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Economic Growth, Production Trends, and Constraints of Rubber Plantations in Assam

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Abstract:

Natural rubber, a vital industrial raw material derived from Hevea brasiliensis, plays a significant role in global and national economies, particularly in the automobile sector. While Southeast Asia dominates global production, India ranks among the leading producers, with increasing emphasis on expansion in the northeastern region. Assam has emerged as an important rubber-producing state, with substantial growth in area and production between 2011 and 2022, largely driven by smallholder farmers. The study highlights that rubber cultivation in Assam has expanded significantly, with production increasing nearly fourfold, although employment generation has declined due to mechanization and improved efficiency. The sector is spatially concentrated in a few districts such as Karimganj, Goalpara, Karbi Anglong, Cachar and Kokrajhar reflecting regional disparities in development and productivity. Despite its growth potential, rubber cultivation in Assam faces several

challenges, including climate variability, small and fragmented landholdings, lack of technical knowledge, price fluctuations, inadequate infrastructure, pest and disease attacks, labour shortages, and a long gestation period. The study emphasizes the need for balanced regional development, improved infrastructure, technological adoption, and institutional support to ensure sustainable growth of the rubber sector in Assam.

Keywords: Natural Rubber, Rubber Cultivation, Economic Growth, Assam, Production Constraints

Introduction:

Natural rubber is a highly versatile, elastic and waterproof polymer obtained from the latex of *Hevea brasiliensis* and around 70 percent of the total natural rubber production is primarily utilized in building automobile tyres, while the rest is used for making engine mounts, seismic bearings, conveyor belts, footwear, medical gloves, hoses and waterproof gear etc. Southeast Asian countries dominate global natural rubber industry and controls around 85 percent of the world's output (*World Population Review*), where Thailand (4.82 million metric tons), Indonesia (3.04 million metric tons), Vietnam (1.26 million metric tons), India (0.775 million metric tons), China (0.66 million metric tons) and Malaysia (0.485 million metric tons) account for vast majority of global output (*Association of Natural Rubber Producing Countries*). Thailand with (36 percent) is the world leading rubber producing country, followed by Indonesia with (14 percent), Vietnam with 9 percent and India with 7 percent of natural rubber production is the fourth largest rubber producing countries in the world.

The first experimental rubber plantation began in India occurred in 1895 on the hill's slopes of Kerala, however, on commercial scale basis rubber plantation was introduced in 1902 in India. The majority of production is concentrated in the southern and northeastern regions of India due to the favourable hot and humid climates with high rainfall. Today Kerala is the largest producer (70 to 90 percent) of natural rubber in India, followed by Tripura, Karnataka, Assam and Tamil Nadu. Rubber plantation in India is experiencing a strategic shift towards expansion in the Northeastern states while consolidating in traditional areas like Kerala, which, with Tamil Nadu, account for about 85% of production.

Rubber plant was introduced in Assam in the mid-1950s with the aim of diversifying agricultural income, promoting rural development and rehabilitating areas. While early experimentation on rubber plantation began in around 1955, substantial systematic development occurred later through the efforts of rubber Board and soil conservation department of Assam. Substantial progress in Assam and around Northeast India occurred during 1985-1990 (7^{th} Five Year Plan) with the initiative of Rubber Board.

India's rubber industry is a vital component of the nation's agricultural and industrial sectors, catering to diverse industries such as automotive, construction, and textiles. Kerala remains India's largest natural rubber producer in 2021-22, accounting for over 90 percent of the total, with total national production projected at approximately 7.89 lakh tones for 2021-2022. Following Kerala, major production comes from Tripura (9.00 percent), Karnataka (6.00 percent), Assam (5.4 percent), and Tamil Nadu (3.5 percent) and Meghalaya to name a few. The sector is driven by high auto-tyre demand, although imports remain significant, with production increasing slightly. Meghalaya contributes to the fast-growing rubber producing Northeastern region along with Tripura and Assam, collectively making about 17 percent of India's total natural rubber output.

With over 51,000 hectares cultivated, Assam is one of the top rubber-producing state in India employing 1,86,417 persons in 2021-2022 and earning 548.60 crore rupees from rubber production annually. Rubber cultivation in Assam is primarily concentrated in the districts of Karimganj (27.50 percent), Goalpara (16.13 percent), Karbi Anglong (14.39 percent), Kokrajhar (6.01 percent), Cachar (4.90 percent), Bongaigaon (2.52 percent) and Kamrup (5.33 percent) of the total area of the district, which together account for a significant portion of the state's natural rubber cultivation area (*Statistical Handbook, 2021-2022*). While rubber production in Assam is highest in the districts of Karimganj (22.32 percent), Goalpara (20.03 percent), Karbi Anglong (13.96 percent), Kokrajhar (9.99 percent), Cachar (16.08 percent), Bongaigaon (4.70 percent) and Kamrup (3.31 percent) of the total area of the district, which together account for a significant portion of the state's natural rubber cultivation area (*Statistical Handbook, 2021-2022*). Smallholder farmers from millions of households all over the rubber producing districts rely on latex tapping for their livelihood. As such an attempt has been made in this paper to study the *'Economic Growth, Production Trends, and Constraints of Rubber Plantations in Assam'*.

Database and Methodology:

The study is based on secondary data collected from various sources, including the Census of India, Statistical Handbook of Assam, Economic Surveys, published and unpublished reports, books, research articles, and online sources. Time-series data for the period 2011 to 2022 have been primarily obtained from the Statistical Handbook of Assam, published by the Government of Assam for the periods from 2011 to 2022.

The collected data have been analyzed using appropriate simple statistical techniques. The results are presented through suitable tables. Software such as Microsoft Office and Excel has been used for data processing, analysis, and presentation of results.

Objectives of the Study:

(i) To examine the area, production, and employment generation of rubber cultivation in Assam during the period 2011-2022;

(ii) To analyze the production trends in the five leading rubber-producing districts of Assam from 2011 to 2022;

(iii) To identify and assess the major constraints faced by rubber plantations in Assam.

Review of Literature:

1. Rubber Production in the Global Context:

Rubber cultivation has significantly influenced rural livelihoods in many parts of the world. Thongyou M. (2014) examined the transformation of livelihood strategies in a village in northeastern Thailand over 62 years, highlighting the long-term socio-economic role of rubber cultivation. Similarly, Silaban E.P.K., Satmoko S., and Prayoga K. (2021) analyzed the effects of the temporary closure of a rubber factory in Indonesia, noting that households adopted diversified livelihood strategies combining farm and off-farm income sources.

2. Rubber Production in India (2011-2022):

a) National Production Trends: Studies indicate a steady increase in rubber production in India due to expansion in cultivated area and improved practices. Sinumon T.G. and Mahalakshmi K. (2020) found that small rubber growers in Kerala face challenges such as inadequate institutional support, financial constraints, labour shortages, and price instability. Declining rubber prices have adversely affected farmers' income and living standards.

b) Regional Studies: Rubber cultivation in India has traditionally been concentrated in Kerala, Tamil Nadu, and Karnataka, but has expanded into north-eastern states due to policy initiatives. Sanyal J., Sikidar S., and Timung A. (2015) examined the socio-economic conditions of plantation workers in Karbi Anglong, Assam, highlighting issues such as low wages and poor working conditions. Sanjenbam Sher Singh, Jitendra Kumar Chauhan, and Loukham Devarani (2021) studied Rubber Producers' Societies (RPS) in Northeast India, emphasizing Assam's role as a non-traditional rubber-growing region. Nurul Islam (2013) analyzed the economic impact of rubber cultivation in Goalpara district, showing its contribution to rural income and employment.

c) Socio-Economic and Employment Dimensions: Rubber cultivation plays an important role in supporting rural livelihoods, particularly in northeastern India. Singh S. and Chauhan J.K. (2021) highlighted employment generation and livelihood diversification, while also noting challenges related to labour and mechanization. Binitha M. and Raj S.J.M. (2018) examined the socio-economic conditions of plantation labourers in Kanyakumari district, identifying low wages and poor infrastructure as key concerns. Chakraborty A. et al. (2018) discussed environmental issues associated with rubber expansion in Northeast India, including land-use change and deforestation.

Overall, the literature suggests that rubber cultivation has experienced steady growth in Assam, supported by policy initiatives and socio-economic benefits. However, challenges related to productivity, sustainability, market access, and technology adoption continue to persist.

Findings of the study:

1.1 Area, production and employment generation of rubber production in Assam:

Rubber production in Assam has seen consistent growth between 2001 and 2022, expanding from a minor plantation crop to a significant commercial sector. Assam has emerged as a key rubber producer in Northeast India, with over 51,000 to 60,000 hectares under cultivation, predominantly driven by small growers of rubber production.

Area of rubber cultivation in Assam has nearly doubled from 32117.43 hectares in 2011 to 59750.29 hectares in 2022 indicating the growing rubber cultivation. The rubber production in Assam has increased by four-fold from 10950 MT in 2011 to 40637.39 MT in 2022 due to improved productivity and better technology. However, the value of rubber decreased sharply during 2015 and then sharply increased during 2022 due to the price changes, market demand and quality of variation. On the other hand, due to mechanization (less labor needed), changes in reporting method and shift to more efficient production systems, the number of persons engaged in rubber cultivation and production decrease drastically from 3034993 during 2011 to 186417 persons during 2022 (Table 1).

Table 1: Area, Production and Employee generation of Rubber Production in Assam, 2011-2022

Year	Area (in Hectare)	Production (MT)	Total Value in Crore Rs.	Employment Generation
2011-2012	32117.43	10950	227.76	3034993
2015-2016	55989.71	16399.63	185.32	174763
2021-2022	59750.29	40637.39	548.60	186417

Source: Statistical Handbook of Assam, 2021-2022

The table 2 shows the district-wise distribution of area, production, and employment generation in Assam. A clear variation can be observed among the districts in their contribution.

Firstly, districts like Karimganj, Goalpara, Karbi Anglong, and Cachar are the major contributors. Karimganj alone accounts for the highest share in area (27.50%), production (22.32%), and employment (27.50%), making it the leading district. Goalpara and Karbi Anglong also contribute significantly, showing a balanced share in all three aspects. Cachar, despite having a relatively smaller area (4.90%), contributes a high proportion of production (16.08%), indicating higher productivity.

Secondly, districts such as Kokrajhar, Kamrup, Chirang, and Bongaigaon show moderate contribution. These districts play a supportive role in overall production and employment generation. On the other hand, several districts like Barpeta, Nalbari, Majuli, and Charaideo have very low shares in area, production, and employment. Their contribution to the overall sector is minimal, possibly due to limited resources, lack of infrastructure, or low productivity.

An important feature of the table is that in most districts, the percentages of area, production, and employment are nearly equal. This indicates a direct relationship among these factors and suggests uniform productivity across regions. However, exceptions like Cachar and Goalpara show relatively higher production compared to their area, indicating better efficiency.

The highest rubber cultivation area in Assam is concentrated Karimganj (27.5 percent) Goalpara (16.13 percent), Karbi Anglong (14.39 percent), Kokrajhar (6.014 percent), Cachar (4.90 percent), Kamrup (5.33 percent), Chirang (3.24 percent), Udalguri (3.097 percent) and Kamrup Metro (3.09 percent) (*Statistical Handbook, 2011-2022*). The highest rubber production was found in Karimganj (22.32 percent), Goalpara (20.03 percent), Cachar (16.08 percent), Karbi Anglong (13.96 percent), Kokrajhar (9.99 percent), Chirang (5.5 percent), Bongaigaon (4.70 percent) etc.

Table 2: District-wise Area and Production of Rubber in Assam during 2021-2022

Sl. No	District	Area (in Hect.) Percentage	Production (in MT) Percentage	Employment Generation (Nos.) Percentage
1	Kokrajhar	6.014	9.99	6.01
2	Dhubri	2.61	0.60	2.6
3	Goalpara	16.13	20.03	16.13
4	Barpeta	0.06	0.08	0.06
5	Morigaon	0.52	0.26	0.52
6	Nagaon	0.43	0.59	0.43
7	Sonitpur	0.53	0.42	0.53
8	Lakhimpur	0.38	0.12	0.38
9	Dhemaji	0.36	0.20	0.36
10	Tinsukia	0.15	0.12	0.15
11	Dibrugarh	0.20	0.11	0.20
12	Sivasagar	0.20	0.18	0.20
13	Jorhat	0.42	0.10	0.42
14	Golaghat	0.51	0.40	0.51
15	Karbi Anglong	14.39	13.96	14.4
16	Dima Hasao	1.142	0.35	1.14
17	Cachar	4.90	16.08	4.90
18	Karimganj	27.50	22.32	27.50
19	Hailakandi	1.56	1.89	1.56
20	Bongaigaon	2.52	4.70	2.52
21	Chirang	3.24	5.51	3.24
22	Kamrup	5.33	3.31	5.33
23	Kamrup Metro	3.09	1.82	3.09
24	Nalbari	0.075	0.04	0.075
25	Baksa	0.40	0.28	0.40
26	Darrang	0.64	0.35	0.64
27	Udalguri	3.097	1.95	3.10
28	Hojai	1.09	1.22	1.09
29	Biswanath	0.50	0.49	0.50
30	Charaideo	0.007	0.0011	0.0005
31	Majuli	0.02	-	0.019
32	West Karbi Anglong	1.91	2.51	1.91
33	Tamulpur	0.08	0.027	0.08
	Assam	**59750.26**	**40637.39**	**186417**

Source: Statistical Handbook of Assam, 2021-2022

Some districts are performing better as though the cultivated area is less, their productivity is more such as Kokrajhar, Goalpara, Chirang, West Karbi Anglong, Cachar, Bongaigaon etc. However, the productivity of some districts are much less than their cultivable area under rubber such as Dhubri, Dima Hasao, Karimganj, Kamrup, Kamrup Metro, Udalguri etc. The highest number of people employed for rubber cultivation was found in the district of Karimganj (27.50 percent) followed by Goalpara (16.13 percent), Karbi Anglong (14.4 percent), Kokrajhar (6.01 percent), Cachar (4.90 percent), Kamrup Rural (5.33 percent), Chirang (3.24 percent), Udalguri (3.10 percent) and Kamrup Metro (3.09 percent).

In conclusion, the data reveals that the sector is highly concentrated in a few districts, while the rest of districts contribute very little. This highlights the need for balanced regional development and improved productivity in less-performing districts.

1.2 Trend of rubber production in highest five highest producing districts of Assam 2011-2022:

Between 2011 and 2022, rubber production in Assam experienced a consistent upward trend, with the state emerging as a key producer in Northeast India, rising to over 30,000 tonnes by 2019-20. The five highest producing districts-Karbi Anglong, Goalpara, Kamrup, Karimganj, and Cachar (with others like Dima Hasao also contributing) account for the majority of the state's rubber cultivation.

The table 3 presents the changes in area, production, and employment generation across selected districts of Assam for the years 2011-12, 2015-16, and 2021-22. It shows significant growth as well as fluctuations over time.

Firstly, there is a steady increase in area under cultivation in most districts. For example, Kokrajhar increased from 1833 hectares in 2011-12 to 3593.51 hectares in 2021-22. Similarly, Karimganj and Goalpara also show substantial expansion. At the state level, the total area nearly doubled from 32,117 hectares to 59,750 hectares, indicating expansion of the sector.

Secondly, production has increased remarkably, especially after 2015-16. For instance, Goalpara's production rose from 1745 MT in 2011-12 to over 8000 MT in 2021-22. Karimganj and Karbi Anglong also show strong growth trends. Overall production in Assam increased from 10,950 MT to 40,637 MT, reflecting improved productivity and better farming practices.

However, employment generation shows a declining trend. In 2011-12, employment was extremely high (over 30 lakh), but it dropped drastically to around 1.7 lakh in 2015-16 and remained almost stable in 2021-22. This sharp decline may be due to mechanization, improved efficiency, or changes in data estimation.

Table 3: Top Rubber producing districts in Assam, 2001-2022

Name of Districts	2021-2022			2015-2016			2011-2012		
	Area (Hectare)	Production (MT)	Employment Generation (Nos)	Area (Hectare)	Production (MT)	Employment Generation (Nos)	Area (Hectare)	Production (MT)	Employment Generation (Nos)
Kokrajhar	3593.51	4058.78	11212	2920.65	493.44	10920	1833	180	54990
Goalpara	9640.51	8141	30078	9595.75	6699.65	30515	8045.6	1745	241368
Karbi Anglong	8601.01	5672.69	26835	8825.29	3298.24	27000	5172	3439	1007000
Karimganj	16429	9069.5	51258	18544	2860.51	56745	4200.74	1494	690020
Cachar	2930	2469.58	9142	2732	348.68	8687	1406	940	38000
Bongaigaon	1508.02	1908.27	4705	2831.03	375	9003	2548.5	380	76455
Assam	**59750.26**	**40637.39**	**186417**	**55989.71**	**16399.63**	**174763**	**32117.43**	**10950**	**3034993**

Source: Statistical handbook of Assam, India

Another important observation is that some districts like Karimganj, Goalpara, and Karbi Anglong consistently contribute a large share in all three aspects, making them key regions. On the other hand, districts like Cachar and Bongaigaon show moderate but fluctuating performance.

In conclusion, the data indicates that while area and production have increased significantly, employment has declined sharply. This reflects a shift towards more productive and technology-driven practices, along with regional disparities in growth.

1.3 Constraints of rubber Plantations in Assam:

Rubber cultivation in Assam, despite its strong potential, faces several challenges that affect productivity and sustainability due to a shortage of skilled labour, low-quality sheet production, and high transportation costs. They are-

a) Climate Changes: Climate change is one of the major challenges affecting rubber cultivation in Assam. Both deficient and excessive rainfall disrupts latex flow and reduce yield. Moisture stress adversely affects tree growth and latex production, while excessive rainfall and waterlogging can damage roots, promote fungal diseases, and reduce the number of tapping days. Rubber requires a stable warm climate; therefore, extreme heat or sudden drops in temperature negatively affect productivity. Low temperatures and cold waves reduce latex flow and slow down the physiological processes of rubber trees. In addition, high humidity combined with cloud cover encourages fungal diseases such as leaf fall. Storms and strong winds can cause physical damage to plantations and reduce their stability. Increasing variability in rainfall and temperature patterns due to climate change creates uncertainty in production cycles. In Assam, climatic conditions are often not ideal for rubber cultivation, as excessive rainfall and humidity hinder tapping operations and reduce latex quality. Moreover, frequent floods in many parts of the Brahmaputra Valley cause significant damage to rubber plantations.

b) Small holdings: Small and fragmented landholdings are a major constraint in rubber cultivation in Assam. Most farmers cultivate rubber on small plots, which limits large-scale production and reduces overall profitability. These smallholders often lack adequate resources for proper plantation management. The scattered nature of landholdings makes efficient cultivation difficult and restricts the adoption of improved agricultural practices and modern machinery, thereby increasing dependence on manual labour. Farmers also face challenges in accessing institutional credit and financial support. Heavy dependence on monsoon rainfall further adds uncertainty to production. For small-scale farmers, inputs such as seeds, fertilizers, and pesticides are relatively expensive, increasing the cost of cultivation. In addition, inadequate storage, poor transportation facilities, and weak bargaining power result in lower returns. Most smallholders remain focused on subsistence rather than commercial production. They are also more vulnerable to natural hazards such as floods (which are common in Assam), as well as pests and crop failure. Furthermore, limited awareness and adoption of modern agricultural techniques and innovations continue to hinder productivity and growth.

c) Lack of technical knowledge and training: Inadequate technical knowledge among rubber cultivators is a significant constraint, leading to improper tapping

techniques that reduce latex yield and may damage trees. A poor understanding of essential plantation management practices such as spacing, pruning, and weeding further lowers productivity. Limited awareness of soil fertility management and appropriate fertilizer use negatively affects soil health and long-term sustainability. Moreover, insufficient knowledge of pest and disease control contributes to the spread of infections, resulting in yield losses and plantation damage. The use of low-quality planting materials, along with inefficient processing methods and limited adoption of modern technologies, also hampers production. In addition, a lack of training in water management and climate adaptation increases the vulnerability of plantations to environmental stress.

d) Price Fluctuations: Rubber prices are highly volatile due to fluctuations in global demand and supply, changing international market trends, and competition from synthetic alternatives. When prices decline, farmers often reduce tapping intensity or abandon plantations because of low profitability, leading to a drop in overall production. On the other hand, sudden price increases may encourage overexploitation of trees, which can harm their long-term productivity. Price instability creates uncertainty, discouraging farmers from investing in improved plantation management, high-quality planting materials, and modern technologies. Small and marginal farmers are particularly affected, as they lack the financial capacity to withstand income fluctuations. Furthermore, dependence on middlemen and inadequate market infrastructure reduces the share of profits received by producers. Overall, price volatility not only affects farmers' immediate income but also undermines the sustainability and long-term development of rubber cultivation.

e) Inadequate infrastructure and processing facilities: Inadequate infrastructure and limited processing facilities are major constraints on rubber production in Assam. Poor road connectivity and transport networks restrict farmers' access to markets and processing units, increasing costs and reducing profits. Many growing areas, particularly in remote and hilly regions of Karbi Anglong, lack proper storage and collection centers, leading to delays and deterioration in latex quality. The absence of modern processing and rubber sheet manufacturing units forces reliance on inefficient traditional methods, resulting in low-quality output and reduced market value. Limited access to electricity, irrigation, and technical support further hampers efficient processing. Small and marginal farmers are especially

affected, as they lack access to centralized facilities and cooperative systems, making it difficult to produce standardized, high-quality rubber. Overall, these limitations reduce productivity and hinder the sector's growth and commercialization.

f) Pest and disease attacks: Pests and diseases are major constraints on rubber production in Assam, as the warm and humid climate encourages their rapid spread. Diseases such as leaf fall, powdery mildew, and root rot, along with pests like termites and mealybugs, damage plant health and reduce latex yield and quality. These issues increase management costs and can even lead to plantation losses. The problem is aggravated by limited farmer awareness and inadequate access to control measures, while effective management through early detection, preventive practices, resistant varieties, and proper treatments remains insufficiently adopted.

g) Labour-related: Labour-related issues are a major constraint in rubber cultivation in Assam, as the sector is highly labour-intensive, especially during tapping and processing. A key challenge is the shortage of skilled workers, particularly trained tappers, leading to inefficient tapping, lower yields, and tree damage. Rising labour costs further increase production expenses, making it difficult for small and marginal farmers to afford regular labour. In addition, labour availability is often seasonal and irregular due to migration, while absenteeism affects timely plantation management. The younger generation's declining interest in this physically demanding and low-return activity has also contributed to a shrinking workforce.

h) Long gestation period: Rubber trees require about 6-7 years to mature before tapping begins, delaying income generation for farmers. During this gestation period, cultivators must bear costs of planting and maintenance without returns, creating a financial burden especially for small and marginal farmers. The lack of interim income discourages adoption and expansion of rubber cultivation, while risks from climate, pests, and price fluctuations further increase uncertainty. Limited access to credit and institutional support worsens the situation. Consequently, the long gestation period constrains both the growth and sustainability of the sector, highlighting the need for financial assistance, intercropping practices, and stronger institutional support.

Conclusion:

Rubber cultivation in Assam has expanded significantly from 2011 to 2022, with the cultivated area nearly doubling and production increasing almost fourfold due to improved technology and productivity. However, employment has sharply declined because of mechanization and efficiency gains. The sector is largely concentrated in a few key districts like Karimganj, Goalpara, Karbi Anglong, and Cachar, with some districts showing higher productivity despite smaller areas. Overall, while area and production have grown steadily especially in the top five producing districts regional disparities persist, and employment generation has reduced. Despite its growth, the sector faces major challenges including climate variability, small and fragmented landholdings, lack of technical knowledge, price fluctuations, poor infrastructure, pest and disease attacks, labour shortages, and the long gestation period of rubber trees, all of which affect productivity, profitability, and sustainability.

In conclusion, while rubber cultivation in Assam shows strong growth potential, there is a need for balanced regional development, improved infrastructure, modern technological adoption, better institutional and farmer support to ensure the sustainable and inclusive growth of the sector. As natural rubber is in high demand in the international market, increasing plantation and adopting proper scientific practices can make rubber cultivation a viable pathway for rural development in Assam.

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