ECONOMIC ANALYSIS OF PRODUCTION, MARKETING AND PRICE BEHAVIOUR OF COCOA IN KERALA

By

ANILA V S

(2019-11-166)

DEPARTMENT OF AGRICULTURAL ECONOMICS

COLLEGE OF AGRICULTURE

VELLANIKKARA, THRISSUR- 680 656

KERALA, INDIA

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COLLEGE OF AGRICULTURE

VELLANIKKARA, THRISSUR- 680 656

KERALA, INDIA

2021

DECLARATION

I, hereby declare that this thesis entitled **"Economic analysis of production, marketing and price behaviour of cocoa in Kerala"** is a bonafide record of research work done by me during the course of research and that it has not previously formed the basis for the award to me of any degree, diploma, fellowship or other similar title, of any other University or Society.

Anila V S

2019-11-166

Vellanikkara

21/01/2022

CERTIFICATE

Certified that this thesis, entitled **"Economic analysis of production, marketing and price behaviour of cocoa in Kerala"** is a bonafide record of research work done independently by **Ms. Anila V S (2019-11-166)** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship, or associateship to her.

Vellanikkara
21/01/2022

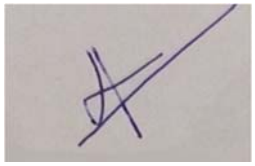
Dr. Anil Kuruvila
(Major Advisor, Advisory Committee)
Professor
Department of Agricultural Economics
College of Agriculture, Vellanikkara

CERTIFICATE

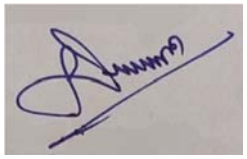
We, the undersigned members of the advisory committee of **Ms. Anila V S (2019-11-166),** a candidate for the degree of **Master of Science in Agriculture** with major field in **Agricultural Economics** agree that this thesis, entitled **"Economic analysis of production, marketing and price behaviour of cocoa in Kerala"** may be submitted by **Ms. Anila V S** in partial fulfillment of the requirement for the degree.

Dr. Anil Kuruvila
(Major Advisor, Advisory Committee)
Professor
Department of Agricultural Economics
College of Agriculture, Vellanikkara

Dr. A. Prema
(Member, Advisory Committee)
Professor and Head
Department of Agricultural Economics
College of Agriculture, Vellanikkara



Dr. Minimol J S
(Member, Advisory Committee)
Professor
Department of Plant Breeding and Genetics
Cocoa Research Centre
College of Agriculture, Vellanikkara



Ms. Divya K M
(Member, Advisory Committee)
Assistant Professor
Department of Agricultural Economics
College of Agriculture, Vellanikkara

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Introduction

1. INTRODUCTION

Cocoa (*Theobroma cacao*) is one of the important plantation crops which is widely cultivated in African, American and Asian countries for its delicious beans. Ancient Mexican societies like Mayans and Aztecs regarded cocoa to be the 'Food of Gods' and used it in spiritual ceremonies. Cocoa was considered as an indispensable element of their life and was used in important functions from birth to funeral. Cocoa was used in the barter system and was provided as dowry for weddings (Pohlan and Perez`, 2010). The processing of cocoa bean produces cocoa powder, cocoa liquor and cocoa pulp, which serve as major inputs for chocolate and confectionary industries. Cocoa products are also used in the preparation of various food items like cakes, puddings, ice creams, candies, choco-pastas *etc*. Cocoa powder and dark chocolate contain significant amounts of polyphenols, particularly flavanols, which aid to improve the health by reducing blood pressure, improving arterial elasticity and boosting the anti-inflammatory action within the body (Crozier *et al*., 2011).

The centre of origin of cocoa is the rainforests of Amazon basin (Thompson, 1956). Later, the cultivation was initiated in other countries including Central America, Europe, Italy, Africa and Asia (Ross, 2011). In India, cocoa was initially introduced in Courtallam of Tirunelveli district in 1798 from Amboyna Islands of East Indies (Ratnam, 1961). The earlier plantations of Criollo variety of cocoa were established at Burliar Fruit station of Nilgiris during 1873-74 and at Kallar during 1930-35 (Apshara, 2017). Nearly half of the world's total cocoa production is accounted by Ivory Coast and Ghana (Sirohi, 2018). The contribution of India to the world cocoa production is very meagre and it stands as the eighteenth largest producer of cocoa in the world (GOI, 2018).

The Mondelez International, formerly Cadbury played a significant role in commercialising cocoa cultivation in India. The Cadbury initiated its activities in India during 1948 and even after setting up the company in India, Cadbury continued to procure raw materials by importing from international market. Consequently, Cadbury's profit margin was affected by high transaction costs involved in the imports. Moreover, the price volatility of cocoa was very high in the international market due to supply shocks in producing countries which affected the procurement of raw materials and thus prompted Cadbury to initiate cocoa cultivation in India. D.H.Urquhart, the

chief chemist of Cadbury, analysed the possibility for cocoa cultivation in India and he suggested that the conditions in Kerala were the most suited to carry out commercial cultivation of cocoa. On the basis of the report submitted by him, Government of India entrusted Indian Council of Agricultural Research (ICAR) to carry out research activities on cocoa. Since 1964, research works on cocoa cultivation are being carried out in Central Plantation Crops and Research Institute (CPCRI) (Jayasekhar and Ndung'u, 2018).

The Cadbury established a cocoa plantation of approximately 10 ha area in Kalpetta in Kerala during 1958 and a processing plant in Thane, Maharashtra. The central scheme implemented in the third five-year plan played a major role in commercialising cocoa cultivation in Kerala, Karnataka and Tamil Nadu. Consequently, in 1965, the area under cocoa in Kalpetta increased to 80 ha and in Karnataka, the commercial cultivation of cocoa was started in an area of 14 ha. The seedlings of good quality cocoa were not available to farmers and it was imported to India by the Hindustan Cocoa (formerly Cadbury) from Malaysia. From 1971-72, the Government of India took the initiative to import seedlings and subsequently cocoa nurseries were established under the initiative of state governments of Kerala, Karnataka and Tamil Nadu. When Malaysian government restricted cocoa exports in 1973-74, seed materials from indigenous sources were used to raise seedlings in India. During the fifth five-year plan, the central government sponsored a scheme, which enabled setting up of cocoa seed gardens in Kerala and Karnataka. The Government of Kerala took considerable efforts in popularising cocoa cultivation by developing suitable cocoa varieties, distributing cocoa seedlings, organising special campaigns and launching a state scheme to plant cocoa in 400 ha in a phased manner during 1973-74. The price of cocoa remained high in the international market during this period, which encouraged many farmers to take up cocoa cultivation. As a result, the area under cocoa cultivation in India rose from 1,927 ha in 1970-71 to 29,000 ha in 1979-80 (Asopa and Narayanan, 1990).

During 1978-79, the price of dry cocoa beans was ruling at ₹40 per kg. But in 1980-81, the cocoa price in international market crashed to ₹18 per kg. During these years of the price crisis, the Cadbury unit in India had to stop its operation due to labour related issues (Asopa and Narayanan, 1990). They found it more profitable to import cocoa from international market (Jayasekhar and Ndung'u, 2018) and as a result, the

procurement of cocoa beans from farmers in India by Cadbury was almost stopped. Although, Kerala and Karnataka government tried to procure cocoa beans through Kerala State Cooperative Marketing Federation and Central Arecanut Marketing and Processing Co-operative Limited (CAMPCO), their efforts remained less successful due to the low procurement price fixed as compared to the international price (Asopa and Narayanan, 1990). Also, the procurement and processing centres were restricted to regions where intensive cocoa cultivation was carried out and farmers had to transport the produce by incurring high transportation cost. Drought along with the damage caused by rodent pests made cocoa cultivation uneconomical in many parts of the country. On the other hand, the prices of cocoa remained low during the period from 1986 to 1990. As the farmers began to face huge losses, they withdrew from cocoa cultivation by cutting down the cocoa trees. Thus, the area under cocoa cultivation in India declined from 29,000 ha in 1980-81 to 16,862 ha in 1989-90, along with the consequent decline in production from 7,715 t in 1985-86 to 7,000 t in 1989-90 (DCCD, 1991).

The cocoa economy of Kerala remained more or less stagnant during the period from 1980 to 1990 and it revived after 2000-01 due to the contributions from research, especially with the initiation of cocoa programmes in Kerala Agricultural University at Thrissur in 1978 and the Cadbury-KAU Co-operative Research Project in 1986 (Suma and Minimol, 2016). With the objective of stabilising the market demand, Central Arecanut and Cocoa Marketing Processing Co-operative Marketing Limited (CAMPCO), Mangalore started a Chocolate Manufacturing Factory at Kemminje, Karnataka in 1986 and after 2000, it entered the marketing scenario in 1990 by diversifying and exporting cocoa products (Malhotra *et al.*, 2016).

The area under cocoa in India rose from 12,402 ha in 1998-99 to 82,940 ha in 2016-17, while the production also increased from 5,198 MT in 1998 to 18,920 MT in 2016-17 (DCCD, 2016). In India, cocoa is cultivated intensively in Andhra Pradesh, Karnataka, Kerala and Tamil Nadu. The largest area under cocoa cultivation (29,480 ha) is in Tamil Nadu, whereas Andhra Pradesh had the highest cocoa production (8,090 MT) in 2016-17 (GOI, 2018).

The export of cocoa products from India has significantly increased over the years. During 1987-88, India exported 202.4 MT of cocoa products worth ₹36 lakhs,

whereas in 2018, the cocoa exports significantly increased to 27,603 MT worth ₹1,35,086 lakh. Significant quantities of Indian cocoa is being exported to USA from India since 2013. Cocoa exports from India to USA has increased substantially from 3,061 MT worth ₹10,482 lakh in 2013-14 to 8,696 MT worth 36,667 lakh rupees in 2018-19 (APEDA, 2020).

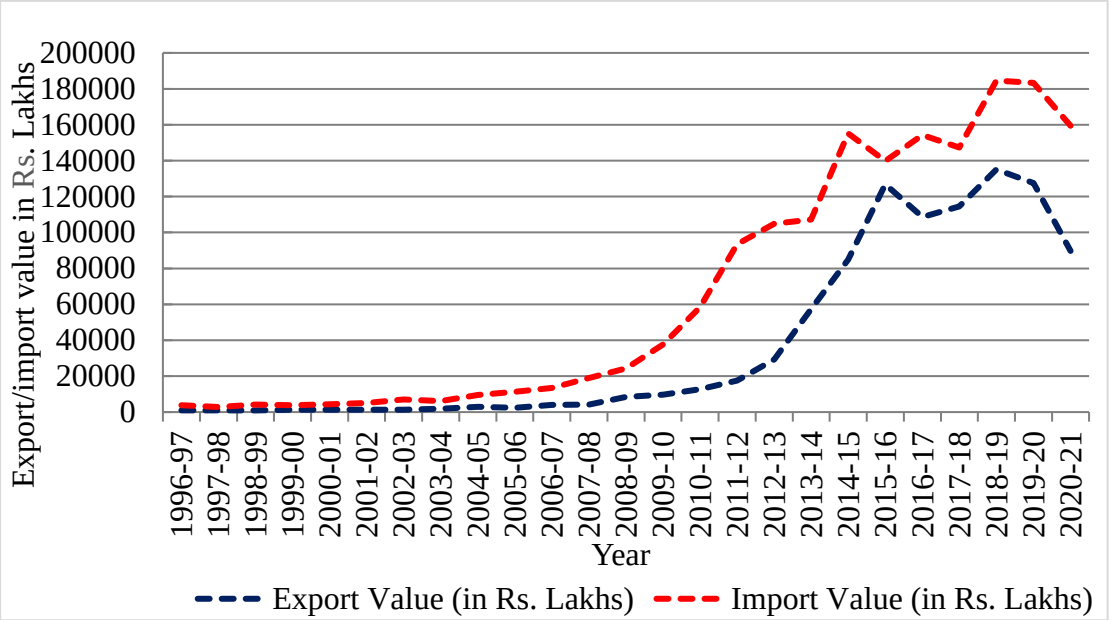

Figure 1. Export and import of cocoa and cocoa preparations in India

The consumption of chocolate is highest in Europe and America. In 2017, the per capita chocolate consumption was found to be the highest in Switzerland (8.8 kg) followed by Austria (8.1 kg) and Germany (7.9 kg) (Statista, 2017). Though, the chocolate consumption in India is far behind other western countries, it is reported that the per capita consumption of chocolates in India has increased three-fold over the past three years. This is mainly due to the increase in disposable income, changes in lifestyle, awareness about wide variety of chocolate products through advertisements, social media campaigns and increased availability of the cocoa products at affordable prices (Gayathri and Sumana, 2018).

The global cocoa bean market is expected to grow at a Compound Annual Growth Rate (CAGR) of 7.3 per cent from 2019 to 2025. In 2018, a surplus was noticed in the global supply-demand of cocoa and it was estimated to increase to 30,000 metric tonnes by 2019 (Voora *et al.*, 2019). In India, the demand of cocoa has increased over years. In 2015-16, 30,000 metric tonnes of cocoa were consumed in India and 57 per

cent of this was supplied through cocoa imports (Seetharaman, 2017). In 2018-19, the cocoa imports (31,960 MT) exceeded the exports (27,603 MT) (APEDA, 2018). The demand of cocoa is growing at 15 per cent every year but there is no corresponding increase in production (Nair, 2018), which indicates that the domestic cocoa production should be promoted so as to reduce cocoa imports and make India self-sufficient in cocoa production.

Kerala was the second largest producer of cocoa in India, with a production of 7,510 MT in 2017-18. The area and production of cocoa in Kerala increased from 8,200 ha and 5,300 MT respectively in 1993 to 16,590 ha and 7,510 MT in 2017 (GOI, 2018). Idukki district had the maximum area of 9,715 ha under cocoa cultivation in 2017-18, followed by Ernakulam (1,047 ha) and Kottayam (921 ha). However, the productivity of cocoa in Kerala has declined from 0.64 MT per ha in 1993-94 to 0.45 MT per ha in 2017-18 (GOK, 2019).

The small size of holdings, damages caused by rats and squirrels and, poor fertility status of soil are some of the factors limiting cocoa production in Kerala. Cocoa is mostly raised in Kerala as an intercrop in coconut and arecanut gardens and the cultivation as a sole crop is not very common. The price of cocoa is highly volatile and the domestic price movements are highly correlated with price behaviour in international markets. The diseases such as phytophthora pod rot and vascular streak dieback also limit the cocoa yield in the state (Prasannakumari *et al.*, 2009).

In the above background, it is important to study the production of cocoa in Kerala, with special reference to the economics of production and marketing and, prices of cocoa, which are indispensable for identifying the constraints in the production of cocoa in Kerala. Hence, the present study aims to analyse the economics of production, marketing and price behaviour of cocoa in Kerala.

The specific objectives of the study are:

1. To analyse the trends in area, production and productivity of cocoa in India and Kerala
2. To analyse the price behaviour of cocoa
3. To estimate the efficiency and economics of cocoa production

4. To study the marketing practices and economics of marketing of cocoa in Kerala
5. To determine the major constraints in production and marketing of cocoa in Kerala and suggest policy measures for improving the efficiencies of production and marketing

Limitations of the study

The primary data collection was based on the responses from farmers and intermediaries in Idukki and Ernakulam districts. Due to the Covid-19 pandemic and related restrictions, primary data collection was mostly done through telephonic interviews. As many of the questions were answered from memory, there is possibility for recall bias in these answers. In spite of all the above limitations, maximum care has been taken to ensure that such limitations do not affect the validity of the findings or results of the study by cross checking the responses through different questions. As cocoa has gained importance only recently in India, the literature on cocoa and associated journals were found to be limited in number. However, concerted efforts have been made to review all relevant literature for the present study.

Plan of the thesis

The thesis has been divided into five chapters. The first chapter describes the importance, uses, history of cocoa cultivation in India, current production scenario, consumption pattern and constraints in cocoa cultivation. The review of the relevant past studies which are of relevance to the present study are included in the second chapter. The third chapter provides a short description of the study area and methodology including the analytical techniques followed in the present thesis research. The fourth chapter includes results and discussion. A summary of the study is presented in the fifth chapter, followed by references, abstract and appendices.

Review of literature

2. REVIEW OF LITERATURE

The concepts and methodologies from past studies which are relevant for the present study have been included in this chapter. The reviews are categorised and presented under the following sub headings:

2.1 Trend and growth rate analysis

2.2 Price behaviour

2.3 Economics of production

2.4 Marketing channels and price spread

2.5 Constraints in production and marketing

2.1 Trend and growth rate analysis

Fialor (1985) analysed the Compound Annual Growth Rates (CAGRs) in area, production, productivity and exports of cocoa for seven major cocoa producers in the world for the period from 1971 to 1980. Globally, the area under cocoa was found to decline at the rate of one per cent per annum. Negative growth rates in area were observed for Ghana, Nigeria and Ecuador, whereas positive growth rates were observed for Brazil, Cameroon, Ivory Coast and Malaysia. The global production of cocoa grew at an annual growth rate of 1.4 per cent. Malaysia recorded the highest rate of growth in production of 91 per cent, followed by Ivory Coast and Brazil with growth rates of 20 per cent and 12 per cent respectively.

Abang and Ndifon (2002) analysed the trend in world cocoa production during the period from 1975-76 to 1996-97 using time series data for seven major cocoa producers, *viz.*, Ivory coast, Ghana, Cameroon, Nigeria, Brazil, Indonesia and Malaysia. The results of the study indicated that global cocoa production rose from 1.08 million metric tonnes in 1976-77 to 1.97 million metric tonnes in 1994-95. Those countries with higher production shares were found to be having higher instability indices, whereas countries with lower production shares exhibited lower instability in production. The Coefficient of Variation (CV) was used to compute the production risk and it was found to vary between 10 per cent and 90 per cent.

Hilal (2012) carried out a study to analyse the global trends in production and trade of tea. The four major tea producers in the world were identified as China, India, Kenya and Sri Lanka. On analysing the growth in production during the period from

2000 to 2008, it was noticed that the overall production of tea in Kenya and China increased by 81 per cent and 46 per cent during the study period, whereas in India and Sri Lanka the production declined by three per cent and four per cent respectively. The trend in export was calculated for the period from 1961-62 to 2008-09 using linear trend model. Sri Lanka, Kenya and China depicted an upward trend, with positive coefficient values of 1500, 7332 and 5745 respectively, whereas the exports from India registered a declining trend value of -732. The declining trend in Indian tea exports could be due to increased domestic tea consumption and lower rate of replanting of 1.5 per cent per year.

A study to analyse the changes in area, production and productivity of tea and coffee in India was carried out by Darvishi and Indira (2013). It was concluded that liberalization had a positive impact on the production of export-oriented commodities. The area, production and productivity of tea and coffee increased from 1989-90 to 2010-11. The CV declined for both tea and coffee from 31.25 per cent to 18.58 per cent and 15.11 per cent to 10.08 per cent respectively during the period, which indicated that both crops had attained stability in production during the post-liberalization period.

George and Chandrasekhar (2014) estimated the CAGRs for area, production and productivity of rubber and rubber exports during the period from 2005-06 to 2011-12. The area, production and productivity of rubber showed an increasing trend in India as well as Kerala. The CAGRs for area, production and productivity of rubber in India were 2.56 per cent, 3.49 per cent and 1.59 per cent per annum respectively, whereas in Kerala they were 1.31 per cent, 3.09 per cent and 1.75 per cent per annum respectively during the period. The rubber exports declined from 73,830 tonnes in 2005-06 to 27,145 tonnes in 2011-12, with a CAGR of -16.82 per cent per annum. It was evident that the introduction of Value Added Tax in 2005 brought significant changes in domestic as well as international trade of rubber.

Karunakaran (2016) discussed the trend, variability and dynamism of area, production and productivity of arecanut in Kerala. An exponential growth function was fitted for computing the CAGRs. The area and production rose by 0.99 per cent per annum and 5.75 per cent per annum respectively during the period from 1960-61 to 2014-15. About 65 per cent share of the total production in Kerala during 2014-15 was contributed by Kasargod, Kannur and Malappuram. Kasargod was identified as the

district with highest productivity (1953 kg/ha) in Kerala, whereas Alappuzha, with a productivity of 408 kg/ha, was identified to be the least productive district in the state.

Thulasiram *et al.* (2018) made an attempt to analyse the growth and trade performance of cocoa in India. The period of the study was divided into Period I (1994-95 to 2003-04) and Period II (2004-05 to 2013-14).The CAGRs of area, production, productivity and export performance were worked out using exponential growth functions. The growth rate of area was found to be higher during period II (11.85 per cent) as compared to period I (6.18 per cent), whereas the growth rate in production, was found to be higher during period I (7.53 per cent) as compared to period II (5.16 per cent). A decline in productivity of -5.96 during period II was observed. During the study period, a positive growth in area (10.13 per cent) and production (6.80 per cent) and a negative growth rate (-1.83 per cent) in productivity were observed. Since the crop was in the initial stages of growth in most of the cocoa producing states, the productivity levels were low and it could be the reason for the negative growth rates in productivity. On analysing the quantity and value of cocoa exports from India, it was found that both the export value and export quantity showed positive growth rates of 17.11 per cent and 18.72 per cent respectively. It was concluded that the export competitiveness could be improved by improving the domestic production levels by enhancing the farmers' knowledge regarding better farm management practices and also by improving the processing technology.

Saha *et al.* (2021) analysed the trends in area, production and productivity of tea in Bangladesh during the pre-liberalisation (1947-1970) and post-liberalisation (1972-2018) periods using exponential growth models. The results of the study showed that the production of tea witnessed an increase from 18.88 million kg in 1947-48 to 82.13 million kg in 2018-19 and the rate of growth in production was more during the post-liberalisation period (245 per cent) as compared to the pre-liberalisation period (103 per cent). The higher growth rates in production and yield during the post-liberalisation period could be due to the intensification of production process by adoption of high yielding clonal varieties, adequate use of fertilizers and manures, systematically practicing intercultural operations, enhanced knowledge of farmers from attending training programmes *etc.*

2.2 Price behaviour

Joseph and Naidu (1992) conducted a study to determine the influence of seasonality on the prices of cardamom. The secondary data on selling price, export price and monthly sales during the period from 1974-75 to 1988-89 were used for the analysis. The ratio to trend method was used to work out the seasonal indices. It was concluded that the seasonality in selling price was more prominent as compared to the export price. The seasonal index estimate for sales price recorded the maximum value of 108.9 during January and minimum value of 91.71 was found during July. The seasonal index for export price was relatively stable and it recorded the minimum value of 93.2 during August and the maximum value of 103.28 was estimated during November. The selling prices were found to be directly related to export as well as export price.

Hema *et al.* (2007) carried out a study to analyse the major factors influencing price volatility of black pepper using the data on area, production, productivity and price of black pepper for the period from 1970-71 to 2002-03. The findings suggested that an increase in imports as well as decrease in prices at the international level caused the domestic pepper prices to decrease drastically. The yield also showed a decline due to the increased incidence of drought, temperature fluctuations and increased infection caused by *Phytophtora capsici.* The yield variation was found to be more for large farmers who were able to harvest 1,235 kg per hectare as compared to small and marginal farmers who could harvest only 157 kg per hectare. The decrease in the yield along with an increase in input cost led to the drastic fall in farm gate price from ₹130 per kg in 2000 to ₹65 per kg in 2006. But the retail market price continued to prevail high at ₹220 per kg. The supply volatility was found as an important factor responsible for increased price instability in the international market. Vietnam emerged as a strong competitor for India in the export scenario as the former was able to trade large quantity at a cheaper price as compared to black pepper from India for which the landed price was comparatively high.

Gummagolmath (2012) analyzed seasonality of market arrivals and prices in major onion markets of India. He reported that in markets such as Lasalgaon, prices and arrivals moved in the opposite direction, *i.e.*, with the increase in market arrivals prices decreased and vice-versa. Similar trend was observed for prices of onion in

Ahmedabad, Chennai, Pune and Tamil Nadu. In markets such as Delhi, Bangalore and Hubli, during certain period of the year the prices and arrivals were found to be positively related. This happened because larger number of traders and exporters entered the markets to purchase superior quality onions during this period and the increased demand for onions caused the prices to rise. With increased demand and prices, more farmers brought their produce to these markets, resulting in coincidence of increased arrivals with higher prices. During the rest of the period, only few traders visited the markets to purchase onions, resulting in lower demand for onion. The quality of onion during was also found to be inferior and as a result low arrivals coexisted with low prices in those markets during this period.

Oomes *et al.* (2016) concluded that global cocoa prices were mainly determined by the prices prevailing in London International Financial Futures and Options Exchange (NYSE-LIFFE) and New York Intercontinental Exchange (ICE) cocoa future markets. The findings of the study revealed that cocoa prices were found to be less volatile as compared to prices of other commodities in the world market and the price volatility was mainly due to supply shocks. Both the demand and supply of cocoa were found to be price inelastic. However, the supply curve was found to be more elastic in the long run with an elasticity value of 0.285 as compared to the short run elasticity of 0.078. The elasticity of demand remained low during short run (-0.088) as well as the long run (-0.029). The price of cocoa in the spot market and farm gate prices were found to be influenced by futures market prices of cocoa. Even though inefficiencies existed in setting of price, liberalisation was found to have helped to equalise the farm gate price with the world price levels.

Jnanadevan (2018) reported that the rapid fluctuations in prices was one of the major problems experienced by coconut farmers of Kerala. The supply factors were found to be responsible for the rapid price fluctuations. The decline in area under coconut cultivation, shift in cultivation to other profitable crops, high cost along with low returns from coconut cultivation and high incidence of pests and diseases were some of the major reasons responsible for decline in coconut production, which eventually resulted in price fluctuations.

Preethi *et al.* (2019) analysed the price behaviour of coconut in Alappuzha and Kozhikode markets of Kerala. The comparison of price data in two different periods

viz., 1980-81 to 1995-96 and 1996-97 to 2015-16 was carried out. The prices of coconut in both the markets exhibited an increasing trend and seasonal patterns were also evident in the prices. A rise in price was noticed in Alappuzha market during December and the price attained its minimum value during April in the first period and July in the second period respectively. An entirely different seasonal pattern in prices was observed for Kozhikode market, with prices attaining peak values during the months of September and February. The prices were found to be minimum during May and October, for the first and second periods respectively. The differences in the pattern of seasonality could be attributed to the differences in the time of harvests and market arrivals. The cyclical and irregular variations were found to be varying and without any distinct patterns.

Tothmihaly (2018) analysed the price volatility of cocoa in the global market. Due to the limited uses and fewer substitutes, the price of cocoa was mainly determined by the demand for and supply of cocoa beans. Due to the steep increase in stocks-to-grinding ratio, cocoa price decreased drastically and reached the lowest value during 2000. Thereafter, the stocks to use ratio declined from 70 per cent to less than 40 per cent. This coincided with increase in nominal and real prices of cocoa from 888 to 3,064 US dollar per ton and from 116 to 2,836 US dollar per ton respectively. It was also found that changes in stocks to use ratio resulted in rapid changes in price volatility, *i.e*. large price effects were found to be corresponding with decline in stocks and small price effects were noticed due to increase in stocks. The global cocoa supply was found to be highly price inelastic, with a short run elasticity estimate of 0.07 and a long run elasticity of 0.57. The demand for cocoa also proved to be extremely price inelastic, with -0.06 and -0.34 as the short run and long run elasticity estimates.

The study conducted by Sabu *et al*. (2019) pointed to the issue of price volatility of black pepper in India. The trend, seasonal, cyclical and irregular variations in domestic and international prices of black pepper were analysed from 1980-81 to 2017-18 and the instability in prices was evaluated using Cuddy Della Valle Index. The results of the study revealed that domestic and international prices exhibited wide variation during the post-liberalisation period (January 1995 to December 2017) as compared to the pre-liberalisation period. The instability in prices was observed in both domestic as well as international markets during the pre-liberalisation period and the magnitude of instability was found to increase in the domestic market in the post-

liberalisation period, whereas it declined in the international market. The increasing trend in prices was noticed both in Indian and international markets. The seasonal pattern was evident in the prices of black pepper and the highest value was noticed during October in Kerala and September in New York. A decrease in price was evident from November to February during the harvest period. The cyclical variations in prices were prevalent and were found to be of different lengths. The irregular variations were more prominent during the pre-liberalisation era as compared to post-liberalisation era.

Vishnu *et al.* (2019) conducted a study to determine the price behaviour of small cardamom in Idukki district of Kerala and Theni district of Tamil Nadu. Trend, seasonal, cyclical and irregular variations in prices of cardamom were worked out for the period from 2008-09 to 2018-19. Due to the attractive colour and high pungency level of the freshly harvested produce, the price of small cardamom was found to be higher during the harvesting season. The trend analysis revealed that price of the produce increased gradually till 2010, declined thereafter and subsequently attained the peak value during January 2017. The seasonal variations in prices were prominent and the peak value was observed during April, while it reached the lowest value during October. During the study period, prominent cyclical variations were observed during the initial years, which declined over time.

2.3. Economics of production

Singh *et al.* (2009) conducted a study to analyse the economics of farming systems in Uttar Pradesh. The primary data sourced from 197 farmers were used for the analysis. The findings of the study indicated that the major farming systems in the study area included livestock-based, vegetable-based, cereal-based and sugarcane-based farming systems. Most of the farmers adopted sugarcane-based farming system (71 per cent), followed by livestock-based farming system (19 per cent). Livestock was identified to be an integral part of all farming systems. The sugarcane-based cropping system involved the highest cost of cultivation of ₹21,259 per ha, whereas the lowest cost of cultivation of ₹10,838 per ha was reported for the cereal-based farming system. The cost incurred for inputs (seeds, fertilizer and machinery), labour and marketing accounted for 92 per cent of the total cost and the least expenditure was incurred for plant protection chemical in all the farming systems considered for the study.

Kiruthika (2013) studied the economics of production of turmeric in Erode district of Tamil Nadu. Out of the 90 farmers considered for the study the small, marginal large farmers were 31,27 and 32 respectively. The cost of cultivation and gross returns were worked out for small, medium and large farms separately. The study indicated that the cost of cultivation was the least for large farms (₹1,61,644) as compared to marginal (₹2,02,220) and small farms (₹1,73,883). The cost of production also depicted a similar trend with ₹19, ₹22 and ₹26 per kilogram for large, small and marginal farms respectively. Hence, higher gross and net returns were found to be associated with large farms due to the larger area and lower cost of production as compared to small and medium farms.

Balakrishnan *et al.* (2017) estimated the economics of rubber cultivation in Kottayam district for farmers who were members of the Rubber Producer Societies (RPS) and non-RPS farmers. It was found that the cost of establishment remained the same for both the groups and it amounted to ₹57,195 per acre. The cost of cultivation of non-RPS members were found to be high (₹72,589 per acre) as compared to RPS members (₹62,541 per acre). A significant difference in the yield levels was noticed between the two groups. The RPS members attained the yield of 800 kg processed rubber per acre per year, whereas the non-RPS farmers were capable of attaining only 732 kg of processed rubber per year. As a result, the gross returns were found to be 10 per cent higher for RPS members as compared to the non-RPS farmers.

Kishore and Murthy (2017) worked out the economic feasibility of carrying out coconut cultivation in Karnataka. The primary data collected from 80 farmers were analysed using tools of investment analyses like Net Present Value (NPV), Benefit Cost Ratio (BCR), Pay Back Period and Internal Rate of Returns. The main component in the establishment cost of coconut was identified as the maintenance cost (88 per cent of establishment cost) and the total cost of cultivation amounted to ₹1,61,827 per hectare. The marketable surplus of coconut was found to be 14,026 nuts per hectare and profit from sales of mature nuts, tender nuts and copra amounted to ₹905 per hectare, ₹21,591 per hectare and ₹22,856 per hectare respectively. The NPV calculated for 50 years turned out to be positive (₹3,76,861 per hectare), which indicated the feasibility of taking up coconut cultivation.

Vinodhini and Deshmukh (2017) studied the economics of coconut farming in Tamil Nadu. The total cost for establishing coconut orchard, which was estimated for a period of five years, amounted to ₹2,28,082 per hectare and the cost incurred on labour was found to be the highest (₹1,14,165). The gross return was found to be ₹1,28,700 per hectare, out of which 98 per cent was obtained from main product (raw coconut) and the remaining was obtained from by-products. The net returns and BCR were estimated as ₹35,427 per hectare and 1.39 respectively.

On analysing the economics of production of arecanut in Kasaragod district of Kerala, Janeesa (2018) reported that 80 per cent of the production cost was accounted by labour. It was also found that 18 per cent of the total expenditure incurred on production cost was on plant protection chemicals due to the increased incidence of diseases such as Mahali and yellowing. The establishment and maintenance costs were estimated as ₹3,43,386 per hectare and ₹2,01,522 per hectare respectively. The aggregate cost of production was estimated as ₹150 per kg. It was found that on attaining an average yield of 1,750 kg per ha and with an average price of ₹227 per kg, it was possible to attain a gross return of ₹3,97,250 per ha and a net return of ₹13,086 per ha.

Jayasekhar and Muraraleedharan (2019) analysed the economics of coconut cultivation in Kerala and found that the average cost of production was ₹8.94 per nut for a well-managed coconut garden. Due to the shortage of skilled labour as well as high demand for labour, the wages were found to be very high, which in turn raised the cost of cultivation. The total cost of cultivation was estimated as ₹1,40,800 per ha, out of which 56 per cent and 26 per cent were incurred for labour and, manures, fertilizers and plant protection chemicals respectively. The cost of production of copra was worked out as ₹83.25 per kg, out of which 24 per cent was incurred for processing.

Sabu (2019) analysed the economics of production, marketing and price behaviour of nutmeg in Kerala. The primary data for the study was collected from nutmeg farmers in Thrissur and Ernakulam districts. Since nutmeg is a perennial crop, the establishment and maintenance costs were considered separately and the amortised value of establishment cost was added to the maintenance cost to determine the cost of cultivation. High operation-wise cost was noticed in Ernakulam district as compared to Thrissur district because of the prevalence of higher labour charges and increased input

usage. The establishment cost of nutmeg was estimated as ₹1,74,425 per hectare, whereas the annual cost of maintenance was assessed as ₹77,269 per hectare. The amortised value of establishment cost was ₹17,519 per hectare and the interest on working capital incurred at an interest rate of seven per cent was estimated as ₹5,408. Thus, the total cost of cultivation of nutmeg was found to be ₹1,01,196 per hectare, while the gross returns and net returns were reported as ₹1,44,643 per hectare and ₹44,447 per hectare respectively.

2.4. Marketing channels and price spread

Ipe (1986) analysed the structure and performance of rubber markets in Kerala. The important marketing channels identified in the marketing of rubber included, (i) Producer-primary dealer-secondary dealer-industrial consumer, (ii) Producer-primary dealer-broker-secondary dealer-industrial consumer, (iii)Producer-secondary dealer-industrial consumer, (iv) Producer-petty merchants-primary dealer-secondary dealer-industrial consumer, (v) Producer-primary dealer-rubber based small industries and, (vi) Producer-primary marketing societies- District Co-operative Rubber Marketing Society-Kerala State Co-operative Rubber marketing Federation. The gross marketing cost per quintal was estimated as ₹28.82, out of which the major share of 25.85 per cent was incurred for transportation expenses. The producer's share in consumer rupee was found to be 95.27 per cent. It was found that even though the marketing margins were low, the practice of selling mixed lots reduced the quality of the produce, while it enabled some of the marketing intermediaries to gain better profits.

Krishnaswamy (1995) reported that cocoa marketing in India lacked marketing efficiency, which has caused the production of cocoa to remain stagnant in the country. Most of the farmers sold their produce to village merchants and representatives of manufacturing units, whereas the proportion of farmers who were involved in direct selling remained considerably low. Though procurement centres were set up by Cadbury India *Ltd.* and CAMPCO, most of the selling process were mediated by the middlemen, which in turn reduced the price received by the producer. Most of the farmers had poor knowledge regarding grading practices and resorted to selling admixtures of good and poor-quality beans. This lowered the quality of beans sold and thus, reduced the profits earned by farmers.

Ogunleye and Oladeji (2007) made an attempt to analyse the preferences for market outlets by farmers for marketing of cocoa in Osun State in Nigeria. The responses collected from 60 farmers indicated that the major factors which influenced choice of market outlets include promptness of payment, mode of payment, price received from sale, distance from the farm, transaction costs and grading mechanism involved in sale. It was found that 48 per cent of the farmers preferred to sell their produce to itinerant middlemen due to prompt payment in the form of cash, which enabled them to meet their urgent cash needs. It was also reported that 24.1 per cent of the farmers sold their produce to cocoa merchants, whereas 18.1 per cent of the producers were found selling through cooperative marketing societies. Government agencies were not at all preferred by farmers due to the delay involved in transactions.

The study made by Anang (2011) in Bibiani-Anhwiaso-Bekwai district of Ghana to analyse the nature of the cocoa market revealed that the market was partially liberalised in nature. Even though price competition didn't prevail, it was found that competition between licensed buying companies existed. The decrease in concentration ratio during the period from 1993-94 to 2008-09 indicated involvement of more firms in cocoa sector with liberalisation. The Herfindahl index reduced from 0.66 in 1993-94 to 0.19 during 2000-01, which indicated a decline in the market power. The marketing behaviour of farmers revealed strong buyer loyalty as they had greater preference for customers who offered incentives and cash rewards.

Karunakaran (2014) identified three main channels in the marketing of arecanut in Kerala which included, (i) producer-village traders/itinerant merchants-private wholesaler-retailer-consumer, (ii) producer-private wholesaler-retailer-consumer, and (iii) producer-CAMPCO-retailer-consumer. The gross price spread as the share of farm price as well as the share of retail price were found to be least for channel (iii). The study showed the role of CAMPCO in enhancing producer's share in price paid by the consumer. It was found that the average annual growth rate of farm price increased from 0.10 per cent in 1954-55 to 30.78 per cent in 2011-12. Thus, while comparing the levels of farmgate prices in the pre and post-establishment periods of CAMPCO, it was understood that the formation of CAMPCO has enabled the stabilization of arecanut prices in Kerala by improving the marketing scenario of arecanut, which in turn ensured better price realisation for farmers.

UNCTAD (2016) reported that liberalization has caused the producer's price of cocoa to vary with changes in prices in the global market. In Ivory Coast and Ghana, the share of producer price was found to be less after liberalization as compared to the pre-liberalization period, whereas in Cameroon, Equador and Indonesia, increase in producer price was observed in the post-liberalisation period. Unregulated markets, reduced tax, minimum price and efficient marketing system were identified as the main factors favouring rise in producer price, whereas the distortion in exchange rate and high level of inflation were responsible for reducing the producer price.

Kumar *et al.* (2017) identified four different channels involved in the marketing of coconut in Raigad district of Maharashtra and estimated the marketing costs, marketing margin, marketing efficiency and producer's share in consumer rupee for each of the channel. The marketing channels identified included, (i) Producer-consumer, (ii) Producer-village trader- retailer-consumer, (iii) Producer-wholesaler-retailer-consumer and (iv) Producer-village trader-wholesaler-retailer. Channel II was found to be preferred by maximum number of farmers (37.78), whereas the least number of the farmers sold their produce through channel IV. The producer's share in consumer rupee and efficiency were found to be the highest in channel I, even though it was found to be the least followed one. Village traders and wholesalers were identified as the important marketing intermediaries.

Bymolt *et al.* (2018) conducted survey in Ivory Coast and Ghana to analyse the marketing behaviour of cocoa producers. Based on the study, it was reported that the annual producer's price of cocoa was fixed by Producer Price Review Committee (PPRC) in Ghana and by the government in Ivory Coast, while the farmers possessed no rights to negotiate over the price. During the period from 2000-01 to 2014-15, only 57% of the International Cocoa Organisation (ICCO) daily price was received by cocoa famers of Ghana whereas 51% was received by farmers in Ivory Coast. The price received by the producers were found to be very low as compared to that received by producers in other liberalised countries. During 2016, when the global cocoa supply increased, cocoa prices decreased drastically and most of the local buyers cancelled the pre-existing contract agreement with cocoa farmers in Ivory Coast and they refused to buy the produce. Along with this, the Ivory Coast government cut down the producer's price by 36 per cent, which in turn resulted in reduced level of profit earned by the farmers.

Contrareas *et al.* (2020) identified the major marketing channels involved in cocoa value chain in Columbia. The cocoa production in Columbia was carried out by large number of small scale and medium scale farmers (80 per cent). Local enterprises, commission agents, producer associations and second level associations were the major intermediaries involved in cocoa bean procurement. The Casa Luker and Nutresa were identified as major Columbian companies involved in processing and marketing of cocoa. The domestic consumption of cocoa in Columbia was found to be very high (1300g/year), while the exports were only 19 per cent of the total production. It was found that the farmers were receiving only four to six per cent of the consumer price. The companies possessed greater control over the value chain and the farmers possessed only lesser access to information on market demand, prices and opportunities.

Raj (2020) conducted a study to identify the major marketing intermediaries involved in marketing of tea in Assam. The districts of Tinsukia, Dibrugarh, Sibsagar, Jorhat and Golaghat were chosen for the study as it constituted 65 per cent of the Small Tea Growing Groups (STGs) of Assam. The small tea growers, self-help groups, commission agents and processors were recognized as the key players in the marketing of tea. About 65 per cent of the farmers preferred handling of their produce by the commission agents, who played a crucial role in lending financial aid to the farmers because of which most of the them were compelled to sell their produce to them. The Self Help Groups (SHGs) owned by Bought Leaf Factories (BLF) were identified to be the least preferred marketing channel (preferred by only one per cent), eventhough it was found to be popular in recent years.

2.5. Constraints in production and marketing

The constraints in organic cocoa production in Bron-Densuso region of Ghana was studied by Ayenor *et al.* (2004). The results of the study indicated that the low yield along with the increased incidence of pests, (especially capsid attack) and diseases, including black pod disease, were the major production constraints faced by the farmers. The other crucial problems faced by the farmers included financial problems during pre-harvest season and faulty tenurial agreement. It was found that most of the farmers had only less knowledge regarding the identification of pests. It was also evident from the study that the malfunctioning of tenurial agreements could indirectly cause decline in yield due to non-adoption of scientific crop management practices,

resulting in increased weed growth. The withdrawal of the organic cocoa marketing company from the business also created difficulties for the farmers in carrying out organic cocoa cultivation as a profitable venture.

Khader (2005) conducted a study to analyse the problems faced by cocoa farmers of Kerala. The findings of the study indicated that most of the cocoa farmers lacked financial support from governmental agencies. The incidence of pests, diseases and rodents led to severe reduction in yield. The major marketing constraints faced by cocoa farmers included low marketing efficiency, lack of processing facility and rapid price fluctuations. Even though procurement was carried out by CAMPCO and Cadbury India *Ltd*., the process involved middlemen which consequently lowered the prices received by the farmers. Also, the collection centres were located far away from the production centres which increased the difficulty in marketing. It was evident from the study that cocoa was mostly raised as a supplementary crop by majority (97.92 per cent) of the respondents without following scientific production practices, which led to lower levels of production. The study also revealed that only 35 per cent of the respondents received training for carrying out cocoa production, which was also found to be insufficient. Due to the prevalence of various constraints including low levels of profit and rapid price fluctuations, most of the farmers shifted from cocoa cultivation to other remunerative plantation crops.

Herath *et al.* (2012) conducted a study to analyse the constraints faced by coconut farmers of Sri Lanka. The study was conducted by collecting responses from coconut growers who visited the Coconut Technology Park from July to November 2011. A total of 153 farmers were contacted for the survey and constraints were ranked using a five-point Likert scale. The Average Problem Score (APS) was calculated in the study to prioritise the constraints. The most important problem identified was the non-availability of good quality certified seedlings. The other major issues included high incidence of pest damages, low market price, poor accessibility of technology, unavailability of labour, capital and inputs.

Bhoopathy (2016) conducted a study to find the constraints faced by farmers in marketing of coconut in Coimbatore. The Garrett ranking technique was carried out to find out the major constraints based on the primary data gathered from 200 farmers. The shortage of water due to failure of rain was recognized as the most important

constraint, followed by the rapid fluctuations in price of coconut, lack of subsidy, high cost of labour, power cuts, lack of storage facility, low price for coconut products, scarcity of labour and unawareness regarding the management of pests and diseases.

The constraints faced by coconut farmers and marketing intermediaries during production and marketing was studied by Kalidas *et al.* (2020). The study was conducted across 15 Taluks of Coimbatore, Tirupur, Erode and Namakkal districts in Tamil Nadu. The Response Priority Index (RPI) calculated based on the responses of the participants was used for analysing and ranking the constraints. Among the production constraints, the RPI value was the highest for loss of yield due to pests and diseases, which indicated the need for providing adequate and timely training to farmers. The other major production constraints identified included loss of yield due to nutrient deficiency, prevalence of old and senile palms, increased labour cost, inadequate institutional support and non-adoption of scientific farming practices. Rapid price fluctuations, lack of proper price fixing mechanisms, irregular and late payments, limited market information, high brokerage, marketing inefficiencies, increased cost for storage and transportation were some of the major marketing constraints faced by the farmers. Some of the important constraints faced by market intermediaries and processors as identified by the study were improper market information, lack of adequate quantity, high marketing cost, lower capacity utilization, high price fluctuations, lack of institutional set up *etc.*

Umamaheshwari and Vignesh (2017) conducted a study in Pollachi district to identify the constraints faced by farmers in cocoa cultivation. It was found that most of the farmers (44 per cent) lacked expert advice regarding cocoa cultivation and they depended on other farmers and friends for seeking knowledge regarding cultivation practices. Majority of the respondents (54 per cent) carried out cultivation in farms ranging from six to 15 acres and most of them (61 per cent) were able to reap only profits ranging from Rs 10,001 to Rs 15,000 per acre. About 61 per cent of the respondents marketed their produce through private players, which showed the predominance of private agencies in the marketing scenario. There was absence of government intervention in the marketing of cocoa which enabled the private players to take advantage. Most of the farmers were dissatisfied with the existing pricing mechanism as they received only low prices.

Akinlabi *et al.* (2019) analysed the risks associated with production and marketing of cocoa in Ondo state of Nigeria by ranking the constraints using the Kruskel Wallis test. The high incidence of pest and disease was identified as the most important production constraint followed by high cost of agrochemicals ang high cost of maintenance. The other major constraints associated with the production included high production cost, low productivity and lack of technical knowledge. Among the constraints associated with marketing, inflating pricing system was identified as the most significant followed by high marketing costs, low price and lack of market information.

Methodology

3. METHODOLOGY

In this chapter, an attempt has been made to discuss the methodologies and the important research tools used for the study. Also, details regarding the sampling procedure, methods used for selection of the study area and samples, as well as the important sources of data are listed out.

3.1. AREA OF THE STUDY

Idukki and Ernakulam districts which accounted for 90 per cent and 10 per cent respectively of the gross cultivated area under cocoa in Kerala (GOK, 2019), were purposively chosen for the study. The study was carried out to analyse the production and marketing aspects of cocoa cultivation in Kerala, with special reference to Idukki and Ernakulam districts.

3.1.1. Idukki District

Idukki district came into existence on 26th January 1972. The name 'Idukki' is believed to have its origin from the word 'Idukku', which denotes gorge. The district plays an important role in spice trade due to prevalence of the favourable climatic factors for the cultivation of commercial spice crops like black pepper and small cardamom. Hence, the district is known as the 'Spice Garden of Kerala'. Idukki, the second largest district in Kerala in terms of the geographical area, lies within the Western Ghats and hence, is enriched with dense forests and mountains. The villages are sparsely populated while the urban areas are densely populated. Black pepper, small cardamom, cocoa, tapioca and banana are some of the important crops cultivated in Idukki.

3.1.1.1. Location and land utilisation pattern

Idukki district is in the central part of Kerala and it lies within 9° 15′ N and 10° 2′ N latitudes and 76° 37`E and 77° 25` E longitudes, covering an area of 4356 sq kms. The district shares its boundaries with Kottayam and Ernakulam districts on its west, Madurai and Ramanathapuram on its east, Thrissur and Coimbatore districts on its north and in the south the district is bounded by Kottayam and Pathanamthitta districts.

According to the Directorate of Economics and Statistics, Kerala (GOK, 2019), the total cropped area in Idukki accounted for 60.93 per cent (265876 ha) of the total

geographical area during 2018 -19. The net sown area and area sown more than once in Idukki district accounted for 47.04 per cent and 13.88 per cent of the geographical area respectively. While 45.47 per cent of the total geographical area of the district was occupied by forests, the share of area which was allocated for non-agricultural uses was found to be 3.32 per cent.

Table 3.1. Land utilization pattern in Idukki district in 2018-19

Particulars	Area in hectares	Share in total geographical area (in per cent)
Total geographical area	436328	100
Forest	198413	45.47
Land put to non-agricultural use	14494.47	3.32
Barren and uncultivable land	1364	0.31
Permanent pastures and other	0	0.00
Land under miscellaneous tree crop	154.72	0.04
Cultivable waste land	1921.34	0.44
Fallow other than current fallow	1150.99	0.26
Current fallow	1788.18	0.41
Marshy land	0	0
Still water	10560	2.42
Water-logged area	0	0.00
Social forestry	1190	0.27
Net area sown	205291.27	47.05
Area sown more than once	60584.98	13.89
Total cropped area	265876.25	60.93

Source: Agricultural Statistics 2018-19, Directorate of Economics and Statistics, Government of Kerala

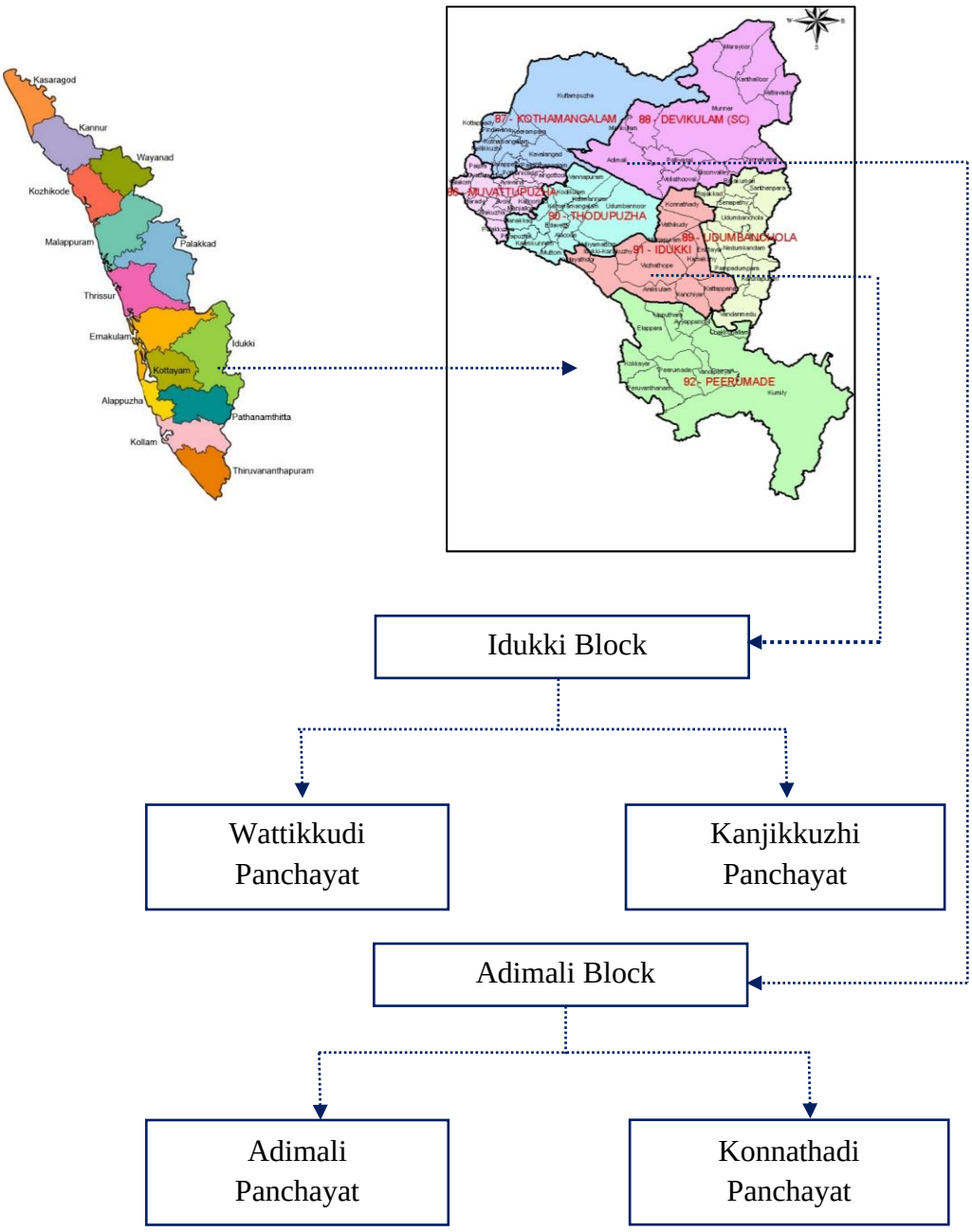

Figure 2- Map of the study area- Idukki District

3.1.1.2. Topography and climate

Idukki district lies in the Western Ghats and 90 per cent of the area lies within the high ranges occupied with mountains, hills and deep valleys. It is located at an altitude of 3900 feet above the mean sea level.

Idukki district has a different climate due to its peculiar location. The highland has a cold climate and prevalence of mist is common, whereas the western part of the district experiences moderate climate. The district receives South-West monsoon during the months from June to September and North-East monsoon during the months of October and November. Eastern and north eastern regions of the district receive the lowest amount of rainfall.

3.1.1.3. Demography

The total population of Idukki district as per the 2011 census was 11,07,453. The population exhibited a negative growth rate of -1.93 per cent during the period from 2001-02 to 2011-12. The district was identified with the lowest sex ratio of 1006 females per 1000 males in Kerala. Though, the overall literacy level in the district has witnessed an increase over the years, Idukki had the lowest literacy rate of 92.20 per cent as compared to other districts. The urban literacy rate (95.74 per cent) was found to be higher when compared to the rural literacy rate (92.03 per cent). Of the total number of workers (5,16, 363), the number of main workers and marginal workers were found to be 4,15,947 and 1,00,416 respectively. The number of female workers (1,28,381) was found to be less as compared to that of the male workers (2,87,566).

3.1.1.4. Description of selected panchayats

The two blocks in Idukki district having maximum area under cocoa cultivation were identified as Idukki and Adimali blocks. Hence, these blocks were purposively selected for the study. From each of the identified block, two panchayats having maximum area under cocoa cultivation were identified. From Idukki block, Wattikkudi and Kanjikkuzhi panchayats were selected and, Adimali and Konnathadi panchayats were chosen from Adimali block.

The area under wetland, dryland, forest and others (plantations) in each of the selected panchayats are given in Table 3.2. It could be observed from the table that the proportion of area under wetland was relatively less in all the panchayats. In Wattikkudi and Konnathadi panchayats, majority of the area was classified as dryland (nearly 99

per cent). In the case of Kanjikkuzhi and Adimali panchayats, the proportion of the area under forest cover alone accounted for 74 and 78 per cent of the geographical area respectively, while that under dryland was 25 per cent and 19 per cent respectively.

Table 3.2. Panchayat-wise area according to type of land in Idukki district

Block	Panchayat	Area (in cents)				
		Wetland	Dryland	Forest	Others (Plantations)	Total
Idukki Block	Wattikkudi	8906 (0.5)	1619262 (99.5)	-	-	1628168 (100)
	Kanjikkuzhi	2895 (0.12)	604507 (25.71)	1743973 (74.17)	-	2351375 (100)
Adimali Block	Adimali	102203 (2.16)	911045 (19.29)	3700995 (78.36)	8873 (0.19)	4723116 (100)
	Konnathadi	4248 (0.16)	2722228 (99.84)	-	-	2726476 (100)

Source: Panchayath level statistics, 2011, Idukki, Government of Kerala

Note: Figures in parentheses indicate per cent to row total

Table 3.3. Cropping pattern in selected blocks of Idukki district in 2018-19

Crop	Area (in hectare)	
	Adimali	**Idukki**
Rice	57.2 (0.26)	48.03 (0.26)
Arecanut	262.65 (1.19)	218.76 (1.18)
Black Pepper	7253.66 (32.74)	5944.16 (32.01)
Coconut	2329.5 (10.51)	2846.31 (15.33)
Cashew	181.08 (0.82)	260.93 (1.41)
Papaya	123.71 (0.56)	105.37 (0.57)
Nutmeg	1567.94 (7.08)	707.65 (3.81)
Banana and plantain	1125.05 (5.08)	1270.06 (6.84)
Tapioca	761.84 (3.44)	837.36 (4.51)
Jack	2680.06 (12.10)	1360.83 (7.33)
Mango	636.26 (2.87)	503.83 (2.71)
Turmeric	49.77 (0.22)	21.37 (0.10)
Ginger	101.19 (0.46)	82.17 (0.44)
Tamarind	72.24 (0.33)	55.18 (0.30)
Clove	69.17 (0.31)	168.18 (0.91)
Cocoa	3769.51 (17.01)	3003.51 (16.19)
Vegetables	255.66 (1.15)	589.29 (3.17)
Tubers	263.12 (1.19)	99.04 (0.53)
Others	594.97 (2.68)	444.83 (2.40)
Gross cropped area	22154.58 (100)	18566.87 (100)

Source: Agricultural Statistics 2018-19, Directorate of Economics and Statistics, Government of Kerala

Note: Figures in parentheses indicate per cent to column total

The details of the cropping pattern in Adimali and Idukki blocks are presented in Table 3.3. It could be observed from the table that black pepper occupied 32.74 per cent and 32.01 per cent of the gross cropped area in Adimali and Idukki blocks respectively, which accounted for the highest area occupied by any crop in 2018-19. Cocoa was the second largest cultivated crop, which occupied 17.01 and 16.17 per cent of the gross cropped area in Adimali and Idukki blocks respectively. Rice was the least cultivated crop in terms of the share in gross cropped area of the district.

3.1.2. Ernakulam District

Ernakulam is a district located in the central part of Kerala. It came into existence on 1st April 1958 and has an important role in the growth of trade and commerce in Kerala. ''Ernakulam' is believed to have originated from the words "Ere Naal Kulam", which means pond for a long time. It is also known as 'Queen of Arabian Sea' and 'Commercial capital of Kerala'. The district has an area of 3068 sq. km., with a population density of 1072 persons per sq. km. It is one of the important metropolitan cities in Kerala and is the third most populous district in Kerala. Nutmeg, pineapple, banana and tapioca are some of the important crops cultivated in the district.

3.1.2.1. Location and land utilisation pattern

Ernakulam district is located between 9° 42′ and 10° 46′ N latitudes and 76° 12′ and 76° 36′ E longitudes . It is bordered by Arabian sea in the west, Thrissur district in the north, Idukki district in the east and is bounded by Alappuzha and Kottayam districts in the south.

According to GOK in 2018-19, the district had 162093.416 ha of gross cropped area, which was 53 per cent of the total geographical area in 2018-19. The net sown area and area sown more than once in the district were 146766.16 ha and 15327.26 ha respectively, which accounted for about 47.6 per cent and 5.01 per cent of the total geographical area respectively. About 23.69 per cent of total geographical area was occupied by forest cover, while 15.21 per cent was used for non-agricultural purposes.

Table 3.4. Land utilization pattern of Ernakulam district in 2018-19

Particulars	Area in hectares	Share in total geographical area (in per cent)
Total geographical area	305826	100
Forest	70617	23.09
Land put to non-agricultural use	46530.62	15.21
Barren and uncultivable land	294.7	0.10
Permanent pastures and others	0	0
Land under miscellaneous tree crop	118.74	0.04
Cultivable waste land	15730.86	5.14
Fallow other than current fallow	6827.92	2.23
Current fallow	7373.02	2.41
Marshy land	0	0
Still water	11171	3.65
Water-logged area	290	0.09
Social forestry	106	0.03
Net area sown	146766.16	47.99
Area sown more than once	15327.26	5.01
Total cropped area	162093.42	53.00

Source: Agricultural Statistics 2018-19, Directorate of Economics and Statistics, Government of Kerala

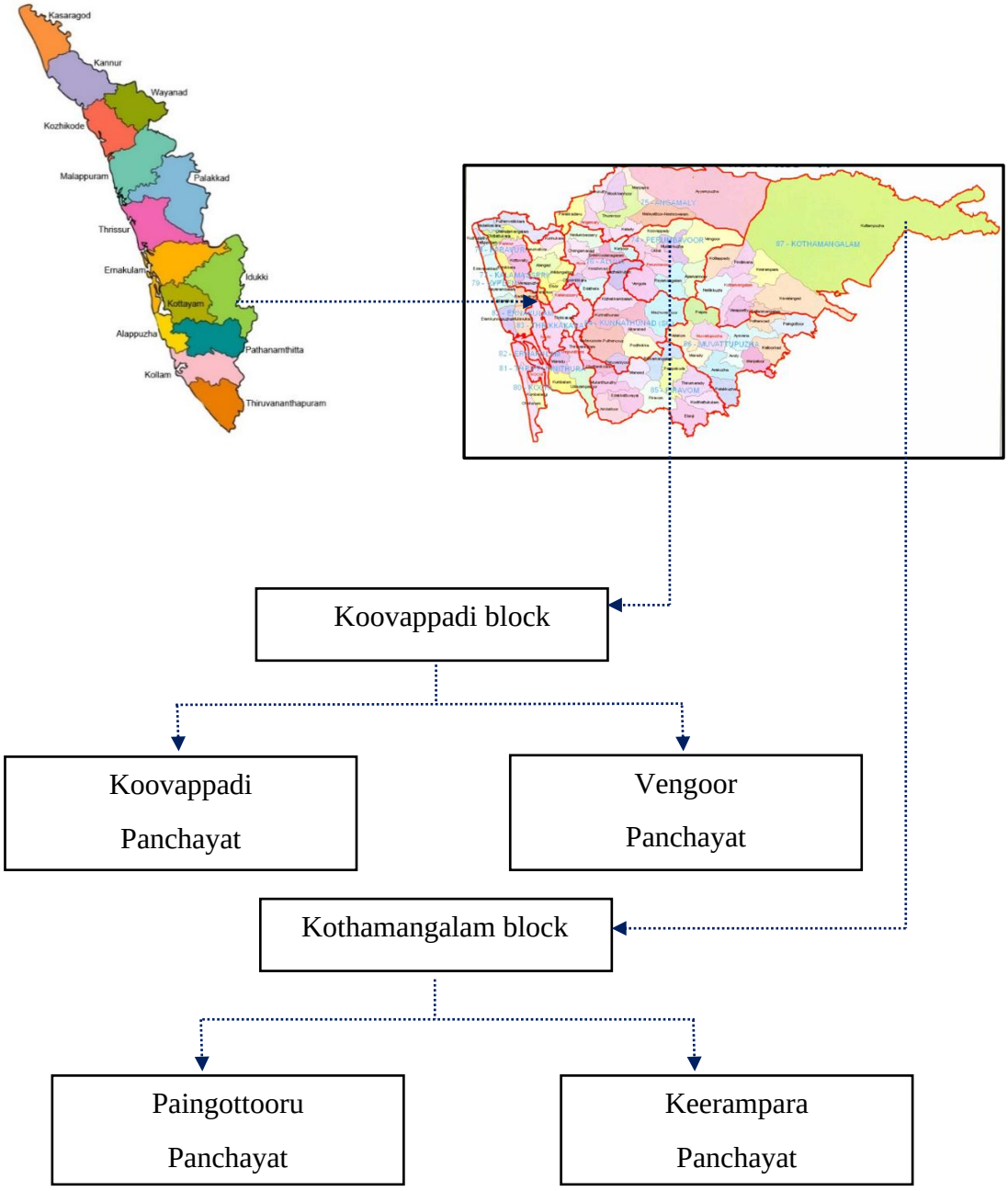

Figure 3- Map of the study area- Ernakulam District

3.1.2.2. Topography and climate

Ernakulam is located 7m above the Mean Sea Level (MSL). Depending on the physiography, the land area in the district is classified as lowland, midland and highland. The western part of the district includes part of Western Ghats, Kothamangalam, Muvattupuzha and Aluva, which are hilly in terrain and has elevation of more than 300m above Mean Sea Level (MSL). The midland region is mostly plain land with adequate drainage facility, while the lowland occupies only 20 per cent of the total land area.

Tropical climate with an average annual temperature of 26.5℃ is prevalent in the district. The average annual rainfall is nearly 2882 mm, while the average temperature varies between 25.4℃ during August and 28.2℃ in March. The maximum temperature of 31.5℃ is noticed during March and the minimum temperature of 23.2 ℃ is observed during January. The district receives peak rainfall of 568 mm during June. The maximum humidity of 89 per cent is prevalent from June to August.

3.1.2.3. Demographic features

The total population of Ernakulam as per the census of 2011 was 32,82,388. A growth rate of 5.6 per cent was recorded for the period from 2001-02 to 2011-12. The literacy rate in the district witnessed an improvement from 93.20 per cent in 2001 to 95.68 per cent in 2011. The sex ratio in the district was found to be 1028 females per 1000 males. Out of the 12,49,343 workers, 10,61,388 were found to be main workers and 1,87,955 were marginal workers. Out of the total workers, 8,31,346 were from the urban area, whereas 4,17,997 workers were from rural areas .

3.1.2.4. Description of selected panchayats

Two blocks in Ernakulam district having maximum area under cocoa cultivation were identified as Kothamangalam and Koovappadi blocks. Hence, these blocks were selected for the study. From each of the identified block, two panchayats having maximum area under cocoa cultivation were selected. From Koovappadi block, Vengoor and Koovappadi panchayats were selected and, Paingottoor and Keerampara panchayats were chosen from Kothamangalam block.

The details of the distribution of land under wetland, dryland, forest and others (plantation) in each panchayat are depicted in Table 3.5. It could be observed from the table that the proportion of area under wetland was relatively less in all the panchayats.

In Paingottoor and Keerampara panchayats, majority of the area was under dryland and it accounted for 81.59 per cent and 84.64 per cent of the total area respectively. In the case of Vengoor panchayat, forest accounted for the highest share of 78.38 per cent, whereas in Koovappadi panchayat most of the area (72.57 per cent) was under dryland.

Table 3.5. Panchayat-wise area according to type of land in Ernakulam district

Block	Panchayat	Area (in cents)				
		Wetland	Dryland	Forest	Others (Plantations)	Total
Kothamangalam Block	Paingottoor	109703 (18.41)	486181 (81.59)	-	-	595884 (100)
	Keerampara	113959 (15.36)	627576 (84.64)	-	-	741535 (100)
Koovappadi Block	Vengoor	16282 (3.54)	83163 (18.08)	360434 (78.38)	-	459879 (100)
	Koovappadi	202543 (27.43)	535696 (72.57)	-	-	738239 (100)

Source: Panchayath level statistics, 2011, Ernakulam

Note: Figures in parentheses indicate per cent to row total

Table 3.6. Cropping pattern in selected blocks of Ernakulam district in 2018-19

Crop	Area (in hectare)	
	Kothamangalam	**Koovappadi**
Rice	436.51 (4.60)	561.34 (6.48)
Arecanut	423.72 (4.46)	290.88 (3.36)
Black Pepper	246.89 (2.60)	117.01 (1.35)
Coconut	3655.41 (38.52)	2639.26 (30.45)
Cashew	29.87 (0.31)	29.98 (0.35)
Papaya	74.62 (0.79)	60.28 (0.70)
Nutmeg	448.62 (4.73)	995.15 (11.48)
Banana and plantain	834.1 (8.79)	1471.97 (16.98)
Tapioca	738.21 (7.78)	664.84 (7.67)
Jack	402.03 (4.24)	269.61 (3.11)
Mango	276 (2.91)	232.46 (2.68)
Turmeric	64.18 (0.68)	21.7 (0.25)
Ginger	13.67 (0.14)	11.23 (0.13)
Tamarind	37.75 (0.40)	39.54 (0.46)
Clove	0 (0)	0.11 (0)
Cocoa	480.47 (5.06)	183.52 (2.12)
Vegetables	216.97 (2.29)	123.2 (1.42)
Tubers	798.76 (8.42)	696.09 (8.03)
Others	312.33 (3.28)	258.91 (2.98)
Gross cropped area	9490.11 (100)	8667.08 (100)

Source: Agricultural statistics 2018-19, Directorate of Economics and Statistics, Kerala

Note: Figures in parentheses indicate per cent to column total

The cropping pattern in Kothamangalam and Koovappadi blocks during 2018-19 are presented in Table 3.6. It could be observed from the table that in both of these blocks, coconut was the most widely cultivated crop, which occupied 38.52 per cent and 31.07 per cent of gross cropped area in Kothamangalam and Koovappadi blocks respectively. The area under cocoa cultivation occupied 5.06 per cent and 2.11 per cent of the gross cropped area in Kothamangalam and Koovappadi blocks respectively.

3.2. SAMPLING DESIGN

Primary and secondary data were used for the study. Idukki and Ernakulam districts were purposively selected for the study as these districts accounted for about 90 per cent and 10 per cent respectively of the area under cocoa in Kerala during 2018-19. From Idukki district, 108 samples were randomly selected and 12 samples were randomly selected from Ernakulam district based on proportionate sampling, thus making the total sample size of 120. From each of the district, two blocks having maximum area under cocoa namely, Adimali and Idukki blocks in Idukki district and Koovappadi and Kothamangalam blocks in Ernakulam district were purposively selected for the study. From Adimali block and Idukki block, 54 farmers each were randomly chosen, while from Kothamangalam and Koovappadi blocks, nine and three farmers respectively were randomly chosen based on proportionate sampling. From each of the selected block, two panchayats having maximum number of cocoa farmers were purposively selected. Farmers were randomly selected from the list of cocoa farmers obtained from the Krishi Bhavans. From each of the selected panchayat, equal number of farmers were randomly selected. Data was also collected from 20 village traders, five wholesalers and three processors. The price behaviour of cocoa was analysed using time series data on monthly prices of wet beans.

3.2.1. Collection of data

The primary data was collected from the sample respondents using pre-tested and structured interview schedules. The details regarding the socio-economic profile of farmers, crop and non-crop activities, cost of cultivation, sources of credit and constraints in production and marketing were gathered from the sample farmers and analysed using appropriate tools of analyses. Also, village traders, wholesalers and processors were interviewed for collecting the details regarding various marketing intermediaries involved in cocoa trade, procurement and sale of cocoa, labour involved in processing, facilities for storage *etc*. For the study, secondary data was collected from

Pink Data sheet of World Bank; Ministry of Agriculture and Farmers Welfare, Government of India; Statistics for Planning, Government of Kerala; Price statistics, Department of Economics and Statistics, Government of Kerala and The Cashew and Cocoa journal, Directorate of Cashewnut and Cocoa Development.

3.3. ANALYSIS OF DATA

The primary and secondary data were analysed using several analytical tools explained below:

3.3.1. Primary Data

The primary data in the form of responses obtained from interviewing cocoa farmers, village traders, wholesalers and processors in the study area were collected, tabulated, analysed and interpreted after appropriate analysis, including averages and percentages.

3.3.2. Trend and growth rate analysis

The trend for any variable under study can be understood by studying the growth rate. The Compound Annual Growth Rates (CAGRs) of area, production and productivity of cocoa were estimated using exponential growth function as,

$$Y_t = ab^t$$

Where $Y_t = \text{area, production or productivity of cocoa}$

a = intercept

b = regression coefficient

t = number of years

Taking logarithms on both sides

$$\ln Y_t = \ln a + t \ln b_t$$

$$Y_t' = A + Bt$$

Here,

$$Y_t' = lnY_t$$

$$A = \ln a$$

$$B = \ln b_t$$

The regression coefficient was calculated by using the method of Ordinary Least Squares (OLS) and CAGR was worked out using the formula,

CAGR= (antilog B-1) X 100

3.3.3. Trend break analysis

The trend breaks in the data were identified using the methodology for structural break analysis suggested by Bai and Perron (1998). Consider the multiple linear regression with m breaks (m+1 regimes), with h as the minimum length assigned to a segment

$$y_t = x_i\beta + z_i\delta_j + u_t$$

y_t = dependent variable

x_i (p x 1) and z_i (q x1) = vectors of covariates

β and δ_j = vectors of coefficients

u_t = disturbance term

The break points are treated as unknowns and the purpose is to estimate the unknown regression coefficients together with the breakpoints when T observations on y_t, x_t, z_t are available. This is a partial structural change model since the parameter vector β is not subjected to shift and is estimated using the entire sample. When p= 0, a pure structural change model in which all the coefficients are subjected to change is obtained. The variance of u_t need not be constant. Therefore, breaks in variance are permitted provided they occur at the same dates as the trend breaks in the parameters of regression.

The multiple linear regression may be expressed in matrix form as,

Y= XB+$\bar{Z}\delta$ + U

Where:

Y= $(y_1 \ldots . y_{r)`}$

X= $(x_1 \ldots . x_{r)`}$

$\bar{Z}$ = the matrix which diagonally partitions Z at $(T_1 \ldots . T_{m)`}$, i.e. $\bar{Z}$ = diag $(Z_1 \ldots Z_{m+1})$ with $Z_i = (zr_{i-1} + 1 \ldots . zr_i)`$

True value of a parameter is denoted with a 0 superscript. In particular, $\delta^0 = \left(\delta_1^{0`}, \ldots \delta_{m+1}^{0`}\right)` and\ (T_1^0, \ldots . , T_m^0)$ are used to denote, respectively, the true values of the

parameters δ and the true break points. The matrix $\overline{Z_0}$ is the one which diagonally partitions Z at $(T_1^0, \ldots., T_m^0)$. Hence, the data-generating process is assumed to be

Y= $X\beta^0 + \overline{Z^0}\delta^0 + U$

The method of estimation considered is thus based on the least square principle. For each m-partition $(T_1 \ldots . . T_{m)}$ denoted $\{T_j\}$. Substituting these in the objective function and denoting the resulting sum of squared residuals at $S_T(T_1, \ldots T_m)$, the estimated break points $(\widehat{T_1}, \ldots \widehat{T_m})$ are such that $(\widehat{T_1}, \ldots \widehat{T_m}) = argmin_{T_1, \ldots . T_m} S_T(T_{1, \ldots .} T_m)$ where minimisation is taken over all partitions $(T_1, \ldots T_m)$ such that $T_i - T_{i-1} > q^2$. Thus, the break-point estimators are global minimizers of the objective function. The regression parameter estimates are the estimates associated with the m-partition $\{\widehat{T_j}\}$ i.e. $\hat{\beta} = \hat{\beta}(\{\widehat{T_j}\}), \hat{\delta} = \hat{\delta}\left(\{T_j\}\right)$. Since, the break points are discrete parameters and can only take finite number of values, they can be estimated by a grid search. This method becomes rapidly computationally excessive when m>2. Instead of a dynamic programming algorithm that allows computation of estimates of the break points as global, minimizers of the sum of squared residuals can be devised to efficiently estimate the optimal breakpoints for the series starting from one to maximum allowed by T and h.

The Strucchange package of R-studio was used to obtain the breakpoints on log-transformed values of area, production and productivity of cocoa in India and Kerala. Sample of 28 observations of cropped area from 1993 to 2018 was used for the analysis. The h value was not predetermined and the program was set to obtain the maximum possible breakpoints among the various combinations of break points. The optimal breakpoints were chosen based on a two-step validity test on the Residual Sum of Squares (RSS) and the Bayesian Information Criteria (BIC). The lowest value of RSS was considered optimal on the first step. In case the optimal breakpoints found in step one coincided with the lowest BIC, this was taken as optimal breakpoint. Therefore, the lowest BIC held precedence on validity.

3.3.4. Price behaviour analysis

Price behaviour of cocoa was studied using the technique of classical time series (Croxton *et al.*,1979; Spiegel, 1992).The time series analysis was used for studying the price behaviour of cocoa and a multiplicative model was used for analysis. The monthly

prices of wet cocoa beans in Kerala and international market were decomposed into four time series components *viz*., trend, seasonal, cyclical and irregular variations.

Multiplicative model is indicated as,

$$Y(t) = T \times S \times C \times I$$

Y(t): Value of a variable at time t

T: Secular trend

S: Seasonal variation

C: Cyclical variation

I: Irregular variation

3.3.4.1. Estimation of trend value

The general tendency of a time series data to increase or decrease over a long period of time is referred to as trend. The R squared values of different trend models including linear trend model, quadratic model, cubic model, exponential model and polynomial model obtained by the method of Ordinary Least Square (OLS) were compared and the trend line with the highest R squared value was considered as the best fit.

Linear trend:

$$Y_t = a + b_t$$

Quadratic trend:

$$Y_t = a + b_t + c_t^2$$

Cubic trend:

$$Y_t = a + b_t + c_t^2 + d_t^3$$

Exponential trend:

$$Y_t = ab^t$$

Polynomial trend: $Y_t = a + b_t + b_t^2 + b_t^3 + b_t^4 + \cdots b_t^k$

3.3.4.2. Estimation of seasonal variation

The seasonal variations in a time series are due to rhythmic forces which operate in a regular and periodic manner over a period of 12 months and have the same pattern every year. In order to obtain a statistical measure of the pattern of seasonal variation

in time series, seasonal indices were estimated by employing 12 point centred moving average method after removing the effect of trend, cyclical and irregular variations.

3.3.4.3. Estimation of cyclical variation

The oscillatory movements in a time series with a period of oscillation greater than a year is referred to as cyclical variation. These are regular ups and downs with duration of more than one year. Cyclical variations in prices of cocoa in international markets as well as major markets of Kerala was studied using multiplicative model of time series. The estimation of cyclical variations were done in three steps.

1. Removal of trend components
2. Removal of seasonal effect
3. Removal of irregular components

1. Removal of trend component

The trend component was calculated by the method of OLS. The original price data was divided by the trend for removal of trend component from the data.

$$Y_t = T_t * S_t * C_t * I_t$$

$$\frac{Y_t}{T_t} = \frac{T_t * S_t * C_t * I_t}{T_t} = S_t * C_t * I_t$$

2. Removal of seasonal component (De-seasonalisation)

The seasonal indices calculated by the method of moving average is used to divide the de- trended data so that the cyclical and irregular components are remaining.

$$\frac{S_t * C_t * I_t}{S_t} = C_t * I_t$$

3. Removal of irregular component

The irregular components are closely entangled with the cyclical component and data has to be smoothened using short period moving average to obtain cyclical component accurately.

3.3.4.4 Estimation of irregular variation

The irregular variations are the purely random variations which occur as a result of unforeseen and unpredictable forces which operate in an irregular manner. Indices for irregular variation are obtained by dividing the cyclical-irregular indices by cyclical indices. Symbolically,

$$\frac{C_t * I_t}{C_t} = C_t$$

3.3.5. Economics of cocoa cultivation

Cocoa is a perennial plantation crop. The growth stages of cocoa are divided into four main stages: pre-bearing phase (1 to 2 years), early bearing phase (2 to 5 years), yield stabilising phase (5 to 20 years) and yield declining phase (20^{th} year onwards). Hence, the economic lifespan of cocoa is regarded as 20 years.

All costs involved in the cultivation of cocoa from planting till harvesting are categorised into two categories *viz*., establishment cost and maintenance cost. The costs incurred from the planting stage till the bearing stage are considered as the establishment cost. It includes the amount spent for land preparation, digging of pits, planting, manure and fertilizer application, irrigation charges, application of plant protection chemicals and pesticides *etc.*

The maintenance cost includes all charges from the time a farm is established till the senescent stage of farm. It includes cost incurred for inputs like manures, fertilizers, weedicides, organic manure, plant protection chemicals *etc.* and the expenses incurred for carrying out the intercultural operations including pruning, spraying of plant protection chemicals, harvesting *etc.*

The establishment and maintenance costs were worked out separately. The amortised value of the establishment cost was added to the maintenance cost to find out total cost of cultivation.

3.3.6. Resource use efficiency

The main factors determining cocoa yield were determined by estimating a Cobb Douglas production function using the OLS method. The important factors were found out by statistically testing for the significance of the coefficients in the regression equation.

The CD production function can be expressed algebraically as,

$$Y = a_0 X_1^{a1} X_2^{a2} X_3^{a3} X_4^{a4} X_5^{a5} \quad \text{.....(1)}$$

Y= Returns per hectare from cocoa cultivation

X_1= Experience in farming (years)

X_2= Age of the tree (years)

X_3= Human labour (man days/ ha)

X_4= Cost incurred on manure (₹/ha)

X_5= Cost incurred on plant protection chemicals (₹/ha)

a_0 is the constant and a_i (i= 1,2,……5) denotes elasticity coefficient of the corresponding input variable

On applying natural logarithm to equation 1 it is transformed as follows:

$$\ln Y = a_0 + a_1 \ln X_1 + a_2 \ln X_2 + a_3 \ln X_3 + a_4 \ln X_4 + a_5 \ln X_5$$

Marginal Value Product (MVP)

The Marginal Value Product (MVP) indicates the increase in gross returns or Total Value Product (TVP) from the use of an additional unit of input, while keeping the level of other inputs as constant. The estimated regression coefficients were used to compute the value of MVP using the formula:

$$MVP = b_i * \frac{Average\ yield\ of\ output\ at\ geometric\ mean\ level\ of\ input}{Geometric\ mean\ of\ i^{th}\ input} * P_i$$

b_i is the regression coefficient of i^{th} input

P_i = Price of the output

Marginal Factor Cost (MFC)

The Marginal Factor Cost (MFC) is the change in total input cost resulting from the use of an additional unit of the input. The price of a unit quantity of input was treated as the value of MFC, which is also referred to as the Marginal Input Cost (MIC). In the case of labour, the average wage rate was considered as the unit cost, whereas, for plant protection chemicals and manure, the average price per kilogram of input was considered as the value of MFC.

Resource use efficiency (r)

$$\text{Resource use efficiency (r)} = \frac{Marginal\ Value\ Product\ (MVP)}{Marginal\ Factor\ Cost\ (MFC)}$$

where r = efficiency ratio

The value of resource use efficiency is interpreted as:

If r is less than 1, the resource is excessively used or overutilized (no scope to increase the use). Hence, decreasing the quantity of input use will increase the profit level

If r is greater than 1, the resource is underutilized (there is scope to increase the use). Hence, increasing its quantity of input use will increase the profit level

If r is equal to 1, it indicates that the resource is efficiently utilized and the point of profit maximization is attained

3.3.6.1 Marketing channel

The path through which the agricultural commodity moves from the farmer to the final consumer is referred to as the marketing channel. Depending on the type and form of the commodity and the amount of produce to be transported, the length of marketing channel may vary and a number of intermediaries or middlemen may be involved in the marketing channel. Intermediaries may include village traders, wholesalers, processors and exporters. In this study, an attempt has been made to identify the major market intermediaries and the marketing channels involved in cocoa marketing. The marketing cost, marketing margin of various intermediaries, producer's share in consumer rupee and price spread were computed using the primary data. The marketing efficiencies in various channels of cocoa were also worked out.

3.3.6.2. Marketing cost

Market intermediaries charge for the functions they perform and it is known as marketing cost. It may include labour charges, transportation cost, cost of packaging, rent, advertising charges, loading and unloading charges and, interest rate.

3.3.6.3. Marketing margin

Marketing margin refers to the profit of various intermediaries involved in moving the produce from the farmer to the consumer.

3.3.6.4. Price spread

The difference between the price paid by a consumer and the price received by a farmer for an equivalent quantity of the commodity transacted is referred to as the price spread or gross marketing margin.

Price spread= Consumer's price- Producer's price

3.3.6.5. Producer's share in consumer rupee

The price received by the farmer expressed as a percentage of the retail price is called producer's share in consumer rupee.

$$P_s = \frac{P_p}{C_p} * 100$$

P_s= Producer's share in consumer rupee

P_p= Producer's price

C_p= Consumer's price

3.3.7. Marketing efficiency

The marketing efficiency is the ratio of the market output to market input. An increase in this ratio represents improvement in marketing efficiency and a decrease denotes decreased efficiency. It is calculated by using the Shepherd's formula,

$$ME = \frac{V}{I}$$

ME= Marketing efficiency

V= Consumer's price

I= Total marketing cost

3.3.8. Constraints involved in production and marketing of cocoa

The analysis of constraints was carried out using Garrett ranking technique. Initially, the major constraints faced by the farmers during production and marketing phases were identified and listed out. The respondents were then asked to rank each constraint and the ranks were converted to percentage using the formula:

Per cent position = $\frac{100(R_{ij}-0.5)}{N_{ij}}$

Where R_{ij}= Rank given for i^{th} factor by j^{th} individual

N_{ij}= Number of factors ranked by j^{th} individual

From each rank 0.5 is subtracted because rank is an interval on a scale and its midpoint best represents the interval. Then, the percentage positions were transformed into scores on a scale of 100 points by referring to the table given by Garret and Woodworth (1969). From the scores so obtained, the mean score level was derived and the constraints were ranked based on the mean score level.

Results and Discussion

4. RESULTS AND DISCUSSION

The present study entitled 'Economic analysis of production, marketing and price behaviour of cocoa in Kerala' analysed the major trends in area, production and productivity of cocoa in India and Kerala; examined the price behaviour of cocoa; estimated the economics of cocoa production; calculated the efficiency of marketing channels and identified the major constraints in production and marketing of cocoa. The salient findings of the study are summarised and listed under the following major sub-headings:

4.1. Trend in area, production and productivity of cocoa in India

4. 2. Trend in area, production and productivity of cocoa in Kerala

4.3. Price behaviour of cocoa in Indian and international markets

4.4. Socio-economic profile of sample cocoa farmers

4.5. Economics of cocoa cultivation

4.6. Resource use efficiency in cocoa production

4.7. Marketing of cocoa

4.8. Constraints in production and marketing of cocoa

4.1. Trend in area, production and productivity of cocoa in India

The trend in area of cocoa in India is depicted in Figure 4. It could be observed from the figure that the area under cocoa cultivation in India has progressively increased over the years. The area under cocoa was only 11,900 hectares in 1993-94 and it progressively increased to 98,000 hectares in 2019-20. A polynomial function of order two was fitted for finding the trend as it had the highest R squared value among all other fitted function.

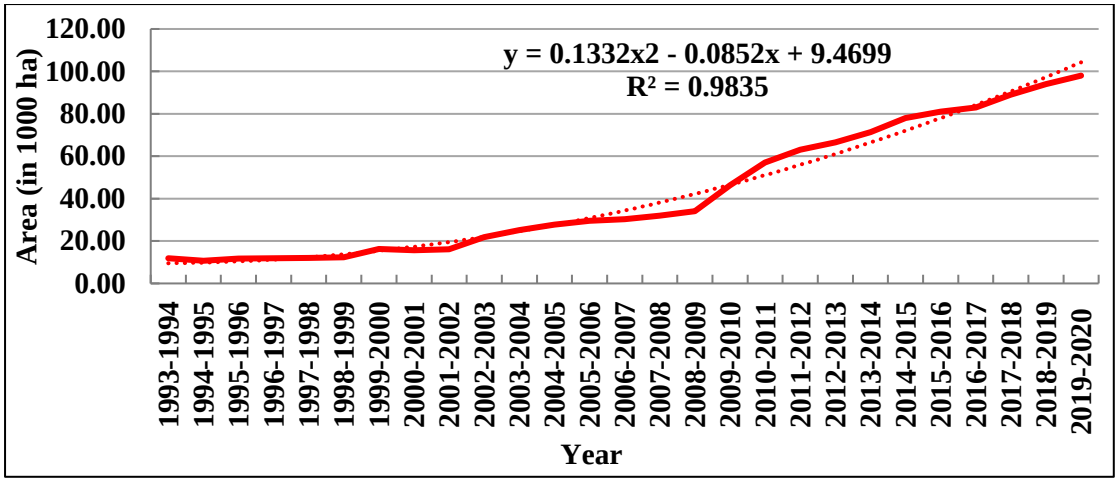

Figure 4. Trend in area of cocoa in India (1993-94 to 2019-20)

The trend breaks in the data were identified using multiple structural tests by Bai and Perron (1998). Four optimal breakpoints in trends were identified with Residual Sum of Squares (RSS) value of 0.2915 and Bayesian Information Criterian (BIC) value of -12.69. The points of trend breaks in area under cocoa in India were identified as 1998, 2002, 2008 and 2012. The first phase in the area under cocoa in India was from 1993 to 1998 and during this phase, the area increased at a CAGR of 1.6 per cent per annum. The second phase was from 1998 to 2002 and in this phase the growth in area under cocoa was 1.29 per cent. The third phase from 2002 to 2008 had a growth rate of 4.92 per cent, while the fourth phase from 2008 to 2012 registered a growth rate of 1.25 per cent per annum. The last phase which was from 2012 to 2020 showed the highest growth rate of 5.19 per cent. The initial phases, had smaller growth rates in comparison with the latter phases, which could be attributed to the implementation of government programmes for promoting the cultivation of cocoa. The development plans for cocoa implemented in 2005 under the National Horticultural Mission and the subsequent area expansion schemes implemented in Kerala, Karnataka, Tamil Nadu and Andhra Pradesh during 2005-06 could be the major factors responsible for the increase in area under cocoa in India.

Table 4.1. Estimated number of breakpoints in area under cocoa in India

Particulars	Area				
	m=1	**m=2**	**m=3**	**m=4**	**m=5**
Breakpoints	2008	2001	2001	**1998**	1997
		2009	2008	**2002**	2001
			2012	**2008**	2005
				2012	2009
					2013
RSS	3.24	0.82	0.48	**0.29**	0.28
BIC	32.55	2.36	-5.56	**-12.69**	-6.73

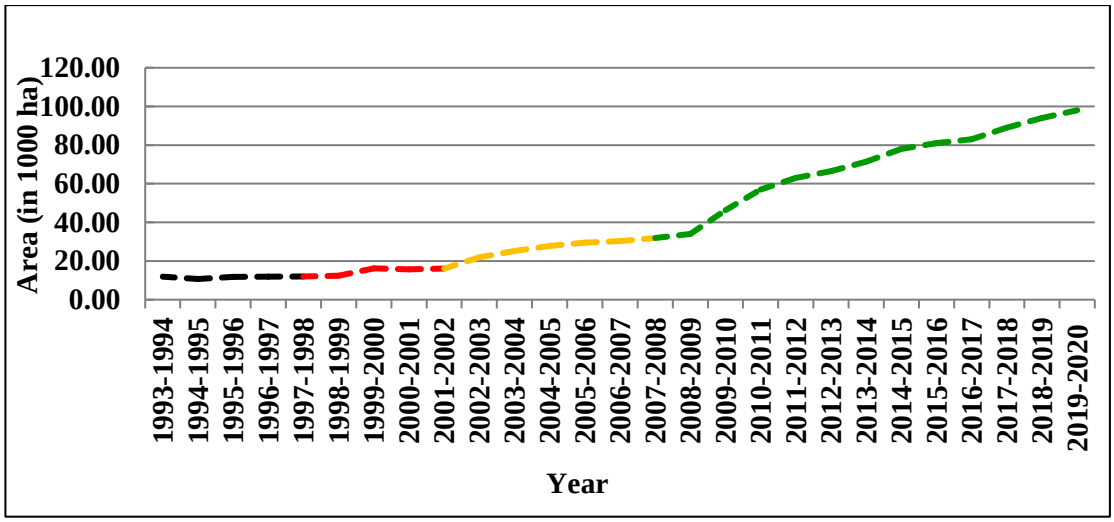

Figure 5. Trend breaks in area under cocoa in India (1993-94 to 2019-20)

Table 4.2.CAGRs in area under cocoa in India during different periods

Year	1993-98	1999-02	2003-08	2009-12	2013-19	1993-19
CAGR (per cent per annum)	1.6	1.29	4.92	1.25	5.19	10.19

The production of cocoa increased from 6,700 tonnes in 1993-94 to 26,000 tonnes in 2019-20. Polynomial function of order two gave the best fitted trendline.

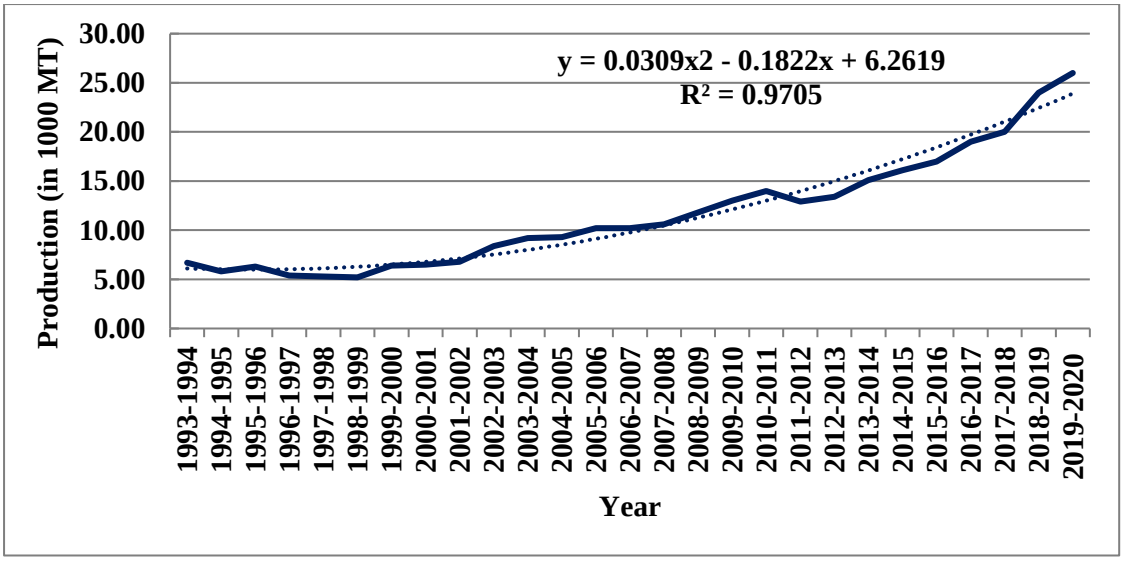

Figure 6. Trend in production of cocoa in India (1993-94 to 2019-20)

The optimum number of breaks in production were identified to be three, with an RSS value of 0.2988 and BIC value of -12.69. With a polynomial function of order two fitted for the data, the breaks in production were observed during 2001, 2007 and 2015. The first phase from 1993 to 2001 had a CAGR of 0.6 per cent per annum, while a CAGR of 4.57 per cent per annum was observed during the second phase from 2001 to 2007. The third phase from 2007 to 2015 exhibited a CAGR of 4.73 per cent per annum, which was slightly higher than the previous phase. The production drastically increased at the rate of 11.18 per cent per annum in the third phase from 2015 to 2019.

Table 4.3. Estimated number of breakpoints in production of cocoa in India

Particulars	**Production**				
	m=1	**m=2**	**m=3**	**m=4**	**m=5**
Breakpoints	2007	2001	**2001**	2001	1998
		2012	**2007**	2007	2002
			2015	2011	2007
				2015	2011
					2015
RSS	1.63	0.63	**0.29**	0.23	0.22
BIC	14.06	-4.78	**-12.69**	-18.07	-12.74

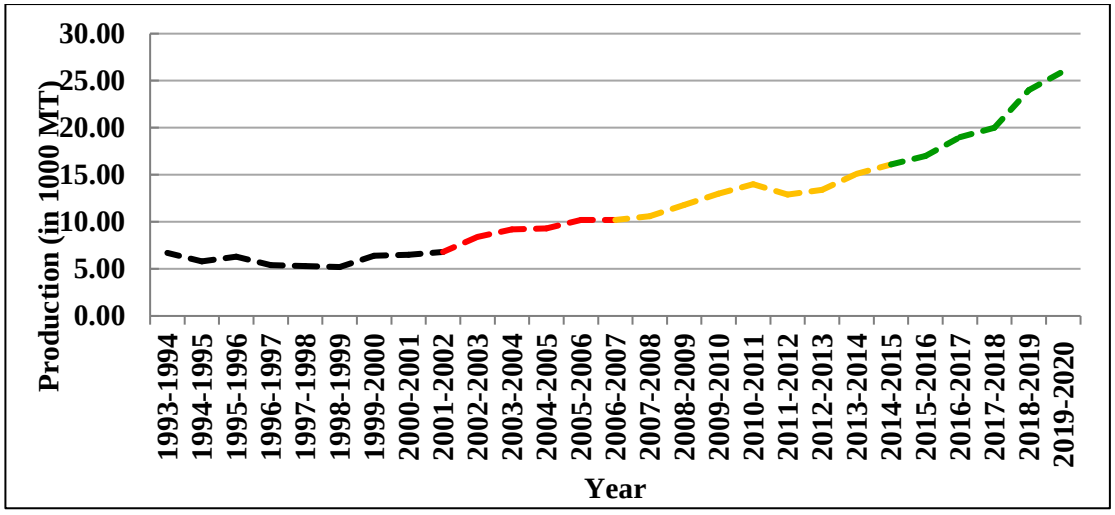

Figure 7. Trend breaks in production of cocoa in India (1993-94 to 2019-20)

Table 4.4. CAGRs in production of cocoa in India during different periods

Year	1993-01	2002-07	2008-15	2016-19	1993-19
CAGR (Per cent per annum)	0.6	4.57	4.73	1.25	6.07

The productivity of cocoa has shown a slightly declining pattern over the years, declining from 0.6 MT per ha in 1993-94 to 0.4 MT per ha in 2019-20. In recent years, many cocoa farms have been established in Andhra Pradesh, resulting in an increase in area under the crop. As these cocoa plantations were only in the initial stages of establishment and have not come to yielding, the increase in production over the years was found to be comparatively low when compared to the increase in area, which was in turn reflected as decline in productivity of cocoa in India.

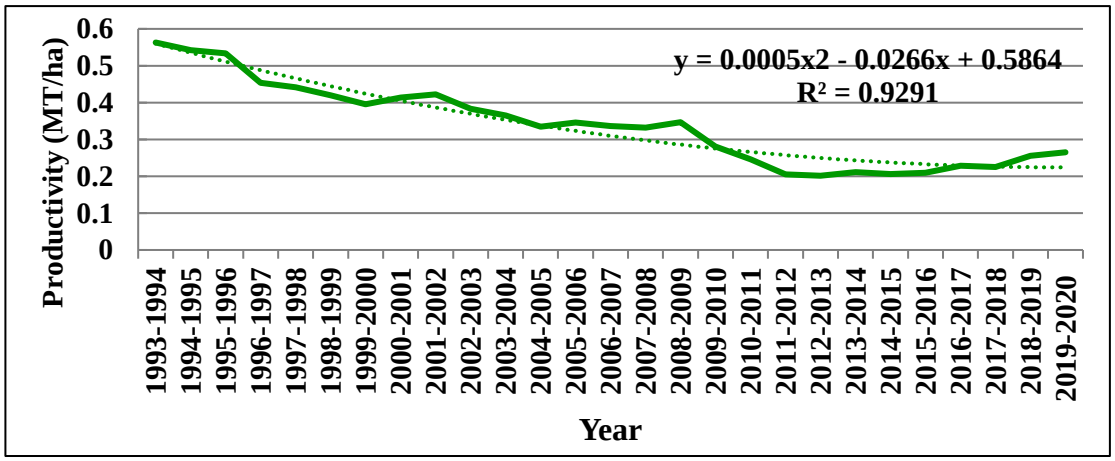

Figure 8. Trend in productivity of cocoa in India (MT/ha)

The optimal number of breaks in productivity was found to be four, for which the RSS and BIC values of 0.1267 and -35.1764 were estimated. The first phase identified for productivity of cocoa in India was from 1993 to 1996, which exhibited a decline in productivity at -6.4 per cent per annum. In the second phase from 1996 to 2002 also a decline of -1.8 per cent per annum was observed. While a CAGR of -2.65 per cent was identified in third phase from 2002 to 2009, a slight reduction in the magnitude of negative growth rate to -2.01 per cent was observed in the fourth phase from 2009 to 2015. The fifth phase from 2015 to 2019, with a CAGR of 5.8 per cent per annum was the only phase with a positive growth rate. The growth in area as well as productivity resulting in a concomitant increase in production could be attributed to the training and promotional activities undertaken under the Mission for Integrated Development of Horticulture (MIDH) in 2014 with the aim of boosting the production and productivity of cocoa in India.

Table 4.5. Estimated number of breakpoints in productivity of cocoa in India

Particulars	**Productivity**				
	m=1	**m=2**	**m=3**	**m=4**	**m=5**
Breakpoints	2008	1997	1996	**1996**	1996
		2008	2002	**2002**	2001
			2009	**2009**	2005
				2015	2009
					2015
RSS	0.59	0.27	0.16	**0.12**	0.11
BIC	-12.98	-27.53	-34.01	**-35.17**	-30.53

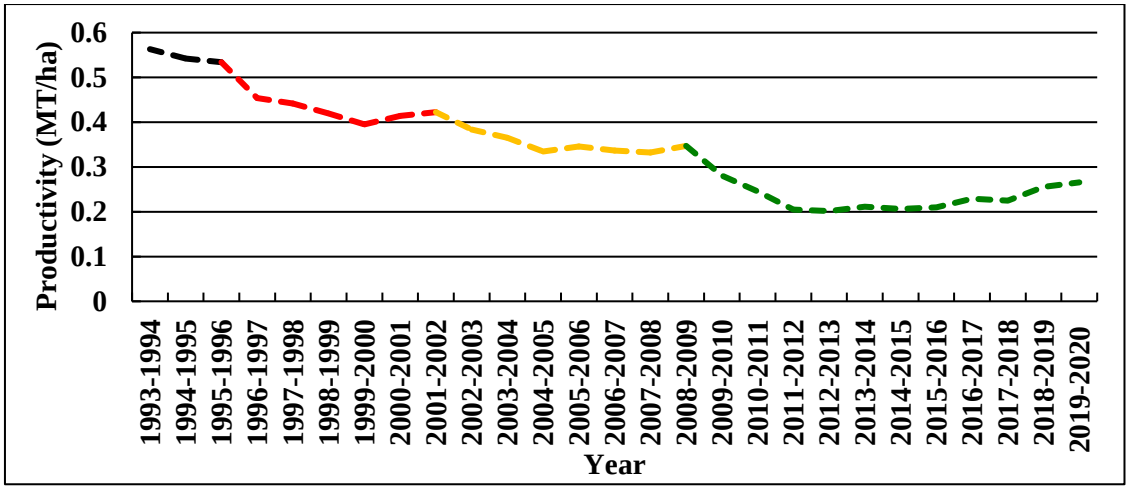

Figure 9. Trend breaks in productivity of cocoa in India (1993-94 to 2019-20)

Table 4.6. CAGRs in productivity of cocoa in India during different periods

Year	1993-96	1997-02	2003-09	2010-15	2016-19	1993-19
CAGR (Per cent per annum)	-6.4	-1.8	-2.65	-2.01	5.78	-3.73

4.2. Trend in area, production and productivity of cocoa in Kerala

The area under cocoa cultivation in Kerala increased from 10,500 ha in 1978-79 to 23,381 ha in 1981-82. Thereafter, with the fall in prices of cocoa in the international market and the resultant decline in prices in the domestic market, the area under cocoa cultivation in Kerala declined drastically till 1994 to 6,907 ha and then it gradually increased to 13,891 ha in 2018-19. A polynomial function of order two with an R squared value of 0.70 was found to be the best fitted trendline for area under cocoa in Kerala.

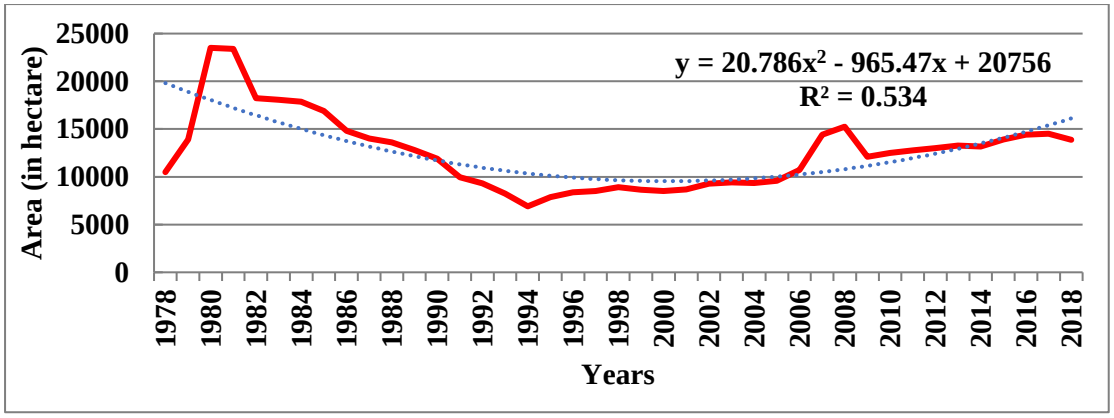

Figure 10. Trend in area under cocoa in Kerala (1978-79 to 2018-19)

The trend breaks in area under cocoa in Kerala were noticed during 1984, 1990 and 2006.The optimal trend breaks in area were identified as three, with RSS and BIC values of 0.7699 and -16.9181 respectively. The initial period from 1978 to 1984 was characterized with a CAGR of 6.87 per cent per annum, while the second phase from 1984 to 1990 had registered a negative growth of -5.11 per cent per annum. A CAGR of 2.49 per cent was noticed in the third phase from 2006 to 2018. The dynamics in the area under cocoa in Kerala could be attributed to the changes in the price of cocoa in the international market. During 1978, the price of cocoa in the international market was ₹40 per kg, whereas it decreased to ₹17 per kg in 1982. After remaining almost stagnant till 1992, the prices started to increase gradually. The price of dry bean was ₹33 per kg in January 1992, subsequently increasing to ₹70 by January 2006 and by 2018 the prices increased to ₹161 per kg. The low prices of cocoa in the international market during the period from 1980 to 2000 compelled most of the cocoa farmers in Kerala to shift to other remunerative crops. After 2000, the high prices in the international market as well as the promotional activities by the state government and Mondelez International could have motivated the farmers to again engage in cocoa cultivation.

Table 4.7. Estimated number of breakpoints in area under cocoa in Kerala

Particulars	Area				
	m=1	**m=2**	**m=3**	**m=4**	**m=5**
Breakpoints	1998	1990	**1984**	1984	1984
		2006	**1990**	1990	1990
			2006	2000	2000
				2006	2006
					2012
RSS	2.09	0.92	**0.76**	0.72	0.71
BIC	9.17	-16.73	**-16.91**	-12.04	-4.91

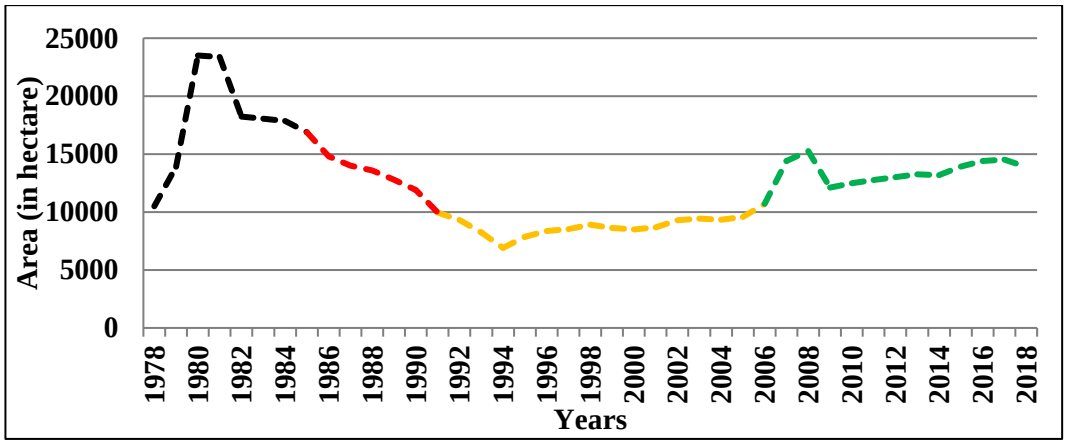

Figure 11. Trend breaks in area under cocoa in Kerala (1978-79 to 2018-19)

Table 4.8. CAGRs in area under cocoa in Kerala during different periods

Year	1978-84	1985-90	1991-06	2007-18	1978-18
CAGR (Per cent per annum)	6.87	-6.13	1.02	3.59	-0.51

The production of cocoa remained low during the period from 1978 to 2006 and from 2006, an increase in production was noticed. The production of cocoa in Kerala had a significant increase from 3.53 tonnes in 1996-97 to 13.4 tonnes in 2018-19.

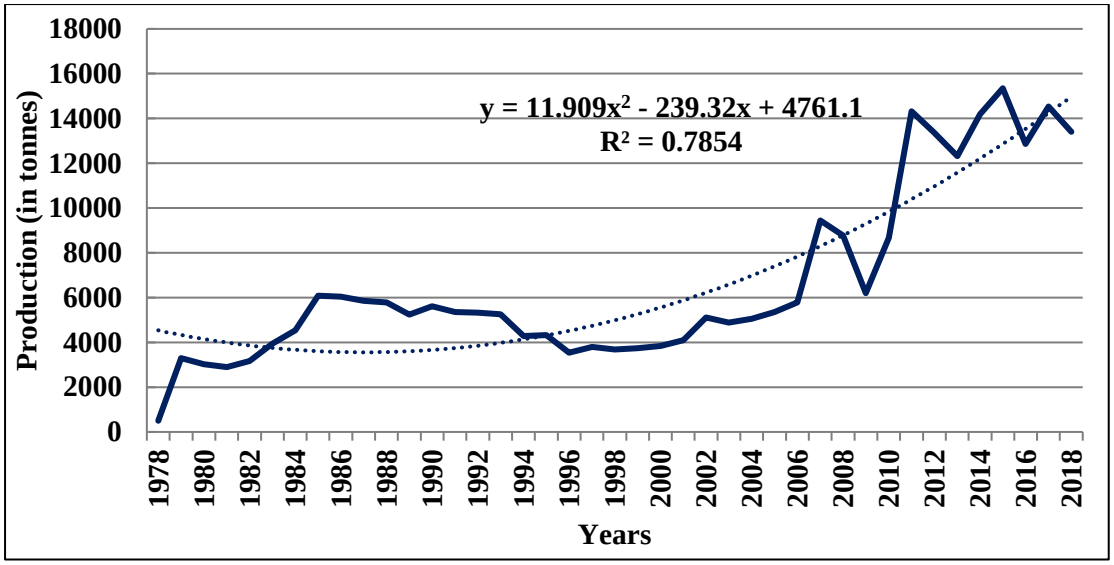

Figure 12. Trend in production of cocoa in Kerala (1978-79 to 2018-19)

In the case of cocoa production in Kerala, two optimal break points with a RSS value of 4.518 and a BIC value of -48.209 were identified in the trend. The first phase from 1978 to 1983 had a positive growth rate of 33.69 per cent per annum, while the second phase from 1983 to 2006 showed a decline in production, with a CAGR of -0.912 per cent per annum. During the third phase from 2006 to 2018, a positive growth rate of 5.84 per cent per annum was noticed in production. Till 1980s, the prices of cocoa remained high in the international market, which encouraged many farmers in Kerala to engage in cocoa cultivation, which caused the increase in area and production. The decline in prices of cocoa in the international market since 1980 and severe drought in Kerala during 1982-83, together caused considerable reduction in cocoa production in the state. Thereafter, the cocoa production started to witness considerable increase since 2006, which could be attributed to the adoption of superior hybrids released by Central Plantation Crops Research Institute (CPCRI) and Kerala Agricultural University (KAU) by the farmers of Kerala.

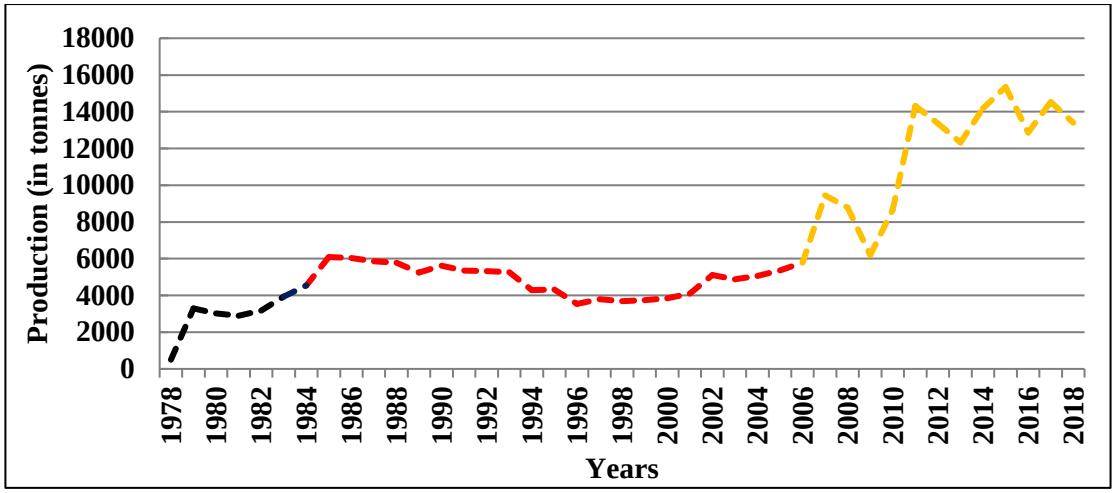

Figure 13.Trend breaks in production of cocoa in Kerala (1978-79 to 2018-19)

Table 4.9. Estimated number of breakpoints in production of cocoa in Kerala

Particulars	Production				
	m=1	**m=2**	**m=3**	**m=4**	**m=5**
Breakpoints	2006	**1983**	1983	1983	1983
		2006	2004	1993	1992
			2010	2004	1998
				2010	2004
					2010
RSS	6.90	**4.51**	3.94	3.55	3.58
BIC	58.19	**48.20**	50.07	53.23	61.01

Table 4.10. CAGRs in production of cocoa in Kerala during different periods

Year	1978-83	1984-06	2007-18	1978-18
CAGR (Per cent per annum)	33.69	-0.91	5.84	4.09

The productivity of cocoa increased from 0.047 tonnes per ha in 1978-79 to 0.97 tonnes per ha in 2018-19. An exponential function with an R squared value of 78 per cent was found to be the best fitted trendline for area under cocoa in Kerala.

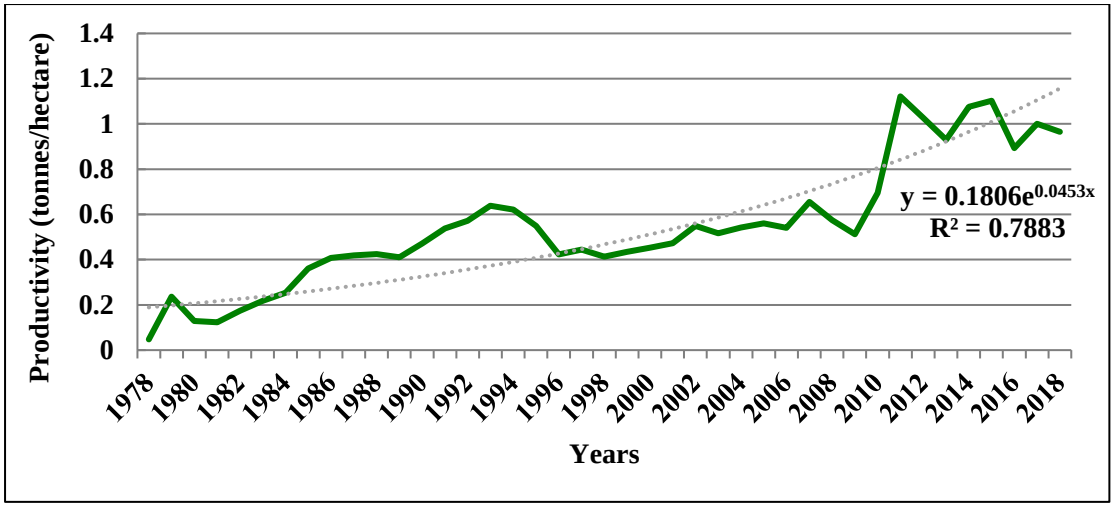

Figure 14. Trend of productivity of cocoa in Kerala (1978-79 to 2018-19)

The optimal number of break points in productivity of cocoa in Kerala was found to be two and the corresponding RSS and BIC values were 2.807 and 28.699 respectively. During the initial phase from 1978 to 1984, the productivity of cocoa in Kerala grew with a CAGR of 20.24 per cent, whereas it declined by 1.32 per cent per annum during the second phase from 1984 to 2010. A decline in productivity of-1.5 per cent was observed during the third phase from 2010 to 2018.

Table 4.11. Estimated number of breakpoints in productivity of cocoa in Kerala

Particulars	**Productivity**				
	m=1	**m=2**	**m=3**	**m=4**	**m=5**
Breakpoints	1984	**1984**	1983	1983	1983
		2010	1989	1989	1989
			2010	2003	1995
				2010	2001
					2010
RSS	5.83	**2.80**	2.37	2.28	2.10
BIC	51.27	**28.69**	29.33	35.06	39.14

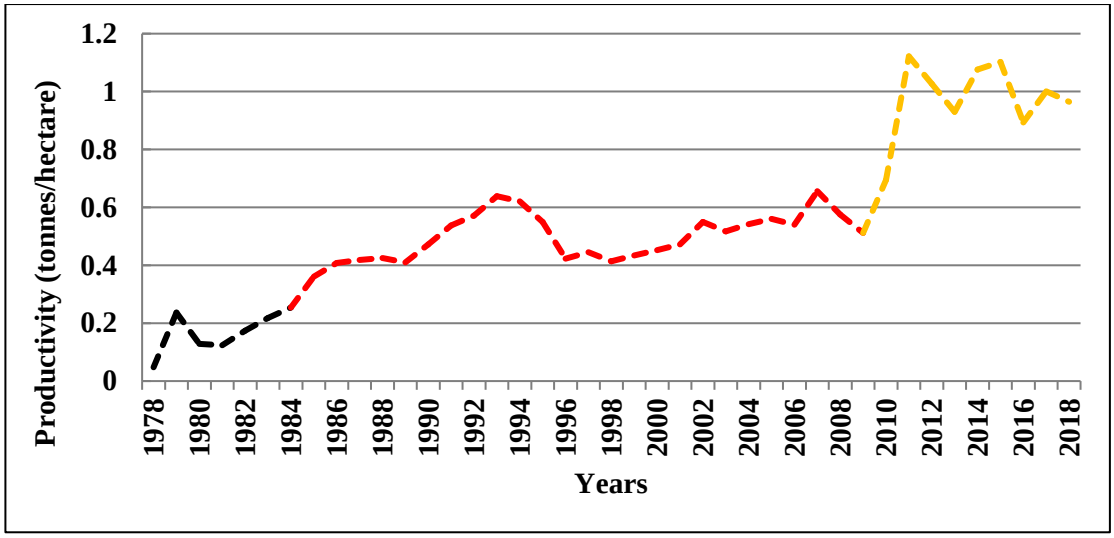

Figure 15. Trend breaks in productivity of cocoa in Kerala (1978-79 to 2018-19)

Table 4.12. CAGRs in productivity of cocoa in Kerala during different periods

Year	1978-84	1985-10	2011-18	1978-18
CAGR (Per cent per annum)	20.24	1.32	-1.5	4.63

Kerala Agricultural University (KAU)-Cadbury research project

The research in cocoa was initiated in Kerala Agricultural University in 1979 as part of the Kerala Agricultural Development project funded by the world bank. The research programme abruptly came to a halt in 1984, but was resumed in 1987 as Cadbury-KAU Cooperative research project. It is rated as one of the best research projects in cocoa around the world and is also the only project that has been funded by a Multi-National Company. The thrust areas of research in the project included crop improvement, crop management, crop protection, post-harvest handling and farm level value addition. The KAU has one of the largest collection of germplasm of cocoa in the world which consists of nearly 611 genotypes. Effective screening of germplasms, successful hybridization and breeding programmes have led to the development of 190 superior varieties, seven clones and three hybrids. The quality hybrid pods maintained under polyclonal and biclonal seed gardens are currently being distributed to farmers. The research activities undertaken by KAU have significantly helped to improve the production and productivity of cocoa in India.

4.3. Price behaviour of cocoa in Indian and international markets

4.3.1. Price behaviour of wet cocoa beans in international market

The variations in prices prevailing in the international market influence the prices prevailing in the domestic market and hence has a direct influence on cocoa cultivation in Kerala. Hence, the price behaviour of cocoa was studied by using time series data on international prices of cocoa. The international price data of cocoa dry beans sourced from Pink Data Sheet of World Bank (World Bank, 2021) was used for analysing the price behaviour. The trend, seasonal, cyclical and irregular variations were analysed and the results are represented graphically from Figure 16 to Figure 19.

4.3.1.a. Trend analysis of international prices

The trend analysis was carried out for the international prices of cocoa by using the method of moving averages. A gradual increase in price level of cocoa was observed during the period from 1980-81 to 2018-19. The prices remained comparatively low during the period from 1980 to 1992 and it exhibited a gradually increasing trend from 1992 to 1998. The prices of cocoa witnessed considerable increase since 2002, although a slight fall in the prices were observed during the years from 2003 to 2008, 2010 to 2013 and 2016 to 2018. The international cocoa price has risen from ₹23.75 per kg in January 1980 to ₹160.94 per kg in July 2018-19. The fall and rise in world cocoa prices could be attributed due to the surplus and deficit conditions in world cocoa production respectively, as compared to the demand for cocoa. The findings are in accordance with the findings reported by Bymolt *et al.* (2018), who made a study on world cocoa prices.

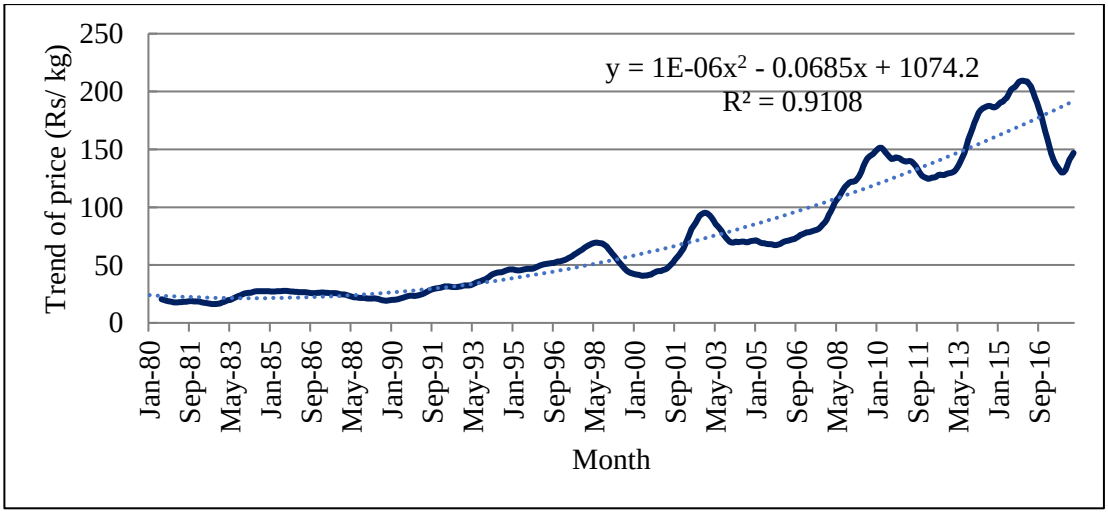

Figure 16. Trend in international prices of dry cocoa bean (1980-81 to 2018-19)

4.3.1.b. Seasonal variations in international cocoa prices (1980-81 to 2018-19)

The seasonal variations in a time series are due to the rhythmic forces which operate in a regular and periodic manner over a period of 12 months and have the same pattern every year. The seasonality in cocoa prices were analysed and it was found that annually international prices of cocoa start to decline from January and reaches the lowest value during April-May. From June, the price increases and reaches the maximum in September, while it remains comparatively low during October-November. Further, the price increases and remains stable during December and January. The seasonal fluctuations in international prices could be attributed to the variations in supply and demand at the international level, and seasonality in production of cocoa in major producing countries.

Table 4.13.Seasonal indices for international prices of dry cocoa beans

Month	Seasonal indices
January	100.5
February	99.7
March	99.9
April	98.1
May	98.1
June	98.7
July	101.5
August	101.2
September	102.7
October	99.9
November	99.3
December	100.5

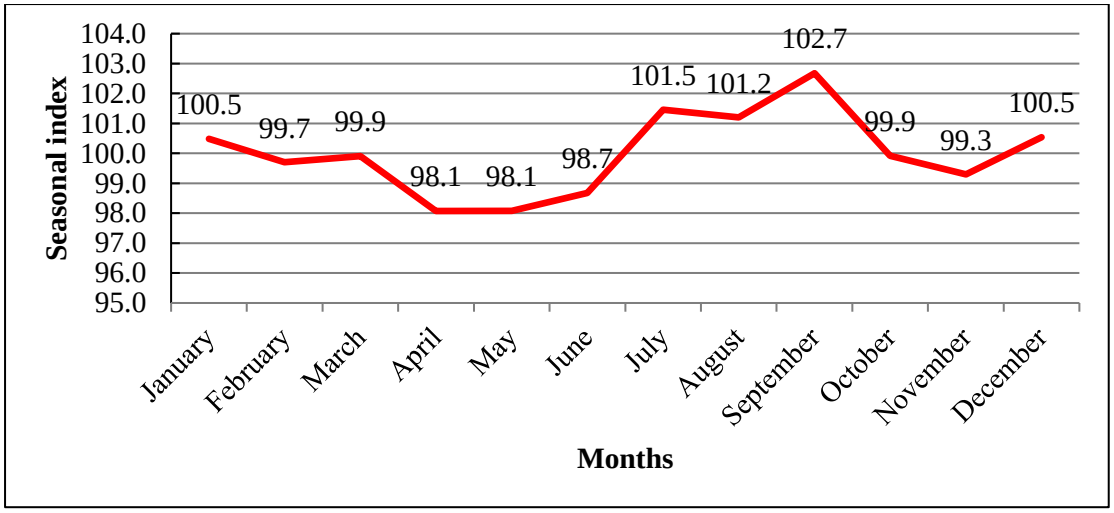

Figure 17. Seasonality in international prices of dry cocoa beans

4.3.1.c. Cyclical variations in international prices of dry cocoa beans (1980-81 to 2018-19)

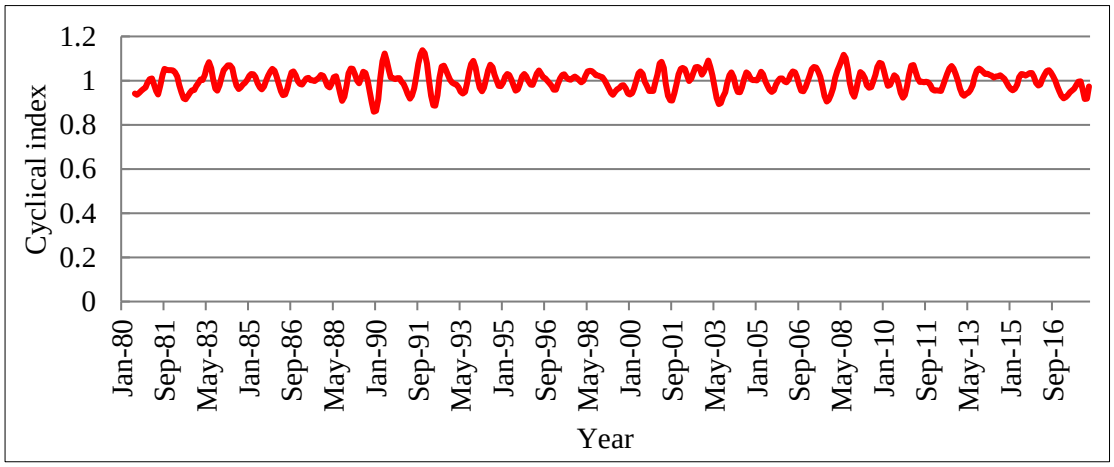

Figure 18. Cyclical variations in international prices of dry cocoa beans

The cyclical variations are the variations which are repeating at a regular interval of usually seven to nine years and are characterised by the periods of boom, trough, recession and depression. During the overall study period from 1980 to 2017, the cycles in international prices were observed to be of shorter duration, which lasted for 1-2 years and were also frequent in nature.

4.3.1.d. Irregular variations in international cocoa prices (1980-81 to 2018-19)

The irregular variations are erratic and random variations, the causes of which remain largely unknown. These variations were found to be less prominent in the international prices of cocoa.

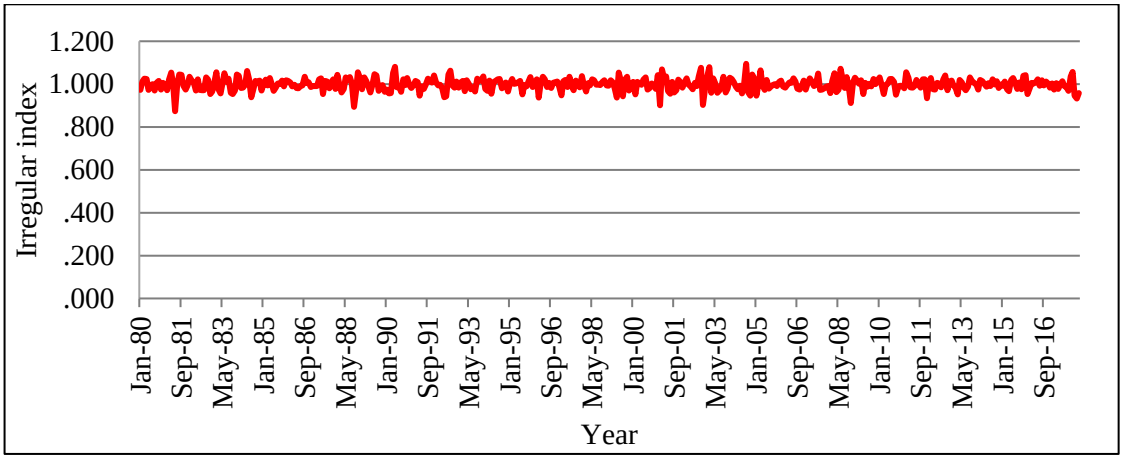

Figure 19. Irregular variations in international cocoa prices (1980-81 to 2018-19)

4.3.2. Price behaviour of wet cocoa beans in major markets of Kerala

The behaviour of wet cocoa bean prices in six major markets of Kerala, *viz.*, Pala, Thiruvalla, Muvattupuzha, Kothamangalam, Kattappana and Thodupuzha, during the period from 2005-06 to 2021-22 were analysed. The price data was decomposed into the trend, seasonal, cyclical and irregular components.

4.3.2.a. Trend analysis of wet cocoa bean prices in Kerala (2005-06 to 2021-22)

The monthly wet cocoa bean prices in all the markets under study showed an increasing trend during the period from 2005 to 2021. It could be observed from the plots that the trend in prices revealed similar patterns in all the markets.

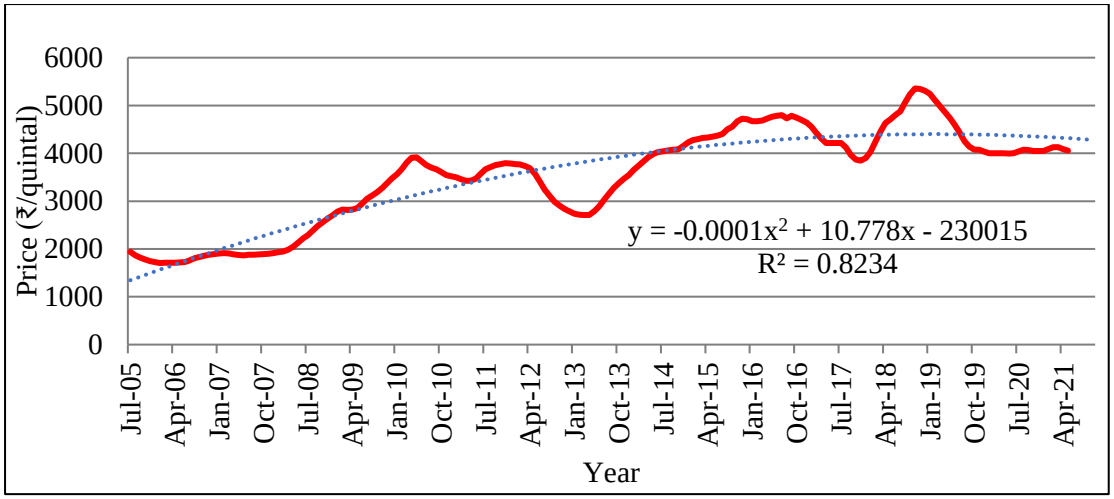

Figure 20. Trend in wet cocoa bean prices in Pala (2005-06 to 2021-22)

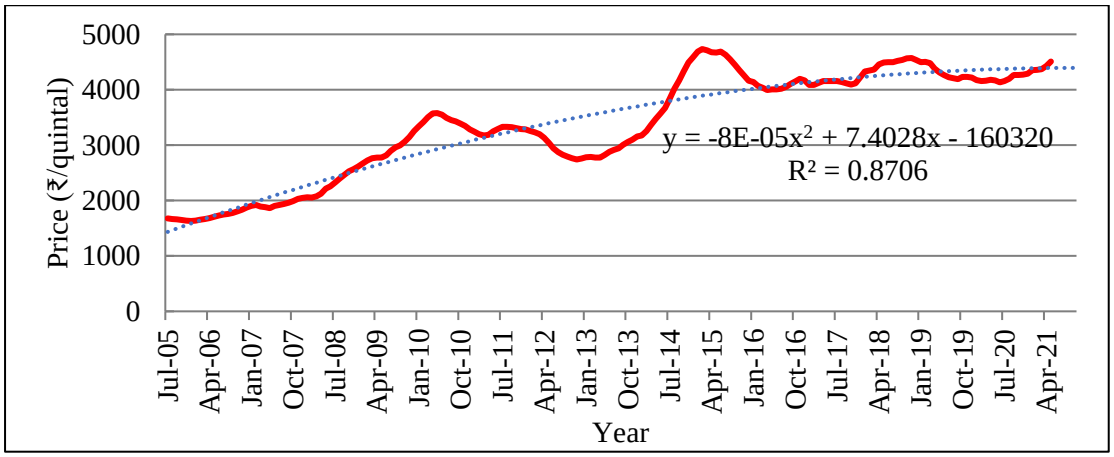

Figure 21. Trend in wet cocoa bean prices in Thiruvalla (2005-06 to 2021-22)

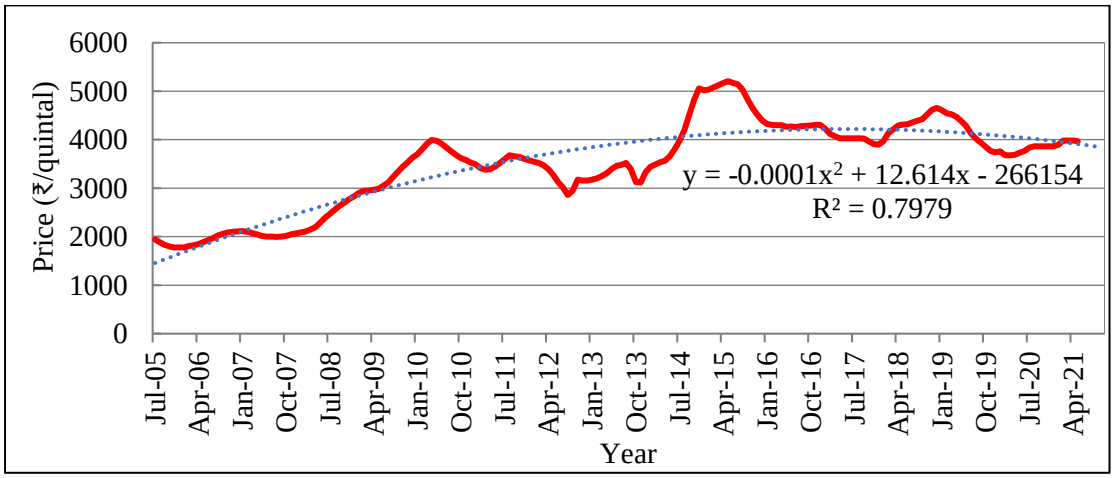

Figure 22. Trend in wet cocoa bean price in Muvattupuzha (2005-06 to 2021-22)

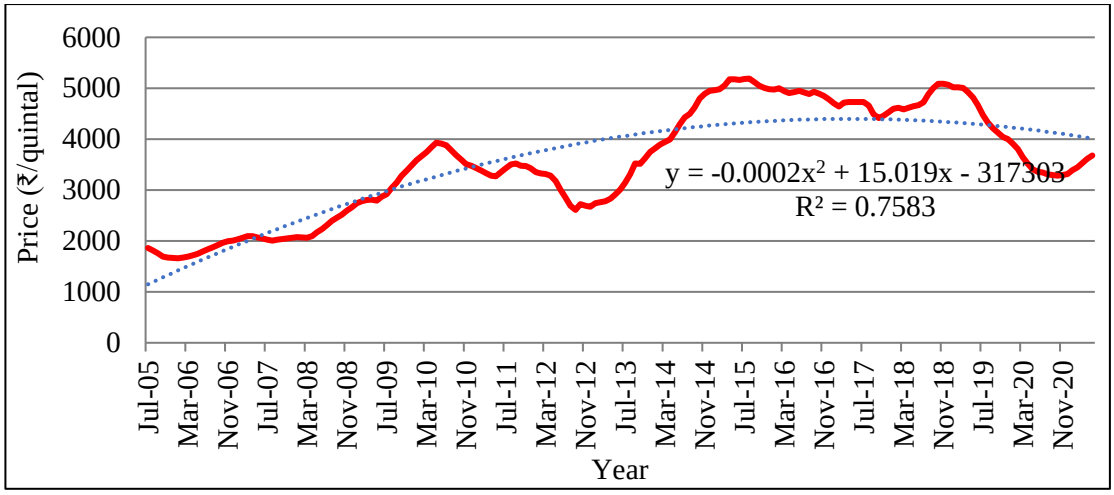

Figure 23. Trend in wet cocoa bean prices in Kothamangalam (2005-06 to 2021-22)

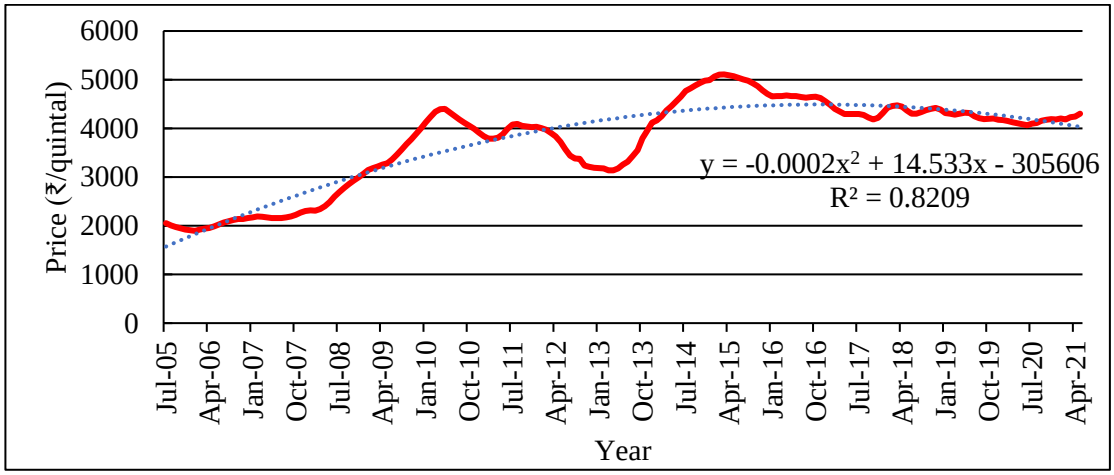

Figure 24. Trend in wet cocoa bean prices in Thodupuzha (2005-06 to 2021-22)

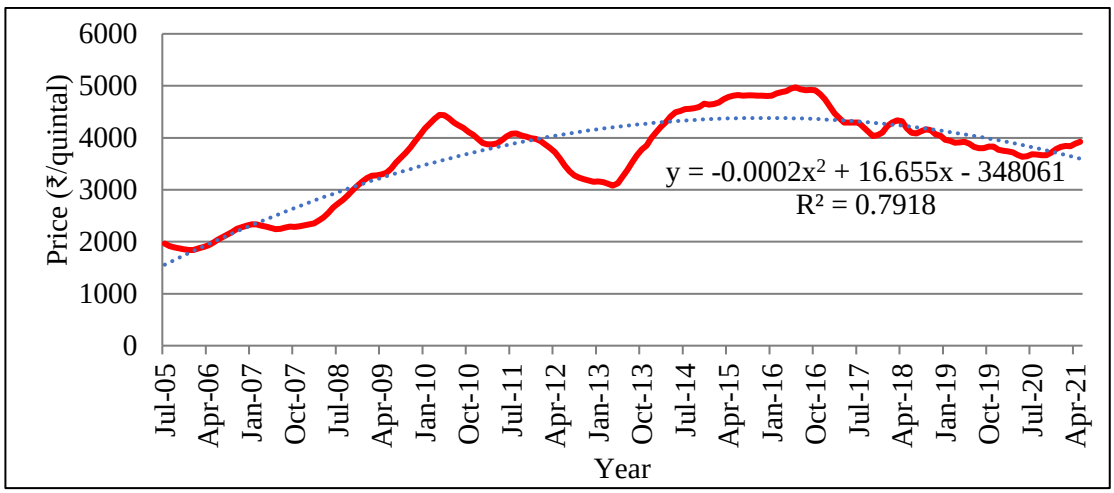

Figure 25. Trend in wet cocoa bean prices in Kattappana (2005-06 to 2021-22)

4.3.2.b. Seasonal variation in wet cocoa bean prices in major markets of Kerala (2005-06 to 2021-22)

The analysis of the wet bean cocoa prices in Kerala showed that the prices exhibited similar seasonal patterns in all the markets. The highest prices prevailed during February in Muvattupuzha and Kattappana markets, whereas in all the other markets, the maximum price was observed during May. The prices exhibited a declining pattern from June onwards and attained the lowest values during the months from August to October. Thereafter, it started increasing and attained peak values by April-May. The changes in supply, variations in quality of the produce and price changes in the international markets due to changes in market fundamentals are the factors responsible for the seasonal variations in prices. During the summer months, the production will be comparatively low and hence the market supply will also be less. Even then the beans fetch higher prices during these months because of the higher recovery percentage during these months. The flowering and pod formation are highest during the period from June to October and hence the supply is also high during these months. Because of the higher moisture content in the pod during these months, the recovery percentage will be less and hence, the prices are lower in these months.

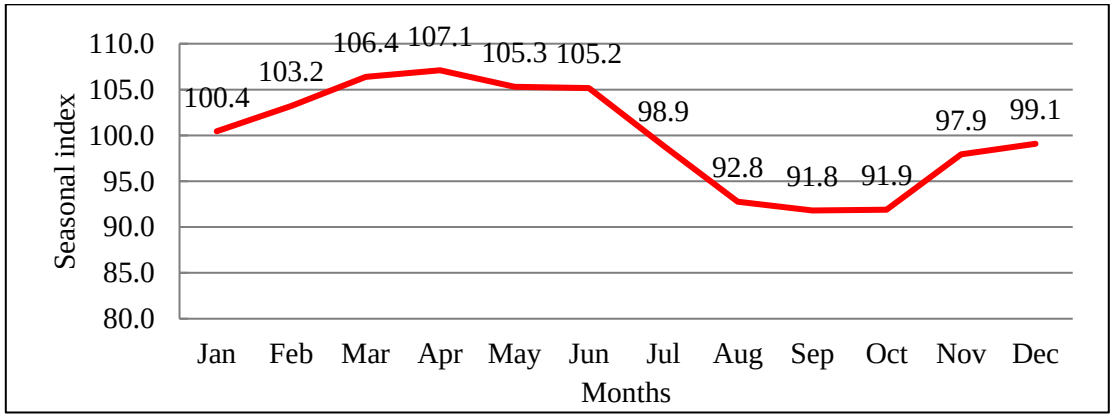

Figure 26. Seasonal variation in prices of wet cocoa beans in Pala

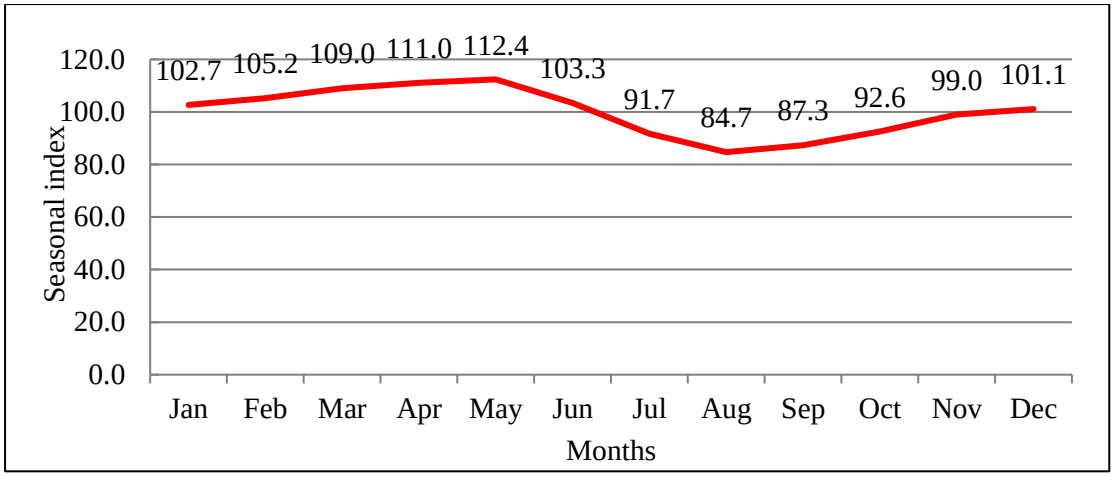

Figure 27. Seasonal variation in prices of wet cocoa beans in Pathanamthitta

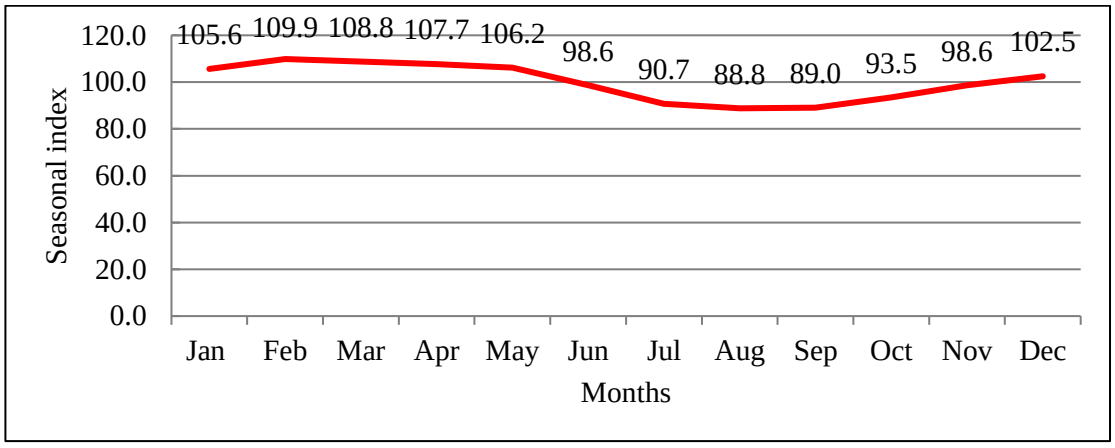

Figure 28. Seasonal variation in prices of wet cocoa beans in Muvattupuzha

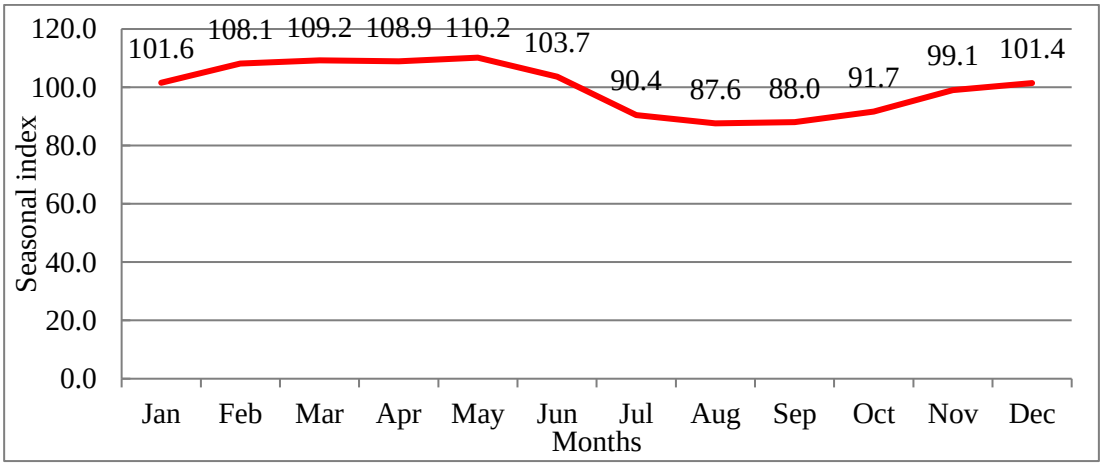

Figure 29. Seasonal variation in prices of wet cocoa beans in Kothamangalam

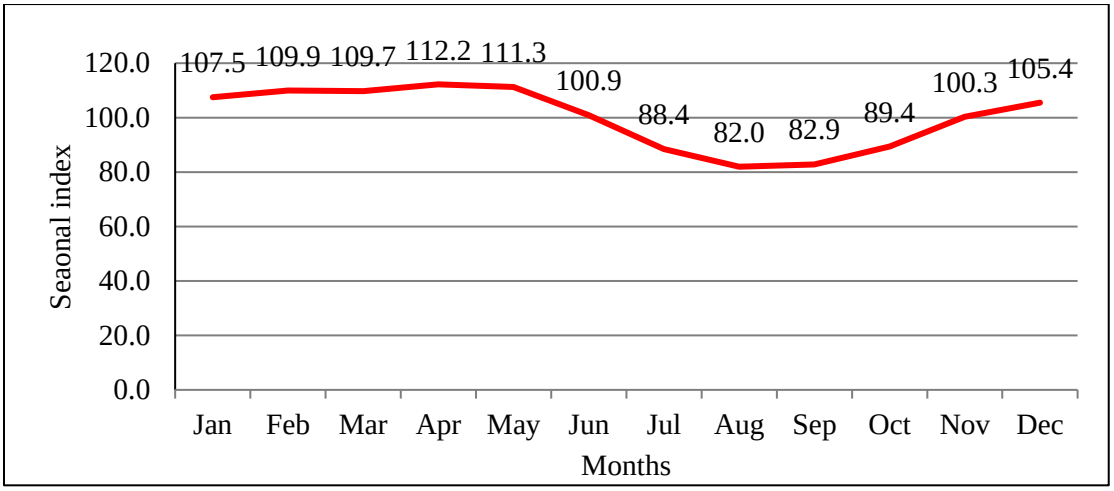

Figure 30. Seasonal variation in prices of wet cocoa beans in Thodupuzha

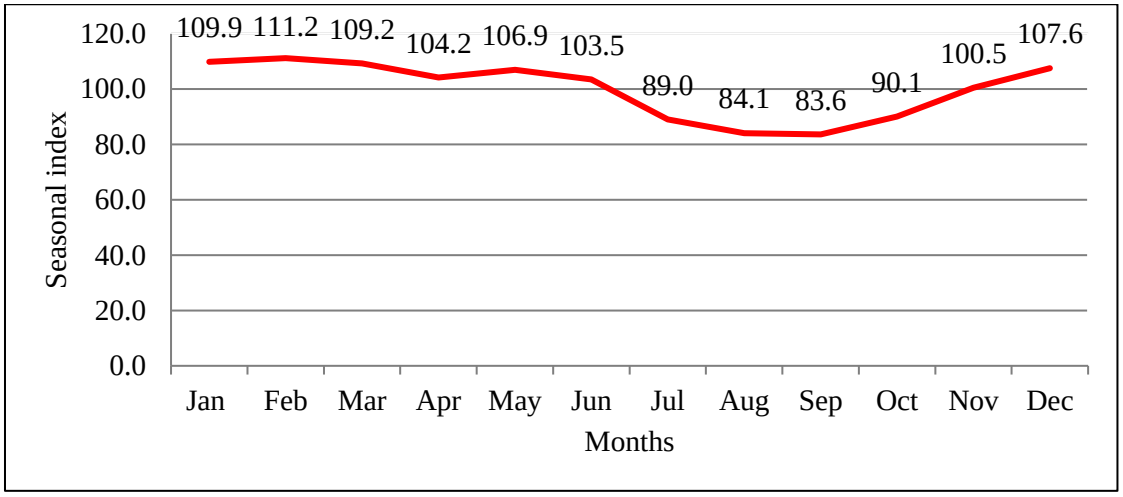

Figure 31. Seasonal variation in prices of wet cocoa beans in Kattappana

4.3.2.c. Cyclical variations in wet cocoa bean prices in Kerala (2005-06 to 2021-22)

The cyclical variations in wet cocoa bean prices were not found to be dominant in any of the markets considered in Kerala. Most of the price cycles were found to be short and frequently occurring ones with varied durations.

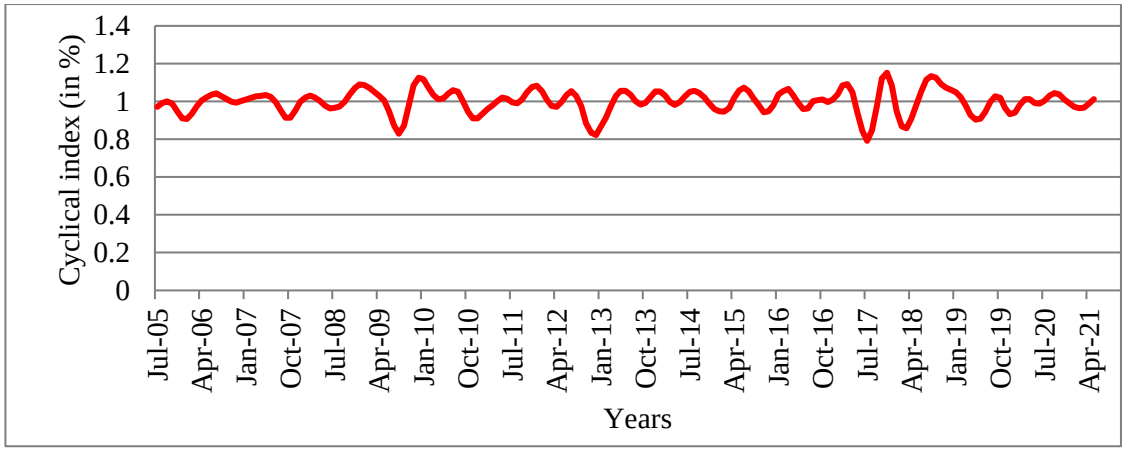

Figure 32. Cyclical variations in prices of wet cocoa beans in Pala

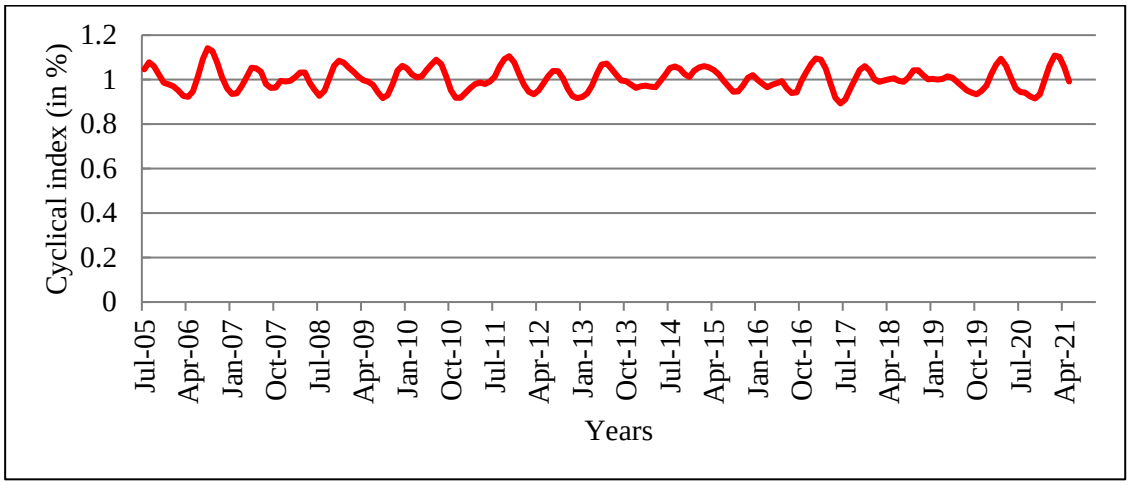

Figure 33. Cyclical variations in prices of wet cocoa beans in Pathanamthitta

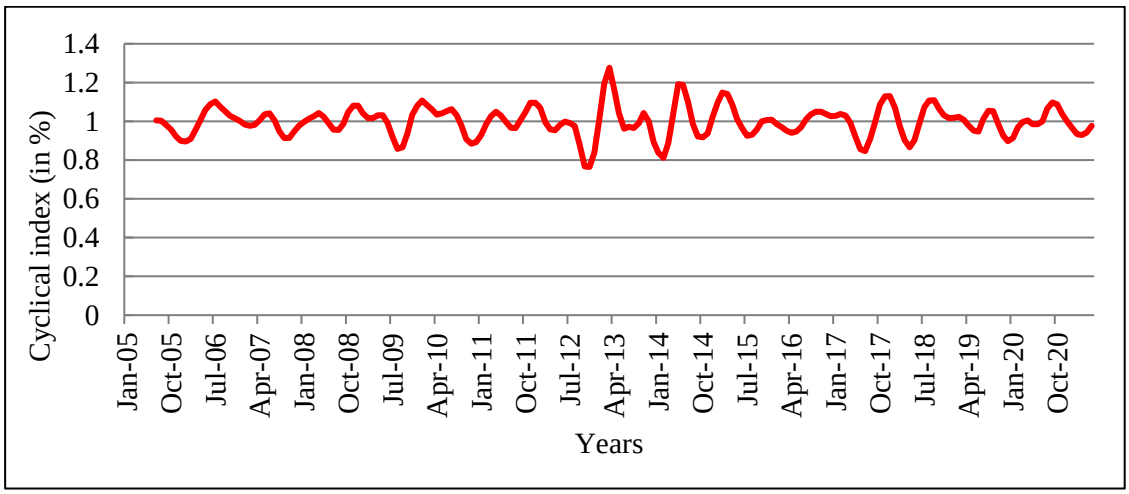

Figure 34. Cyclical variations in prices of wet cocoa beans in Muvattupuzha

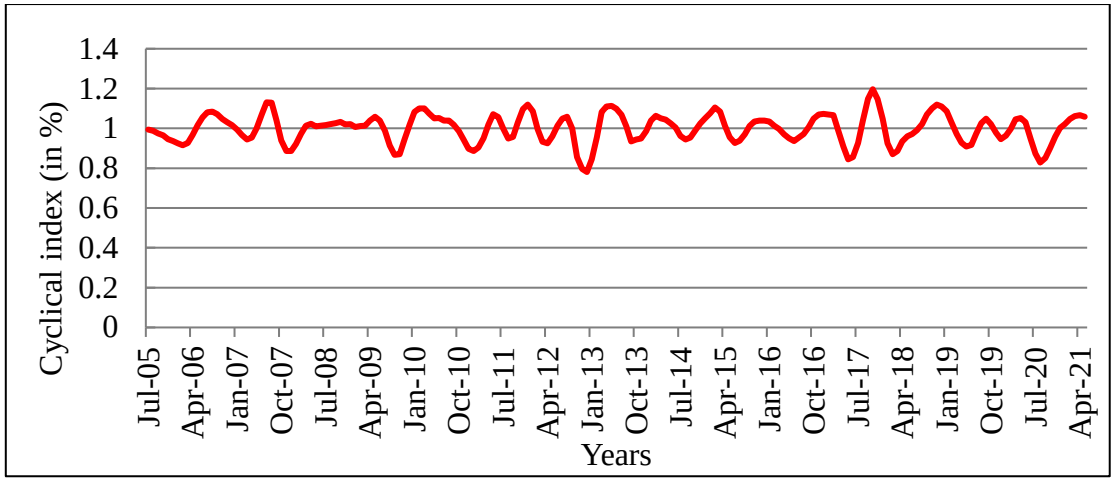

Figure 35. Cyclical variations in prices of wet cocoa beans in Kothamangalam

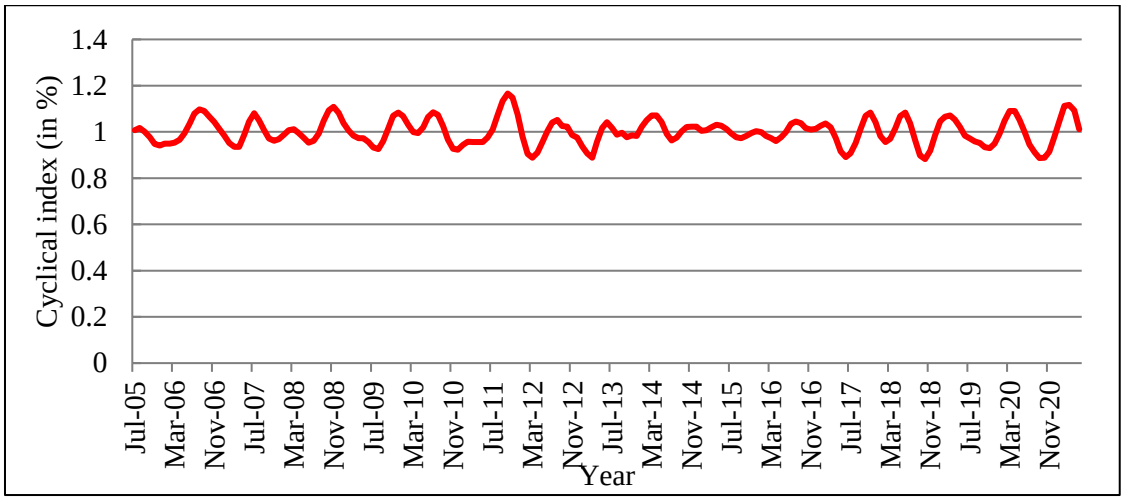

Figure 36. Cyclical variation in prices of wet cocoa beans in Thodupuzha

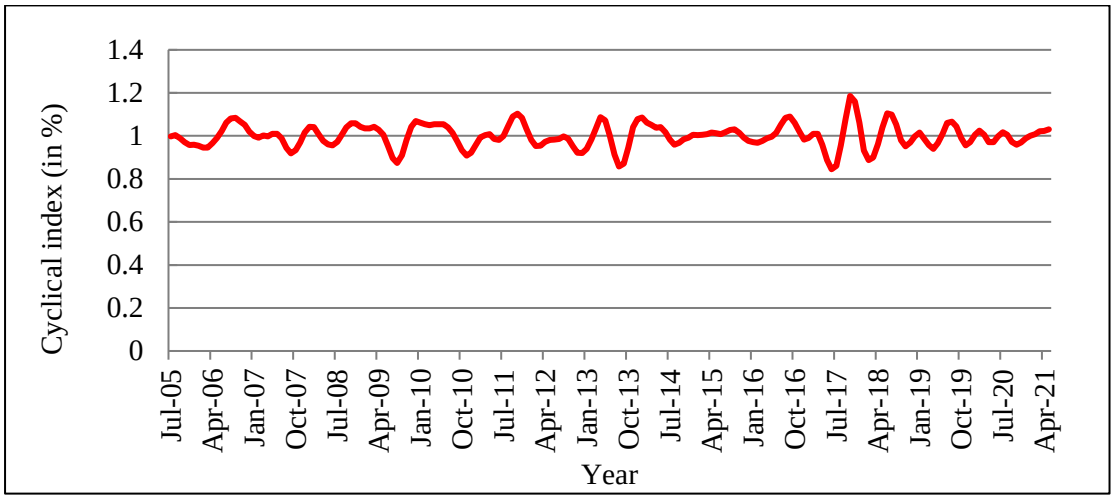

Figure 37. Cyclical variations in prices of wet cocoa bean in Kattappana

4.3.2.d. Irregular variations in wet cocoa bean prices in Kerala (2005-06 to 2021-22)

With the exception of 2012, the irregular variations were found to be less prevalent in all the markets under the study.

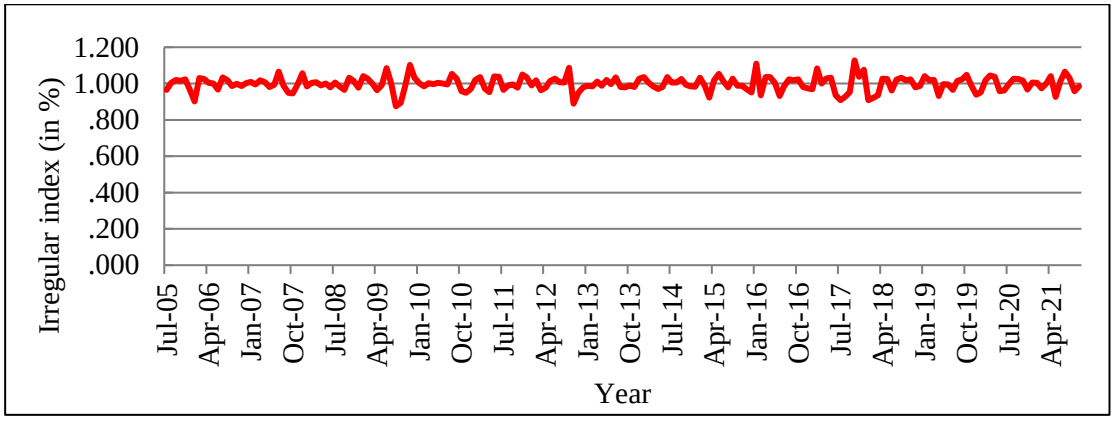

Figure 38. Irregular variations in prices of wet cocoa beans in Pala

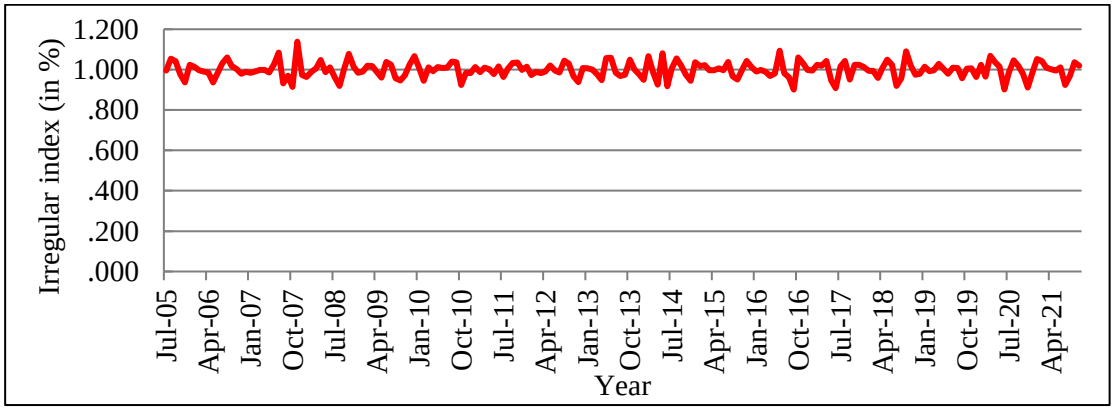

Figure 39. Irregular variations in prices of wet cocoa beans in Pathanamthitta

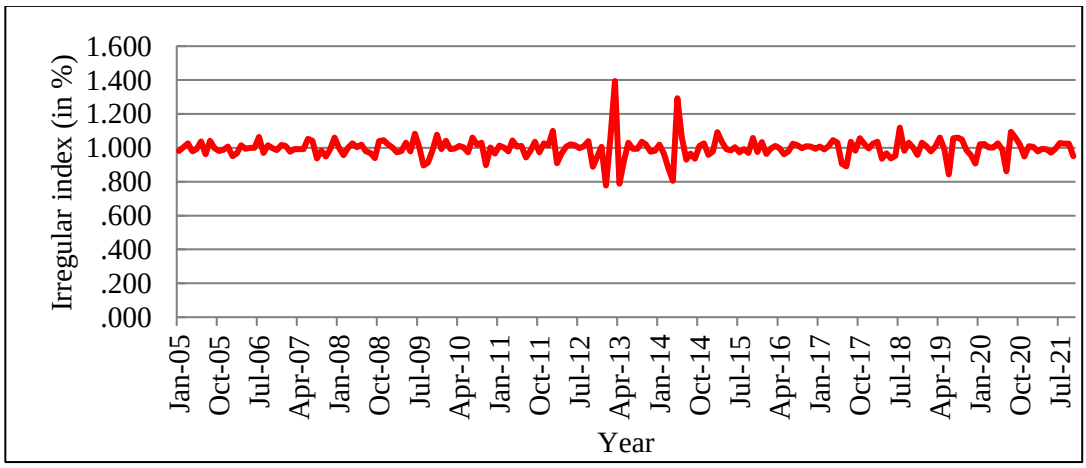

Figure 40. Irregular variations in prices of wet cocoa beans in Muvattupuzha

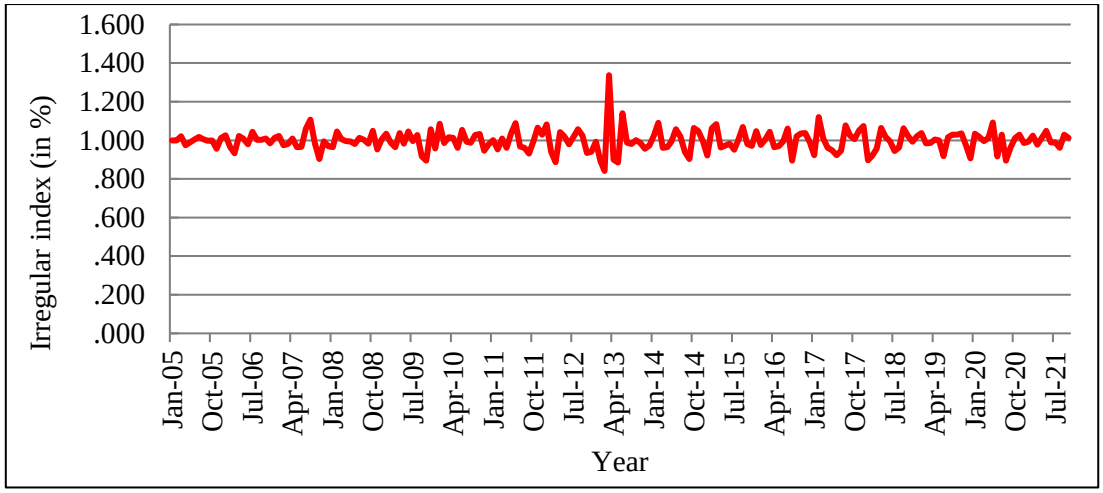

Figure 41 . Irregular variations in prices of wet cocoa beans in Kothamangalam

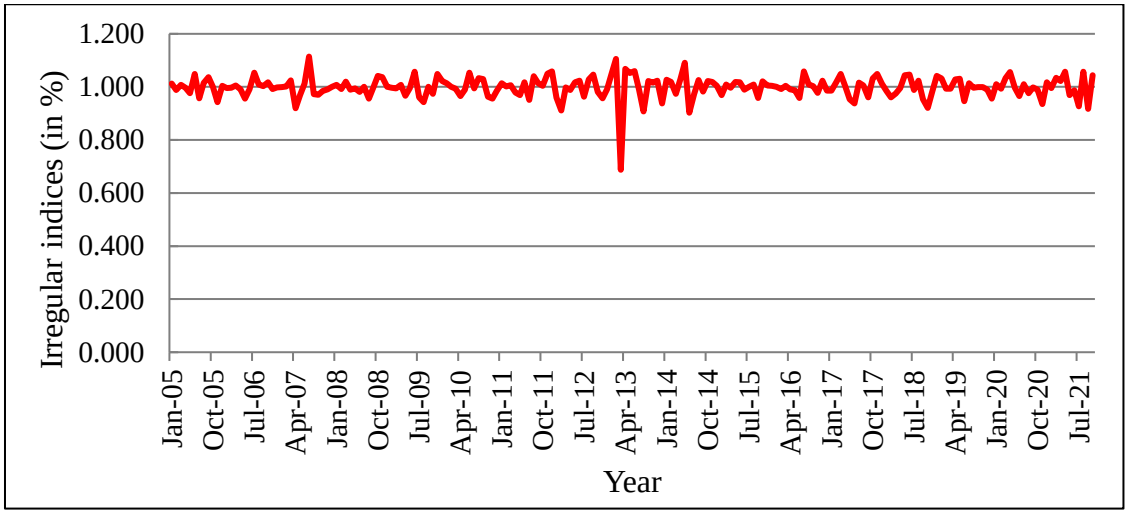

Figure 42. Irregular variation in prices of wet cocoa beans in Thodupuzha

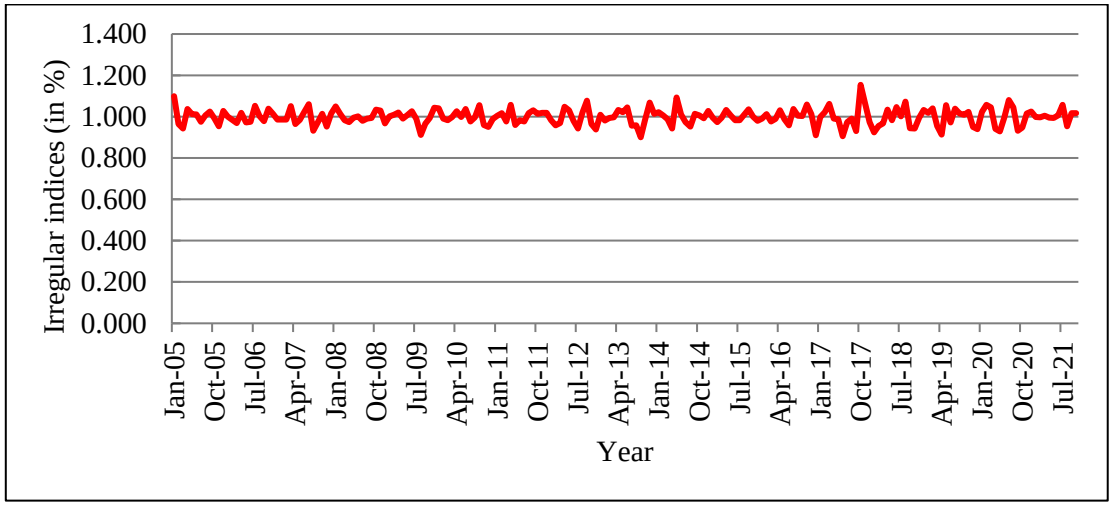

Figure 43. Irregular variations in prices of wet cocoa beans in Kattappana

4.4. Socio-economic profile of sample farmers

The socio-economic characteristics of the sample cocoa farmers were studied by classifying the sample population on the basis of age, gender, experience in farming, literacy level, occupational status, annual income, average size of family and size of the landholding. Also, the major intercrops grown in the sample farms and the subsidiary enterprises undertaken along with farming were also identified.

4.4.1 Age

The sample respondents were classified into six different groups based on their age. Most of the sample farmers belonged to the age group of 41-50 and the farmers in this age group in Adimali, Idukki, Kothamangalam and Koovappadi blocks accounted for 24.07, 33.33, 44.44 and 66.67 percent in the total sample respectively. Out of the 120 respondents, only five per cent belonged to the age group of 20-30, while only about four per cent were in the age group of 70-80. These findings suggest that the farmers in the middle age group were more actively involved in cocoa cultivation.

Table 4.14. Classification of sample respondents based on age

Age group	Idukki district		Ernakulam district		Total sample
	Idukki Block	Adimali Block	Kothamangalam Block	Koovappadi Block	
20- 30	1 (1.85)	4 (7.41)	1 (11.11)	0 (0)	6 (5.00)
31- 40	20 (37.04)	20 (37.04)	2 (22.22)	0 (0)	42 (35.00)
41- 50	13 (24.07)	18 (33.33)	4 (44.44)	2 (66.67)	37 (30.83)
51- 60	7 (12.96)	6 (11.11)	0 (0)	0 (0)	13 (10.83)
61- 70	9 (16.67)	6 (11.11)	2 (22.22)	0 (0)	17 (14.17)
71- 80	4 (7.41)	0 (0)	0 (0)	1 (33.33)	5 (4.17)
Total	54 (100.00)	54 (100.00)	9 (100.00)	3 (100.00)	120 (100.00)

Note: Figures in parentheses indicate per cent to column total

4.4.2. Gender

The sample respondents were classified on the basis of gender and the details of the classification are presented in Table 4.15. It could be observed from the table that

the female respondents were limited to 13.33 per cent of the sample population, whereas the male respondents accounted for the remaining 86.67 per cent of the total population.

Table 4.15. Classification of sample respondents based on gender

Gender	Idukki district		Ernakulam district		Total sample
	Idukki Block	Adimali Block	Kothamangalam Block	Koovappadi Block	
Male	46 (85.19)	47 (87.04)	8 (88.89)	3 (100)	104 (86.67)
Female	8 (14.81)	7 (12.96)	1 (11.11)	0 (0)	16 (13.33)
Total	54 (100.00)	54 (100.00)	9 (100.00)	3 (100.00)	120 (100.00)

Note: Figures in parentheses indicate per cent to column total

4.4.3. Farming experience

The sample farmers were grouped on the basis of their farming experience into five categories as described in Table 4.16. It could be observed from the table that 60 per cent of the respondents had 10 to 20 years of experience in farming, nearly 30 per cent of the respondents had more than 20 years of experience and 8.3 per cent of the respondents were found to be having less than 10 years of experience in farming. These indicate that the majority of the sample respondents had considerable years of experience in cocoa cultivation.

Table 4.16. Classification of farmers based on experience in farming

Experience (in years)	Idukki district		Ernakulam district		Total sample
	Idukki Block	Adimali Block	Kothamangalam Block	Koovappadi Block	
Less than 10 years	5 (9.26)	4 (7.41)	1 (11.11)	0 (0.00)	10 (8.00)
10 to 20 years	33 (61.11)	32 (59.26)	6 (66.67)	3 (100)	74 (60.00)
21 to 30 years	14 (25.93)	12 (22.22)	2 (22.22)	0 (0.00)	28 (23.00)
31 to 40 years	2 (3.70)	5 (9.26)	0 (0.00)	0 (0.00)	7 (6.00)
More than 40 years	0 (0.00)	1 (1.85)	0 (0.00)	0 (0.00)	1 (1.00)
Total	54 (100.00)	54 (100.00)	9 (100.00)	3 (100.00)	120 (100.00)

Note: Figures in parentheses indicate per cent to column total

4.4.4. Literacy level

The educational status of the sample respondents was analysed and they were classified on the basis of their educational qualifications into five groups and the details are presented in Table 4.17. It was found that more than 53.33 per cent of the respondents possessed only secondary school education, whereas 20 per cent of the respondents had completed higher secondary education. The post graduates were least in number and accounted for a share of only 4.17 per cent.

Table 4.17. Classification of farmers based on educational qualification

Education	Idukki district		Ernakulam district		Total sample
	Idukki Block	Adimali block	Kothamangalam Block	Koovappadi Block	
Secondary	27 (50.00)	30 (55.56)	5 (55.56)	2 (66.67)	64 (53.33)
Higher secondary	11 (20.37)	10 (18.52)	3 (33.33)	0 (0)	24 (20.00)
Diploma	3 (5.56)	3 (5.56)	0 (0)	0 (0)	6 (5.00)
Graduate	11 (20.37)	9 (16.67)	1 (11.11)	0 (0)	21 (17.50)
Post graduation	2 (3.70)	2 (3.70)	0 (0)	1 (33.33)	5 (4.17)
Total	54 (100.00)	54 (100.00)	9 (100.00)	3 (100.00)	120 (100.00)

Note: Figures in parentheses indicate per cent to column total

4.4.5. Occupation

Based on the occupational status of the sample respondents, they were grouped into different categories and the details of the occupational classification of the sample farmers are presented in Table 4.18. It was found that about three-fourth of the respondents had farming as their main occupation, while 17.50 per cent were self-employed. The respondents who were employed in the private sector accounted for only 2.50 per cent of the sample farmers.

Table 4.18. Classification of sample respondents based on occupation

Occupation	Idukki district		Ernakulam district		Total sample
	Idukki Block	Adimali Block	Kothamangalam Block	Koovappadi Block	
Farming	34 (62.96)	44 (81.48)	7 (77.77)	2 (66.66)	87 (72.50)
Private sector	1 (1.85)	1 (1.85)	1 (11.11)	0 (0.00)	3 (2.50)
Self employed	14 (25.93)	7 (12.96)	0 (0.00)	0 (0.00)	21 (17.50)
Government sector	5 (9.26)	2 (3.70)	1 (11.11)	1 (33.33)	9 (7.50)
Total	54 (100.00)	54 (100.00)	9 (100.00)	3 (100.00)	120 (100.00)

Note: Figures in parentheses indicate per cent to column total

4.4.6. Annual income

The sample respondents were grouped into different sub-groups based on their annual income as shown in Table 4.19. It could be observed from the table that 10 per cent of the respondents had annual income between ₹25000 to ₹75000, whereas nearly 17.50 per cent of the respondents earned an annual income ranging from ₹75000 to ₹2,00,000. Those farmers receiving income above ₹2,00,000 accounted for only 15.83 per cent of the total sample respondents.

Table 4.19. Classification of sample respondents based on annual income

Annual income (in ₹)	Idukki district		Ernakulam district		Total sample
	Idukki Block	Adimali Block	Kothamangalam Block	Koovappadi Block	
25000-50000	7 (12.96)	4 (7.41)	1 (11.11)	0 (0.00)	12 (10.00)
50000-75000	16 (29.63)	14 (25.93)	4 (44.44)	3 (100)	37 (30.83)
75000-1 lakh	7 (12.96)	12 (22.22)	2 (22.22)	0 (0.00)	21 (17.50)
1 lakh- 2 lakh	10 (18.52)	19 (35.19)	2 (22.22)	0 (0.00)	31 (25.83)
>2 lakh	14 (25.93)	5 (9.26)	0 (0.00)	0 (0.00)	19 (15.83)
Total	54 (100.00)	54 (100.00)	9 (100.00)	3 (100.00)	120 (100.00)

Note: Figures in parentheses indicate per cent to column total

4.4.7. Family size

The respondents were categorized according to their family size as shown in Table 4.20. It could be observed that Nearly 88 per cent of the respondents had three to five members in their families, while only 4.16 per cent of the respondents had more than five members in their families. This indicated the prevalence of medium sized families in the study area.

Table 4.20. Classification of sample respondents based on family size

Family size	Idukki District		Ernakulam District		Total sample
	Idukki Block	Adimali Block	Kothamangalam Block	Koovappadi Block	
1-2 members	3 (5.56)	5 (9.26)	1 (11.11)	0 (0.00)	9 (7.50)
3-5 members	48 (88.89)	47 (87.04)	8 (88.89)	3 (100)	106 (88.33)
>5 members	3 (5.56)	2 (3.70)	0 (0.00)	0 (0.00)	5 (4.17)
Total	54 (100.00)	54 (100.00)	9 (100.00)	3 (100.00)	120 (100.00)

Note: Figures in parentheses indicate per cent to column total

4.4.8. Landholding size

The size of land holding possessed by the sample respondents were analysed, on the basis of which the respondents were categorised into marginal farmers (with landholding size of less than one hectare), small farmers (with landholding size from one to two hectares), semi medium farmers (with landholding size from two to four hectares), medium farmers (with landholding size from four to 10 hectares) and large farmers (with landholding size of more than 10 hectares). The farmers have been grouped as given in Table 4.21. It could be observed from the table that three-fourth of the cocoa farmers surveyed in the study were marginal famers and about one-fourth were small farmers. There were no semi-medium or large farmers in the sample considered for the study.

Table 4.21. Classification of sample respondents based on size of land holding

Area of land holding	Idukki District		Ernakulam District		Total sample
	Idukki Block	Adimali Block	Kothamangalam Block	Koovappadi Block	
<1 hectare	39 (72.22)	39 (72.22)	9 (100.00)	3 (100.00)	90 (75.00)
1-2 hectares	14 (25.93)	15 (27.78)	0 (0.00)	0 (0.00)	29 (24.17)
2-4 hectares	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
4-10 hectares	1 (1.85)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.83)
Total	54 (100.00)	54 (100.00)	9 (100.00)	3 (100.00)	120 (100)

Note: Figures in parentheses indicate per cent to column total

4.4.9. Type of cocoa farming

On the basis of the type of inputs used for cocoa farming, the sample farms were categorised as either organic or nonorganic and the details are presented in Table 4.22. The organic cocoa cultivation refers to farming by using organic inputs alone and there is no use of fertilizers and chemicals in those farms. It could be observed from the table that 70 per cent of the sample respondents were following organic cultivation for cocoa. Most of the organic farmers marketed the produce within the local markets without any differentiation from cocoa produced in the nonorganic manner, as there was no separate market for organically produced cocoa. As a result, about 71 per cent of the organic cocoa cultivators received the same price as that of cocoa produced in inorganic manner. Only 29.7 per cent of farmers who were organically cultivating cocoa were certified organic cultivators and hence were able to sell their produce at premium prices.

Table 4.22. Categorisation of sample farmers based on nature of cocoa farming

Nature of cocoa farming	Idukki District		Ernakulam District		Total sample
	Idukki Block	Adimali Block	Kothamangalam Block	Koovappadi Block	
Organic	37 (68.52)	39 (72.22)	7 (77.78)	1 (33.33)	84 (70.00)
Inorganic	17 (31.48)	15 (27.78)	2 (22.22)	2 (66.67)	36 (30.00)
Total	54 (100.00)	54 (100.00)	9 (100.00)	3 (100.00)	120 (100.00)

Note: Figures in parentheses indicate per cent to column total

4.4.10. Details of number of cocoa trees in sample farms

Since cocoa is grown as an intercrop in Kerala, it was found that no systematic layout or spacing was followed in majority of the sample farms. Hence, instead of the area under cocoa farming, the number of cocoa trees per sample holding was also collected and the details are presented in Table 4.23. Based on the number of trees per holding the sample farms were categorized into different groups for the purpose of comparison. The number of cocoa trees per holding varied between a minimum of 10 and a maximum of 1000. Nearly 40 per cent of the sample farmers cultivated 200-500 cocoa trees in their farms.

Table 4.23. Details of number of cocoa trees per sample farm holding

	Idukki District		Ernakulam District		
Number of cocoa trees	Idukki	Adimali	Kothamangalam	Koovappadi	Total sample
1-100	10 (18.52)	17 (31.48)	6 (66.67)	0 (0.00)	33 (27.50)
100-200	18 (33.33)	10 (18.52)	3 (33.33)	2 (66.67)	33 (27.50)
200-500	21 (38.89)	26 (48.15)	0 (0.00)	1 (33.33)	48 (40.00)
>500	5 (9.26)	1 (1.85)	0 (0.00)	0 (0.00)	6 (5.00)
Total	54 (100.00)	54 (100.00)	9 (100.00)	3 (100.00)	120 (100.00)

Note: Figures in parentheses indicate per cent to column total

4.4.11. Subsidiary enterprises in sample cocoa farms

The details of the subsidiary enterprises undertaken along with cocoa farming by the sample farmers are presented in Table 4.24. It could be observed from the table that out of the 120 farmers, about 40 per cent were also rearing livestock along with cocoa cultivation. The commonly raised livestock were found to be cow, followed by poultry and goat. Undertaking livestock activity not only enhances the income of the farmer, but also helps to reduce the dependency on the purchase of external inputs for farming. Since organic manure is an essential component for cocoa farming, rearing of livestock provided the farmers with manures, which in turn helped the farmers to reduce the cost of cultivation of cocoa.

Table 4.24. Details of subsidiary enterprises undertaken by sample farmers

	Idukki district		Ernakulam district		
Subsidiary enterprises	Idukki	Adimali	Kothamangalam	Koovappadi	Total
Cow	20 (37.04)	19 (35.19)	1 (11.11)	1 (33.33)	41 (34.17)
Goat	1 (1.85)	1 (1.85)	0 (0.00)	0 (0.00)	2 (1.67)
Poultry	4 (7.41)	2 (3.70)	0 (0.00)	0 (0.00)	6 (5.00)
None	29 (53.70)	32 (59.26)	8 (88.89)	2 (66.67)	71 (59.17)
Total	54 (100.00)	54 (100.00)	9 (100.00)	3 (100.00)	120 (100.00)

Note: Figures in parentheses indicate per cent to column total

4.5. Economics of cocoa cultivation

Cocoa was raised as an intercrop by majority of the respondents and sole cropping was undertaken by less than one per cent of the respondents. It was mainly raised as an intercrop among coconut, arecanut, rubber and nutmeg trees and the spacing between the cocoa plants varied based on the different cropping systems in which cocoa trees were grown. Hence, the number of cocoa plants per hectare also varied from farm to farm. The number of trees per hectare was calculated for each of the farm holding and an average of these observations was arrived as 400 cocoa trees per hectare, which was used for working out the cost of cultivation per hectare. The

cost of cultivation was separately worked out for Ernakulam and Idukki districts and the weighted average costs for these districts was also estimated.

Cocoa is a perennial crop, requiring two years for establishment and most of the trees start bearing from third year onwards. However, the yield stabilisation is attained only by the fifth year and it continues to give stable yield upto 20 years. The yield starts to decline from the 20th year and hence, most of the farmers replant the old trees after 20 years of planting. The costs incurred for carrying out the planting or establishment activities during the first two years of planting until the trees start yielding are considered for working out the establishment cost. It includes the expenditure incurred on purchase of inputs and expenditure on other planting operations from planting to the yielding phase.

The costs incurred from the third year to fifth year of planting are considered as the total cost during the early bearing phase. Those expenses from the fifth year till the 20th year are considered as the costs in the yield bearing phase and that which occurs after the 20th year of planting are accounted as costs incurred in the yield declining phase. All the costs which are incurred during the early bearing, yield stabilising and yield declining phases are included under the maintenance cost.

4.5.1. Expenditure incurred in establishment phase

The costs incurred during the establishment phase of cocoa cultivation have been worked out for Idukki and Ernakulam districts. The weighted averages of the total costs incurred in 1st year and 2nd year were worked out and sum of these two was indicated as the aggregate of establishment cost. For each of the operation, the cost incurred per tree was also estimated. It was found that seedlings raised from seeds of good quality and vigour were commonly used for planting in both the districts. Apart from these, farmers also purchased seedlings for planting from Mondelez International and other private nurseries. Planting is usually done just before the commencement of the south-west monsoon and the cocoa seedlings are planted in pits with organic manure. The application of lime was common in Idukki district as the soil was acidic in nature, whereas it was not widely practised in Ernakulam district. The establishment cost in Idukki and Ernakulam districts were estimated as ₹1,78,022 per hectare and ₹2,10,150 per hectare respectively. The higher cost in Ernakulam district could be attributed to the high labour charges as compared to Idukki district. In the establishment

phase, the highest cost was incurred for weeding operations and it accounted for 35.6 per cent of the total cost in Ernakulam, while it was found to be 30 per cent in Idukki. The problem of weeds was found to be severe during the establishment phase and more number of weeding operations are required for effectively managing cocoa farms. Once the cocoa plant gets established, weeds are less due to its thicker and wider canopy coverage and high litter fall. Irrigation is critical during the initial stages of growth for cocoa plants and the cost of irrigation accounted for 20.9 per cent and 22.7 per cent of the total cost in Idukki and Ernakulam districts respectively. Most of the farmers employed only hired labour for weeding and pruning operations, while the remaining operations were mostly carried out by the farmer himself or by utilising the family labour. Nearly 33 per cent of the total cost in the establishment phase was incurred on hired labour and the balance 63 per cent of the cost was incurred on family labour in the establishment phase. The weighted average cost worked out as ₹1,14,037 in the first year and ₹66,776 in the second year of establishment. The aggregate establishment cost for cocoa was estimated as ₹1,80,813 per ha.

Table 4.25. Operation-wise cost of cultivation for cocoa in establishment phase (₹/ha)

Sl. No.	Planting operations	Idukki district			Ernakulam district			Weighted average of total cost incurred in 1st year	Weighted average of total cost incurred in 2nd year	Aggregate establishment cost
		1st year	2nd Year	Total cost	1st year	2nd Year	Total cost			
1.	Planting seeds in polybags	5765 (5.14)	0 (0.00)	5765 (3.24)	6250 (4.67)	0 (0)	6250 (2.97)	5807 (5.09)	0 (0.00)	5807 (3.21)
2.	Digging of pits, application of organic manure and planting	21706 (19.35)	0 (0.00)	21706 (12.19)	31700 (23.71)	0 (0)	31700 (15.08)	22575 (19.80)	0 (0.00)	22575 (12.49)
3.	Shade regulation/ mulching	4081 (3.64)	2500 (3.80)	6581 (3.70)	4500 (3.37)	3000 (3.92)	7500 (3.57)	4117 (3.61)	2543 (3.80)	6660 (3.68)
4.	Manure application	9840 (8.77)	9840 (14.94)	19680 (11.05)	8600 (6.43)	8600 (11.25)	17200 (8.18)	9732 (8.53)	9732 (14.57)	19464 (10.76)
5.	Fertilizer application	6443 (5.74)	6443 (9.78)	12886 (7.24)	4500 (3.37)	4500 (5.89)	9000 (4.28)	6274 (5.50)	6274 (9.40)	12548 (6.94)
6.	Weeding	26460 (23.59)	26460 (40.18)	52920 (29.73)	37500 (28.05)	37500 (49.05)	75000 (35.69)	27420 (24.04)	27420 (41.06)	54840 (30.33)
7.	Pruning	2911 (2.60)	2911 (4.42)	5822 (3.27)	3250 (2.43)	3250 (4.25)	6500 (3.09)	2940 (2.58)	2940 (4.40)	5880 (3.25)
8.	Irrigation	27260 (24.30)	10000 (15.18)	37260 (20.93)	32800 (24.53)	15000 (19.62)	47800 (22.75)	27741 (24.33)	10434 (15.63)	38176 (21.11)
9.	Application of soil ameliorants	3333 (2.97)	3333 (5.06)	6666 (3.74)	2000 (1.50)	2000 (2.62)	4000 (1.90)	3217 (2.82)	3217 (4.82)	6434 (3.56)
10.	Application of plant protection chemicals	4368 (3.89)	4368 (6.63)	8736 (4.91)	2600 (1.94)	2600 (3.40)	5200 (2.47)	4214 (3.70)	4214 (6.31)	8428 (4.66)
	Total cost	1,12,167 (100)	65,855 (100)	1,78,022 (100)	1,33,700 (100)	76,450 (100)	2,10,150 (100)	1,14,037 (100)	66,776 (100)	1,80,813 (100)

Note: Figures in parentheses denote per cent to column total

4.5.2. Input-wise cost for establishment of cocoa

The input-wise cost incurred for establishment of cocoa was estimated and are presented in Table 4.26. Among all the inputs, the charges incurred for labour accounted for the highest share in the total cost incurred for inputs in the first and second years of establishment. The costs incurred on labour was ₹1,38,952 per hectare and ₹1,68,800 per hectare in Idukki and Ernakulam districts respectively and were 78 and 80 per cent of the total establishment cost respectively. The weighted average input-wise cost was also found to be highest for human labour and it accounted for 78 per cent of the total cost. The respective shares of other inputs in the establishment cost were found to be very minimal.

Table 4.26. Input-wise establishment cost of cultivation (₹/ha)

Sl. No.	Planting operations	Idukki district			Ernakulam district			Weighted average		
		1st year	2nd Year	Total Cost	1st year	2nd Year	Total cost	Weighted average of total cost 1st year	Weighted average of total cost 2nd year	Total input-wise establishment cost
1.	Labour charges	86869 (77.45)	52083 (79.09)	138952 (78.05)	104450 (78.12)	64350 (84.17)	168800 (80.32)	88397 (77.52)	53149 (79.59)	141547 (78.28)
2.	Planting materials	10239 (9.13)	0 (0.00)	10239 (5.75)	16500 (12.34)	0 (0.00)	16500 (7.85)	10783 (9.46)	0 (0.00)	10783 (5.96)
3.	Shade/mulch	2786 (2.48)	1500 (2.28)	4286 (2.41)	3250 (2.43)	2000 (2.62)	5250 (2.50)	2826 (2.48)	1543 (2.31)	4369 (2.42)
4.	Manure	4510 (4.02)	4510 (6.85)	9020 (5.07)	4600 (3.44)	4600 (6.02)	9200 (4.38)	4517 (3.96)	4517 (6.76)	9035 (5.00)
5.	Fertilizer	3749 (3.34)	3749 (5.69)	7499 (4.21)	2700 (2.02)	2700 (3.53)	5400 (2.57)	3657 (3.21)	3657 (5.48)	7315 (4.05)
6.	Plant protection chemicals	3012 (2.69)	3012 (4.57)	6024 (3.38)	1200 (0.90)	1200 (1.57)	2400 (1.14)	2854 (2.50)	2854 (4.27)	5708 (3.16)
7.	Soil ameliorant	1000 (0.89)	1000 (1.52)	2000 (1.12)	1000 (0.75)	1600 (2.09)	2600 (1.24)	1000 (0.88)	1052 (1.59)	2052 (1.13)
8.	Total cost	1,12,167 (100)	65,855 (100)	1,78,022 (100)	1,33,700 (100)	76,450 (100)	2,10,150 (100)	1,14,037 (100)	66,776 (100)	1,80,813 (100)

Note: Figures in parentheses denote per cent to column total

4.5.3. Cost of cultivation of cocoa in maintenance phase

During the maintenance phase, application of soil ameliorants (mostly lime or dolomite) was done based on soil testing. In Idukki, most of the farmers resorted to lime application during every alternate year as the soils are highly acidic. However, in Ernakulam, this practise was not widespread. Application of manures or fertilizers was done just before the commencement of rain as it facilitated better nutrient absorption and utilisation. Pruning was carried out in cocoa gardens by cutting excess branches and maintaining the tree canopy in the form of an umbrella-like structure, which helped to increase the yield by optimising the penetration of sunlight into the canopy. Cocoa was mostly raised as a rainfed crop in Ernakulam and in most of the areas of Idukki. Irrigation was carried out only by very few farmers of Idukki during the maintenance phase. It was found that all the sample farmers harvested cocoa once or twice a week and were of the opinion that under good climatic conditions and efficient managerial practices, harvest can be reaped annually for 52 days. However, the peak harvest was mostly confined to two main seasons, from June to September and December to February in the study area. The early bearing nature and the possibility for increased number of harvests have attracted many farmers to cocoa farming.

The operation-wise costs incurred during the maintenance phase of cocoa cultivation were worked out separately for Idukki and Ernakulam districts. The costs incurred during the early establishment, stabilisation and yield declining phases were computed separately and the weighted average of the costs in the three phases was estimated to obtain the aggregate cost for the yielding phase. In Idukki district, costs incurred during the early bearing, yield stabilisation and yield declining phases were ₹50,904, ₹80,916 and ₹56,925 per hectare per year respectively. The costs incurred in the early bearing, yield stabilisation and yield declining phases for cocoa cultivation in Ernakulam district were estimated as ₹36,925, ₹52,525 and ₹18,400 per hectare per year respectively. The operations like application of manures, fertilizers and soil ameliorants and pruning were carried out only once in a year during the early bearing and yield stabilisation phases in both the districts. The application of plant protection chemicals is critical in determining the yield from cocoa due to the increased incidence of black pod rot disease. As the disease incidence was very high in Idukki as compared to Ernakulam, greater number of sprayings were given in Idukki as compared to the latter. Hence, the cost of spraying plant protection chemicals was found to be higher in

Idukki and was estimated as ₹8100, ₹19,754 and ₹18,114 per hectare in the early bearing, yield stabilising and yield declining phases respectively. In irrigated cocoa farms of Idukki, cost incurred for irrigation accounted for 21 per cent of the total cost in the early bearing phase, while it was found to be 11 per cent in the yield stabilisation phase. The harvesting expenses were found to be higher in Idukki due to increased number of harvests and was estimated as ₹8,419 per ha per year as compared to ₹6,710 per ha per year for Ernakulam. In both the districts, among all the phases, the cost incurred for harvesting was found to be higher in the yield stabilisation phase.

Generally, the yield of cocoa plants starts to decline after 20 years of planting. The yield of cocoa was found to be comparatively lower in Ernakulam as compared to Idukki district in the yield declining phase and hence, only manuring, pruning and harvesting operations were carried out in Ernakulam during this phase. In Idukki, the farmers were found to be reaping good yield even during the yield declining phase, because of which all the managerial operations carried out in the yield stabilisation phase were also followed in the yield declining phase. The weighted average maintenance cost for cocoa cultivation in Idukki and Ernakulam districts were estimated as ₹70,573 and ₹39,460 per ha per year respectively. The application of fertilizers, soil ameliorants and plant protection chemicals were not done during the yield declining phase in Ernakulam. Also, cocoa was raised as a rainfed crop in Ernakulam and as a result cost of irrigation was also not accounted while calculating the maintenance cost. These factors are responsible for the wide difference in cost of cultivation among the two districts.

Table 4.27. Operation-wise maintenance cost for cocoa cultivation in Idukki and Ernakulam districts (₹/ha)

Sl no	Activity	Idukki District				Ernakulam District			
		Early bearing phase	Yield stabilisation phase	Yield declining phase	Weighted average	Early bearing phase	Yield stabilising phase	Yield declining phase	Weighted average Cost
1.	Manure Application	6340 (12.45)	15236 (18.83)	10930 (19.20)	13137 (18.61)	8850 (23.97)	12350 (23.51)	10400 (56.52)	10560 (26.76)
2.	Application of soil ameliorant	8066 (15.85)	10903 (13.47)	7623 (13.39)	9576 (13.57)	6750 (18.28)	9300 (17.71)	0 (0.00)	6420 (16.27)
3.	Pruning	3340 (6.56)	5215.2 (6.45)	4707 (8.27)	4910 (6.96)	4800 (13.00)	5075 (9.66)	4000 (21.74)	4750 (12.04)
4.	Application of plant protection	8100 (15.91)	19754 (24.41)	18114 (31.82)	18385 (26.05)	5700 (15.44)	10850 (20.66)	0 (0.00)	6620 (16.78)
5.	Application of fertilizer	8358 (16.42)	10824 (13.38)	9034 (15.87)	10036 (14.22)	5200 (14.08)	5800 (11.04)	0 (0.00)	4400 (11.15)
6.	Cost of irrigation	11000 (21.61)	9125 (11.28)	0 (0.00)	6107 (8.65)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
7.	Cost of harvesting	5700 (11.20)	9858.7 (12.18)	6517 (11.45)	8419 (11.93)	5625 (15.23)	9150 (17.42)	4000 (21.74)	6710 (17.00)
8.	Total	50,904 (100.00)	80,916 (100.00)	56,925 (100.00)	70,573 (100.00)	36,925 (100.00)	52,525 (100.00)	18,400 (100.00)	39,460 (100.00)

Note: Figures in parentheses denote per cent to column tota

Table 4.28. Aggregate operation-wise maintenance cost for cocoa cultivation (₹ per hectare)

Sl no.	Operation	Early bearing phase	Yield stabilising phase	Yield declining phase	Weighted average cost
1	Manure Application	7344 (16.21)	15026 (19.06)	10896 (19.99)	12871 (19.11)
2	Application of soil ameliorant	7539 (16.24)	10786 (13.68)	7146 (13.11)	9250 (13.73)
3	Pruning	3924 (8.66)	5204 (6.60)	4662 (8.55)	4894 (7.26)
4	Application of plant protection chemicals	7140 (15.76)	19106 (24.23)	16982 (31.15)	17172 (25.49)
5	Application of fertilizer	7094 (15.66)	10458 (13.26)	8469 (15.53)	9455 (14.04)
6	Cost of irrigation	6600 (14.57)	8461 (10.73)	0 (0.00)	5478 (8.13)
7	Cost of harvesting	5670 (12.51)	9807 (12.44)	6359 (11.67)	8243 (12.24)
8	Total	45,312 (100.00)	78,851 (100.00)	54,517 (100.00)	67,365 (100.00)

Note: Figures in parentheses indicate per cent to column total

The aggregate operation-wise maintenance cost for cultivation of cocoa was worked out and is depicted in Table 4.28. It could be observed from table that in the aggregate operation-wise maintenance cost, the cost incurred for spraying plant protection chemicals accounted for the highest share of 25 per cent of the total cost and it amounted to ₹17,172 per hectare respectively. The average weighted cost for spraying plant protection chemicals per tree was found to be ₹42. The cost incurred for application of manures, fertilizers and that for harvesting were found to be ₹12,871 per ha, ₹9,455 per ha and ₹8,243 per ha per year respectively. It was also found that most of the sample farmers employed only hired labour for carrying out spraying and pruning operations. Nearly 38 per cent of the costs incurred during the maintenance phase was incurred for hired labour and 62 per cent of the costs was incurred for family labour.

4.5.4. Input-wise cost of cultivation of cocoa

The input-wise cost of cultivation for cocoa during the maintenance phase was computed and the details are summarised in Table 4.29. In both the districts, the cost incurred for labour was found to be having the highest share and it accounted for 53 per cent and 61 per cent of the total input costs in Idukki and Ernakulam respectively.

The application of plant protection chemicals accounted for the second largest share of 22 per cent of the total input cost in Idukki, whereas in Ernakulam, the share of the cost incurred on purchase of manure was found to be having the second highest share of 15 per cent in total input cost.

Table 4.29. Input-wise maintenance cost for cultivation of cocoa in Idukki and Ernakulam districts (₹/ha)

Sl no.	Inputs	Idukki District				Ernakulam District			
		Early bearing phase	Yield stabilising phase	Yield declining phase	Weighted mean for yielding phase	Early bearing phase	Yield stabilisation phase	Yield declining phase	Weighted mean for yielding phase
1	Human labour	35530 (69.80)	43380 (53.61)	29232 (51.35)	37960 (53.79)	24125 (65.34)	30725 (58.50)	12000 (65.22)	24340 (61.68)
2	Manure	3000 (5.89)	11300 (13.96)	7070 (12.42)	9268 (13.13)	4800 (13.00)	6900 (13.14)	6400 (34.78)	5960 (15.10)
3	Soil ameliorant	3666 (7.20)	7226 (8.93)	3973 (6.98)	5858 (8.30)	2500 (6.77)	5000 (9.52)	0 (0.00)	3000 (7.60)
4	Fertilizer	4408 (8.66)	5551 (6.86)	4012 (7.05)	4941 (7.00)	2200 (5,96)	2200 (4.19)	0 (0.00)	1760 (4.46)
5	Plant protection chemical	4300 (8.45)	13459 (16.63)	12638 (22.20)	12544 (17.77)	3300 (8.24)	7700 (14.66)	0 (0.00)	4400 (11.15)
6	Total cost	50,904 (100.00)	80,917 (100.00)	56,925 (100.00)	70,574 (100.00)	36,925 (100.00)	52,525 (100.00)	18,400 (100.00)	39,460 (100.00)

Note: Figures in parentheses indicate per cent to column total

Table 4.30. Aggregate input-wise cost of cultivation for cocoa in maintenance phase (₹/ha)

Sl no.	Inputs	Early bearing phase	Yield stabilising phase	Yield declining phase	Weighted average
1	Human labour	30968 (68.34)	42459 (53.85)	28155 (51.64)	36555 (54.26)
2	Manures	3720 (8.21)	10980 (13.92)	7028 (12.89)	8927 (13.25)
3	Soil ameliorants	3199 (7.06)	7064 (8.96)	3724 (6.83)	5564 (8.26)
4	Fertilizers	3524 (7.78)	5307 (6.73)	3761 (6.90)	4613 (6.85)
5	Plant protection chemicals	3900 (8.61)	13040 (16.54)	11848 (21.73)	11704 (17.37)
6	Total cost	45,312 (100.00)	78,851 (100.00)	54,517 (100.00)	67,365 (100.00)

Note: Figures in parentheses indicate per cent to column total

The aggregate cost incurred for inputs is depicted in Table 4.30. The weighted average cost incurred for labour in the maintenance phase was estimated as ₹36,555 per ha, while that incurred for plant protection chemicals accounted for ₹11,704 per ha and the respective shares in total input cost were 54 per cent and 17 per cent. The cost for manures, fertilizers and soil ameliorants accounted for 13, 12 and eight per cent of the total input cost respectively. The weighted average input-wise cost of cultivation in the yielding phase was estimated as ₹ 67,365 per hectare.

Table 4.31. Operation-wise cost per tree during establishment and maintenance phases of cocoa cultivation (₹ per tree)

Sl no.	Operations	Establishment phase	Early bearing phase	Yield stabilising phase	Yield declining phase	Weighted average cost
1.	Planting seeds in polybags	15				
2.	Digging of pits, application of organic manure and planting	57				
3.	Shade regulation/ mulching	16				
4.	Manure Application	48	19	37	27	33
5.	Application of soil ameliorants	16	19	27	17	23
6.	Pruning	15	10	13	11	12
7.	Application of plant protection chemicals	21	18	47	42	43
8.	Application of fertilizers	31	17	26	21	23
9.	Weeding	137				
10.	Cost of irrigation	96	16	22	0	14
11.	Cost of harvesting	-	14	25	15	20
11.	Total	452	113	197	136	168

The cost per tree during the phases of establishment, early bearing, yield stablilisation and declining yield were worked out and the results are presented in Table 4.31. The cost incurred per tree during the establishment phase was estimated ₹452 and it could be observed from the table that the highest cost during the establishment phase was for weeding (₹137 per tree).A higher number of weeding operations are required during the establishment phase and hence, it has the highest share in the cost during the establishment phase. The weighted average of the cost incurred during the maintenance phase was ₹168 per tree. The highest cost during the maintenance phase was incurred for spraying plant protection chemicals and it was estimated as ₹43 per tree.

Table 4.32. Input-wise cost per tree in establishment and maintenance phases of cocoa cultivation (₹ per tree)

Sl no.	Input	Establishment phase	Early bearing phase	Yield stabilising phase	Yield declining phase	Weighted average
1.	Human labour	353	77	106	70	91
2.	Planting material	27				
3.	Shade/mulch	11				
4.	Manure	23	10	28	17	21
5.	Soil ameliorant	5	8	17	9	14
6.	Fertilizer	19	9	13	10	12
7.	Plant protection chemicals	14	10	33	30	30
8.	Total input cost	452	112	197	136	168

The input-wise costs incurred per tree during the establishment phase and various phases in the maintenance phase were worked out and are presented in Table 4.32. The highest cost was incurred for human labour during all phases of cocoa cultivation and the cost incurred for labour per tree accounted to ₹353 during the establishment phase and ₹91 during the maintenance phase. The weighted average cost for plant protection chemicals was estimated as ₹30, whereas the costs incurred per tree for manures and fertilizers were ₹21 and ₹12 respectively.

4.5.5. Cost of cultivation of cocoa

Table 4.33. Cost of cultivation of cocoa in Kerala (₹ per ha)

Sl. no.	Particulars	Cost (₹/ha)	Cost (₹/tree)
1.	Establishment cost	1,80,813	452
2.	Amortised cost	14,569	36
3.	Annual maintenance cost	67,365	168
4.	Interest on working capital at 7 per cent	4,715	11
5.	Total cost	86,649	215

The cost of cultivation of cocoa refers to the expenses made to raise cocoa in one hectare of land. Since cocoa is raised as an intercrop, the cost incurred for cultivating an average number of cocoa trees (average number of 400 cocoa trees based on the primary data) were worked out to calculate the cost of cultivation. The establishment cost was estimated as ₹1,80,813 per hectare. The amortisation of the establishment cost was done using the formula $\frac{[i(1+i)^n]}{[(1+i)^n-1]}$ where, i is the rate of interest and n is the economic life span of the crop. The economic lifespan of cocoa was considered as 30 years. The amortised cost was worked as ₹14,659 per hectare, which was added to the annual maintenance cost of ₹67,365 and interest on working capital at seven per cent of ₹4,715 per hectare. Thus, the total cost of cultivation was worked out as ₹86,649 per hectare per year.

4.5.6. Cost of production of cocoa

Table 4.34. Cost of production of cocoa in Kerala (₹ per kg)

Sl. No.	Particulars	Yield increasing phase	Yield stabilising phase	Yield declining phase	Weighted average
I	**Cost of production of wet bean (₹ per kg)**				
1.	Cost of cultivation (₹/ha/year)	63,052	98,939	72,902	86,649
2.	Average productivity (kg/ha)	618	1577	845	1237
3.	Cost of production (₹/kg)	102	62	86	70
4.	High productivity (kg/ha)		3183		
5.	Cost of production in areas having high productivity (₹/kg)		31		
II	**Cost of production of dry bean (₹ per kg)**				
6.	Cost of drying and fermentation (₹ per ha)	3,650 {9}	9,622 {24}	7,500 {18}	8,306 {20}
7.	Sum of cost of cultivation and cost of drying and fermentation (₹ per ha)	66,702 {166}	1,08,561 {271}	80,402 {201}	94,955 {237}
8.	Average productivity of dry beans (kg/ha)	206 {0.5}	525 {1.31}	282 {0.7}	421 {1.05}
9.	Cost of production of dry beans (₹/kg)	323	206	286	225

Note: Values indicated within {} denotes cost per tree/ productivity per tree

The cost of production refers to the expenditure made to produce a unit quantity of the commodity. In the case of dry beans, cost of fermentation and drying were also added to the maintenance cost to find out the total cost of production. The cost of cultivation and average production during the early bearing, yield stabilising and yield declining phases were worked out separately. The cost of production for one kilogram of cocoa beans was obtained by dividing the cost of cultivation per hectare with the average production per unit area of land (i.e. productivity in kg per ha) during each of the yielding phase. Hence, the cost of production of wet beans for early bearing, yield stabilising and yield declining phases were found to be ₹102, ₹62 and ₹86 per kg respectively. Thus, the weighted average cost of production for the maintenance phase

of cocoa cultivation was estimated as ₹70 per kg. While considering the maintenance costs alone, the weighted average cost of production of wet beans was found to be ₹54 per kg.

In the case of cocoa cultivated in certain areas of Idukki, a higher productivity as compared to average productivity in other areas was observed. In comparison to the normal productivity of one to four kg per tree per year during the yield stabilising phase, the farmers of Murickassery, Mankuva, Mariyapuram and Thekkinthand were able to produce seven kg to 25 kg per tree per year. Use of budded cocoa plants was one of the reasons which has led to this higher productivity. Buds obtained from superior mother plants with desirable characteristics like greater pod value (large number of beans per pod), large sized beans, large sized pods and reduced husk thickness were used for budding. Pods in such budded plants were large sized and three to four pods were sufficient to obtain one kg of wet beans. Also, as compared to the normal budding practice in which the branches of original plant are chopped off after budding, the branches of budded as well as parent plants are retained, thus, resulting in increased yield. Two popular cultivars identified in the study area were Treesa and Rose Red which were capable of yielding 12.5 to 25 kg wet bean per tree per year (50 to 100 pods per year). However, a higher cost of maintenance was involved while cultivating budded trees and hence, it has not received wider acceptance among the cocoa farmers.

Also, few of the farmers were able to obtain higher yield by artificial pollination. The trees which were artificially pollinated were capable of yielding 36 kg wet beans per tree per year. Hence, these outlier values in productivities were considered separately and average was obtained for the high productivity values as 3,183 kg per hectare *i.e.* 7.9 kg per tree per year during the yield stabilising phase. The cost of production in the case of cocoa farms with very high productivity was found to be ₹30 per kg.

It was found that normally three kg of wet beans yield one kg of dry beans. The average cost of fermentation and drying were estimated as ₹8,306 per ha and hence the total cost of production of dry bean was worked out as ₹225 per kilogram. While considering cost incurred on drying, fermentation and maintenance cost of cocoa, the cost of production of dry bean was worked out as ₹179 per kg.

4.5.7. Gross and net returns from cocoa cultivation

The average gross returns from cocoa cultivation in terms of wet beans was found to be ₹1,07,949 per hectare and in terms of dry beans it was estimated as ₹1,72,611. Since, the cost of cultivation was ₹86,649 per hectare, the net returns from wet beans was found to be ₹21,300 per hectare, while that from dry beans was found to be ₹85,962 per hectare. The returns obtained from cocoa cultivation were found to be comparatively lower due to the low market prices which prevailed for wet cocoa beans and dry cocoa beans during the survey period. The returns obtained using the average market price for 2021 as published by Government of Kerala (GOK, 2021) was computed separately to understand the difference in gross returns due to variation in prices. It was found that there were variations in the average annual cocoa prices and the yearly average price of cocoa in 2018, 2019 and 2020 were ₹44, ₹42 and ₹38 per kg respectively. There is volatility in annual price of cocoa which was the reason for the variations in gross returns obtained from cocoa cultivation in different years.

Table 4.35. Gross returns and net returns from cocoa cultivation (₹/ha)

Particulars	**Value (in ₹)** (July 2021 price)	**Value (in ₹)** (Annual average price in 2021)
Price (wet beans) (₹/kg)	35	48
Price (dry beans) (₹/kg)	180	210
Average gross returns from wet beans (₹/ha)	1,07,949	1,48,032
Average gross returns from dry beans (₹/ha)	1,72,611	2,01,379
Cost of cultivation (₹/ha)	86,649	86,649
Net returns from wet beans (₹/ha)	21,300	98,391
Net returns from dry beans (₹/ha)	85,962	1,14,730

4.6. Resource use efficiency in cocoa cultivation

To assess the resource use efficiency in cocoa cultivation in relation to the factors influencing the returns, production function analysis was carried out. In this study, Cobb-Douglas production function, one of the most widely used production functions in the economic analysis of problems relating to the empirical estimation of production in agriculture was fitted. The production function was estimated using OLS method. The overall goodness of fit of the model was tested using the F test and t-test

was used for testing the significance of the estimated elasticity coefficients. The gross returns from cocoa cultivation (₹ per ha) was considered as the dependent variable and the independent variables considered for the regression analysis were experience of the farmer, average age of the cocoa trees, expenditure on labour, expenditure on manures and expenditure on plant protection chemicals. Scatter plots of the variables used for regression analysis were observed and the outlier values were removed to avoid bias in the results. Hence, the total sample size of the data used for regression was 115. The results of the production function analysis are presented in Table 4.36 and Table 4.37.

Table 4.36. Mean values of the variables used in production function analysis

Sl no.	**Variables**	**Minimum value**	**Mean value**	**Maximum value**
1.	Gross returns from cocoa cultivation (₹/ ha)	8,160	1,07,949	3,12,000
2.	Cost of labour (₹/ha)	2,000	26,687	48,600
3.	Age of the trees (years)	3	14	40
4.	Experience (years)	5	20	50
5.	Cost of manure (₹/ha)	1,600	9,596	24,000
6.	Cost of plant protection chemicals (₹/ha)	2,000	12,606	29,400

Table 4.37. Estimates of Cobb-Douglas production function analysis

Sl no.	Explanatory variable	Elasticity values	Standard error	t ratio	Significance
1	Intercept	-3.58	2.33	-1.53	0.12
2	Experience in farming (years)	-0.06	0.17	-0.36	0.71
3	Age of the tree (years)	-0.63	0.15	-4.12	0.00009***
4	Cost of labour(₹/ ha)	0.29	0.19	1.54	0.13
5	Cost of manure (₹/ha)	0.66	0.15	4.22	0.00006***
6	Cost of plant protection chemicals (₹/ha)	0.80	0.16	5.07	0.000002***
$R^2 = 0.48$			Adjusted $R^2 = 0.45$		

Note: *** indicates significance at one per cent level

The fitted regression equation can be denoted as:

$$Y = -3.58 - 0.06\,X_1 - 0.63\,X_2 + 0.29\,X_3 + 0.66\,X_4 + 0.80\,X_5$$

Where Y= Gross income from cocoa cultivation (₹/ha)

X_1 = Experience (years)

X_2 = Age of the tree (years)

X_3 = Cost of labour (₹/ha)

X_4 = Cost of manure (₹/ha)

X_5 = Cost of plant protection chemicals (₹/ha)

The fitted regression equation had an R squared value of 48 per cent and adjusted R squared value of 45 per cent. It could be observed from the table that out of the five independent variables considered for the regression analysis, three variables were found to be significantly influencing the gross returns from cocoa cultivation. The age of the tree, cost of plant protection chemicals and cost of manures were found significantly influencing the gross returns at one per cent level of significance. The age of the tree was found to be negatively influencing the returns from cocoa cultivation, whereas cost incurred on manure and plant protection were found to be positively influencing the returns from cocoa farming. A one per cent increase in the age of the cocoa tree from the mean level was found to decrease the per hectare gross returns from cocoa cultivation by 0.63 per cent. The mean age of trees in the study area was found to be 14 years and since it was within the yield stabilising phase from five to twenty years, it could have positively influenced the gross returns from cocoa cultivation. It could be concluded that one per cent increase in cost incurred on each of the input namely manure and plant protection chemicals from their respective mean levels would increase the returns per hectare of cocoa cultivation by 0.66 and 0.80 per cent respectively from the mean level. Manures form an integral component in cocoa cultivation and the average cost incurred on manure application was found to be ₹9,596 per ha. Application of manure enhances soil health by increasing the number of beneficial soil microorganisms. It also helps in conserving soil moisture and helps to reduce the moisture stress especially during the summer season. Hence, the application of manure helps to enhance the yield and returns from cocoa cultivation. Spraying of plant protection chemicals is very crucial in determining the yield from cocoa cultivation because the incidence of diseases and pests deteriorate the quality of cocoa. The average expenditure incurred on plant protection chemicals was found to be ₹12,606 per ha. Adequate and timely application of plant protection chemicals help in improving the yield from cocoa cultivation.

4.6.1. Returns to scale

The returns to scale is defined as the proportionate increase or decrease in the output when all the factors of production are simultaneously increased or decreased. The returns to scale can be regarded to be constant if the sum of all the parameters in the regression equation is equal to one, increasing returns to scale occurs if the sum of estimates is found to be greater than one and will be of decreasing returns to scale, if sum of the estimates is less than 1. Here, the sum of elasticity estimates was found to be 1.06 and hence, it denotes decreasing returns to scale.

4.6.2. Resource use efficiency in cocoa cultivation

The Marginal Value Products (MVPs) of significant factors of production in the production function analysis were worked out and compared with the Marginal Factor Cost (MFCs) or Marginal Input Cost (MICs) to determine the resource use efficiency of different inputs and the results are presented in Table 4.38.

Table 4.38. Resource use efficiency of different inputs in cocoa cultivation

Sl no.	Inputs	Marginal Value Product (MVP)	Price of input (Px)	Resource use efficiency (MVP/Px)
1.	Manure	266.9	4	66.74
2.	Plant protection chemical	243.16	330	0.73

The ratio of MVP to price of manure was found to be 66.74, whereas for plant protection chemical it was found to be 0.73. Since the value of ratio of MVP to price of plant protection chemicals is less than one, it indicates that there is overutilization of plant protection chemicals and there is a need for rationalising the use of plant protection chemicals. The ratio of MVP to price of manure was found to be 66.74. It indicates that manure is underutilized and there exists scope for further increasing the use of manures in cocoa cultivation. Hence, it could be concluded based on the results of the resource use efficiency analysis that the use of plant protection chemicals should be reduced, whereas the use of manure should be increased in cocoa cultivation so as to increase the profit levels.

4.7. Marketing of cocoa

Cocoa is mainly marketed as beans by the farmers and is sold either as wet cocoa beans or dry cocoa beans. The wet cocoa beans are extracted by splitting up the cocoa pod and are marketed as fresh produce. The wet cocoa beans are fermented for three to five days, then dried under sunlight or artificially dried and are sold as dry beans. Fermentation process is crucial in determining the quality and colour of cocoa beans and for the development of required flavour. The appropriate fermentation of cocoa beans will give a rich brown colour to the beans and is crucial for the development of the chocolate flavour. Inadequate fermentation of cocoa beans will result in increased bitterness and astringency in the liquor as well as produces dull, grey chocolate powder. An over-fermented bean has a strong smell of putrefaction. Thus, fermentation process is critical in determining the quality of cocoa bean which in turn influences the price. Most of the farmers sell cocoa as wet beans during the rainy season due to lack of drying facilities, whereas during summer season they sell as dry beans. The dry beans fetch higher prices as compared to wet beans. The cocoa beans are processed and marketed as cocoa butter, cocoa powder, chocolates, chocolate spreads *etc.* While studying the marketing of cocoa, it was found that large number of middle men were involved in the trade of cocoa and the share of the final price received by the farmers were found to be comparatively low. The intermediaries involved in the marketing of cocoa were village traders, wholesalers, processors and exporters.

4.7.1. Marketing intermediaries

4.7.1.1 Village traders

The village traders are small shopkeepers who are engaged in selling of groceries or who procure spices as well as cocoa bean from farmers. They are located close to the farms and the farmers mostly sold their produce to them. They collect or aggregate the wet beans and dry beans and in turn sell to wholesalers or processors. Some of the village traders also resorted to drying of wet beans before marketing, which helped them to earn higher margins.

4.7.1.2. Wholesalers

The wholesalers collect the wet and dry beans from farmers and village traders. Then they sort and dry the produce and sell it to processors. They also sell small quantities of dry bean to the private companies.

4.7.1.3. Processors

The processors procure wet as well as dry beans either from the farmers or the wholesale dealers, sort the lots into different grades and process the beans into various cocoa products. The products are then marketed directly to the consumers or sold through supermarkets. The major processing companies identified in the study area were Mondelz International *Ltd.*, Lotus Chocolate Co. *Ltd.* and Morde Foods Pvt. *Ltd.*

4.7.1.4. High Range Organic Producer Company *Ltd.* (HOPCL)

The High Range Organic Producer Company *Ltd.* (HOPCL) is an organic producer company functioning in Adimali and has a membership of four hundred certified organic cocoa farmers. It plays a vital role in ensuring organic certification for its registered farmers by providing training on cultivation practices and also assist the farmers in renewing the organic certification. The organic certification is given only to those farms which do not use any chemical fertilizers or pesticides for a period of at least three years. The organic certification is given by a certification company named Indocert located in Aluva. Every year, the farm is inspected twice and the collected soil and plant samples are examined to ascertain whether all the farm operations are carried out using organic inputs and acceptable management techniques. The HOPCL has encouraged many farmers to shift to organic cultivation by ensuring premium price for their organic produce. The HOPCL has signed a contract with an Italian company 'Go Ground' in 2015 for a period of five years for trading organic cocoa and the company pays ₹ four per kg as the commission to the society for assisting the company in getting premium organic produce from farmers in Idukki.

4.7.1.5. Exporters

The exporters procure fresh wet beans directly from the farmers, then sort the beans to separate the inferior quality beans from the superior ones and the beans are then exported after drying. 'Go Ground' is an exporting company owned by an Italian Mr. Luca Beltrami, which is effectively functioning since 2015 in Udumbanchola Taluk in Idukki district. The farmers are paid ₹15 to 20 higher than the market price for the premium organic produce that they sell to the company. Only, disease and damage free organic produce are procured from the farmers by the company. The organic dry beans thus procured are exported at premium prices to countries including USA, Belgium, and Vietnam.

4.7.2.Marketing channel

The chain of intermediaries through which the commodity moves from the producer to the consumer is referred to as the marketing channel. Since, cocoa has a great demand in the processing industry and as majority of the farmers in the study area lacked processing skills, the produce was mostly sold to processors or exporters through various intermediaries. Cocoa is marketed by farmers either as wet beans or as dry beans. Depending on the form in which the produce is marketed by different intermediaries, the marketing channels in cocoa trade have been identified as follows:

I. Farmer (wet bean) - Processor cum retailer- Consumer

II. Farmer (wet bean) - Village trader (dry bean) - Processor cum retailer- Consumer

III. Farmer (wet bean) - Village trader (dry bean) - Wholesaler (dry bean) - Processor cum retailer - Consumer

IV. Farmer (wet bean) - Wholesaler (dry bean) - Processor cum retailer - Consumer

V. Farmer (dry bean) - Wholesaler (dry bean) - Processor cum retailer - Consumer

VI. Farmer (wet bean) - Village trader (wet bean) - Wholesaler (dry bean) - Processor cum retailer - Consumer

VII. Farmer (dry bean) - Village trader - Wholesaler - Processor cum retailer - Consumer

VIII. Farmer (wet bean) - Exporter - Consumer

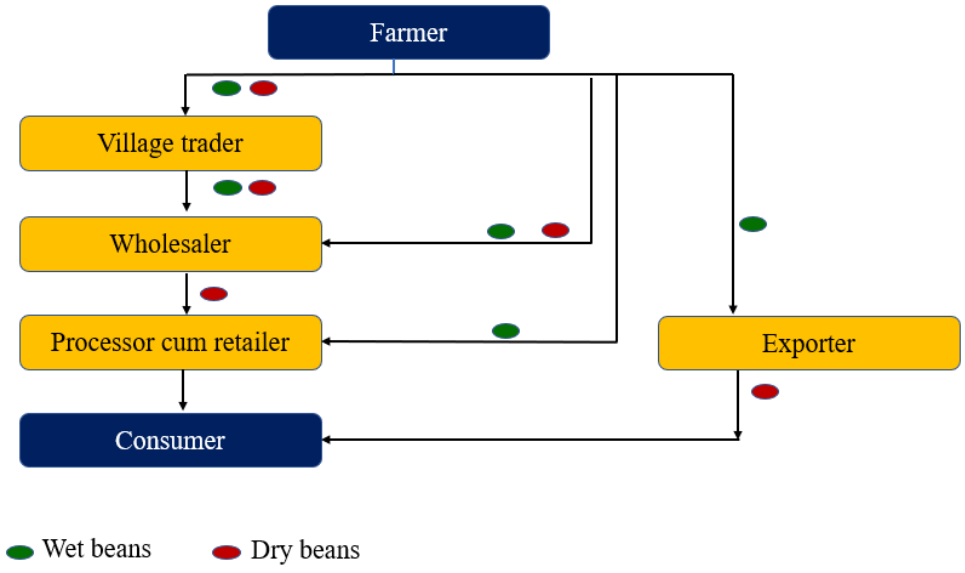

Figure 44. Marketing channels for cocoa in Kerala

4.7.2.1. Selling behaviour of sample farmers

The results of the classification of the sample farmers based on their selling behaviour is presented in Table 4.39. It could be observed from the table that nearly three-fourth of the farmers in the study area sold their produce to the village traders, while 20 per cent of the respondents marketed the produce directly to the exporters. It was also found that only four per cent of the farmers were directly selling cocoa beans to the processors. Since, the village traders are located nearby the farms and they procure the produce regularly, the farmers preferred to sell the produce to the village traders. Exporters only procured the wet beans of best quality and only few processors procured cocoa directly from farmers. Hence, the number of farmers who directly market cocoa to processors and exporters are less as compared to those who market through village traders.

Table 4.39. Classification of sample farmers based on selling behaviour

Marketing functionaries	Idukki	Ernakulam	Total
Village traders	77 (71.30)	12 (100)	89 (74.17)
Wholesalers	1 (0.93)	0 (0.00)	1 (0.83)
Processors	5 (4.63)	0 (0.00)	5 (4.17)
Exporters	25 (23.15)	0 (0.00)	25 (20.83)
Total	108 (100.00)	12 (100.00)	120 (100.00)

4.7.3. Marketing cost

The marketing costs are the expenses incurred towards the operations carried out by the farmers and intermediaries during different stages of marketing of cocoa. These costs are incurred for various processes such as drying, fermentation, sorting, loading, transportation, unloading and packing. Among all other costs incurred in the marketing channel, the amount spent for processing was found to be the highest. Processing costs varied depending on the form of product marketed and these charges were lesser for cocoa butter and cocoa powder, whereas it was found to be comparatively higher for chocolates.

Even though the cocoa farmers received the highest price for their produce when it was sold to the exporters, only 20.8 per cent of the farmers were found selling to

exporters as the exporters were willing to buy only premium quality organic cocoa. Most of the cocoa growers marketed cocoa beans to village traders as they were located close to the farms. Also, the procurement of the cocoa beans was regularly done on a daily basis by the village traders and they accepted products of even lower quality, which in turn motivated the farmers to sell the produce to them.

Table 4.40. Marketing costs incurred in different marketing channels of cocoa (₹ / kg)

Market intermediary	Functions	Channel I	Channel II	Channel III	Channel IV	Channel V	Channel VI	Channel VII	Channel VIII
Farmer	Drying	-	-	-	-	5	-	5	-
	Transportation	-	2	2	-	-	2	2	-
Village Trader	Drying	-	5	5	-	-	-	-	-
	Loading and unloading	-	0.4	-	-	-	-	-	-
Wholesaler	Loading and unloading	-	-	0.8	0.8	0.8	0.8	0.8	-
	Transportation	-	-	2	2	2	2	2	-
	Drying, fermentation and sorting	-	-	1.5	1.5	1.5	1.5	1.5	-
	Packing	-	-	1	1	1	1	1	-
Processor	Loading and unloading	0.3	0.3	0.3	0.3	0.3	0.3	0.3	-
	Transportation	2	2	2	2	2	2	2	-
	Drying, fermentation and sorting	5	5	5	5	5	5	5	-
	Processing charges	-	-	-	-	-	-	-	-
	i) Butter and powder	19.95	19.95	19.95	19.95	59.85	19.95	59.85	-
	ii) Chocolate bars	37.24	37.24	37.24	37.24	111.72	37.24	111.7	-
	Packing	2	2	2	2	2	2	2	-
	Storage	4	4	4	4	4	4	4	-
Exporter	Loading and unloading	-	-	-	-	-	-	-	3.6
	Transport	-	-	-	-	-	-	-	3
	Drying and fermentation	-	-	-	-	-	-	-	5
	Packing	-	-	-	-	-	-	-	0.6
	Storage	-	-	-	-	-	-	-	4
	Total marketing cost	**70.49**	**77.89**	**82.79**	**75.79**	**195.17**	**77.79**	**197.2**	**16.2**

4.7.4. Marketing margin

The marketing margin refers to the difference between the price received by a seller at a particular stage of marketing and the price paid by him at the preceding stage of marketing during an earlier period. The marketing margins obtained by the intermediaries while marketing cocoa are presented in Table 4.41. It could be observed from the table that the exporters and processors derived a comparatively higher marketing margins as compared to other marketing intermediaries. The net price received by farmer was found to be comparatively lower while marketing cocoa as wet beans when compared to marketing as dry beans and the lowest producer's share of ₹33 per kg was obtained by the farmer while marketing cocoa through channel II and III.

4.7.5.Price spread

The price spread is defined as the difference between the price received by producer and the price paid by the final consumer for an equivalent quantity of a commodity. Since cocoa is handled by a number of market intermediaries, the price spread in the marketing of cocoa was often very high. The price spread was found to be the least while marketing cocoa as dry beans as compared to marketing as other processed cocoa products. The producer's share in consumer's rupee was found to be the highest in channel V and channel VII as compared to other channels, since the farmers in these channels were selling cocoa as dry beans and the dry beans were priced high as compared to wet beans. Normally, 3 kg of wet beans are required to produce 1 kg of dry bean. So, 0.33 kg of dry bean is obtained from one kilogram of wet beans. In the study area, farmers who sold wet beans received only ₹35 per kg, whereas farmers who were engaged in selling dry beans received ₹180 per kg, resulting in 71.4 per cent increase in price when sold as dry bean. This difference in pricing is responsible for increased producer's price in channel V and channel VII.

Table 4.41 Price spread in different marketing channels of cocoa (₹/ kg)

Sl no.	Marketing Intermediary	Channel I	Channel II	Channel III	Channel IV	Channel V	Channel VI	Channel VII	Channel VIII
1.	Farmer's selling price	40	35	35	40	180	35	180	65
	Marketing cost	0	2	2	0	2	2	2	0
	Net price received by farmer	40	33	33	40	178	33	178	65
2.	Village trader's selling price	0	180	180	0	0	37	182	0
	Marketing cost	0	5	5	0	0	0	0	0
	Marketing margin	0	139	140	0	0	2	2	0
3.	Wholesaler's selling price	0	0	190	190	190	190	190	0
	Marketing cost	0	0	5	5	5	5	5	0
	Marketing margin	0	0	4	144	4	147	2	0
4.	Processor's selling price								
i)	Cocoa butter	240	240	240	240	718	240	718	0
ii)	Cocoa powder	246	246	246	246	738	246	738	0
iii)	Chocolate bars	860	860	860	860	2179	860	2179	0
	Marketing cost								
i)	Cocoa butter	33	33	33	33	73	33	73	0
ii)	Cocoa powder	33	33	33	33	73	33	73	0
iii)	Chocolates	50	50	50	50	125	50	125	0
	Marketing margin								
i)	Cocoa butter	167	27	16	16	454	16	454	0
ii)	Cocoa powder	173	33	22	22	474	22	474	0
iii)	Chocolates	769	629	619	619	1863	619	1863	0
5.	Exporter's selling price	0	0	0	0	0	0	0	150
	Exporter's marketing cost	0	0	0	0	0	0	0	16
	Exporter's marketing margin	0	0	0	0	0	0	0	68

6.	Consumer's purchase price								
i)	Cocoa butter	240	240	240	240	718	240	718	0
ii)	Cocoa powder	246	246	246	246	738	246	738	0
iii)	Chocolate bars	860	860	860	860	2179	860	2179	0
iv)	Dry bean	0	0	0	0	0	0	0	150
7.	Total marketing cost								
i)	Cocoa butter	33	40	45	38	80	40	80	0
ii)	Cocoa powder	33	40	45	38	80	40	80	0
iii)	Chocolates	50	57	62	55	132	57	132	0
iv)	Dry bean	0	0	0	0	0	0	0	16
8.	Total marketing margin								
i)	Cocoa butter	166	166	161	161	459	166	459	0
ii)	Cocoa powder	172	172	167	167	479	172	479	0
iii)	Chocolates	769	769	764	764	1868	769	1868	0
iv)	Dry bean	0	0	0	0	0	0	0	68
9.	Price spread								
i)	Cocoa butter	200	205	205	200	538	205	538	0
ii)	Cocoa powder	206	211	211	206	558	211	558	0
iii)	Chocolate	820	825	825	820	1999	825	1999	0
iv)	Dry bean	0	0	0	0	0	0	0	85
10.	Producer's share in consumer rupee								
i)	Cocoa butter	16.6	14.5	14.5	16.6	25	14.5	25	0
ii)	Cocoa powder	19.4	14.2	14.2	19.4	24.3	14.2	24.3	0
iii)	Chocolate	4.65	4.06	4.06	4.65	8.2	4.06	8.2	0
iv)	Dry bean	0	0	0	0	0	0	0	43

4.7.6. Marketing efficiency

The marketing efficiency refers to the ratio of total value of goods marketed to the sum of total marketing costs and margins. The marketing efficiencies in different channels were worked out using Sheperd's formula and the results are presented in Table 4.42. Cocoa is used by consumers as processed products such as cocoa butter, cocoa powder, chocolate bars *etc*. Since farmers lacked infrastructure and skills for processing, most of them marketed their produce either as wet beans or dry beans to either village traders or wholesalers, which were subsequently sold to processors. The marketing efficiencies for four different cocoa products (dried bean, cocoa butter, cocoa powder and chocolates) were estimated. The marketing efficiency was analysed for cocoa products in channels I to VII, whereas in Channel VIII efficiency in exporting of dry cocoa bean was analysed. Amongst the seven channels in which the marketing of processed cocoa products were studied, the marketing efficiency was found to be the highest in channel VIII in which dry bean was sold as the final product. In channel VIII, the produce is marketed directly from producer to exporter and hence, the marketing margin was found to be the minimum. Also, since the produce is marketed as dry beans, the marketing costs incurred are also minimum. Hence, the efficiency of channel VIII was found to be the highest due to the minimal marketing costs and marketing margins. In all other channels except channel VIII, processed cocoa products were marketed. The costs incurred in processing is high and as the farm level processing was not undertaken, there were large number of middlemen involved in handling the produce in these marketing channels. Hence, the marketing costs and marketing margins incurred in these channels remained high, thus lowering the overall efficiency in marketing.

Table 4.42. Marketing efficiency of different cocoa products in various channels

Sl no.	Particulars	Channel I	Channel II	Channel III	Channel IV	Channel V	Channel VI	Channel VII	Channel VIII
1.	**Total marketing cost**								
i)	Cocoa butter	33	41	46	39	80	41	80	-
ii)	Cocoa powder	33	41	46	39	80	41	80	-
iii)	Chocolates	51	58	63	56	132	58	132	-
iv)	Dry bean	-	-	-	-	-	-	-	16
2.	**Total marketing margin**								
i)	Cocoa butter	167	166	161	161	460	166	460	-
ii)	Cocoa powder	173	172	167	167	480	172	480	-
iii)	Chocolates	769	769	764	764	1869	769	1869	-
iv)	Dry bean	-	-	-	-	-	-	-	69
3.	**Price spread**								
i)	Cocoa butter	200	205	205	200	538	205	538	-
ii)	Cocoa powder	206	211	211	206	558	211	558	-
iii)	Chocolate	820	825	825	820	1999	825	1999	-
iv)	Dry bean	-	-	-	-	-	-	-	85
4.	**Producer's share in consumer rupee**								
i)	Cocoa butter	16.7	14.5	14.5	16.7	25.0	14.5	25.0	-
ii)	Cocoa powder	19.4	14.2	14.2	19.4	24.3	14.2	24.3	-
iii)	Chocolate	4.7	4.1	4.1	4.7	8.2	4.1	8.2	-
iv)	Dry bean	-	-	-	-	-	-	-	43
5.	**Marketing Efficiency**								
i)	Cocoa butter	1.20	1.15	1.15	1.20	1.32	1.15	1.32	-
ii)	Cocoa powder	1.19	1.15	1.15	1.19	1.31	1.15	1.31	-
iii)	Chocolate	1.04	1.03	1.03	1.04	1.08	1.03	1.08	-
iv)	Dry bean	-	-	-	-	-	-	-	1.80

4.7. Constraints in production and marketing of cocoa

The major constraints in production and marketing of cocoa were identified and ranked by using Garrett ranking technique and the results are presented in Table 4.43. The major constraints identified included high incidence of black pod rot disease, infestation of tea mosquito bug, attack by mammalian pests and rodents, low yield due to changes in climatic conditions, difficulty in spraying operations, low price of the produce, lack of availability of drying and processing facilities and unavailability of labour. The Garrett scores for these constraints were 75.22, 55.44, 51.97, 51.71, 48.17, 45.91 and 38.31 respectively.

Table 4.43. Constraints involved in production and marketing of cocoa

Sl No.	Constraints	Garrett Score	Rank
1	Severe incidence of black pod rot disease	75.22	1
2	Infestation of tea mosquito bug	55.44	2
3	Attack of rodents and mammalian pests	51.97	3
4	Low yield due to change in weather	51.71	4
5	Difficulty in spraying plant protection chemical	48.17	5
6	Low price	45.91	6
7	No facility for drying and processing	38.31	7
8.	Unavailability of labourers	37.56	8

The most serious issue affecting cocoa production was found to be the severe incidence of black pod rot disease, with a Garrett score of 75.22. The peak period of fruiting occurs during rainy season and it coincides with the high incidence of black pod rot disease, which drastically reduces the yield. Even though spraying of Bordeaux mixture was found to be effective previously, it was reported that lately, large number of sprayings are required for managing the disease effectively.

The constraint ‘attack of tea mosquito bug’, with a Garrett score of 55.44, was identified as the second most important constraint. Severe infestation by tea mosquito bug drastically reduced the yield by deteriorating the quality of cocoa, making the produce non-marketable. The infestation created more panic among the organic cocoa growers as no suitable organic measures were available for controlling the pest attack. The incidence of pests was also found to be severe during the summer season.

Most of the places in the study area were found to be vulnerable to the attack of mammalian pests like monkeys, civets, rats and squirrels during the fruit bearing season. The cocoa pods could be only harvested after ripening, but as soon as the fruits ripen it was getting attacked by the vertebrate pests, thus making it non-marketable. The attack was found to be more prevalent in the isolated farms which were close to the forest areas.

The floods during 2018 and the changes in the climate have severely affected cocoa cultivation. In many areas in Konnathadi, the trees in the yield stabilising phase were found to be either yielding less or non-bearing. The returns from cocoa were meagre, which forced the farmers to cut down cocoa trees and shift to other remunerative crops like cardamom and nutmeg.

The erratic and continuous rainfall was found to be the major factor making the cultivation practices difficult. Spraying of plant protection chemicals requires to be done twice or thrice annually, at an interval of 45 days for effective management of black pod rot disease. The spraying cannot be done if the rains are prolonged. Also, the spraying would be ineffective if prolonged downpour occurs. The disease incidence was found to be very severe in many places of Idukki and Ernakulam and the farmers were forced to cut down the cocoa trees.

According to the farmers, the prices of both wet cocoa bean and dry cocoa bean in 2021 were to be found lower than the market prices that prevailed in 2020. The average price of wet beans in July 2021 was ₹35 per kg and dry bean was ₹180 per kg, whereas the price of wet beans and dry beans during July 2020 were ₹60 per kg and ₹210 per kg respectively. The prices prevailing in 2021 were insufficient to meet the operational expenses for farming and under the present scenario, cocoa cultivation was found to be nonremunerative.

Most of the farmers realized that the share of the price received by them was negligible as compared to that received by the processors and exporters. Majority of the farmers were incapable of drying the cocoa beans and marketed as wet beans during the rainy season. As a result, their income from cocoa farming was found to be low, especially during the monsoon period. The farmers lacked the skills and infrastructure for processing and the Multi-National Companies were taking advantage of this situation.

For carrying out pruning as well as for spraying operations in cocoa, hired labour is required. Lack of availability of labourers and high cost of labour is yet another problem faced by the farmers. Apart from these major problems, other concerns include lack of irrigation facility and lack of subsidy for cocoa farming. Though CAMPCO used to procure cocoa from the farmers, currently it is not being done and the marketing is mostly under the control of private companies. Farmers are forced to sell the produce at the prices offered by the companies as they lack knowledge about the pricing mechanism. Price volatility and sudden price fall affect the farmers severely as there is no minimum support price for cocoa.

Summary and Conclusions

5. SUMMARY AND CONCLUSIONS

The present study entitled 'Economic analysis of production, marketing and price behaviour of cocoa in Kerala' analysed the major trends in area, production and productivity of cocoa in India and Kerala; examined the price behaviour of cocoa; estimated the economics of cocoa production; calculated the efficiency of marketing channels and identified the major constraints in production and marketing of cocoa.

The study was based on both primary and secondary data. Idukki and Ernakulam districts which accounted for 90 per cent and 10 per cent respectively of the gross cultivated area under cocoa in Kerala were purposively chosen for the study. In order to estimate the economics of cultivation and marketing of cocoa, primary data was collected from 120 farmers in Idukki and Ernakulam districts and 20 village traders, five wholesalers, three processors and an exporter. For the study, secondary data was collected from Pink Data sheet of World Bank; Ministry of Agriculture and Farmers Welfare, Government of India; Statistics for Planning, Government of Kerala; Price statistics, Department of Agricultural Economics and Statistics, Government of Kerala and The Cashew and Cocoa journal, Directorate of Cashewnut and Cocoa Development.

The socio-economic characteristics of the respondents like age, gender, education, occupation, annual income, experience in farming, landholding size and type of cocoa farming were analysed using the primary data. The respondents were grouped into six different categories based on their age and it was found that majority of them (35 per cent) were aged between 31 and 40 years, which suggested that farmers in the middle age group were actively involved in cocoa cultivation. In the overall sample, about 86 per cent of the respondents were males and 14 per cent were females. It was found that 53 per cent of the respondents possessed only secondary school education and 60 per cent of the respondents had an experience of 10 to 20 years in farming. Nearly 72 per cent of the sample respondents had agriculture as their major source of income, even though two-third of the sample respondents were marginal farmers who owned landholdings of less than one hectare. The annual income of nearly 30.83 per cent of respondents was between ₹50,000 and ₹75,000 per year. It was found that though majority of the respondents (70 per cent) carried out organic cultivation of

cocoa, only 29.7 per cent of them marketed cocoa as an organically labelled produce at a premium price.

The secondary data on area, production and productivity of cocoa in India were analysed and it was found that the area under cocoa cultivation had progressively increased during the period from 1993-94 to 2019-20. The production of cocoa in the country also increased from 6,700 tonnes to 26,000 tonnes, while the productivity had declined from 0.6 tonnes per ha to 0.4 tonnes per ha during the study period. The area, production and productivity of cocoa in Kerala increased during the period from 1978-79 to 2018-19. The area increased from 10,500 ha in 1978-79 to 13,891 ha in 2018-19, whereas the production increased from 500 tonnes to 13,400 tonnes during the same period. The productivity of cocoa in Kerala improved from 0.047 tonnes per ha in 1978-79 to 0.96 tonnes per ha in 2018-19. The implementation of various governmental schemes and promotional activities to boost cocoa cultivation, advances in research activities, increase in prices of cocoa products and the adoption of superior varieties by farmers could have caused the significant growth of cocoa cultivation in India as well as Kerala.

The time series analysis was used for studying the price behaviour of cocoa and the data on monthly prices in international market from 1980-81 to 2018-19 and in six major markets of Kerala, *viz*., Pala, Thiruvalla, Muvattupuzha, Kothamangalam, Thodupuzha and Kattappana during the period from 2005-06 to 2021-22 were used for the analyses. The trend analysis indicated that the price of cocoa witnessed a sustained increase in international markets during the period from 1980-81 to 2018-19. The changes in demand and supply for cocoa products in the global market were identified as the major factor responsible for fluctuations in international cocoa prices. The analysis of the seasonal variations showed that the international prices remained comparatively low during the months of April and May while the peak price was observed during September. Thus, seasonality was clearly evident in international prices cocoa prices, whereas cyclical and irregular variations were less pronounced. The prices of cocoa in all the major markets of Kerala showed similarly increasing trend during the period from 2005-06 to 2021-22. The prices in Kerala were found to be the lowest during the months from August to October, while the prices were highest during the months of April and May. The changes in supply, variations in quality of the produce and price fluctuations in the international markets due to changes in market

fundamentals could be considered as the factors responsible for seasonal variations in prices of cocoa in Kerala. The cyclical and irregular variations of cocoa prices in Kerala were found to be insignificant.

The establishment and maintenance costs for cultivation of cocoa were worked out separately and the amortized value of establishment cost was added to maintenance cost to estimate the cost of cultivation of cocoa. The establishment cost of cocoa was worked as ₹1,78,022 per hectare and ₹2,10,150 per hectare in Idukki and Ernakulam districts respectively. Among all the inputs, the expenditure incurred for labour accounted for the highest share in the total establishment cost and the cost incurred on labour was ₹1,38,952 per hectare and ₹1,68,800 per hectare in Idukki and Ernakulam districts respectively. The weighted average establishment cost of cocoa was estimated as ₹1,80,813 per ha. The costs incurred during the early bearing, yield stabilising and yield declining phases were ₹50,904, ₹80,916 and ₹56,925 per ha per year in Idukki and, ₹36,925, ₹52,525 and ₹8,400 per ha per year in Ernakulam respectively. The aggregate maintenance cost for cocoa cultivation was worked out as ₹67,365 and the cost incurred for labour had the highest share of 60 per cent in the total maintenance cost. The total cost of cultivation was estimated as ₹86,649 per ha. The cost of production of wet bean was found to be ₹70 per kg, while the cost of production of dry bean was estimated as ₹225 per kg.

The efficiency of cocoa cultivation was analysed using the Cobb Douglas production function analysis and the cost incurred on plant protection chemicals, cost incurred on manures and age of the tree were found significantly influencing the returns from cocoa at one per cent level of significance. The fitted regression equation had an adjusted R square value of 45 per cent and the returns to scale was found to be increasing in nature. The ratio of MVP to price for manure was found to be 66.74, whereas for plant protection chemicals it was estimated as 0.73. This indicated that the plant protection chemicals were over utilised in the cultivation of cocoa whereas manure was underutilised. Thus, it can be concluded that the use of plant protection chemicals should be reduced and the use of manures should be increased so as to increase the returns from cultivation of cocoa.

The marketing of cocoa involved large number of intermediaries and hence, the share of the consumer's price received by the producer was found to be low in most of

the marketing channels of cocoa. The producer's share in consumer rupee was found to be higher while marketing dried bean as compared to marketing of wet bean. The highest producer's price of ₹180 was found in channel V and VII, whereas the lowest producer's price of ₹35 was observed in channels II, III and VI. The marketing efficiency in all the channels under study were found to be very low due to high marketing costs incurred, increased marketing margins extracted by the intermediaries and the involvement of large number of intermediaries in the marketing of cocoa. Among the seven channels in which the processed cocoa products were marketed, the marketing efficiency was found to be the highest in channel VIII in which dry bean was sold as the final product.

The major constraints associated with production and marketing of cocoa were identified by means of Garrett ranking technique. The high incidence of phytophthora was found to be the most serious constraint affecting the yield and returns from cocoa. The other major constraints included the damage caused by tea mosquito bug, attack by rodents and mammalian pests, yield decline due to climate change, difficulty involved in spraying operations, low price of the product, lack of availability of drying and processing facilities and shortage of labourers for performing pruning and spraying operations.

The following policy suggestions are proposed for improvement of production and marketing of cocoa:

1. Farmers and farm labourers should be trained to do the operations like pruning and fermentation in a systematic manner so as to improve the quality of cocoa beans marketed.
2. Farmers should be directed to apply the plant protection chemicals, manures and fertilizers as per the recommended doses as specified in the package of practices for cultivation of cocoa.
3. Although most of the cocoa farmers follow organic cultivation practices, the prices received by the farmers for organic cocoa is same as that produced using chemical inputs as there were no separate markets for marketing organic produce. Farmers should be made aware of the possibilities for higher income from selling certified organic produce and should be motivated to obtain organic

certification for their cocoa farms. Also, government should set up separate mechanism for procurement and marketing of organic cocoa.

4. Most of the farmers lacked drying facilities and were unable to dry cocoa beans during rainy season. Making arrangements for common drying facilities for the farmers will help them to realize better profit margin especially during the rainy season as the dried beans fetch higher price than the wet beans.
5. The market price of cocoa in the study area decreased drastically to ₹35 per kg during 2021 from ₹60 per kg in 2020. Cocoa is found to be a highly price volatile commodity and at present, no Minimum Support Price (MSP) or government procurement exist for cocoa. Hence, the farmers are forced to sell the produce to private companies. They are unaware of the pricing mechanism and are forced to sell cocoa at the rates determined by the market intermediaries. If MSP is announced and procurement is made by the government, it will definitely help the farmers to earn a remunerative price. Also, a system of price deficiency payment (as in the case of Natural Rubber) which is based on real time estimation of cost of cultivation, may be developed so as to ensure stable income to the cocoa farmers. All these will motivate the farmers to expand the area under cocoa cultivation and properly manage the cocoa farms according to the recommended package of practices.
6. There are no specific standards for grading or pricing the produce in the existing market conditions. The lots brought by farmers are pooled and hence the best quality as well as the worst cocoa fetch the same price. Setting up standards for grading and pricing will help the farmers to earn better profits.
7. Farmers should be motivated to undertake processing of cocoa. The dissemination of information on the technology for processing and provision of financial assistance for setting up infrastructure facilities required for carrying out processing at the farm level will motivate the farmers to undertake processing activities and thereby help them to move up in the value chain.
8. Farmers should be motivated to form Farmer Producer Organisations (FPOs) and Cooperatives, so that operations like spraying of plant protection chemicals, drying and processing can be carried out collectively and thereby help in lowering the cost.

Survey with cocoa farmers

Cocoa tree with high yield

Cocoa infested with black pod rot disease

Cocoa pod damaged by rodents

Plate I

Cocoa wet beans

Cocoa dry beans

Survey with cocoa wholesaler

Plate II

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Appendices

APPENDIX I
SURVEY QUESTIONNAIRE
Survey-questionnaire for farmers
Kerala Agricultural University
College of Agriculture
Vellanikkara, Thrissur
Department of Agricultural Economics

Economic analysis of production, marketing and price behaviour of cocoa in Kerala

District: Block: Panchayath:

Idukki (1)				Ernakulam (2)			
Idukki (1.1)		Adimali (1.2)		Kothamangalam (2.1)		Koovappadi (2.2)	
Wattikkudi (1.1.1)	Kanjikkuzhi (1.1.2)	Adimali (1.2.1)	Konnathadi (1.2.2.)	Paingottoor (2.1.1)	Keerampara (2.1.2)	Koovappadi (2.2.1)	Vengoor (2.2.2)

* Codes for districts, blocks and panchayaths is given within paranthesis

1. Socio economic profile of farmers:

1. Name of the farmer:

2. Age:

3. Gender:

4. Address:

5. Phone no:

6. Educational qualification:

Class	Up to 9^{th}	SSLC	Pre-degree	Graduate	Diploma	Post graduate	Others
Code	1	2	3	4	5	6	7

7. Experience in:
   i) farming (years)
   ii) cocoa farming (years)

8. Annual income:

Income	<Rs.25000	Rs.25000-Rs.50000	Rs. 50000-Rs. 75000	Rs. 75000-Rs.100000	Rs.100000-Rs.200000	>Rs.200000
Code	1	2	3	4	5	6

2. Family details

Sl no.	Name	Gender (M/F)	Relationship with the respondent	Age	Education	Occupation		Annual income	
						Primary	Secondary	Primary	Secondary

*A- Agriculture, E- Employed, SE- Self-employed, NE- Non employed, S- Student

3. Land Details:

Particulars	Owned (ha)	Leased in (ha) (From which year)	Leased out (ha) (From which year)	Total (ha)
Wet land				
Garden land				
Permanent fallow				
Value (Rent /Revenue) of land/year				
Total (ha)				

4. Crop details:

Sl. No.	Crop	Variety Local/HYV	Area/No.	Main Product		By-product	
				Quantity (kg)	Value (Rs)	Quantity	Value
I	Perennial Crops						
Mono-crop – Specify Pre-bearing (1-2 year)/Early bearing (2-5 year)/ Stable bearing (5-20 year) /Yield declining (20th year onwards)– denote age							
Mixed –crop							
II Annual Crops							

5. Details of non-crop activities:

Sl. No	Activities	Area/No	Annual maintenance expenses	Gross returns
1	Livestock activities			
2	Poultry			
3	Self - employment			
4	Others			

6. Cost of cultivation

Variety: Age of plantation: Total no. of cocoa trees: No of cocoa trees in yielding stage:

No. of harvests per year: Yield (kg/ha): Price/kg:

Operations	Quantity	Rate/unit	Human labour					
			Hired labour		Family labour		Total labour cost	
Land preparation								
Digging of pits								
Refilling pits with topsoil and compost								
Planting								
Manure application								
Fertilizer application								
Application of soil ameliorants (Dolomite application from 3rd year)								
Intercultural operations i)Weeding ii)Pruning and shade regulation iii)Mulching iv)Top working								
Irrigation cost								
Intercropping								
Application of plant protection chemicals								
Application of pesticides								

Harvesting								
Splitting of pods and separation of beans								
Post-harvest operations i)Fermentation ii Drying iii) Storage								
Land tax/cess								
Other expenses								
Total								

Fixed inputs	Year of purchase	Initial cost (Rs)	Useful life (years)
Land value			
Farm building			

Rental value of land: Land revenue:

Interest on fixed capital: Interest on working capital:

Machinery and equipment	Quantities	Year of purchase	Initial cost	Subsidy (if any)	Useful life (years)
1.Pump sets (No.) 2.Spade (No.) 3.Gunny sack (No.) 4.Plastic sack (No.) 5.Basket (No.)					

	Skilled labour		Unskilled labour	
	M	F	M	F
Wage rate (Rs./ man days)				

Year / Crop	Current Year (2021)				Previous Year (2020)				Year before previous (2019)			
	Qty (kg)	Average Price	Peak Price	Lowest Price	Qty (kg)	Average Price	Peak Price	Lowest Price	Qty (kg)	Average Price	Peak Price	Lowest Price
Cocoa beans												
Cocoa beans fermented												
Cocoa beans dried												
Cocoa beans processed												

By products if any:

7. Details on contact with developmental agencies

Sl. No.	Agencies	Type of Assistance			
		Planting materials	Technology	Subsidy	Marketing
1	Agricultural Department				
2	CPCRI				
3	KAU				
4	Co-operatives				
5	NGO				
6	Others				

a. What support do you expect from institutional agencies to withstand price fluctuations and for the improvement of yield?

8. Details of credit:

Have you availed any credit? Yes / No (If yes, specify year also)

Sl. No.	Sources of Finance	Type of Loan			Loan Amount	
		ST	MT	LT	Taken	Outstanding
1	Nationalized bank					
2	Co-operative bank					
3	Gold Loan					
4	Money lender					
5	Friends & relatives					
6	Others					

9. Replanting, land improvement and others (last five years)

Activity	Extent of coverage	Total expenditure	Amount of subsidy & Source	Year
Replanting (number of plants)				
Replanting (No. of plants) – Shifted to other crops				
Land improvement (area)				
Irrigation (area)				
Farm machinery				
Any other investment				

10. Details on Marketing:

I. Farm Level Details		
1.	Total quantity of cocoa beans harvested	
2.	Total marketed quantity of cocoa beans	
3.	When do you sell the produce?	
4.	To whom do you sell the produce? (Code)	
5.	Reason for sale to village traders (Code)	
6.	Distance to the market	
7.	Any market charges (commission/brokerage)	
8.	Cost of processing (Rs/kg of beans)	
9.	Mode of Transport	
10.	Price received per kg:	
11.	Mode of Payment	
12.	Storage	
(i)	Time period of storage	
(ii)	Method of storage	
(iii)	Cost of Storage	
(iv)	Other remarks	
13.	Loading and unloading charges	
14.	Transport charges	
15.	Commission/brokerage	
16.	Other charges, if any	
17.	Source of information on price	

Code for 4			**Code for 5**
Method of sale	Quantity	Price per unit	1.Lack of processing facility 2. Low marketable surplus 3.To obtain high price for the produce 4. No transport facility 5.Transportation cost
1.Village traders			
2.Wholesalers			
3.Processors			
4.Exporters			

5.Chocolate manufacturing companies (specify)			6. Immediate cash payment for loans taken 7. Traditional practice 8. Minimal procedures in selling the produce 9. Lack of awareness about other opportunities 10. other reasons (specify)
6. Others			

18. Are you aware of the channel through which your produce reaches the ultimate consumers?
19. Reasons for sales to the local leader/wholesaler/consumer/commission agents/agencies?
20. Do you know the price at which final intermediary sells the produce to ultimate consumers?
21. Sources of information on price data?
22. Are you member of any producer organization / Cooperative / SHG (PDS)
23. Any contractual agreement of selling of the produce
24. If yes, since which year?
25. How the price is determined?
26. Is there any incentive/bonus?

11. Constraints in production and marketing

Ranking of production constraints:

S1. No	Problem	Occurrence of problem (yes/ no)	Extent of problem (5-point scale)	Rank
1.	Inadequacy of high yielding and disease-free planting materials			
2.	Low yield			
3.	Small land holding size			
4.	Problem due to poor fertility status of soil			
5.	Labour shortage			
6.	Shortage of irrigation facilities			
7.	High labour charges			
8.	Occurrence of diseases			
9.	Damage caused by rodents			
10.	High post-harvest loss			
11.	Lack of awareness regarding proper crop management practises			
12.	Others (if any)			

Ranking of marketing constraints:

Sl. No.	Problem	Occurrence of problem (yes/no)	Extent of problem (5-point scale)	Rank
1.	Low price			
2.	Rapid fluctuations in price			
3.	Low demand			
4.	Less profit as compared to other perennial crops			
5.	More distance to markets			
6.	High transportation charges			
7.	Transport losses			
8.	Non availability of storage facilities			
9.	Lack of processing unit for value addition			
10.	Distress sale to traders			
11.	Labour problem (loading and unloading)			
12.	Others (if any)			

Survey-questionnaire for cocoa processors
Kerala Agricultural University
College of Agriculture
KAU (P.O)
Vellanikkara, Thrissur
Department of Agricultural Economics

Economic analysis of production, marketing and price behaviour of cocoa in Kerala
Cocoa processing – unit level survey

1. Name of the person :

2. Name of the unit :

3. Address for communication :

4. Phone number:

5. Ownership pattern:

I. Proprietorship II. Partnership III. Private Ltd. Company

IV. Government Owned V. Cooperative

6. Year of establishment :

7. Location of the unit from city (kms) :

8. Processing capacity of unit/day :

9. Nature of the unit : I. Processing II. Processor cum distributing.

10. What is the processing capacity of your factory?

11. Whether your factory functions throughout the year? Yes/No

12. Reasons for non-functioning throughout the year

a. Shortage of raw materials
b. Water scarcity and power cuts
c. Labour scarcity
d. Other reasons specify

13. How many labours are employed in your unit? Male:
Female:

14. Wage rate of labourers of various categories in your firm? Male:
Female:

15. What are the processing methods followed?

16. Details on purchase of cocoa

Season	Variety	Quantity purchased (kg)	Sources and place of purchase	Purchase price (Rs. /kg)
I				
II				

17. Which parameter you look for in the purchase of cocoa? (specify quality characteristics)

18. Give details of the transportation charges incurred?

From which place	Quantity	Mode of transport	Transportation	Loading charges	Unloading charges

19. Any loss during transportation (quantity and value)? :

20. Do you have storage facility?

21. What is the method of storage being followed?

22. What is the storage expense incurred?

23. Is there any loss during storage? (quantity)

24. Is there any loss during processing? (quantity)

25. What is the processing cost incurred (Rs. / quintal of cocoa)?

26. To whom you sell cocoa? Exporters/ Chocolate manufacturing company/Others

27. Wet cocoa bean (kgs) Price:

28. Dried cocoa bean (kgs) Price:

29. Flavoured cocoa beans (kgs) Price:

30. Roasted cocoa beans (kgs) Price:

31. Cocoa mass: Price:

32. Cocoa butter: Price:

33. Cocoa husk/shell/pod: Price:

34. Cocoa powder: Price:

35. Chocolates: Price:

Survey-questionnaire for market intermediaries

Kerala Agricultural University
College of Agriculture
Vellanikkara, Thrissur
Department of Agricultural Economics

Economic analysis of production, marketing and price behaviour of cocoa in Kerala

District: Block: Panchayath:

1.Name and address of respondent:

2. Gender

3. Age

4. Type of market intermediary: (Village trader/ Wholesaler/ Exporter)

5. No of years of experience in cocoa trading:

6. Main product(s) dealt with:

7. Quantity (volume) of transaction/year:

8. Do you have any shop/stall for marketing the produce?

9. If yes, place of operation, number and size of stalls?

10. Transactions made:

a. Purchase of produce: Time:

b. Sale of produce: Time:

11. From whom you mostly purchase?

12. Quantity purchased/year?

13. Average price paid/quintal?

14. To whom is the product sold?

15. Cocoa transacted during the year:

Sl no.	Season	Place		Distance	Total quantity transacted	Purchase Price	Remarks
		From	To				
1.							
2.							
3.							

16. Expenditure

Sl no.	Particulars	Amount	Remarks
1.	Transport cost		
2.	Loading and unloading charges		
3.	Weighing charges		
4.	Drying charges (if any)		
5.	Other processing expenses (if any)		
6.	Storage cost		
7.	Brokerage		
8.	Taxes		
9.	Other expenses		
10.	Selling price (Rs./ Quintal)		

17. Storage of cocoa:

a) Quantity stored: b) Method of storage:

18.Known marketing channels through which the produce reaches the ultimate consumer?

19. Constraints faced in buying it from producers/traders:

20. Problems faced in marketing of cocoa:

21. Give suggestions to overcome the problems:

APPENDIX II

Sources of secondary data with the duration

Particulars	Period	Sources
Area, production and productivity of cocoa in India	1993 to 2019	Ministry of Agriculture and Farmer's welfare, Government of India
Area, production and productivity of cocoa in Kerala	1978 to 2018	Statistics for planning, Government of Kerala Department of Agricultural Economics and Statistics, Governmnet of Kerala
Prices of cocoa in international market	1980 to 2018	Pink data sheet of World Bank
Prices of cocoa in Kerala	2007 to 2021	Price Statistics, Department of Agricultural Economics and Statistics, Government of Kerala The Cashew and Cocoa Journal, Directorate of Cashewnut and Cocoa Development

ECONOMIC ANALYSIS OF PRODUCTION, MARKETING AND PRICE BEHAVIOUR OF COCOA IN KERALA

By

ANILA V S

(2019-11-166)

ABSTRACT OF THE THESIS

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DEPARTMENT OF AGRICULTURAL ECONOMICS

COLLEGE OF AGRICULTURE

VELLANIKKARA, THRISSUR- 680656

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ABSTRACT

Cocoa (*Theobroma cacao*) is one of the important plantation crops which is widely cultivated for its delicious beans. In India, cocoa is cultivated intensively in Andhra Pradesh, Karnataka, Kerala and Tamil Nadu. The demand of cocoa is growing at 15 per cent every year but there is no corresponding increase in production. The present study entitled 'Economic analysis of production, marketing and price behaviour of cocoa in Kerala' analysed the major trends in area, production and productivity of cocoa in India and Kerala; examined the price behaviour of cocoa; estimated the economics of cocoa production; calculated the efficiency of marketing channels and identified the major constraints in production and marketing of cocoa.

The study was based on both primary and secondary data. Idukki and Ernakulam districts were purposively selected for the study as these districts accounted for about 90 per cent and 10 per cent respectively of the area under cocoa in Kerala during 2018-19. From Idukki district, 108 samples were selected and 12 samples were selected from Ernakulam district based on proportionate sampling, thus making the total sample size of 120. The data was also collected from 20 village traders, five wholesalers and three processors.

The area under cocoa cultivation in India progressively increased from 11,900 ha in 1993-94 to 98,000 ha in 2019-20, resulting in a concomitant increase in production from 6,700 tonnes to 26,000 tonnes even with a decline in productivity from 0.6 t/ha to 0.4t/ha during the study period. In Kerala, the area increased from 10,500 ha in 1978-79 to 13,891 ha in 2018-19, whereas the production increased from 500 tonnes to 13,400 tonnes during the same period. The productivity of cocoa in Kerala improved from 0.047 tonnes per ha in 1978-79 to 0.96 tonnes per ha in 2018-19. The development plans for cocoa implemented in 2005 under the National Horticultural Mission and the subsequent area expansion schemes implemented in Kerala, Karnataka, Tamil Nadu and Andhra Pradesh during 2005-06 could be the major factors responsible for the increase in area under cocoa in India. The adoption of superior hybrids released by Central Plantation Crops Research Institute (CPCRI) and Kerala Agricultural University (KAU) by the farmers as well as the training programmes under Mission for Integrated Development of Horticulture (MIDH) in 2014 has resulted in improvement in production and productivity of cocoa in India.

The trend analysis indicated that the prices of cocoa have witnessed a sustained increase in international markets during the period from 1980-81 to 2018-19. The analysis of the seasonal variations showed that the international prices remained comparatively low during the months of April and May and, the peak price was observed during September. The prices of cocoa in all the major markets of Kerala showed similarly increasing trend during the period from 2005-06 to 2021-22. The prices in Kerala were found to be the lowest during the months from August to October, while were highest during the months of April and May. The cyclical and irregular variations in prices of cocoa in international as well as Kerala markets were found to be insignificant.

The establishment cost of cocoa was worked as ₹1,78,022 per hectare and ₹2,10,150 per hectare in Idukki and Ernakulam districts respectively. The weighted average establishment cost for cocoa was estimated as ₹1,80,813 per ha. The costs incurred during the early bearing, yield stabilising and yield declining phases were ₹50,904, ₹80,916 and ₹56,925 per ha per year in Idukki and, ₹36,925, ₹52,525 and ₹8,400 per ha per year in Ernakulam respectively. The aggregate maintenance cost for cocoa cultivation was worked out as ₹67,365. The total cost of cultivation for cocoa was estimated as ₹86,649 per ha. The cost of production for wet cocoa beans was found to be ₹70 per kg, while the cost of production for dry cocoa beans was estimated as ₹225 per kg.

The efficiency of cocoa cultivation was analysed using the Cobb Douglas production function analysis and the cost incurred on plant protection chemicals, cost incurred on manures and age of the tree were found significantly influencing the returns from cocoa at one per cent level of significance. The ratio of MVP to price for manure was found to be 66.74, whereas for plant protection chemicals it was found to be 0.73 and this indicated that the plant protection chemicals were overutilised, whereas manure was underutilised in cocoa cultivation.

Nearly 70 per cent of the farmers in the study area sold cocoa to the village traders, while 20 per cent of the respondents marketed the produce directly to the exporters. Eight major marketing channels were identified in the study area. The highest producer's price of ₹180 was found in channel V and VII, whereas the lowest producer's price of ₹35 was observed in channels II, III and VI. The marketing

efficiency in all the channels under study were found to be very low due to high marketing costs incurred, increased marketing margins extracted by the intermediaries and the involvement of large number of intermediaries in the marketing of cocoa. The price spread was found to be the least while marketing cocoa as dry beans as compared to marketing as other processed cocoa products. The producer's share in consumer's rupee was found to be the highest in channel V and channel VII as compared to other channels, in which farmers were selling cocoa as dry beans.

The high incidence of phytophthora was found to be the most serious constraint affecting the yield and returns from cocoa. The other major constraints included the damage caused by tea mosquito bug, attack of rodent and mammalian pests, yield decline due to climate change, difficulty involved in spraying operations and low price of the product.

Provision of proper training for cocoa farmers; directing farmers to apply plant protection chemicals, manures and fertilizers as per recommended doses; arranging common drying facilities for farmers and setting up standards for grading and pricing are recommended to address the constraints faced by farmers. Also, if government procurement is done and MSP is announced, it will definitely help the farmers to earn stable and remunerative prices, which will in turn motivate the farmers to expand the area under cocoa cultivation. Farmers should be encouraged to form Farmer Producer Organisations (FPOs) so that the operations like spraying of plant protection chemicals, drying and processing can be carried out collectively and thereby help in lowering the cost.