since these young plantations typically have identical spectral signatures with other fallow lands/scrublands, making mapping problematic. As a result, they added the entire area under two-year-old rubber plantation, which is 10,600 ha according to Rubber Board data, and the total area under rubber plantation was 58,637 ha, which nearly coincides to the official statistics of the Rubber Board, 59,285 ha in 2012. The land under rubber plantations is largely concentrated in the western section of the state, advancing to the northern-east. Satellite data analysis suggests that around 28,133 hectares of prospective wasteland regions such as scrubland, degraded land, marginal and jhum land have been identified for further growth of rubber plantation in the state. However, about 5,186 hectares of potential land for rubber plantations have been identified within the protected forest area, while 22, 947 ha of potential space for rubber plantations have been spotted outside the reserved forest area where rubber plantations may already exist or might be established. They proposed that rubber plantation be actively promoted in wastelands (aside from reserved forest areas) because rubber trees can protect further degradation of denuded wasteland and restore such ecosystems; thus, rubber plantation expansion here can occur without interfering with local food security and biodiversity.

Sharma and Dey (2014) examined the contributions of several institutional actions in Tripura's NR sector Their analysis reveals that the success and development of rubber plantations in the state are primarily due to a collaborative approach between major production-centric institutional interventions such as TFDPCL, TRPCL, the Rubber Board's Block Planting Units-Rubber Producers Societies (BPU-RPS) schemes, and marketing interventions such as the establishment of a centrifuge factory by TFDPCL, the entry of Manimalayar Trading Company promoted by the Rubber Board, and increased participation. They argue that developing a rubber-based manufacturing sector in the state is essential for continuing NR cultivation expansion and ensuring higher producer pricing.

Joseph *et al.* (2009) the MGNREGA's implementation in Tripura has resulted in a lack of family labour for natural rubber plantations.

JesuRajam (2001) in his thesis, the author looked at the types of challenges and limitations that the business and its employees face on a daily basis. The management of rubber plantations, the labourers employed in plantations, and the yield of rubber latex across various parts of the district were all topics covered by the author when discussing the production of rubber latex in the Kanyakumari district. The production of latex and its value, along with the initial investment and yearly production costs, were also described by the author. The productivity of the rubber industry, case studies, and difficulties faced by other countries were all extensively discussed. The issue with workers was also examined, along with their experience, working hours, debt, income, and spending patterns. Additionally cited were the rubber industry's financial advantages and suggestions for development. The author discovered that while some industries perform well, others do not. The author's main conclusion was that the intense competition from Malaysia and Thailand prevented the prices of the produced goods from covering their costs.

Ushadevi and Jayachandran (2001) studied the socioeconomic profile of rubber tappers in Kanjirappallypanchayath, Kerala, taking into account their living circumstances, the labour market, their level of pay, their wage structure, the contribution of women tappers, and the role of institutional support. The authors discovered that trade liberalization policies and the global decrease in the rubber industry had had a major impact on natural rubber pricing in India, which in turn had an impact on the income of small-scale rubber growers and the socioeconomic circumstances of rubber tappers. The rubber tapper was not motivated to become more skilled or use better farming and tapping methods by the decrease in income.

Viswanathan *et al.* (2003) the authors examined inter-regional differences in wages, tapping tasks, employment, and earnings of tappers; they also analyzed the processes of determining tapping and its size in small-holdings; they highlighted the emerging issues from a cross-section of rubber tappers distributed over rubber-growing regions of Kerala. The authors discovered a steady decline in the number of trees that were available for tapping, a trend toward multiple grower dependence, relative stagnancy or decline in the earnings of tappers compared to those of their counterparts in general agriculture, and a consequent shortage of skilled tappers in the midst of

extremely high rates of rural unemployment in the State. In order to resolve the problems, the authors advised exploring potential alternatives highlighted.

Bhowmik (2006) indentified that tripura's rubber plantations face a variety of issues that can be divided into three categories: I climatic; heavy rains lower the number of tapping days, which has an impact on productivity and output. High latex-yielding mature trees frequently get blown away by wind and fall to the ground. (ii) technological/economic; Price fluctuations have an effect on the traditional farming methods used by farmers. The small and marginal farmer frequently skips the appropriate dose of fertiliser during periods of lower prices. A constant concern at high prices is an abundance of supply. Social, political, and institutional factors (iii); o Due to the extremely small wage differences between skilled and unskilled labour, plantations experience labour challenges. Poor productivity is frequently caused by the rubber growers' lack of awareness. Since the majority of tribal farmers lack formal education, they are unable to take instructions seriously.

Datta *et al.* (2019) The main causes of the state's low rubber productivity, according to the Rubber Board, can be summed up as follows: Old and unprofitable Trees, lack of knowledgeable tappers lack of high-yielding varieties, Intensive tapping, lost tapping days from rain, improper tapping technique, prolonged winter, and lack of fertilizer supply. He further suggested to remove trees over 30 year old should be replanted to increase productivity; proper training to tappers to improve skill and productivity of rubber growers; using quality planting materials for higher productivity.

Ali and Manoj (2020) studied the problems of rubber cultivator in Kerala. The study reveals that falling price of rubber has affected the life and livelihood of many cultivators. There was an upward moving trend of rubber from 1990 to 1995. The period 1996 to 2000 was period of high instability. Rubber price again showed upward trend since 2001 continued till 2010. But since 2012, rubber price shows constant negative trend which is still continuing. Non-availability of tappers, low price, low production, are the major problems pointed out by most cultivators.

Pareed and Kumaran (2017). in their study about entitled as “Price Volatility and Its Impact on Rubber Cultivation in India – An Analysis of Recent Trends” published in Journal of Academic Research in Economics (JARE), have sought to make a macro

degree analysis of the influence of rate volatility on rubber cultivation in India. Based on the findings of their study, the authors have recommended techniques for the sustained increase of rubber economy in India.

According to Rubber Board (2021) about 40% of the plantations in the State are tapped by paid tappers, while the remaining 60% are tapped by the growers themselves or members of their families. Around 250 people are still tapping. For up-skilling, they require more hands-on assistance.

Economic review of Tripura (2020-21) As a result of irregular productivity-enhancing projects and ongoing skill development, average productivity has stayed around 1200–1600 kg/ha/year over the past few years. On the other hand, old plantations slowly deteriorate and lose their ability to produce as a result. In the State, the average productivity was 1281 kg in 2020–21. Good agricultural practices (GAPs) have been proven to increase production by 200 kg a year.

2.4 General perspectives after adoption of rubber.

Sarkar, (2012); Matouleibi, (2012) revealed that increased in education level in 2nd and 3rd generation, mostly in 3rd generation can be noticed as they invest for that to make them study even at private ‘English Medium Schools’ and feel that, even if in future rubber crops collapse, their children will have better future.

Sarkar (2011) In his work 'Rubber Plantation: A New Hope for Rural Tribal in Tripura,' he examines the rise of rubber plantations as well as the money generated by them. According to his results, the area under rubber plantation is quickly expanding. Various state government organisations (TFDPCL and TRPCL) and the Rubber Board have made significant contributions to the growth of rubber plantation, rehabilitating tribal jhumias through rubber planting. He emphasises the fact that tribal people may generate money from both immature plantations (through intercropping and casual labour) and mature plantations (by tapping, rubber agency, rubber industry, rubber wood, rubber seed, rubber honey, firewood, biogas, and casual labour). He claims that indigenous people may earn more money from mature rubber plantations than they can

from immature rubber plantations. Rubber planting creates many job possibilities while also decreasing deforestation; hence the state government should encourage greater rubber plantation to reduce unemployment in rural regions in particular and the state in general.

Sarkar (2010) Family sizes have also decreased. Now, they have enough food (though mostly purchased from market), they have been able to come out from indebtness and broken the vicious cycle of poverty

Rubber board (2021) Tripura's total area planted with rubber as of the end of March 2021 is expected to be 86892 hectares, of which 70817 ha are now in the producing stage. 90712 MT of rubber are thought to have been produced. The majority of the mature area is being tapped. The State ranks second in the nation for both area and natural rubber production.

RESEARCH METHODOLOGY

RESEARCH METHODOLOGY

Systematic methodology is a requirement for conducting research. It directly affects the relevance and validity of research findings. The methodology used to study the agro-economic and socio-personal characteristics, as well as the status of rubber growers in relation to production and marketing of the produce in Unakoti, is discussed in this chapter.

3.1 Conceptual framework and design of the study

Rubber plantation in Unakoti started since its introduction in 1963 by state forest department. Although in Unakoti small numbers of farmer started its plantation. Being smallest district of the state and the least producer of natural rubber, very limited number of studies has been conducted regarding its status. The present study is an attempt to explore information about the prospects and problems facing by the growers of the district as well as to draw conclusions regarding the factors that encourage resorting to rubber cultivation. The role of rubber board and other grassroot organization cannot be ignored for the success of rubber sector in Tripura. The study is descriptive study followed exploratory framework of study. In some cases, to know the influence of various factors and to know the comparative status between space, time and scale, the study also derived hypothesis and followed framework of hypothesis testing. The present study adopted longitudinal (farms of different ages were selected) as well cross-sectional design of research.

3.2 Concepts and meaning of the terms used in the study

Prospects of rubber cultivation:

The meaning of prospects is an apparent probability of advancement or success (according to oxford dictionary). The majority of the farmers migrated cultivating other cash or food crops to rubber cultivation for their livelihood. According to Bhowmik (2006) rubber plantations being a viable source of earning for an entire economic life, educated youths can be encouraged to resort to tuber plantations as a source of livelihood. Tripura Rubber Mission (TRM) can initiate short-term certificate course in

plantation management in collaboration with educational institutes' like- Indian Institute of Plantation Management (IIPM), Bangalore, Tripura University, Agartala and IGNOU, New Delhi.

As a prospect, the present study addressed economic prospects, socio-economic prospects, employment opportunities, self-employment and consequently its impact of migration etc.

Processing unit:

It indicates the individuals who have their own processing unit which process the latex into graded sheets.

Co-operative processing unit:

Mainly operated by the co-operative or self-help groups. They processed the centrifuged latex into graded sheets of their group members. They also process other farmers latex at the market rate for per sheet.

Constraints

The word constraint means limitation or restriction. Here constraints indicate the various problems faced by the rubber growers of Unakoti district at the from planting of the seedlings to harvesting of latex.

Gender

It is socially constructed state of an individual of being man or woman. It is used with reference to social and cultural difference rather than biological ones. Women participation in day to day activities in rubber cultivation is moderately low in Unakoti.

Family labour

Workforce engaged in rubber production from family members of the individual farmer.

3.3 Selection of the area of study and individual respondents

3.3.1 Selection of area for study

Among the other districts of Tripura, Unakoti is one of the lowest producers of rubber. Being the smallest district of the state, most of the rubber plantations are concentrated in Kumarghat and Pecharthal block. Among these two blocks specific areas where the rubber concentration is high were selected. The growers are mostly small and marginal. So, these two blocks were taken purposively. Finally individual rubber growers from different patches of these blocks were selected.

Table 3.1 status of rubber growers (as on 31st March 2021)

	Immature Area (ha)	Mature Area (ha)	Total Area (ha)	Production (MT)
Unakoti	**693.43**	**3054.84**	**3748.27**	**3469.65**

Source: Rubber Board (2021)

3.3.2 Selection of respondents

Random sampling was employed to select the respondents. Sampling defines as a part of population selected for drawing conclusions regarding population. Random sampling then applied when individual random sampling is a sampling technique in which each sample has an equal chance of being selected. A random sample is intended to be an unbiased representation of the entire population. A random sample is more suitable in more homogenous and large groups of people. The small rubber growers are establishing SHG themselves, although in a slow rate get benefits from rubber board. 30 respondents from each block were selected randomly.

Table 3.2 Scheme of sampling

UNAKOTI				METHOD
Kumarghat R.D. Block		**Pecharthal R.D. Block**		**purposive**
Paschim Kanchanbari	Dudhpur	Nalkata	Nabincherra	**purposive**
30 farmers from each block were randomly selected. (Total Sampl= 60)				**purposive**

3.4 Research setting

In this chapter some features of Unakoti district are discussed. The study mainly carried out in Kumarghat R.D Block & Pecharthal R.D Block of the district. The study setting seek to describe in terms of socio-economic and agricultural aspects of the areas.

Unakoti district

Unakoti is a district of Tripura. Initially Tripura was one district state, and was trifurcated into three districts from 1st September 1970. North Tripura district started functioning in the office of SDM Kailashahar and partly in Kumarghat, Later, the entire office was relocated to Kailashahar. On November 13, 1987, the Collectorate was relocated to a newly constructed building at Gournagar.As a result, the North Tripura District was divided, and a new district, the "Dhalai District," was established on April 14, 1995, with the district headquarters at Ambassa.The decision to further divide North Tripura District was adopted on January 21, 2012, and the district "UNAKOTI DISTRICT" was formed, with its headquarters at Kailashahar.

Unakoti is the smallest district of the state Tripura with total area 686.97 sq. km, 2 nos. sub division, 5 nos. of blocks (including one newly formed block namely Fakitray RD Block), 3 revenue circles, 12 tehsils, 91 nos. GP & VC, 2 municipal councils, and 6 nos. police stations.

Geography: Dharmaagar subdivision, Panisagar subdivision, and Kanchanpur subdivision of North Tripura district surround the district on the northeast, east, and southeast sides, respectively. It is bounded on the south by Kamalpur subdivision and

Longthari valley subdivision of Dhalai district. It also shares a northern international boundary with Bangladesh.

Demography: According to the 2011 census, the total population of the Unakoti district is 2, 76,506. Males number 1, 40,210 and females' number 1, 36,296, respectively. The overall literacy rate (%) is 86.91. Male literacy (percentage) is 90.92, female literacy (percentage) is 82.79, and females per thousand males are 972.

Climate: The entire state, including the Unakoti area in particular, experiences monsoon weather. However, there is a temperature difference between the plains and hills, with sub-tropical climate in the lowlands and temperate climate in the higher regions. The Unakoti district's geographical characteristics appear to have had an impact on the climate, since the plains are hotter and more humid than the hills, which have a more temperate temperature. The average climate temperature is between 10°C and 35°C. The coldest months for the District are December through February, followed by the warm season from March through May. The months of May and January often record the greatest and lowest temperatures, respectively.

Topography: The Unakoti district's topography is largely made up of rough terrain with some undulating surface. Only around 25% of the district's geographic regions are plains, with the most of them consisting of steep terrain covered in thick woods. The valleys between the hill range are marked by a gradual slope and occasionally little hillocks (Saigal, 1978). Manu plain and Deo plain make up the majority of the district's valley and plain lands. Because of the high humus content that this river from the hills range deposited, a large portion of these plain lands are used for agriculture. Between the Longtarai Mountain in the west and the Sakhan range in the east are the Manu lowlands. Manu River is the main drainage system for it. Small hillocks and rich plain regions where paddy farming and shifting cultivation coexist on this plain make up a portion of it. Between the Machhlithum/Sakhan range in the west and the Jampui hill range in the east, the Deo plain partially encircles the Unakoti area.

Economy: Tripura is predominantly an agricultural state, with agriculture and related sectors employing around 42 percent of the population. However, only around 26% of the area is cultivable, with the remainder being mountainous and wooded. Rice is the state's main crop. The climate of the state is ideal for a wide range of

horticultural/plantation crops such as pineapple, jackfruit, tea, rubber, bamboo, and so on. A subset of the indigenous population cultivates using the jhum (slash and burn) method. Tripura's economy is agrarian, with a high rate of poverty, low per capita income, low capital formation, insufficient infrastructure, geographical isolation, communication bottlenecks, insufficient exploitation, insufficient use of forest and mineral resources, low industrial progress, and a high unemployment problem. It presently has more than 42 percent of its population directly depended on agricultural and its allied sector.

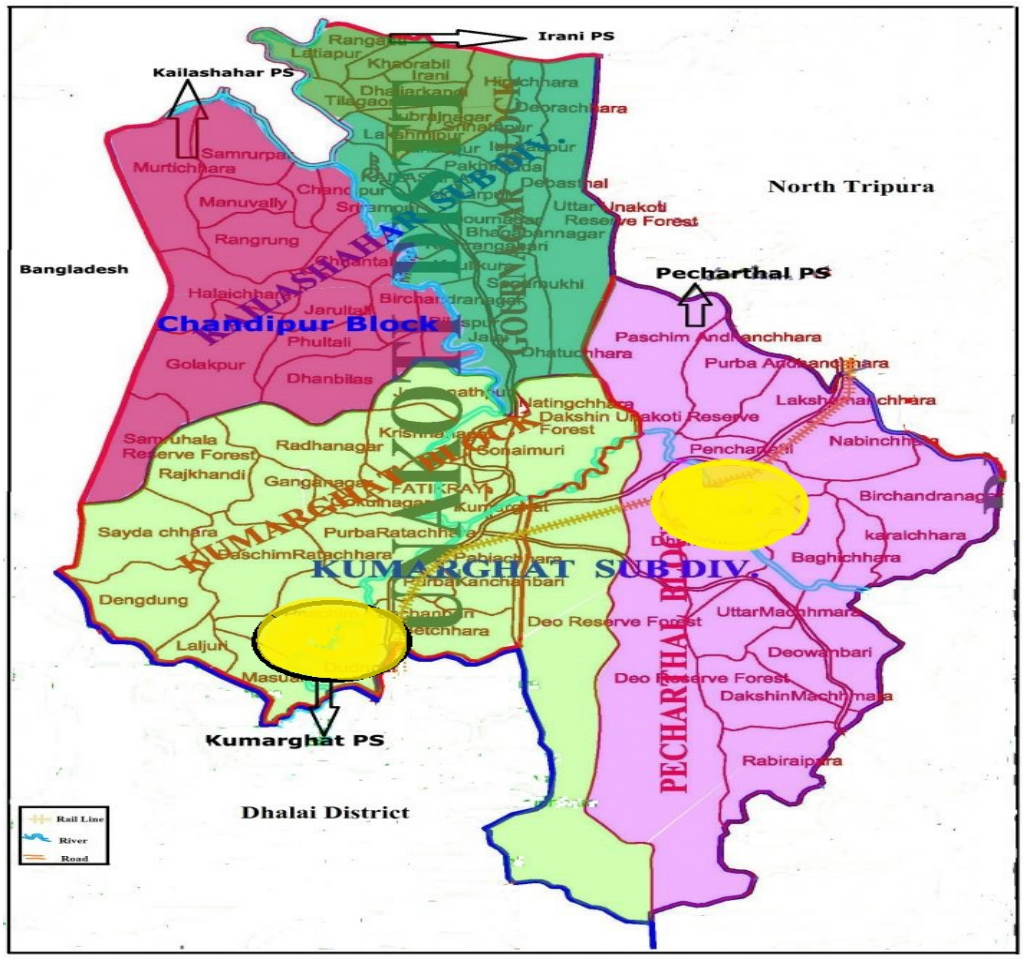


Plate-1 Map of Unakoti showing areas of the study

3.5 Description of different blocks of Unakoti where study is conducted

Kumarghat R.D. Block: The block is surrounded by Chandipur RD Block, Gournagar RD block, Pecharthal RD Block and Manu RD Block. The block is well connected with NH-44 with Assam and Agartala. As of 2022, there would be 114,163 people living in the Tripura state block of Kumarghat. In this Block, there are 89,190 people total, including 45,238 men and 43,952 women, (according to the 2011 Indian census). Kumarghat will have 110,596 residents in 2021. In all, 69,896 persons are literate, including 33,289 women and 36,607 men. 32,940 workers total, 7,766 women, and 25,174 men rely on multiple skills. Agriculture farming is the primary source of income for a total of 6,281 cultivators, of which 5,769 are men and 512 are women. In Kumarghat, 5,241 people are employed as farm labourers, including 4,403 men and 838 women. Total number of villages under Kumarghat block is 23. The climatic condition is same with the other districts of the state.

Dudhpur and Paschim Kanchanbari area has been selected from Kumarghat Block for the study. It has been observed that some processing units are owned by individual farmers and also group processing unit exist under SHGs.

Pecharthal R.D. Block: The population of Pencharthal Block, which is located in the state of Tripura, will be 55,227 in 2022. In this Block, there are 43,146 residents overall, including 22,048 men and 21,098 women, as reported by the 2011 Indian census. In 2021, there will be 53,501 people living in Pencharthal. Of those, 29,951 (or 16,582 men and 13,369 women) are literate. 11,762 men and 5,186 women make up the 16,948 workers who rely on multiple skills. 3,004 cultivators work in the agricultural sector, of which 2,807 are men and 197 are women. 3,832 individuals, 3,139 of whom are men and 693 of whom are women, work as agricultural labourers in Pencharthal. This Block has a total of 16 settlements. The sex ratio in Pencharthal Block is 957 females for every 1000 males.

Nalkata and Nabincherra village are selected from Pecharthal block for the study. The areas selected are mostly hilly. Here co-operative processing units exist mostly. The processing units are mostly run by SHGs.

3.6 The data collection tool---description of the schedule

The study mainly considered primary data for analysis. Primary data were collected through individual interview schedule. However, small amount of data collected from secondary sources.

3.7 Development and pre-testing of the interview schedule

Schedule is a tool, a list of questions that are asked and answered by the interviewer when they are face to face with the interviewee. It aims to verify a claim or hypothesis. Following the completion of the pre-testing procedures for data collection, a schedule is created for the current study. The entire schedule is broken up into various sections.

An interview schedule was specially prepared for collecting information from the respondents, keeping in view focus objectives and variables of the present study. The draft schedule was pre-tested. The schedule was revised and modified with appropriate wordings and contents. Pre-testing helps in ensuring the validity of some measure under local conditions.

3.8 Interview and collection of data through schedule:

Interview: regarded as a systematic method of gathering data in a face-to-face setting where researchers ask respondents a series of predetermined questions in order to gather data on a research problem.

3.9 Selection and measurement of variables:

Socio-economic and personal variables: social variables like caste, religion and family information, Personal variables like age, education, family education status, communication and extension media contact, organizational participation, outside contact; economic variables like primary and secondary occupation; land holding status and land characteristics and occupation, economic status were taken into account.

Variables related to production of rubber: area under rubber, level to technology adopted, employment generation, contribution of rubber in livelihood etc.

Some variables which can directly be measured are taken in numerical values. Qualitative variables were assigned scores following different scales proposed by different authors. For some important aspects constructs were developed for comparison and measurement. The detailed method of measurement is mentioned in the following section.

Age: direct numerical values taken.

Caste: the scale composed of schedule caste, schedule tribe, other backward class and others.

Education: the scale composed of 'illiterate'; 'literate'; 'primary'; 'secondary'; 'higher secondary'; 'graduation and above'; with scores 0,1,2,3,4,5,6 respectively.

Occupational diversity: directly taken as the number of occupation in the family.

Size of land holding: direct numerical values are taken.

Organizational participation: a list of organization are mentioned and based on the participation and special post holding scores are given against it.

Economic status: it was measured with condition of house, drinking water, sanitation with scores. The sum total values are taken as variable values.

Communication with extension worker/organization: the scale composed of frequency of visit with extension worker or other organization. The scale values 0=no contact, rarely=1, frequently=2, Daily=3.

Extension media contact: the list composed of the extension means used by the individual respondents and based on that score have been assigned. The scale with score are, Never=0, Sometimes=1, Regular=2.

Land holding and cultivation status: involves the land details, land area, texture, and topography also irrigation status, whether depended on rubber cultivation, secondary occupation other than rubber.

Reasons for resorting rubber cultivation: here twelve numbers of statements were placed before the respondent regarding the benefits of rubber cultivation in

comparison to other food or cash crops. The respondents were asked to give his agreement based on the scale viz. strongly agree, agree, undecided, disagree, strongly disagree with '+2 to -2 scores. The seasons were collected based on real life situations by observations and from review of literatures. The lists of the reasons are:

1. Ratio of periodic money back and paid out cost is comparatively high in rubber
2. Relative net profit is low in other crop in comparison to rubber
3. Competitive market is not available in other crop in comparison to rubber
4. Quality planting material is not available in comparison to rubber
5. Infrastructural facility like transport, storage etc is not sufficient in comparison to rubber
6. Governmental support is more for rubber than other crops
7. Subsidy /good benefits from rubber board and SHG
8. Started rubber cultivation by observing the success of other farmers
9. Encouragement from rubber board / another agency
10. To come up from climatic and uncertainty associated with cultivation of other crops
11. It gives preplanned expenditure opportunity to the family
12. Unsuitability of land for other crops

Changes of family after resorting to rubber cultivation: here some situations are given such as food security, housing condition, sanitation, drinking water, using modern appliances, luxury goods, availability of loans after shifting to rubber cultivation, capacity of saving money in banks, health security, school going of children, and overall happiness in the family etc. the respondents were asked to give his opinion such way as 'improved'; remained same'; 'deteriorated'.

Changes in locality: some local conditions were put forward the respondents and measured against the responses of highly deteriorated, moderately deteriorated, deteriorated, no change, improved, highly improved with '0 to 6' score.

Variables related to cultivation of other crops: variables are purpose of cultivation with scale statement and scores such as 1=only home consumption, 2=surplus marketing, 3=only for marketing; and level of profitability scale statements 1=not profitable; 2=more or less profitable; 3=highly profitable respectively.

Variables related to rubber cultivation: this includes rubber cultivation status of the respondents in respect of area (in kani), year of establishment, variety, spacing, manurial dose, irrigation status, adjacent crops, and average yield (quital/year/kani), labour employment and the constraints faced during rubber cultivation.

Constraints of rubber cultivation: the respondents were exposed against some constraints with different levels of response as extreme, moderate, and somehow. The list of constraints was collected from locals and from existing literature follows:

1. Higher initial cost
2. No return at initial phase
3. High cost of planting materials
4. Non availability of labor in time
5. High cost of labour
6. Non availability of fertilizer in time
7. High cost of fertilizer
8. Non availability of skilled tapper
9. Non availability of credit in time
10. Problems of pest & diseases
11. Loss due to improper processing
12. Uneven distribution of rainfall
13. Irrigation problems
14. Falling of trees due to strong wind
15. Fluctuations of market price

3.10 Data processing, tabulation and procedure used for analysis

Data processing

The data collected were transferred to the MS Excel worksheet to facilitate statistical analysis. There they were processed, analyzed, classified and given statistical treatments.

3.11 Statistical methods used

The statistical methods used in the study include mean, percentage, correlation, frequency, standard deviation.

Mean

The mean is the average of the values in the given set. We must first add up (sum) all of the data values (x) in order to determine the arithmetic mean of a set of data, and then divide the result by the total number of values (n). Since the symbol for summarizing values is (see Sigma Notation), we arrive at the formula shown below for the mean (x):

$$\bar{x}=\sum x/n$$

Where, X- Represents items to be averaged

n- Represents the number of items.

Percentage

Percentage is used for making simple comparison. For calculating percentage, the frequency of a particular cell is divided by the total frequency and then the result was multiplied by 100 to obtain the percentage. The mathematical expression is follows:

$$\text{Percentage} = \frac{\textbf{Frequency}}{N} \; X \; 100$$

Where, N = number of respondents

Frequency

Frequency is the statistical measure to represent the number of respondents in a particular category.

Standard deviation

The standard deviation is a measurement of how much a group of values vary or are dispersed. While a high standard deviation suggests that the values are dispersed throughout a wider range, a low standard deviation suggests that the values tend to be close to the established mean. For frequency distribution, Standard Deviation (S.D.) is measured as follows:

$$\sigma = \sqrt{\frac{1}{N}} \sum fi \ (Xi - \bar{x})^2$$

Where, σ = standard deviation

N = Total number of observation

X= Value of observation of a particular cell

f = Frequency of observation in the corresponding cell

$\bar{x}$= Mean of the observation

i = any number (e.g. 1, 2, 3.....) denoting position

Pearson's coefficient of correlation (simple correlation)

It is the most used technique for determining how closely two variables are related. This coefficient is predicated on:

(A) That the two variables have a linear relationship.

(b) That there is a passing relationship between the two variables, in which case one of them is dependent and the other is independent.

(c) Both variables are subject to a significant number of independent causes that combine to create a normal distribution.

Pearson's coefficient of correlation can be worked out thus

$$\boldsymbol{r = \frac{\sum(X_1 - \bar{X})(Y_1 - \bar{y})}{n.\sigma X.\sigma Y}}$$

Where, r = coefficient of correlation

Xi = ith value of X variable

$\bar{X}$ = mean of X variable

Yi = ith value of Y variable

$\bar{Y}$ = mean of Y variable

N = number of pairs of observations of X and Y

σ X = standard deviation of X variables

σY = standard deviation of Y variables

The range of Pearson's correlation coefficient, or "r," is between 1. Positive values of "r" denote positive correlation, which means that changes in both variables occur in the same direction, whereas negative values of "r" denote negative correlation, which means that changes in both variables occur in the opposite directions. If the "r" value is zero, there is no correlation between the two variables. r denotes perfect positive correlation when it is (+) 1 and perfect negative correlation when it is (-) 1, suggesting that changes in the independent variable (X) account for all changes in the dependent variable (Y). We may also state that a correlation will be referred to as perfect positive if there is a constant change in the dependent variable in the same direction for a unit change in the independent variable. However, if this happens the other way, the connection is said to be perfect negative. A high degree of correlation between the two variables is indicated by a "r" value that is closer to +1 or -1.

Student's t-test

When two sets of data are significantly different from one another, a t-test can be used to test a statistical hypothesis. It is most frequently used when it is known what test statistic would result if it were known. The test statistic (in certain circumstances) adheres to a Student's t distribution when the scaling term is unknown and is substituted by an estimate based on the data.

This test is only applied when both of the following conditions are met:

• The two sample sizes, or the number, n, of participants in each group, are equal;

• It is reasonable to assume that the variance of the two distributions is the same.

$$t = \frac{\mu_A - \mu_B}{\sqrt{\left[\frac{\left(\Sigma A^2 - \frac{(\Sigma A)^2}{n_A}\right) + \left(\Sigma B^2 - \frac{(\Sigma B)^2}{n_B}\right)}{n_A + n_B - 2}\right] \cdot \left[\frac{1}{n_A} + \frac{1}{n_B}\right]}}$$

$(\Sigma A)^2$: Sum of data set A,

$(\Sigma B)^2$: Sum of data set B, squared

μ_A: Mean of data set A

μ_B: Mean of data set B

ΣA^2: Sum of the squares of data set A

ΣB^2: Sum of the squares of data set B

n^A: Number of items in data set A

n^B: Number of items in data set

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

The study's results are presented in a methodical manner in this chapter, along with comments that is based on analysis. The study made an effort to convey its findings in accordance with its goals while keeping in mind the study's title, prospects and constraints.

4.1 Socio-personal and agro-economic perspectives of rubber Growers of Unakoti.

The most significant influencers of human behaviour toward an action are socio-personal and agro-economic characteristics. These traits can be used to describe the underlying factors that lead to behaviour and decision-making variance among various groups of people. In order to understand the general as well as context-specific characteristics of the many variables under inquiry, it is essential to investigate these qualities in any social science research. The distribution of rubber farmers is shown in this section based on social characteristics (such as religion and caste), economic characteristics (such as occupational diversity within families and economic status of the family), and personal characteristics (such as respondent's age, family size, respondent's education and highest family education, extension media contact, and outside contact).

4.1.1 Distribution of Rubber Growers of Unakoti according to different socio- personal characters

Table 4.1 presented the respondent’s distribution according to age and family size. Nearest chronological age of the respondent and number of family member were directly taken in consideration for analysis although in case of family member, small family considered as members’ upto 4 nos, 5 to 7 members considered as medium family and more than 7 members considered as large family. It is evident from the table that 81.66% respondents were from middle and younger age group whereas only 18.33% were falling in old age group. Here we can say that rubber sector in Unakoti is dominated by younger and middle aged groups. It has opened a new opportunity for self employment for the working age population in Unakoti district.

Table 4.1 Distribution of rubber grower according to age and family size

Age			Family size		
Age (yr)	**Frequency**	**Percentage**	**No of family members**	**Frequency**	**percentage**
<35	22	36.66	Small (up to 4)	54	90.00
36-50	27	45.00	Medium (5-7)	6	10.00
>50	11	18.33	Large (>7)	0	0.00

From the table 4.1 it is also indicated that 90% respondents were from small family size, 10% from medium family size and there were no respondents from large family category under study area. We can conclude that small and medium family holders are involved in rubber cultivation in the area of study.

Fig. 1 (**A** to **D**) depicts the distribution of rubber growers of Unakoti according to religion, caste, economic class and occupation. From the pie chart **A** we can say that 92% of rubber growers of the study area were Hindu, 1% Christian, 7% among others like Buddism and there were no Muslim population. Majority of the tribal groups are religiously Hindus in Unakoti district. Fig. **B** depicts rubber grower's distribution according to caste. Scheduled Caste has the dominance in rubber sector followed by ST and OBC. Only 2% Generals were associated with rubber. Fig. **C** represents the economic class of the rubber growers which shows 62% under BPL and 38% under APL class. Fig. **D** represents the occupational distribution with 70% involved in farming including rubber, 25% involved in business including rubber and 5% having govt. and private services along with rubber cultivation.

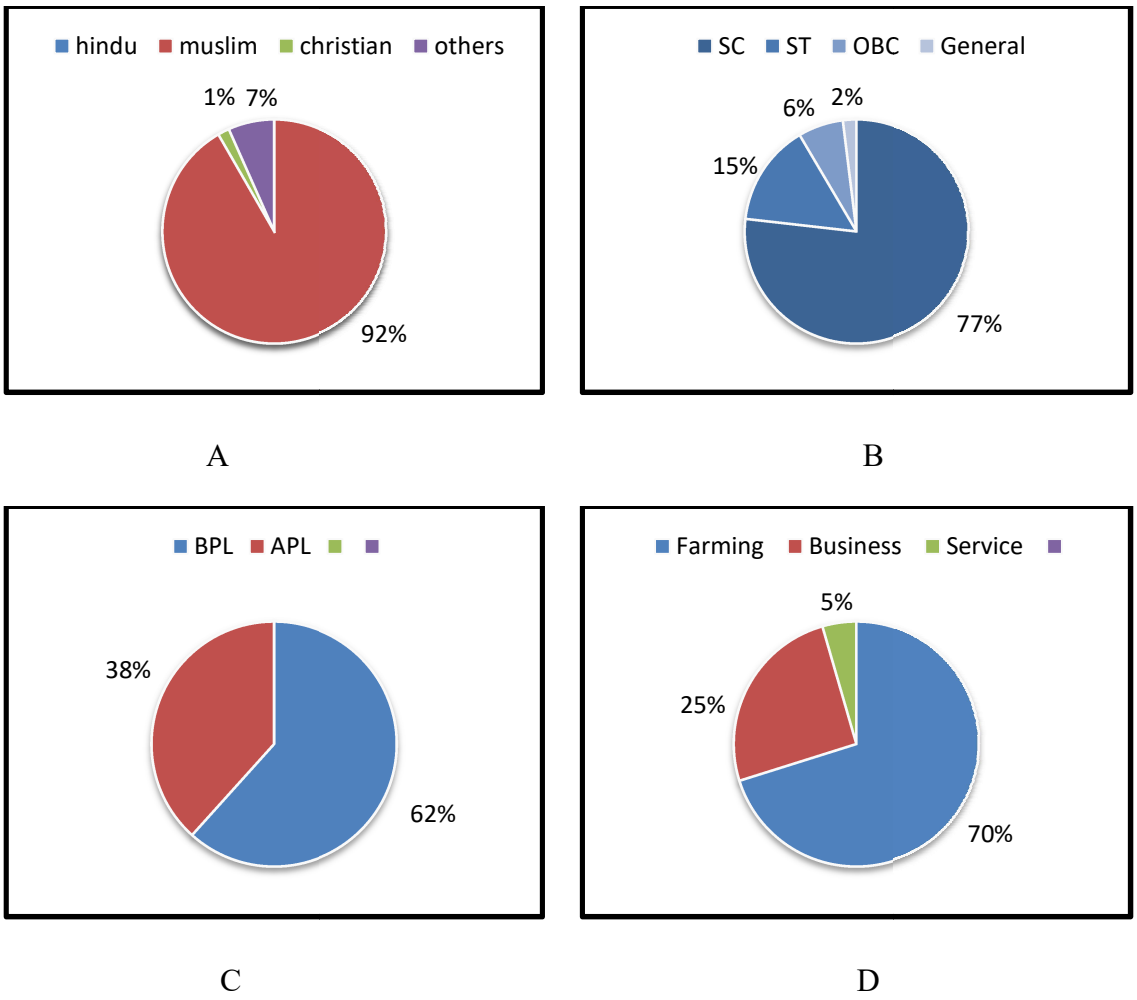


Fig. 4.1 Distribution of rubber growers according to Religion (A), Caste (B), Economic class (C) and Occupation including rubber (D)

Table 4.2 represents the distribution of rubber growers of Unakoti according to respondent's highest family education. Total year of formal education were grouped into six categories as 'Illiterate', 'literate', 'primary', 'secondary', 'higher secondary', and 'graduation and above'. The data revealed that the educational profile of rubber growers of Unakoti with 55% in case of secondary education and 18% in H.S level. 13% respondents having primary education, 12% educated with graduation and above level and only 2% were literate. There were no illiterate respondents among the rubber growers of study area.

Table 4.2 Distribution of rubber growers of Unakoti according to respondent's education and highest family education

Range	Highest family education	
	Frequency	Percentage
Illiterate (not able to read & write	0	0.00
Literate (able to read & write)	1	1.66
Primary (up to class-5)	8	13.33
Secondary (class= 6-10)	33	55.00
Higher Secondary (class=11-12)	11	18.33
Graduation and above	7	11.66

Table 4.3 Distribution of rubber growers according occupational diversity and economic status of family

Occupational diversity			Economic status		
No of occupation	Frequency	Percentage	Score Range	Frequency	Percentage
1	40	66.70	upto 13	6	10.00
2	17	28.30	14 to 16	53	83.33
3 & above	3	5.00	>16	1	1.66

Occupational diversity defines the number of occupations found in the family. Table 4.3 represents the distribution of rubber growers of Unakoti district according to occupational diversity of the family. In the above table range 1, 2 or 3 indicates one and more than one occupations of the respondent's family. From the table it is observed that 66.7% respondents engaged only in rubber cultivation, 28.3% having two types of occupation and only 5% respondents were having three and more than three types of occupations. The possible reason for adopting solely rubber enterprise by majority of the respondents may be because of high returns from rubber and so on.

The distribution of responders by economic position was also shown in the table. In the case of a family's economic status score, many economic factors were taken into consideration and the family was categorised as having a low, medium, or high economic status, with corresponding score ranges of "up to 13," "14 to 16," and "more than 16," respectively. The standard of the housing stock, the availability of sanitary and potable water, and the presence of productive assets were used to gauge the economic situation. The distribution of respondents by economic position is seen in the above table. 83.33% of

respondents have a medium degree of economic status; 1% has a high level; and 10% have a low level. The respondents' overall economic situations can be described as medium to high.

Table 4.4 Distribution of rubber growers of Unakoti district according to media contact, outside contact.

Extension media contact			Outside Contact		
Score Range	Freq	Percentage	Score Range	Freq	Percentage
up to 6	12	20.00	up to 6	38	63.33
7 to 10	6	10.00	7-8	17	28.33
>10	42	70.00	>8	5	8.33

Extension media contact is defined as interactions with various extension media, such as interactions with agricultural development personnel or rubber specialists, participation in extension training or exhibitions, close interaction with daily news publications, viewing of television or radio, etc., and is assessed based on the relative importance of the scores given to these media. According to the table, 20 percent of Unakoti's rubber growers have low extension media interaction, 10% have medium, and 70% have high extension media contact.

Outside contact is also called cosmopoliteness. According to the character of outside contact it is found from the table that 28.33% of the respondents had reported moderate level of cosmopoliteness status followed by low contact of 63 percent of rubber growers. 8.33 percent people had high levels of outside contact.

4.1.2 Analysis of socio-personal characters based on mean values

Table 4.5 represents the mean values of different socio-economic and personal characters of the rubber growers of Unakoti along with a comparative analysis of rubber growers of different study blocks. Mean analysis was taken to get a comparative picture between Blocks. This section is also a confirmatory analysis of the previous section. From the table it is depicted that most of the rubber growers of Unakoti are from middle age group with a mean age value of 42.73 yrs. The mean age of Kumarghat Block’s respondents is higher (45.93 yrs) compared to Pecharthal block (39.53 yrs) which are also statistically differs from each other. The mean education score of the rubber growers of Unakoti is upto class ten (mean value 3.25) which is considered as moderate level in educational status. The mean number of family members of rubber growers’ families of Unakoti (3.43) is found to be same as found in case of both the blocks. In case of highest family education it is found that

the mean family education status is 3.25 whereas in Kumarghat block highest family education status (3.47) was observed higher than Pecharthal block (3.23).

It is revealed from the table 4.5 that mean outside contact score is observed as 6.56 which is little lower than the score of Kumarghat Block (6.83) and slightly higher than Pecharthal block (6.30). We can say that the respondents of Kumarghat block are more cosmopolite than Pecharthal. Similarly extension media contact is observed higher in Kumarghat Block (8.53) than Pecharthal Block (7.67).

Table 4.5 also depicts the average mandays engaged in the rubber sector per month. From the table, it is found that mean mandays needed in operations which is 23.33. in Kumarghat block the mandays provided per month is lower than Pecharthal block but it is interesting to observe that allotted area for rubber plantation is higher in case of Kumarghat block (mean score 7.09) than Pecharthal Block (mean score 5.63). The total land holding including rubber planted area in Unakoti is 2.09 which is lower than both the blocks i.e. Kumarghat with mean score 10.08 and Pecharthal with score 7.90. Land holding in Kumarghat block is higher may be because of mostly plain lands.

Resorting causes strength which stimulates for rubber cultivation is seen to be 8.26 in Unakoti. Whereas, it is higher in Pecharthal block (9.13) may be because the topography of the area are mostly hilly which makes unsuitable for cultivating other crops. In case of Kumarghat (resorting cause strength score 7.40) area it is mostly plain.

The table 4.5 revealed that Pecharthal block (16.20) adopted rubber much widely and early than Kumarghat block (13.00) because in late 90s the rubber board came with rubber based scheme and financial aid to establish rubber sector among the farmers which encourage them resort toward rubber.

Table 4.5 Analysis of socio-economic and personal characters of rubber growers of Unakoti based on mean values

Characters	Unakoti				Block wise		
	Min.	Max.	Mean	CV (%)	Mean		t-value
					Kumarghat	Pecharthal	
Age	30	84	42.73	26.64	45.93	39.53	0.61
Highest family education	1	5	3.25	27.53	3.47	3.23	1.92
No. of family members	1	5	3.43	22.98	3.43	3.43	0.00
Outside contact score	6	9	6.56	13.84	6.83	6.30	2.36*
Extension media contact score	4	11	8.1	21.76	8.53	7.67	1.95
Average mandays provided	10	30	23.33	27.07	22.83	23.83	0.61
Rubber area	0.39	12.21	2.09	104.82	7.09	5.63	0.84
Total Area	0.49	17.75	2.96	96.03	10.08	7.90	0.97
Resorting Cause strength	1	13	8.26	31.23	7.40	9.13	2.73**
Earliness to resort	5	27	14.60	47.60	13.00	16.20	1.82

Note: - * significant at 5%; ** significant at 1%

4.1.3 Agro-economic perspectives of rubber growers

This section represents the agro-economic characteristics of the rubber growers of Unakoti. Table depicted information on different agro-economic aspects. Agro-economic characteristics of the cultivators are also the important determinants of the performance of rubber sector. Under agro-economic characteristics, land holding status rubber farmers, types of crops other than rubber and their profitability were studied.

Table 4.6 Distribution of rubber growers of Unakoti according to total land holdings

Land holding size	Total cultivated land	
	Frequency	Percent
Marginal (up to 2.5 ac)	37	61.66
Small (>2.5 to 5 ac)	21	35.00
Medium (>10 to 25)	2	3.33
Large (>25 ac)	0	0.00

Table 4.6 represents the distribution of rubber growers according to their land holding. From the table it observed that 61.66% of the respondents are marginal farmer holding upto 2.5 ac of land, 35% of respondents are small farmers holding land more than 2.5 ac but less than 5 ac and only 3.33% respondents are medium farmers who are holding land size of more than 10 ac but upto the limit of 25 ac. There is no respondent who had large land holding. The study therefore reveals that rubber growers of Unakoti are dominated by small and marginal land holders.

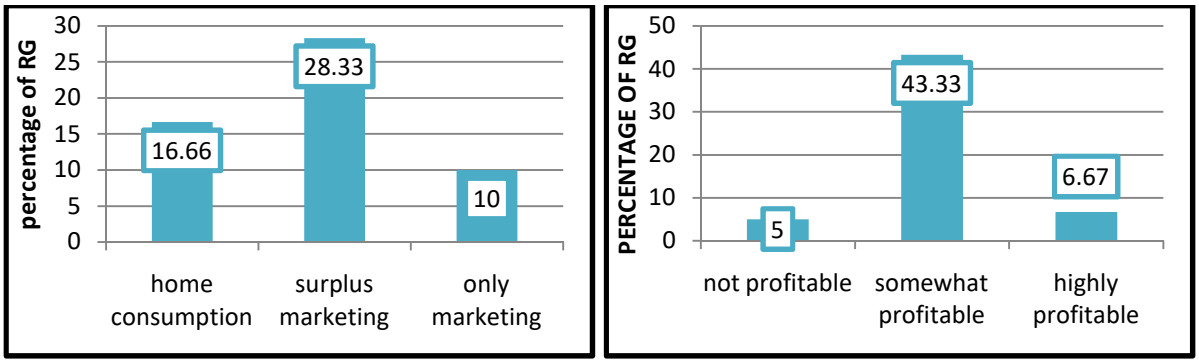
Table 4.7 Crop cultivated by rubber growers other than rubber

Crops cultivated			Area allotted		
No. of crops	frequency	percent	area	frequency	percent
0	25	41.66	0	26	43.33
1	12	20.00	<2.5 ac	26	43.33
2 and more	23	38.33	>2.5 ac	8	13.33
Crops: paddy, summer and winter vegetables, brinjal, arecanut, banana.					

Table 4.7 shows the distribution of rubber grower's family according to their crops cultivation habits. It has been observed that maximum respondents, i.e. 41.66% cultivated only rubber without any other crops. 20% respondents are engaged only one crop (i.e. paddy) other than rubber; and 38.33% respondents are engaged in cultivation of 2 or more crops other than rubber. The crops cultivated in the area were paddy, summer and winter

vegetables, arecanut etc. The table revealed that maximum rubber growers are totally dependent of rubber production.

The table 4.7 also shows that they have allotted limited land areas i.e. mostly less than 2.5 ac (1 ha) for other crops. 43.33% and 13.33% of respondents were allotted area upto 2.5 ac and more than 2.5 ac respectively.



A **B**

Fig. 4.2 Purpose (A) and profitability (B) of cultivation of other crops

Fig. 4.2 **(A)** depicts purpose and profitability of crops other than rubber. The profitability of the crop cultivation was against a 3 point perception scale as 'not profitable', 'somewhat profitable', and 'highly profitable' with 1, 2 and 3 score respectively. Also **Fig. 4.2 (B)** depicts that the purpose of cultivation was surplus marketing for most of the farmers and only 6.67% of rubber growers admitted that cultivation of other crops were highly profitable. From the picture we can predict that one of the important causes for resorting rubber may be that cultivation of other crops as less profitable.

4.2 Scenario of resorting rubber cultivation

This section represents the scenario of rubber resort by the farmers of Unakoti district. It includes analysis on the year wise of farmer resorted to rubber cultivation, the causes responsible for attracting farmers towards rubber cultivation.

4.2.1 Year wise resort for rubber cultivation

Table 4.8 reveals that the respondents of target area had been resorted to rubber cultivation from 1995 to 2016. The maximum resorting to rubber growing system observed from 2010 to 2016. 45% resorting is observed during 2010 and upto 2016.

Table 4.8 Year wise no. of farmers resorted to rubber

Year	No. of farmers		Cumulative number	
	Frequency	Percentage	Frequency	Percentage
up to 1995	1	1.66	1	1.66
1996-2000	12	20.00	13	21.66
2001-2005	11	18.33	24	39.99
2006-2010	9	15.00	33	54.99
beyond 2010	27	45.00	60	100

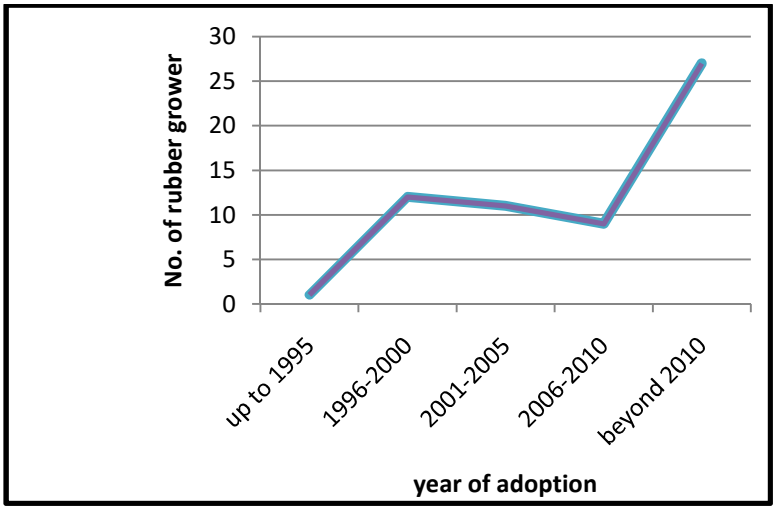


Fig. 4.3 Trend of resorting rubber

This system of conversion from traditional crop cultivation or pineapple to rubber was occurred since introduction of rubber in the state. In late 90s the rubber board came with rubber based scheme and financial aid to establish rubber sector among the farmers which encourage them resort toward rubber.

4.2.2 Causes of resorting rubber

It is crucial to investigate the reasons behind the farmers' decision to switch from traditional crop production to rubber production. These causes are shown in Table 4.9. The reasons for resorting to rubber were discovered through earlier investigations and discussions with the farmers. To evaluate the strength of the causes, a five point scale (-2 to +2, denoting strongly disagree to strongly agree), was utilised. According to the scale, it is clear that the factors that received high scores are seen to be crucial factors in the resorting of rubber, while factors that received low scores might not be thought to be factors in the resorting of rubber.

The most common reason for resorting rubber is unsuitability of land and its topography for other crops (mean score 1.82). The tribal people could turn their wasteland into rubber cultivation. Most of the land falls under hilly topography which does not suits for other crops to cultivate.

In late 90s it has been seen that the rubber board and forest department of the state had come with scheme related to rubber plantation. This encourages people to shift from traditional crop production to rubber production. Government also provided some financial assistance to establish rubber based enterprises.

The next justification for resorting was that, compared to rubber, other crops had lower net profits.

Governmental support for the rubber industry, encouragement from the rubber board and other organisations, a lack of high-quality planting materials, a lack of adequate transportation and storage options, and subsidies from the Rubber Board or SHG were some of the factors, though some people didn't think they were very significant.

The data shows that the primary motivation for turning to rubber production in the Unakoti district was that it supported the family's pre-planned expenditures. Every household has a yearly budget that has been carefully laid out. In order to achieve this budget, farmers rely on farm products. Any unexpected failure could make life difficult for the family. Farmers in the study region favour rubber because it can tolerate this failure. Additionally, it provides additional financial support to farm households.

The term "paid out cost" refers to cultivation costs that must be paid in cash, such as expenditures associated with labour and supplies like plant protection agents. Although the

need for labour in the rubber industry is quite high, the ratio of labour needed for tapping and other operations in the industry is extremely high.

This section of the peasantry class chose to transition to rubber due to the uncertainty associated with traditional crop farming, assurance of financial security, a consistent flow of farm revenue, a relatively low risk of illness, and a comparatively little amount of investment.

Another reason why some respondents turned to rubber was because they had seen other farmers succeed. One of the key drivers of incentive for new technologies is the success of neighboring farmers. One of these activities is the farmer exchange programme. More than any other type of change agent, farmers may learn from one another. Table further supports the conclusion that neighbors and family members had the greatest influence on rubber resort.

The next justification for resorting is related to climate conditions and the unpredictability of growing other crops. Due to its perpetual nature, hardiness, and resistance to unpredictable climate dangers, rubber cannot fail once it is established. As a result, it became crucial when resorting to rubber.

Table 4.9 Causes of resorting to rubber cultivation

Causes	Strongly agree	Agree	Undecided	Disagree	Strongly disagree	Mean score	Rank
Ratio of periodic money back and paid out cost is comparatively high in rubber	16 (26.7)	28 (46.7)	16 (26.7)	0 (00.0)	0 (00.0)	1.00	IV
Relative net profit is low in other crop in comparison to rubber	29 (48.3)	24 (40.0)	7 (11.7)	0 (00.0)	0 (00.0)	1.37	III
Competitive market is not available in other crop in comparison to rubber	0 (00.0)	12 (20.0)	10 (16.7)	38 (63.3)	0 (00.0)	-0.43	XI
Quality planting material is not available in comparison to rubber	0 (00.0)	38 (63.3)	8 (13.3)	14 (23.3)	0 (00.0)	0.40	VII
Infrastructural facility like transport, storage etc is not sufficient in comparison to rubber	0 (00.0)	32 (53.3)	17 (28.3)	11 (18.3)	0 (00.0)	0.35	VIII
Governmental support is more for rubber than other crops	0 (00.0)	60 (100.0)	0 (00.0)	0 (00.0)	0 (00.0)	1.00	IV

Subsidy /good benefits from rubber board and SHG	46 (76.7)	14 (23.3)	0 (00.0)	0 (00.0)	0 (00.0)	1.77	II
Started rubber cultivation by observing the success of other farmers	0 (00.0)	25 (41.7)	0 (00.0)	35 (58.3)	0 (00.0)	-0.17	IX
Encouragement from rubber board / another agency	18 (30.0)	17 (28.3)	8 (13.3)	17 (28.3)	0 (00.0)	0.60	V
To come up from climatic and uncertainty associated with cultivation of other crops	0 (00.0)	3 (5.0)	43 (71.7)	13 (21.7)	1 (1.7)	-0.20	X
It gives preplanned expenditure opportunity to the family	4 (6.7)	18 (30.0)	38 (63.3)	0 (00.0)	0 (00.0)	0.43	VI
Unsuitability of land for other crops	49 (81.7)	11 (18.3)	0 (00.0)	0 (00.0)	0 (00.0)	1.82	I

4.2.3 Influence of socio-economic and personal characters on earliness of resorting rubber

Table 4.10 presented the correlation between Socio-economic and personal characters of rubber growers and earliness of resorting rubber.

Table 4.10 Impact of socio-economic and personal characters on earliness of resorting rubber.

Socio-economic and personal characters of rubber growers	simple correlation coefficient (r-value)
Respondent's chronological age	0.055
Respondent's family size	0.011
Respondent's highest family education	0.044
Respondent's family economic status	-0.137
Family mandays provided for rubber cultivation	-0.014
Respondent's outside contact	0.130
Respondent's media communication	-0.320*
Respondent's land holding	-0.022
Strength of resorting causes	0.276*

It is found from the table 4.10 that respondent's strength of resorting causes have positive correlation with the earliness to the rubber cultivation; whereas media communication in respondent's family had a significant negative correlation.

4.2.4 Changes in family after resorting rubber

Table 4.11 represented the changes in family conditions from food security to overall happiness as perceived by the rubber growers of Unakoti district. The changes were perceived in a three point scale from "deteriorated" to "improved" with (-1) to (+1). From table, different changes in the household level after resorting rubber growing system are known. It is clear that in case of all respondents (100%), overall happiness in the family, food security and health security has been improved. Besides it, 88.3% respondents improved their savings in the bank and 81.7% respondents improved their housing conditions

But their loan availability, school going to children, drinking water facility does not improved much. It is to be notice that women drudgery is completely deteriorated after adopting rubber growing system. Borrowing money has been observed to be deteriorated in case 98.3% respondents.

The most of the rubber growers perceived a positive change in their overall condition after resorting rubber. This may be regarded as the impact of rubber growing system is highly promising in the study area.

In most of the house hold situation except borrowing money and women drudgery none had expressed that the condition is deteriorated.

Table 4.11 Perceived changes in household situation

Situation	Deteriorated	Remained same/no comments	Improved	Mean score	Rank
condition of food security at home	00 (00.00)	00 (00.00)	100 (100.00)	1.00	I
housing condition	00 (00.00)	11 (18.30)	49 (81.70)	0.82	III
sanitation condition	00 (00.00)	26 (43.30)	34 (56.70)	0.57	V
drinking water facility	00 (00.00)	49 (81.70)	11 (18.30)	0.18	IX

using modern appliances	00 (00.00)	30 (50.00)	30 (50.00)	0.50	VII
using luxury goods	00 (00.00)	29 (48.30)	31 (51.70)	0.52	VI
using modern farm equipments	00 (00.00)	21 (35.00)	39 (65.00)	0.65	IV
using farm machinery	00 (00.00)	30 (50.00)	30 (50.00)	0.50	VII
availability of loans	00 (00.00)	49 (81.70)	11 (18.30)	0.18	IX
borrowing money	59 (98.30)	1 (1.70)	00 (00.00)	-0.98	XI
saving with banks	00 (00.00)	7 (11.70)	53 (88.30)	0.88	II
women drudgery	60 (100.00)	00 (00.00)	00 (00.00)	-1.00	XII
health security	00 (00.00)	00 (00.00)	60 (100.00)	1.00	I
school going of children	00 (00.00)	42 (70.00)	18 (30.00)	0.30	VIII
tours and travels	00 (00.00)	60 (100.00)	00 (00.00)	0.00	X
festivals & ceremony	00 (00.00)	60 (100.00)	00 (00.00)	0.00	X
overall happiness in family	00 (00.00)	00 (00.00)	60 (100.00)	1.00	I

4.2.5 Perception regarding change in the locality after resorting rubber

The use of the rubber growing system may be viewed as a system change from the traditional crop cultivation model to a cultivation system focused on cash crops. Similar to how each individual family experiences change during any system transformation, the community level also goes through change in various ways. Development on several societal and communal fronts is facilitated by individual empowerment. The current study attempted to document perceived changes in the neighborhood's general quality of life, including local sanitization, health care accessibility, and other basic household necessities.

One of the most significant capitals in the capital pentagon of the livelihood analysis model is social capital. It is the internal movement of the social network that connects the community's members. The level of contact between members and the presence of local grass-roots organisations were used as indirect variables to measure social capital. Another factor that was considered was leadership and collective voice. Housing, markets, roads, schools, and other changes were generally referred to as infrastructural facilities. The

movement of the labour force was the most significant change taken into account at the locality level. Rural Unakoti does not also exhibit this characteristic because seasonal and persistent out-migration is one of its characteristics.

The table 4.12 reveals changes in the locality environment after adopting rubber cultivation. The change was perceived under the domain of General living condition, social capital formation, leadership & collective say, infrastructure and labour out migration. They were exposed against the scale consisting the response points highly deteriorated (HD); moderately deteriorated (MD); deteriorated (D); no change (NC); improved (I); moderately improved (MI); and highly improved (HI) with (-3); (-2); (-1); 0; (+1); (+2) and (+3) respectively. Table 4.12 represented frequencies of respondents under each response points along with the representative mean score to get a general and comparative picture on change in the locality.

Table 4.12 Perceived regarding improvement in locality after resorting to rubber

Conditions	HD	MD	D	NC	I	MI	HI	Mean score
General living condition	0 (00.0)	0 (00.0)	0 (00.0)	6 10.00	54 90.00	0 (00.0)	0 (00.0)	0.90
Social capital formation	0 (00.0)	2 3.3	0 (00.0)	54 90.00	4 6.70	0 (00.0)	0 (00.0)	0.00
Leadership and collective say	0 (00.0)	0 (00.0)	5 8.3	52 86.7	3 5.00	0 (00.0)	0 (00.0)	-0.03
Infrastructure	0 (00.0)	0 (00.0)	0 (00.0)	14 23.30	46 76.70	0 (00.0)	0 (00.0)	0.77
Out migration	0 (00.0)	16 26.7	11 18.30	33 55.00	0 (00.0)	0 (00.0)	0 (00.0)	-0.72

HD=highly deteriorated; MD=moderately deteriorated; D=deteriorated; NC=no change; I=improved;
MI=moderately improved; HI=highly improved
NB: figures in the parentheses indicate percentage

From the table 4.12, it is observed that the general living condition is perceived as highly improved (HI) by 90% of the respondents, where as 10% respondents perceived as no change or remained same (NC). In no cases any deterioration has been observed.

Here social capital indicates various types of social activities related to relationship with neighbours, relatives, attending social programmes, rituals, festivals, helping attitude to

neighbours etc. and building of grass root organisation like SHG or farmers' club. In the sector of social capital formation, maximum respondents (90%) perceived that it was No changed (NC). 6.7% respondents perceived that it was only improved (I). A very few respondents also perceived it was deteriorated (D) (3.3% cases each).

Leadership and collective say means leadership behaviour, functioning at grass root organization or participation in various kinds of development works etc. 5% respondents perceived that leadership and collective say had been highly improved whereas 86.7% and 8.3% respondents had said that it was no change (NC) and deteriorated (D).

Infrastructure means power access in locality, sanitation and drinking water facilities, health facilities, roads and easily accessibility. In case of infrastructure issue, 76.7% respondents had been observed with improved (I) perception category; whereas 23.3% respondents also perceived as no change (NC) in infrastructure.

But introduction of rubber transformed the traditional farmers to farmer entrepreneur; and once job seeker now is being transformed to the job provider. Their probability of out migration has been highly reduced after resorting to rubber production.

4.3 Status of rubber growers in respect to production

4.3.1 General perspectives of rubber cultivation in Unakoti district.

As the farmers of Unakoti resorted to rubber cultivation from traditional crop cultivation, rubber is distributed between traditional crop lands also. The picture is found in case of rubber growing system in Unakoti is composed of mostly small and medium plots.

Table 4.13 Agronomic perspectives of rubber growing system

Variables	No. of plots where rubber is grown	Total area (Acre)	Age of the garden (Year)
Picture of Unakoti			
Min.	1	0.43	4
Max.	4	12.21	26
Mean	1.23	2.10	13.6
CV (%)	50.32%	104.82%	51.12%
Comparison between blocks			
Kumarghat	1.13	2.36	12
Pecharthal	1.33	1.87	15.2
t-value	0.84NS		

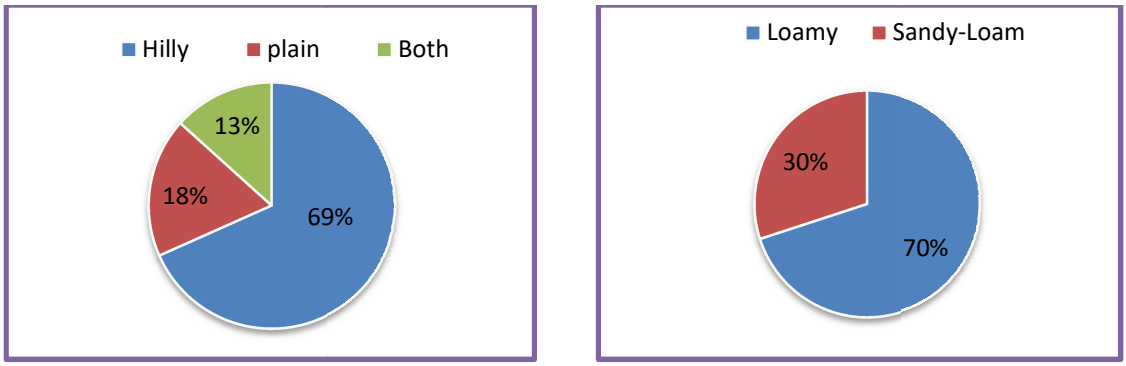
As the farmers of Unakoti district resorted rubber cultivation from traditional crop cultivation, a common feature of land ownership scenario in Tripura is the ownership of fragmented land. The same picture is found in case of rubber growing system also. Rubber growing system of Unakoti composed of mostly small and medium plots. From Table 4.13 we can find that although the average area of rubber cultivation in Unakoti is 2.10 acres ranging widely from only 0.43 ac of minimum area to as high as 12.21 ac of area (CV value 104.82% signifies a very scatter distribution) but these are distributed in 1 to 4 fragmentations with an average per capita fragmentation of 1.23 numbers. Age of the garden as observed varied from 4 years to 26 years with a mean age of 13.6 years.

The Table 4.13 also presented a differentiated picture of blocks which depicted that the mean number of plots where rubber is grown is observed in Kumarghat and Pecharthal

block were 1.13 and 1.33 respectively which are statistically at par in nature. The mean total area of rubber cultivation of Kumarghat Block (2.34 acre) was quite high than in Pecharthal Block (1.86 acre). From Table 4.13 it is seen that the Kumarghat block farmers having significantly higher total land ownership (average 2.34 ac in Kumarghat against 1.86 ac in Pecharthal per capita) than Pecharthal farmers. In the study areas, it was found that the homestead lands were also allotted under rubber in some of the cases.

Average age of the rubber garden in Pecharthal Block (15.2 yrs) was quite higher than Kumarghat block (12 yrs) which are significantly different from each other. This is because Pecharthal Block is dominated by tribal jhumia peoples and they have started rubber cultivation early 90s in their hilly terrain. They started to convert vast areas of community forest lands to rubber plantations in the state (Debbarma, 2018).

Fig. 4.4 depicts the physical perspectives of rubber plots of Unakoti. Texturally, 70 per cent of the rubber plots are sandy-loam, 30 per cent are loamy in nature. The distribution of topography classes in this diagram shows that 69 per cent area was observed as high land category whereas other 18 per cent was plain and 13 per cent area was combination of both hilly and plain category. No area had been observed as low land in nature. The rubber was first introduced in Unakoti in high, uncultivated areas and now spreading towards traditional crop lands distributed mostly in medium topography.



A B

A- Topography of plots; B- Texture of soil

Fig. 4.4 Physical perspectives of rubber plots of Unakoti

A. Establishment of nursery

B. Rubber tree of 2 year age.

C. Trees at the age of 3 year.

D. Trees of 5th year

Plate-2 (A-D) Stages of growth of rubber trees

Table 4.14 General description of rubber cultivation in Tripura

Package	Practices
Seed clone used	RRIM 600 (>90%), RRII 208, RRII 429
Establishment	Clearing of land for planting, making pits with a spacing 10'-15 X 10'-15' for planting the budded rubber saplings. The standard size of the pit is 75cm x 75cm x 75cm.
Nutritional sources	Urea is used in large quantity for initial establishment of the trees once or twice.
Irrigation	Minor or no irrigation is needed. If required, check basin system is followed.
Weeding and intercultural practices	Weeding is done once or twice in a year during pre-mature phase of the tree. Weed cutters can be used for management of weeds in rubber plantations. There is 40-50% savings in weeding cost over manual weeding.
Plant protection	**Patch Canker or Bark Canker is common disease in Tripura. No other disease is reported.** Mancozeb 0.75% (Dithane/ Indofil M-45 10 g/l) can be used to control the disease**.** **Termites (White Ant), Slug and Snail, Mealy Bug are some pests of rubber.**
Tapping	Latex is obtained from the bark of the rubber tree by tapping. Tapping is a process of controlled wounding during which thin shavings of bark is removed. Rubber tree of 6-7 year old starts latex production. Thus tapping is done after 6-7 year onward of tree establishment.

Table 4.14 represented about the general cultivation practices followed by the rubber growers of Unakoti. The respondents of Unakoti district only used RRIM 600 clone type as variety. The plant to plant and row to row (PxP::RxR) spacing as observed varies from 10'-15'x 10'-15'. At the time of establishment they prefer to use of urea and organic manures like FYM.

4.3.3 Yield Performance

From Table 4.15, we can find that respondents of Kumarghat block wait for 6.10 years for first tapping where as Pecharthal Block wait for 6.43 years for first tapping which are significantly same. Average number tapping followed by the respondents of Kumarghat Block is 116.16 which are almost same with Pecharthal Block. The mean yield is found to be as 7.47 qt per acre per year where the range varies from 2.95 to 10.23 qt. The average yield of latex of Kumarghat is 8.31 qt per acre per year which is quite higher than the average yield of Pecharthal (6.63 qt). These yields are significantly different.

Table 4.15 Yield of latex with tapping characters

Variables	Time taken for first tapping	No. of Tapping	Average Yield (qt./acre/yr)
Picture of Unakoti district			
Min.	5	75	2.95
Max.	8	180	10.23
Mean	6.31	124	7.47
CV (%)	12.86	10.93	25.22
Comparison between blocks			
Kumarghat	6.10	116.16	8.31
Pecharthal	6.43	111.00	6.63
t-value	1.59	1.12	3.83

A. Tapping of a mature tree

B. latex flowing to collecting bowl

C. Collection of latex

D. Accumulating

E. Pouring of collected latex into trays mixing with conc. HCl

F. Sun dried Sheets

Plate-3 (A-F) The process of latex harvesting

4.4 Constraint analysis in rubber sector

Table 4.16 represents the distribution of farmers according to their extent of perception of constraints on a whole. It is revealed from the Table 4.16 that 95 per cent respondents of Unakoti face moderate level of constraint where as only 5 per cent respondents have been found with low level of constraints. There is none found with high level of constraints.

Table 4.16 Distribution of rubber growers of Unakoti according to the extent of constraint felt

perceived level of constraints	Unakoti	block wise	
		Kumarghat	Pecharthal
Low (constraint mean upto 1)	3 (5.00)	3 (10.00)	0 (0.00)
moderate (constraint mean score >1 to 2)	57 (95.00)	27 (90.00)	30 (100.00)
High (constraint mean score >1)	0 (0.00)	0 (0.00)	0 (0.00)

NB: figures in the parentheses indicate percentage

The respondents of Pecharthal Block are facing moderate level of constraint more (100 per cent) than the respondents of Kumarghat Block (90 per cent). On the other hand respondents of Kumarghat Block also have to face low level of constraints (10 per cent) and NIL in case of Pecharthal Block.

Table 4.17 Types of constraints felt by the farmers of Unakoti district

Constraints	Somewhat	Moderate	Extreme	NIL	Mean	Rank
Higher initial cost	51 (85.00)	2 (3.30)	1 (1.70)	6 (10.00)	0.97	IX
No return at initial phase	51 (51.00)	8 (13.30)	0 (0.00)	1 (1.70)	1.12	VII
High cost of planting materials	15 (25.00)	38 (63.30)	0 (0.00)	7 (11.70)	1.52	IV
Non availability of labor in time	10 (16.70)	16 (26.70)	0 (0.00)	34 (56.70)	0.70	XI
High cost of labour	0 (0.00)	0 (0.00)	60 (100.00)	0 (0.00)	2.00	III
Non availability of fertilizer in time	10 (16.70)	0 (0.00)	0 (0.00)	50 (83.30)	0.17	XV
High cost of fertilizer	6 (10.00)	23 (38.30)	26 (43.30)	6 (10.00)	1.50	V

Non availability of skilled tapper	14 (23.30)	0 (0.00)	19 (31.70)	27 (45.00)	1.18	VIII
Non availability of credit in time	44 (73.30)	0 (0.00)	0 (0.00)	16 (26.70)	0.73	X
Problems of pest & diseases	23 (38.30)	0 (0.00)	0 (0.00)	37 (61.70)	0.38	XII
Loss due to improper processing	13 (21.70)	0 (0.00)	0 (0.00)	47 (78.30)	0.22	XIII
Uneven distribution of rainfall	2 (3.30)	3 (5.00)	50 (83.30)	5 (8.30)	2.63	II
Irrigation problems	12 (20.00)	0 (0.00)	0 (0.00)	48 (80.00)	0.20	XIV
Falling of trees due to strong wind	60 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	3.00	I
Fluctuations of market price	60 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	3.00	I

NB: figures in the parentheses indicate percentage

Table 4.17 highlights on the type of constraints felt by the farmers along with a mean score to rank the constraints. In the table the various constraints faced by the respondents of Unakoti has been mentioned with their score. The main constraint faced by the respondents is fluctuation of market price and Falling of trees due to strong wind with mean score 3.00.

Higher rainfall led to rubber trees growing more girthily, as seen by the positive link between rainfall and growth. Rainfall that is distributed unevenly affects plant growth and latex quality. Where there was the most rainfall, rubber trees were planted, and they grew the fastest (Sangchanda, 2013).

High labour cost hits especially small farmers. The main cost factor was the cost of labour. Weeding was by far the most expensive of the various labour costs, followed by planting operations. Due to the extremely small wage differences between trained and non-skilled labour, plantations experience labour challenges. Additionally, there are very few trained rubber tappers in the state.

Another constraint is high cost of planting materials with mean score 1.52. The cost of per sampling of rubber is very high for some extent. The cost of per budded sampling in Tripura is Rs. 150-200 presently.

Cost of fertilizer is as government does not give subsidy for rubber in case its production. 43.3% respondents pointed out this.

Shortage of labour is the important constraint. It is a very common constrain faced by all. But this problem is not serious in both blocks. The main reason may be migration of labour to outer state from this district for search of better job. Majority of the farmers (56.7%) said this is not an issue as most of labours are supplied by family itself.

It frequently proves to be too long, the seven-year gestation period. Many small farmers are wary about switching to another line of work within the first seven years. Once the plants are planted, it takes 5 – 6 year period to produce latex. During this period farmers had divert themselves towards alternatives for their livelihood.

Lack of proper information about cultural and pest management is overall not an issue in case of Tripura. The pest and disease infestation is very rarely found in both the Blocks.

Irrigation problems are rarely found as the small and marginal growers mostly rely on rainfed agriculture in case of rubber.

Employing trained tappers is a good idea. The lack of skilled tappers demonstrates the pressing need for training initiatives. Such training activities have already been launched by the Tripura Rubber Mission. But more of these programmes need to air more frequently.

SUMMARY AND CONCLUSION

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary and conclusion

A portion of the local and enthusiastic youth were drawn to develop a rubber growing system by relatively low capital expenditure, favourable climate conditions, low failure risks, high return status, technical support from skilled surplus labourers from the rubber board, and a locally accessible market for sheet rubber. Most of them are educated and jobless, eager to seize the chance presented by this novel idea and seduced by the idea of forming their own identities through independent work in these rubber gardens. Rubber cultivation dates back to 1963 when State Forest Dept. had introduced this crop to Tripura aiming at soil conservation measures with the help of Rubber Board. Natural rubber growing system is gradually emerging as a promising sector in Tripura and being substitutive to the traditional crop production system. However, there have only been a few studies on rubber, particularly in the Unakoti district, and there are not many reports on the socioeconomic and socio-personal traits of rubber producers, the motivations behind entering the industry, or the examination of production-related restrictions. With the following specific goals in mind, the current inquiry was created to assess the rubber developing system.

- To study the agro-economic and socio-personal characteristics of rubber growers of Unakoti district
- To identify causes of resorting rubber production by the rubber growers of Unakoti district.
- To identify the prospects and constraints faced by rubber growers of Unakoti district of Tripura**.**
- To study the general perspective of rubber cultivation in Unakoti district.

The study was carried out in the Unakoti area of Tripura since it has the highest proportion of small and marginal farms. From the dense areas of rubber growers, two blocks from the district and then 30 farmers from each block were randomly selected. The chosen individuals were given a pre-tested Schedule, and data were gathered using the personal interview approach.

A number of independent and dependent variables were chosen based on the literature research and study objectives and a number of indices were established in the study to

evaluate and compare the variables. According on the study's findings, the following conclusions have been made:

- 92% of rubber growers of the study area were Hindu, 1% Christian, 7% among others like Buddism and there were no Muslim population. Majority of the tribal groups are religiously Hindus in Unakoti district. Scheduled Caste has the dominance in rubber sector followed by ST and OBC. Only 2% Generals were associated with rubber. The economic class of the rubber growers which shows 62% under BPL and 38% under APL class. Occupational distribution with 70% involved in farming including rubber, 25% involved in business including rubber and 5% having govt. and private services along with rubber cultivation.
- Rubber growers of Unakoti with 55% in case of secondary education and 18% in H.S level. 13% respondents having primary education, 12% educated with graduation and above level and only 2% were literate. There were no illiterate respondents among the rubber growers of study area.
- Rubber sector in Unakoti is dominated by younger and middle aged groups. It has opened a new opportunity for self employment for the working age population in Unakoti district.
- According to occupational diversity of the family. In the above table range 1, 2 or 3 indicates one and more than one occupations of the respondent's family. It is observed that 66.7% respondents engaged only in rubber cultivation, 28.3% having two types of occupation and only 5% respondents were having three and more than three types of occupations.
- The distribution of respondents by economic position is seen in the study area. 83.33% of respondents have a medium degree of economic status; 1% has a high level; and 10% have a low level. The respondents' overall economic situations can be described as medium to high.
- 20 percent of Unakoti's rubber growers have low extension media interaction, 10% have medium, and 70% have high extension media contact.
- 28.33% of the respondents had reported moderate level of cosmopoliteness status followed by low contact of 63 percent of rubber growers. 8.33 percent people had high levels of outside contact. It is also called cosmopoliteness. According to the character of outside contact it is found from the table that 28.33% of the respondents had reported moderate level of cosmopoliteness status followed by low contact of 63 percent of rubber growers. 8.33 percent people had high levels of outside contact.

- 61.66% of the respondents are marginal farmer holding upto 2.5 ac of land, 35% of respondents are small farmers holding land more than 2.5 ac but less than 5 ac and only 3.33% respondents are medium farmers who are holding land size of more than 10 ac but upto the limit of 25 ac. There is no respondent who had large land holding. The study therefore reveals that rubber growers of unakoti are dominated by small and marginal land holders.
- The distribution of rubber grower's family according to their crops cultivation habits. It has been observed that maximum respondents, i.e. 41.66% cultivated only rubber without any other crops. 20% respondents are engaged only one crop (i.e. paddy) other than rubber; and 38.33% respondents are engaged in cultivation of 2 or more crops other than rubber. The crops cultivated in the area were paddy, summer and winter vegetables, arecanut etc.
- According cultivation of crops other than rubber is found that the purpose of cultivation was surplus marketing for most of the farmers and only 6.67% of rubber growers admitted that cultivation of other crops were highly profitable. From the picture we can predict that one of the important causes for resorting rubber may be that cultivation of other crops as less profitable.
- The most common reason for resorting rubber is unsuitability of land and its topography for other crops (mean score 1.82). The tribal people could turn their wasteland into rubber cultivation. Most of the land falls under hilly topography which does not suits for other crops to cultivate. Government also provided some financial assistance to establish rubber based enterprises. The next justification for resorting was that, compared to rubber, other crops had lower net profits. The next justification for resorting is related to climate conditions and the unpredictability of growing other crops. Due to its perpetual nature, hardiness, and resistance to unpredictable climate dangers, rubber cannot fail once it is established. As a result, it became crucial when resorting to rubber.
- Respondent's strength of resorting causes has positive correlation with the earliness to the rubber cultivation; whereas media communication in respondent's family had a significant negative correlation.
- The most of the rubber growers perceived a positive change in their overall condition after resorting rubber. This may be regarded as the impact of rubber growing system is highly promising in the study area.

- But introduction of rubber transformed the traditional farmers to farmer entrepreneur; and once job seeker now is being transformed to the job provider. Their probability of out migration has been highly reduced after resorting to rubber production.
- The average area of rubber cultivation in Unakoti is 2.10 acres ranging widely from only 0.43 ac of minimum area to as high as 12.21 ac of area (CV value 104.82% signifies a very scatter distribution) but these are distributed in 1 to 4 fragmentations with an average per capita fragmentation of 1.23 numbers. Age of the garden as observed varied from 4 years to 26 years with a mean age of 13.6 years.
- The mean number of plots where rubber is grown is observed in Kumarghat and Pecharthal block were 1.13 and 1.33 respectively which are statistically at par in nature. The mean total area of rubber cultivation of Kumarghat Block (2.34 acre) was quite high than in Pecharthal Block (1.86 acre). It is seen that the Kumarghat block farmers having significantly higher total land ownership (average 2.34 ac in Kumarghat against 1.86 ac in Pecharthal per capita) than Pecharthal farmers. In the study areas, it was found that the homestead lands were also allotted under rubber in some of the cases.
- Average age of the rubber garden in Pecharthal Block (15.2 yrs) was quite higher than Kumarghat block (12 yrs) which are significantly different from each other. This is because Pecharthal Block is dominated by tribal *jhumia* peoples and they have started rubber cultivation early 90s in their hilly terrain. They started to convert vast areas of community forest lands to rubber plantations in the state
- Texturally, 70% of the rubber plots are sandy-loam, 30% are loamy in nature. The distribution of topography classes in this diagram shows that 69% area was observed as high land category whereas other 18% was plain and 13% area was combination of both hilly and plain category.
- The respondents of Unakoti district only used RRIM 600 clone type as variety. The plant to plant and row to row (PxP::RxR) spacing as observed varies from 10’-15’x 10’-15’. At the time of establishment they prefer to use of urea and organic manures like FYM.
- Respondents of Kumarghat block wait for 6.10 years for first tapping where as Pecharthal Block wait for 6.43 years for first tapping which are significantly same. Average number tapping followed by the respondents of Kumarghat Block is 116.16 which are almost same with Pecharthal Block. The mean yield is found to be as 7.47 qt per acre per year where the range varies from 2.95 to 10.23 qt. The average yield of

latex of Kumarghat is 8.31 qt per acre per year which is quite higher than the average yield of Pecharthal (6.63 qt). These yields are significantly different.

- It is revealed that 95% respondents of Unakoti face moderate level of constraint where as only 5% respondents have been found with low level of constraints. There is none found with high level of constraints.
- The main constraint faced by the respondents is fluctuation of market price and Falling of trees due to strong wind with mean score 3.00. Rainfall that is distributed unevenly affects plant growth and latex quality. High labour cost hits especially small farmers. Another constraint is high cost of planting materials with mean score 1.52. The cost of per sampling of rubber is very high for some extent. The cost of per budded sampling in Tripura is Rs. 150-200 presently.

5.2 Suggestions and recommendation

- Only by increasing area and productivity, or both, can production be raised.
- Increases in yield are unquestionably required. The nature and age of the tree (clone), the effectiveness of the tapper, the adaption of cultural practise, etc., all affect yield.
- Employing trained tappers is a good idea. The lack of skilled tappers demonstrates the pressing need for training initiatives. Such training activities have already been launched by the Tripura Rubber Mission. But more of these programmes need to air more frequently.
- Recommended fertilizer dose should apply to get high latex production.
- It is necessary to conduct field-level exploratory surveys to determine the issues rubber farmers confront.
- A campaign to raise awareness of the rubber tree's ecological benefits ought to be launched by the Tripura Rubber Mission. Certain entrenched interest organisations have been blaming rubber plantations for the state's rising average temperature over the past few years. The local daily newspaper may run advertisements outlining the environmental advantages of rubber plantations.
- Since rubber plantations can be a reliable source of income for the entirety of one's working life, educated teenagers can be persuaded to turn to tuber plantations as a means of subsistence.

5.3 Future scope/areas of study

The following area may be addressed in future research topic in respect to rubber are:-

- Marketing channels of different form of rubber in Tripura
- Economic viability of rubber production
- Value chain in rubber.
- Comparative analysis of rubber among all districts of Tripura in respect to productivity.
- Involvement of women in rubber plantation practices.

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APPENDIX

Id No. …….

House hold survey schedule (to be collected from individual farmer only)

Department of Agricultural Extension
Uttar Banga Krishi Viswavidyalaya
Pundibari, Cooch Behar, West Bengal, INDIA

Survey Questionnaire for M.Sc. thesis on

Constraints and Prospects of rubber cultivation in Unakoti district of Tripura

1.	Name of the farmer:		
2.	Address:		
3.	Age:	Education:	
4.	Religion:	Caste:	
5.	Primary occupation:	Economic Class: APL/BPL	
6.	Whether farm families registered with Rubber Board or Community groups (SHG) or Non-registered:		Having Cooperative Processing unit or not

7. Family information

Name of family members	Age	Sex	Education	Primary occupation	Special skill/ Training if any	Man days allotted in own rubber cultivation / month

8. Cultivated land details (in Bigha=0.33ac)

Irrigation status		Topography			Texture		
Irrigated	Un-irrigated	High	Medium	Low	Sandy	Loamy	Sandy-loam

9. Uncultivated land area:

10. Homestead land area:

11. Pond area, if any:

12. Secondary occupation option other than rubber:

Sources of Income	Approximate share in family income (percent)
Agriculture	
Livestock	
Caste occupation	
Farm work (own)	
Business	
Farm/casual labour	
Govt employment	
Pvt. Employment	
Van/rikshaw puller	
Minor business	
Fishery	
Animal husbandry (Piggery/goatery/cow)	
Poultry/duckery	
Marginal works	
Other specify	

13. Organizational participation:

Name of the Organization	Nature of involvement with duration [0=no; 1=member; 2=office bearer; 3=leader]
Panchayat	
SHG	
NGO/Farmer's organization	
Govt. Institution like Rubber Board	
Private Organization	
Other Agency / projects	

14. Outside contact

Places of Visits	Frequency of Visit
District headquarters (every 6 months)	
Sub-division headquarters (every month)	
Nearest town/ Bazar (every week)	
Other towns of State (every 6 months)	
State headquarters (every 6 months)	

15. Extension media contact

Sl No	Name of Extension Media	Nature and frequency of contact		
		Regular	Sometimes	Never
1.	Agril. Development personnel			
2.	Specialist from Rubber Board			
3.	Extension Training			

4.	Development exhibition / krishimela			
5.	Daily Newspaper / extension bulletin			
6.	Radio. Listening			
7.	TV watching			
8.	Contact/progressive farmers			

16. Housing, sanitation and drinking water (√ mark)

Wall	**Floor**	**Roof**	**No. of rooms**	**Sanitation**	**Drinking water**
Bamboo	Kachha	Thatched		No	Pond/river
Tin	Pucca	Talli		Ring (soft wall)	STW (others)
Wood	Tiles	Tin		Ring (hard wall)	STW (Own)
Pucca	Marbel	Pucca		Sanitary	Pipeline

17. Cause of resorting rubber cultivation:

How do you agree with the following statements about yourself [SA=Strongly agree; A=Agree; UD=Undecided; DA=Disagree; SDA=Strongly disagree]

Sl No	**Statements**	**SA (+2)**	**A (+1)**	**UD (0)**	**DA (-1)**	**SDA (-2)**
1	Ratio of periodic money back and paid out cost is comparatively high in rubber					
2	Relative net profit is low in other crops in comparison to rubber					
3	Competitive market is not available in other crop in comparison to rubber					
4	Quality planting material (seed) is not available in comparison to rubber					
5	Infrastructural facilities like transport, storage etc. is not sufficient in comparison to rubber					
6	Governmental/organizational support is more for rubber than other crops					
7	Subsidy/ good benefit from Rubber-Board and SHG					
8	Started rubber cultivation observing the success of other farmers					
9	Encouragement from Rubber board/board/another agency					
10	To come up from climatic and uncertainty associated with cultivation of other crops					
11	It gives pre-planned expenditure opportunity to the family					
12	Unsuitability of land for other crops					

18. After introduction of mass cultivation of rubber in the area what type of changes occurred in the locality as you feel

Change conditions	HD (-3)	MD (-2)	D (-1)	NC (0)	I (+1)	MI (+2)	HI (+3)
General living condition							
Social capital formation							
Leadership & collective say							
Infrastructure							
Out migration							

19. Cultivation status of crops other than rubber

Crops	Area (bigha)	Whether use the following (√ mark)				Purpose of cultivation	How profitable it is
		HYV	Fertilizer	Plant protection	Mechanisation	1=only home consumption 2=Surplus marketing 3=Only for marketting	1=not profitable 2=more or less profitable 3=highly profitable

20. Information regarding rubber plots and establishment

Plot No.	Area (bigha)	Year of establish-ment	Approx. cost of establishment (Rs.)	Variety	Spacing (PxP; RxR)	Basal manurial dose and other treatment	topography of land (plain/hill)	Irrigation Source (Own / Purchased)	System of irrigation	Crops in adjacent field	1st Latex collection month and year	Average Yield / year

*1=irrigation problem; 2= drainage problem; 3=soil not suitable; 4=land not sloppy; 5=plot is isolated from other rubber plantation

21. By whom had you influenced first for rubber cultivation (Friends/neighbours/relatives/SHG members/Rubber board/KPS/ADO/ leaf agent/factory personnel/others? -

22. Day to day activities in rubber plantation

Activities	Qnty/bigha /year	Approx cost associated	Quantity and sources of labour			Undertaken by		
			Family labours	Local labours	Outside labours	Mostly by Male	Mostly by Female	Both
Organic manure								
Fertilizer								
Irrigation								
Weeding								
tapping								
Grading of latex								
Transportation and marketing of latex								

23. Please express your opinion regarding changes in your own family after resorting rubber cultivation

Situation	Improved	Remained same/No comments	Deterio-rated
Condition of food security at home			
Housing condition			
Sanitation condition			
Drinking water facilities			
Using modern household appliances			
Using luxury goods			
Using modern farm equipments			
Using farm machineries			
Availability of loans			
Borrowing money			
Saving with banks			
Women drudgery			
Health security			
School going of children			
Tours and travels			
Festivals and ceremony			
Overall happiness in the family			

24. Constraints faced

Sl. No.	Constraints	Levels		
		Extreme	Moderate	Somewhat
1	Higher initial return			
2	Non-availability of return			
3	High cost of planting materials			
4	Non availability of labour in time			
5	High cost of labour			
6	Non availability of fertilizer in time			
7	High cost of fertilizer			
8	Non availability of skilled tapper			
9	Non availability of credit in time			
10	Problems of pest and diseases			
11	Loss due to improper processing			
12	Uneven distribution of rainfall			
13	Irrigation problem			
14	Falling of trees due to wind			

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C H A P T E R – I | 1 INTRODUCTION One of the most significant items that come from the rainforest is rubber. Although South American indigenous people who live in rainforests have used rubber for generations, rubber's first useful commercial use did not occur until 1839. Charles Goodyear spilled rubber and sulphur on a hot cooktop by mistake that year, causing it to scorch like leather yet stay plastic and stretchy. The white sap from the Hevea tree's bark was refined through a process called vulcanization into an important industrial commodity. Currently, rubber is mostly obtained from the rubber tree (Hevea brasiliensis) or other sources in the form of latex. Making incisions in the bark and collecting the fluid in vessels is a method known as "tapping" that removes the latex, a sticky, milky, and white colloid. The rubber that is produced from the refined latex is then suitable for industrial processing. Latex from significant regions is allowed to congeal in the collection cup. The coagulated lumps are gathered and transformed into dry forms for retail sales. Whether used alone or in conjunction with other materials, natural rubber is widely utilised in a variety of applications and products. It has a high stretch to strength ratio, great resilience, and is water-proof in the majority of its practical forms. By the end of the nineteenth century, industrial demand for rubber-like materials had begun to surpass natural rubber resources, prompting the chemical production of synthetic rubber in 1909. In India commercial production was first introduced

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by British colonists. Although the initial efforts to cultivate rubber on a commercial basis were started as early as 1873 at the

Calcutta Botanical Garden. In Kerala's Thattekadu, the first industrial Hevea plantations were started in 1902. Later, the crop was extended to India's Andaman and Nicobar Islands, Tamil Nadu, and Karnataka. India is now the third- largest producer and fourth-largest consumer of rubber in the world. Natural rubber is the most significant revenue crop in Tripura. Since its introduction in 1963 by the State Forest Department, Tripura has overtaken Kerala as the second-largest producer of natural rubber in the nation, producing around 9% of all rubber produced in India. After Kerala, Tripura boasts the second-largest rubber-