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

By

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(2016-11-046)

THESIS

Submitted in partial fulfillment of the requirement for the degree of

Master of Science in Agriculture

Faculty of Agriculture

Kerala Agricultural University, Thrissur

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COLLEGE OF HORTICULTURE
VELLANIKKARA, THRISSUR – 680656
KERALA, INDIA

2019

DECLARATION

I, hereby declare that the thesis entitled **"Economic analysis of production, marketing and price behaviour of nutmeg in Kerala"** is a bonafide record of research 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.

Vellanikkara,
Date: 01/06/2019

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CERTIFICATE

Certified that this thesis entitled **"Economic analysis of production, marketing and price behaviour of nutmeg in Kerala "** is a record of research work done independently by **Ms. Reshma Sara Sabu (2016-11-046)** 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.

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ACKNOWLEDGEMENT

I humbly bow my head before the ***God Almighty****, who blessed me with strength, knowledge, will power and opportunity to undertake this research study and to complete this endeavor successfully.*

With immense pleasure I avail this opportunity to express my deep sense of whole hearted gratitude and indebtedness to my major advisor ***Dr. Anil Kuruvila****, Associate Professor, Department of Agricultural Economics, College of Horticulture, Vellanikkara and chairperson of my advisory committee for his expert advice, inspiring guidance, practical suggestions, constant patience, untiring help, friendly approach and kind advice at various stages of my research work and thesis preparation and will be remembered forever.*

I would like to express my extreme indebtedness and obligation to ***Dr. Latha Bastine C.****, former Professor and Head, Dept. of Agricultural Economics for her meticulous help, expert advice, forbearance, critical evaluation, constant encouragement and support throughout my course of study.*

I sincerely thank ***Dr. K. Jesy Thomas****, Professor and Head, Dept. of Agricultural Economics, and member of my advisory committee for her unwavering encouragement, timely support and critical examination of the manuscript that has helped me a lot for the improvement and preparation of the thesis.*

I express my heartiest gratitude to ***Dr. Chitra Parayil****, Assistant Professor, Department of Agriculture Economics, RARS Pattambi and member of my advisory committee for her ever willing help, valuable guidance and creative suggestions throughout the period of my study.*

I wish to extend my wholehearted gratitude to ***Dr. N. Mini Raj****, Professor, Department of Plantation crops and spices and member of my advisory committee for her generous support, immense help and most precious suggestions in times of need which helped me to overcome all the insurmountable obstacles.*

I am thankful to all the agricultural officers of the panchayats surveyed, especially ***Dr. Soumya Emil****, Agricultural officer at Puthenvelikara panchayat for her sincere guidance and support.*

I am extremely thankful to all the respondent farmers, especially ***Mr. Johny, Mr. Thomas, Mr. Joseph and Mrs. Marykutty*** *for their co-operation and support during the survey.*

True words of thanks to all my friends, more personally I would like to express my sincere gratitude to my dearest and intimate friends, ***Athi, Abi, Swathy, Sreethu, Roshni, Juby, and Ashwini.*** *I appreciate all my seniors, especially* ***Sachu Sara Sabu*** *for her guidance and emotional support and also* ***Janeesitha, Thasnitha, Arsha chechi, Seenatha, Radhika chechi, Preethi chechy, and Lokesh,S*** *juniors of Department of Agricultural Economics* ***Anirudh, Shana, Swadi, Sindhu, Apeksha*** *and batch mates who helped me in one way or the other. I am extremely thankful to all the Research Associates,* ***Rajeshettan, Sarada chechi*** *and* ***Jayasree chechi*** *and Teaching Assistants of the Department of Agricultural Economics, and* ***Sindhu chechi*** *for their support during the conduct of research. I thankfully remember the services rendered by all the staff members of Student's computer club, College Library, Office of COH and Central library, KAU. I am thankful to Kerala Agricultural University for the technical and financial assistance for persuasion of my study and research work.*

I am speechless! I can barely find words to express all the wisdom, love and support given me for that I am eternally grateful to my beloved parents, ***Sabu Kuriakose*** *and* ***Reena Mary Philip,*** *my beloved siblings* ***Ann and Allen,*** *grandparents* ***K.O. Philipose, Fr.V.Kuriakose*** *and* ***Annamma Philip*** *for their unconditional love, fidelity, endurance and encouragement. They have been selfless in giving me the best of everything and I express my deep gratitude for their love, personal sacrifice and constant prayers without which this work would not have been completed. I am forever indebted to my family members,* ***Peter Mathew, Valsa peter, Reji Philip, Reny Philip, Binu Rachel, Gigi Alexander, Saju Kuriakose, Sanu Kuriakose, Raina Sanu, Vipin Peter, Merin Peter, Jeffy John, Remya Elias, Ponnu, Ninu, Miriaiam, Annu, Chinnu, Diya, Gregory, Chris, Lilly and Isabel*** *for their constant prayers, encouragement and eternal love.*

A word of apology to those I have not mentioned in person and a note of thanks to everyone who helped for the successful completion of this endeavor.

RESHMA SARA SABU

Dedicated to the farming population of Kerala

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Introduction

1. INTRODUCTION

Nutmeg is an important spice crop cultivated for its two distinct products, nutmeg and mace. Nutmeg is the seed kernel inside the fruit and mace or aril is the covering on the kernel and both are being used as condiment and medicine. It is the commercial source for essential oil and nutmeg butter. The spice is used in its ground form in the food processing industry, especially as a standard seasoning in many dishes. It is used as a drug in eastern countries because of its stimulant, carminative, astringent and aphrodisiac properties. Grenada and Indonesia contribute about 80 per cent of the world nutmeg production and the remaining 20 per cent is accounted by India, Malaysia, Papua New Guinea and Sri Lanka (Miniraj and Nybe, 2015).

India is one of the major producers of nutmeg in the world, with an area of 21,465 ha and production of 14,280 tonnes in Triennium Ending (TE) 2016-17. The nutmeg producing states in India are Kerala, Karnataka, Andaman and Nicobar, and Goa. Kerala accounted for 97.2 per cent of the area and 98.2 per cent of the production of nutmeg in India during the TE 2016-17. The area under nutmeg in Kerala has increased from 6,950 ha in 2000-01 to 22,065 ha in 2016-17, whereas the increase in production during the period was from 1,731 tonnes to 13,746 tonnes (Spices Board, 2018). There was about 217.6 per cent increase in the cultivated area and 619.4 per cent increase in nutmeg production in Kerala during the period from 2000-01 to 2016-17. The value of output of nutmeg produced in Kerala was Rs 50,263 lakhs in TE 2017-18, which accounted for 99.8 per cent of the value of output of the crop in the country (CSO, 2018). Thrissur and Ernakulam districts are the major producing regions of nutmeg in the state, together accounting for about 63 per cent of the area and 67 per cent of the production in the state during 2016-17.

Nutmeg is an export oriented commodity and is exported as nutmeg and mace, which are mainly used as raw materials in pharmaceutical, food and cosmetic industries. The major markets for export of nutmeg from India are

Vietnam, United Arab Emirates, Nigeria, United States, Bangladesh and Brazil. The quantity of nutmeg exported from India has increased from 0.101 tonnes in 1988 to 9.75 tonnes in 1998, whereas the value of export increased from 826 US$ to 13,881 US$. From 1998 to 2003, there was a drastic increase in the quantity of export of nutmeg by 124 times and value of exports increased by 328 times. During the period from 2003 to 2017, quantity and value of nutmeg exports increased by seven and four times respectively. Mace is mainly exported to United States, Qatar, Brazil, United Kingdom, Nepal and Saudi Arabia. 36 per cent of the total export of mace from India was to United States in 2017. The quantity of mace exported from India has decreased from 3.10 tonnes in 1988 to 0.07 tonnes in 1998, whereas the value of export decreased from 22862 US$ to 363 US$ during the same period. Even though the export of mace from India, both in terms of quantity and value has increased over years, the increase was much higher during the initial years of 2000s. From 2003 to 2017, quantity of export increased only by two times whereas the value increased by nine times, indicating a higher growth in unit value (WITS, 2019).

India is also importing nutmeg and mace from Indonesia, Srilanka and Germany. The import of nutmeg from other countries has exhibited an increasing trend from 1980 to 2005. After 2008, there was a decline in imports and reached 449 tonnes in quantity and 2640 US$ in value during 2017. The import quantity of mace has increased from 53 tonnes in 1988 to 1779 in 2017, whereas the value of imports drastically increased from 222 US$ to 18,439 US$ (WITS, 2019).

Consequently, the prices of nutmeg have been exhibiting considerable volatility over the years. The price of nutmeg with shell has increased from ₹180 per kg in 2005-06 to ₹348 per kg in 2011-12 and during the past five years there was a decreasing trend and it reached ₹176 per kg in 2017-18, which subsequently increased to ₹230 in January 2019 . A similar trend in prices was also observed for nutmeg without shell and mace. The price of nutmeg without shell was ₹355 per kg in 2005-06, increased to ₹632 per kg in 2011-12 and then decreased to ₹330 per kg in 2017-18, which again increased to ₹456 in January 2019. The price

of mace increased from ₹51 per kg in 2005-06 to ₹1190 per kg in 2011-12 and then declined to ₹441 per kg in 2017-18, which subsequently increased to ₹882 per kg in January 2019 (Spices Board, 2019).

Even though the area and production of nutmeg in Kerala have shown considerable growth over the years, the productivity has shown a varying pattern. The major reason for low productivity in nutmeg in Kerala were identified as unavailability of genuine and disease free planting materials and non-adoption of improved production technologies (Thangaselvabae *et. al.*, 2011).

Nutmeg being a high value crop, the rising prices and the consequent increase in area under the crop has contributed to growth in production. The increase in demand has not been to the tune of the rise in production and hence, the prices were either decreasing or considerably volatile. The limited flexibility in the cropping pattern to market forces in the case of trade dependent perennial cash crops like nutmeg has been causing income volatility and increased risk for the producers. This has been dissuading the farmers from undertaking further investments. Even though nutmeg is exported from India, the position of Indian farmers is low in the value chain as the commodity is mostly exported in the raw form as nutmeg, with or without shell and mace.

With the above background, the overall objective of the present thesis research was to analyse the economics of production and marketing of nutmeg in Thrissur and Ernakulam districts of Kerala.

The specific objectives of the study are

1) To analyze the trend in area, production and productivity of nutmeg in Kerala.
2) To study the price behaviour of nutmeg and mace in Kochi market of Kerala.
3) To estimate the economics and efficiency of nutmeg production.

4) To study the marketing practices and economics of marketing of nutmeg in Kerala
5) To determine the major constraints in production and marketing of nutmeg in Kerala and to suggest policy measures for improving the production and marketing efficiency

LIMITATIONS OF THE STUDY

The primary data is based on the responses from farmers and market intermediaries in Thrissur and Ernakulam districts of Kerala state, which was collected using pretested interview schedules. As majority of the farmers were not maintaining any field book, the data collected from their memory may suffer from recall bias. However, consistent efforts were made to minimize the errors and misconceptions by cross checking the data.

PLAN OF THE THESIS

The thesis has been divided and presented in five chapters. The first chapter gives a general introduction to the thesis explaining the importance and present status of nutmeg cultivation in Kerala. In the second chapter, important past studies which are relevant to the present study are reviewed. The third chapter provides a brief description of the study area and methodology, including the analytical techniques followed in present thesis research. The fourth chapter includes the results and discussion and 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 review of literature is a critical discussion and summary of literature in the particular area of research and it helps to justify the methodology proposed for the study. In this chapter, an attempt has been made to review the past studies which are relevant to the present study, from the point of view of the objectives as well as the methodology.

2.1 Trend and growth rate analyses

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 ANALYSES

The trend in area, production and productivity of sweet potato in different states of India for the period from 1966-67 to 1977-78 was analyzed by Biradar and Annamalai (1992). Exponential function of the form, $Y= ab^t$ was used to fit the time series data to find the Compound Annual Growth Rates (CAGR) of area, production and productivity and the results of the study revealed that there was an increase in area, production and productivity of the crop by 15.3, 22.5 and 6.4 per cent respectively during the period.

A study on the growth and instability of the world black pepper market during the period from 1975 to 1990 and the export performance of Indian black pepper with respect to growth, direction, competitive position and terms of trade was conducted by Jeromi and Ramanathan (1993). They observed that during the first half of eighties, India's export performance has substantially improved, but it has declined

since 1987-88. Analysis of India's export direction revealed that the share of market economies has declined over the years.

Babu *et. al.,* (1996) analyzed the CAGR in area, production and productivity of black pepper for the period from 1956-57 to 1989-90 by fitting the functions of the type $Y=AB^t$. They reported that over the years, area under black pepper has increased by 0.97 per cent and the production by 0.92 per cent per annum, whereas the productivity declined by 0.07 per cent per annum. Further, the variability analysis revealed that growth in black pepper production was accompanied by instability in production, which was caused by instability in both area and productivity.

In a state-wise analysis of growth trends in area, production and productivity of coconut in India, a positive growth rate in area as well as production in the country was observed by Lathika and Kumar (2005). This indicated that the expansion phase of the crop was not over in the country. Being a perennial crop with long gestation period, production growth may not immediately follow an area growth in equal measure and the age composition of coconut palms has a crucial role in influencing its productivity, apart from the actual efficiency of the firm's production system.

Singh and Renu (2009) studied the growth in production and productivity of different pulses in Jharkhand state and reported positive changes in the area under pulses. The CAGR in the area for pea, lentil, chickpea and pigeon pea was estimated to be 8 per cent, 62 per cent, 0.80 per cent and 0.20 per cent respectively. It was found that the growth rates in production for the same crops were 9.2 per cent, 6.8 per cent, 3.5 per cent and 3.9 per cent respectively. The growth rates in productivity for these crops were also observed to be 1.20 per cent, 0.05 per cent, 0.20 per cent and 2.20 per cent respectively. It was observed that variability in area was highest for pea, followed by lentil and pigeon pea and least for chickpea. Variability in yield also showed a similar pattern and was estimated to be the highest for pea, followed by chickpea and lentil respectively, while it was the least for pigeon pea.

Kulkarni *et. al.,* (2012) found that area under cashew cultivation in India has increased by 53 per cent from 5.65 lakh hectares during 1993-94 to 9.23 lakh hectares during 2009-10. The CAGR in production was highest for Maharashtra, followed by Tamil Nadu and Orissa and was found to be 10.81 per cent, 7.30 per cent and 6.24 per cent respectively. The yield of cashew in India increased from 694 kg/ha during 1993-94 to 695 kg/ha during 2009-10.

Thamban *et. al.*, (2016) analysed the trends, challenges and opportunities of coconut production in Kerala and reported that area under coconut cultivation had fallen from 9.26 lakh hectare to 8.09 lakh hectare during the period from 2000-01 to 2013-14. Further, a similar trend was observed in the case of productivity (7322 nuts per hectare), which was 28 per cent lower than the national average (10122 nuts per hectare) and with a negative compound growth rate of 0.96 per cent.

2.2 PRICE BEHAVIOUR

Aravindakshan (1995), after analyzing the prices of coconut oil and copra for the period from 1988 to 1995 reported that there was considerable seasonality in the prices of coconut. The prices of coconut oil and copra increased upto the months of November and December and then showed a declining pattern upto May.

Varghese (2008) analyzed the trend in annual average price of coconut in Nedumangad market, coconut oil in Kochi and Minimum Support Price (MSP) of copra during the period from 1995 to 2007 and estimated the variation of MSP from the market price. The study revealed that high volatility of market price of copra and coconut oil in domestic and international markets was because of market integration in both the markets.

Babu *et. al.*, (2009) used the classical time series analysis to segregate secular, seasonal, cyclical and irregular components in the prices of coconut and coconut products like copra and coconut oil in India. The prices showed an increasing secular

trend and there were noticeable seasonal variations. It was found that the wide spread irregular movements in prices contributed to higher price fluctuations. The domestic prices of copra and coconut oil were found to be higher than the corresponding international prices and were well integrated among themselves and with the international markets.

Jayasree *et. al.*, (2011) analyzed the price behavior of black pepper using time series approach and trend analysis was carried out using the Ordinary Least Squares method. It was observed that prices did not exhibit any specific trend. Ratio to moving average and residue methods were employed to work out the seasonal index and cyclical components respectively and it was reported that there was pronounced cyclical as well as random variations of prices in the domestic market.

Bhavani *et. al.*, (2016) after studying the trend, seasonal, cyclical and irregular variations in prices of chillies observed that the prices exhibited an increasing trend, which was statistically significant at five per cent level. The highest seasonal index was computed for the month of December (108.52), whereas the lowest seasonal index of 95.52 was recorded for February. Only one cycle which had lasted for four years was observed and there was no periodicity in the occurrence of irregular fluctuations..

2.3 ECONOMICS OF PRODUCTION

Job and Mukundan (1981) carried out an investigation on the economics of rubber cultivation among the small holders in Kottayam district of Kerala. Two stage stratified random sampling was used for selecting 100 sample farmers. It was observed that majority of the sample holdings were in the size group of 0.50 to 1.00 hectare. Total cost of cultivation per hectare for establishing rubber i.e., for seven years was estimated as ₹11054 in 1980-81 prices. More than half of the establishment cost was incurred for labour charges. The net return per hectare was ₹3234 during the eighth year, while it was ₹7193 during the 12^{th} year, which was the year of yield

stabilization. Cost of production of sheet rubber per quintal was estimated as ₹305 during the stabilized yield period. Pay Back Period (PBP), Benefit-Cost Ratio (BCR) and Internal Rate of Returns (IRR) were estimated as 9.51 years, 2.04 and 24.20 per cent respectively.

Ipe and Varghese (1990) studied the economics of nutmeg cultivation in Ernakulam district, in the low lands along the banks of Periyar river. Being a perennial crop with a gestation lag of six to seven years and an economic life of about 60 years, estimates of costs and returns over the entire period were developed and discounted at 14 per cent rate of interest. The Pay Back Period (PBP), Net Present Worth, Benefit-Cost Ratio and Internal Rate of Returns were 11 years, ₹1,22,018, 1.89 per cent and 24.6 per cent respectively. Sensitivity analysis showed that the project remained viable even with adverse changes in costs and returns.

John (1993) worked out the economics of cardamom cultivation in Idukki district of Kerala. The cost of establishment calculated for two years was ₹.16,601 per hectare, while the cost of maintenance from the 3rd to 12th year ranged from ₹12,056 to ₹14,674 per hectare and was estimated as ₹11,287 per hectare from 13th to 15th year of cultivation. Cost of production of one kilogram of cardamom varied from ₹172 per kg during the third year (year of first economic yield) to ₹125 from fourth to eighth year. Cardamom cultivation was highly labour intensive and more than 30 per cent of the total annual expenditure was incurred on labour. Capital productivity analyses indicated that the Pay Back Period was four years and the BC Ratio, IRR and NPW were estimated as 1.46, 49.50 per cent and ₹41,294 respectively, when discounted at 11 per cent rate of discount. The results suggested that cardamom had shorter Pay Back Period among the plantation crops and it was profitable to venture into the cultivation of cardamom. The study revealed that cardamom being one of the important plantation as well as spice crop, is a profitable enterprise irrespective of the size of the holding, provided agro-climatically suitable cultivars are made use of for cultivation.

Korikanthimath (1995) carried out large scale field trials adopting high production technology at Chettalli in the Coorg district of Karnataka to study labour utilisation, input requirement and economics of cardamom cultivation. It was observed that highest yield of 1625 kg/ha (dry) was recorded during the fourth year after planting. The average yield of dry cardamom for nine crop seasons was 695.66 kg/ha which was 12 times more than the national average yield of 58 kg/ha. Cultivation of cardamom was found to be highly labour intensive. Out of 747.42 labour days required per ha/year during the bearing period, the requirement of women labourers was higher (64.05 per cent) and 63 per cent of the labour requirement was for harvesting and processing alone. The annual maintenance cost was estimated as ₹35,148/ha. Partitioning of various inputs indicated that the maximum expenditure of ₹19,574.50/ha (55.69 per cent), was incurred for labour. An average net income of ₹1,09,967/ha for nine crop seasons was obtained with an average production cost of ₹57.22/kg.

Sairam *et. al.*, (1998) estimated the cost of cultivation of coconut at different stages of growth in Kasargode district by comparing the rainfed and irrigated conditions for three holding size classes such as marginal, small and large farmers. It was reported that the total cost of cultivation for coconut under irrigation was almost double to that under rainfed condition and the main cause for this was labour charges including family labour, which accounted for about 60 to 70 per cent of total cost in all the stages of cultivation.

Korikanthimath (2000) studied the performance and economics of replanting of small cardamom at Chattily in Kodagu district of Karnataka and found that an average yield of 749 kg/ha of dry cardamom was obtained during five crop seasons, which was 5.35 times higher than the national average of 140 kg/ha. It was found that the highest yield of 1,775 kg/ha of dry cardamom was recorded during the second year after replanting. Out of the 869.8 labour days required per hectare per year during the bearing period, 87.4 per cent of the requirement was for women labourers.

It was observed that 57.8 per cent of the labour requirement was for picking only. The maximum share in the total cost of cultivation was incurred for labour charges (69.45 per cent and ₹57,230/ha). A net income of ₹1,96,986/ha (average of five crop seasons) was obtained at a production cost of ₹130.97/kg of dry cardamom. The undiscounted measure of Pay Back Period was estimated as 2.15 years, while the discounted cash flow measures namely, NPW and BCR were estimated as ₹5,09,296 and 2.78 respectively. It was evident from the study that the replanting of cardamom was an economically viable and financially feasible proposition.

Alagappan and Manoharan (2001) studied the economics of pepper cultivation in Idukki district of Kerala and reported that the total cost of cultivation per acre increased with age of the plants, reached a maximum of ₹14,930 during the period from 7 to 12 years of age of the plantation and then decreased with increase in age and reached a minimum of ₹7,277.97 during the period from 17 to 20 years of age of the plantation. The Payback period, Net Present Worth and Benefit-Cost Ratio were estimated as 4.57 years, ₹2,02,219 and 3.21 per cent respectively.

Bastine *et. al.*, (2004) analyzed the cost of production and capital productivity of coconut in Kerala by considering the annualised establishment cost and annual maintenance cost. They reported that the establishment cost of coconut garden was ₹1, 22,130 with an annual maintenance cost of ₹24,690 and cost of production of ₹4.13 per nut. The Internal Rate of Return was projected to be 7.26 per cent along with a Net Present Value of ₹5286 and Benefit Cost Ratio of 1.02. It was suggested that government intervention was essential to support the farmers and for stabilizing the fluctuating prices.

Varghese (2007) studied the economics of cardamom cultivation in Kerala and stated that the cost of production was very high in small sized farms as compared to medium and large sized farms. This could be attributed to the fact that small size cultivators were applying more manure and obtained low yield per acre. It was found

that the inclusion of the imputed rental value of land to the comprehensive cost structure, made cardamom cultivation an unprofitable venture in Kerala. According to him there is a need for special package from the government to support the small and marginal cardamom farmers who continued the cultivation of the crop purely for survival.

Loganathan *et. al.*, (2016) conducted a comparative study on the cost, returns and economic viability of rainfed and irrigated cashew plantations in Tamil Nadu. It was found that gross returns were more in irrigated farms (₹43,650) when compared to the rainfed farms (₹33,288). The output-input ratio was 1.85 for rainfed and 2.03 for irrigated cashew farms. This indicated that cashew production was highly profitable only in irrigated farms which were achieved by gap filling and modern farming techniques. The NPW was higher for irrigated farms (₹80,027) as compared to the the dry farms (₹57,911) and the BC Ratio was also found to be higher for irrigated farms (2.28). Similarly, the Internal Rate of Return was also more for irrigated farms (42 per cent) when compared to that of the rainfed farms (37 per cent). It implied that it was necessary to create an awareness to adopt irrigated hybrid varieties in the study area, which could reduce the cost of cultivation and moreover, increase the net income in the cashew farms.

2.4 MARKETING CHANNELS AND PRICE SPREAD

Raikar *et. al.,* (1990) estimated the cost of marketing, marketing margins and price spread of cashewnuts in Uttara Kannada and Dakshina Kannada districts of Karnataka. They identified six marketing channels for cashewnut and reported that the producer's share in the consumer rupee was highest when the produce (raw nuts) was sold directly to processing units. They found that it was better to sell the cashew kernels in the local market than in the national market because of both the higher margin derived in the local market and the number of obligations that had to be met

by processors/exporters in exporting the kernels to important centres in India and abroad.

Balachandra and Ramachandra (1994) studied the market structure of arecanut by estimating the efficiency of marketing channels and the price spread between the producer-sellers and the final consumers. They identified three main channels through which arecanut reaches the traders from the producers and reported that market structure had not discriminated the growers across the size groups in terms of the cost of marketing services. It was concluded that the development of co-operative marketing system has provided effective channel for sales of arecanut and has helped in creating a competitive environment.

Haridoss and Chandran (1996) estimated the marketing costs, margins, price spread, effect of variation in the consumer's price on the share of the producers and the retailers, and the efficiency of the marketing channels of coconut. They observed that the producer's share in the retailer's net price of ₹3,015 per 1000 coconuts was ₹2,440. The producer's share in retailer's net price was 80.93 per cent. The marketing margin and marketing efficiency of coconut were found to be ₹170 per 1000 coconuts and 4.24 respectively.

Jayasekhar *et. al.,* (2002) analyzed the price spread of arecanut marketing in Dakshin Kannada district of Karnataka and identified four different marketing channels *viz.*, (i) Producer - Co-operative society - Sales representative - Trader (consumer centre) – Retailer – Panwalah - Consumer (ii) Producer - Trader - Broker - Trader (consumer centre) - Retailer – Panwalah - Consumer (iii) Producer - Commission agent - Trader-Broker - Trader (consumer center) – Retailer – Panwalah - Consumer and (iv) Producer - Co-operative society - Co-operative societies sales depot (consumer center) - Retailer – Panwalah - Consumer. It was observed that producer's share in consumer's price was the highest in the channel IV, while it was

lowest the channel III and hence, Channel IV was identified as the most efficient channel.

Bastine and Narayanan (2004) conducted a study in the central region of Kerala to understand the marketing aspects of coconut. The most commonly used marketing channel identified was the 'producer - copra maker - oil miller - wholesaler - consumer' and price spread in the channel was ₹202 per 100 nuts. They observed a very high price spread as producer's share in consumer's rupee was only 60.58 per cent. They suggested adoption of value addition technologies by the producers either at the individual level or on a collective/co-operative basis to reduce the role of intermediaries and thereby reduction in the price spread.

Gupta and Prasant (2004) identified six major six marketing channels prevailing in cashewnut trade in Goa and reported that about 10 per cent of the producers were selling their produce to itinerant merchants directly in channel-I and channel-II, whereas about 30 per cent of the producers kept close contact with village merchant through channel III and IV to dispose-of their produce. Like-wise channel-III and IV, channel-V is also very much popular among the farmers as about 55 per cent cashewnut growers sell their produce through this channel where they take varioaus facilities like advance money, information about market, spot payment and assured purchasing from the wholesalers. Very few large farmers (about 5 per cent) have chosen channel-VI to sell their produce to processors directly.

Nagendra and Rathod (2010) carried out a study on the production and marketing aspects of coconut in Tumkur district, Karnataka. They observed that the most common marketing channel in the study area was producer - village trader - commission agent - wholesalers - retailers - consumer. It is evident that market intermediaries play a major role in disposing coconut products and by-products.

Ramu (2013) investigated the efficiency of marketing channels of paddy in Chittur Taluk in Kerala. The study revealed that the marketing efficiency of the channel consisting of producers, Supply-Co, Public Distribution System and consumers was higher than that of the other three channels because of the lowest marketing cost, price spread and the highest producer's price.

Hameedu (2014) studied supply chain of cardamom in Kerala and found that the farmers were not conscious about the quality of the product. Marginal farmers did not have access to market information and sold their produce, without sorting or drying to the local traders. According to him that absence of grading system at producer's level was the main problem of cardamom cultivation in Kerala.

2.5 CONSTRAINTS IN PRODUCTION AND MARKETING

Sivanarayana (2000) identified that the constraints for the adoption of recommended arecanut production technology in Kasaragod district, Kerala were unavailability of labour, power shortages, pest and diseases, high labour charges, unavailability of machinery for spraying, harvesting and peeling of arecanut, lack of knowledge, unawareness of the practices, and high cost of fertilizers and pesticides.

Choudhury (2002) examined the major constraints faced by the coconut farmers in Assam and found that lack of awareness of the farmers on recent developments related to crop improvements, crop productions and cropping system, lack of quality planting material and lack of proper management practices like nursery management, nutrient management, irrigation management and cultural practices were the major constrains. Rhinoceros beetle, red palm weevil and termite were the major pests of coconut found in Assam, but incidence of bud rot, stem bleeding and basal stem rot or Ganoderma wilt were also the reasons for the reduction in coconut production..

Gupta and Prasant (2004) studied the constraints in production and marketing of cashewnut in Goa and observed that the major problems faced by the producers were lack of money and essential equipments needed for cashewnut production, lack of soil testing facilities, lack of mechanical grading of the produce and lack of awareness about market news and intelligence. Farmers were unable to store the commodity for more than 2 days and they were forced to sell it on the conditions dictated by the buyers due to low price of the produce. Lack of transportation facilities and pucca road, lack of processing units in some producing areas and lower prices of the produce were the other problems faced by producers in cashewnut marketing.

Chinnappa and Nagaraj (2009) identified the major problems experienced by arecanut farmers were the high transportation cost and shortage of transportation facilities. It was found that transportation cost accounted for 45 per cent of the total marketing costs. They recommended that combined efforts should be made by different agencies such as APMC'S and Co-operative marketing societies involved in arecanut marketing to ensure cheap and efficient transport facilities at the time of bumper production. Further, they also suggested extending of support price to farmers.

Rangasamy (2011), analysed the different aspects of investment in agricultural marketing, market-related infrastructure and agricultural marketing system in Kerala by surveying different respondents like officials of the marketing department, farmers, traders, entrepreneurs, bankers, self-help groups, cooperatives, exporters, retail traders, processing units, Self-Help Groups of VFPCK markets, public sector organisations like HORTICORP and the state government department officials from Idukki, Cochin, Kozhikode and Wayanad. It was observed that investment in agricultural marketing infrastructure in Kerala was influenced to a large extent by processing and value addition and concluded that the investment in agricultural marketing infrastructure in Kerala was very low due to lack of APMC

act, reduced exports, lack of public-private subsidy schemes, ineffective state government policies, less involvement in marketing by farmers, increased involvement by traders, poor management of local self-government markets, less market development activities, lack of awareness about central government subsidy, strong trade unionism and labour problems. Further, he suggested establishment of export testing laboratories and steam sterilization facilities for export oriented spices like black pepper, ginger and nutmeg. It was recommended that drying yard for ginger, turmeric and nutmeg should be created for farmers at field level for primary level processing.

Jnanadevan (2013) analyzed the problems and prospects of coconut cultivation in Kerala and reported that small size of holding with less than 0.1 hectare could not generate adequate income to support the dependent families. He observed that the shortage of farm workers and high labour charges also forced the farmers to ignore the timely adoption of agronomic practices and regular harvesting. About 10 per cent of the coconut palms in the existing plantation were old, senile and unproductive palms, which were overcrowded with perennial trees which cast shade on the palms. The high density of over 200 plants per hectare also caused the low productivity of coconut.

Jaganathan and Nagaraja (2015) in their study to analyze the constraints in adoption of arecanut based cropping system in Dakshina Kannada district, Karnataka reported that major constraints faced among the arecanut growers were non-availability of good quality inputs, price fluctuation, non- availability of skilled labour and quality planting materials, occurrence of pests and diseases, need for subsidies and electricity. They suggested that there is a need for intervention from government to strengthen quality control department for delivery of quality inputs, assuring minimum support price for crops, training labour for skill development, production of planting materials in large quantities, plant protection measures,

providing subsidies for small and marginal farmers which would encourage arecanut growers to adopt multispecies cropping system.

Bhoopathy (2016) analyzed the problems experienced in coconut cultivation by farmers in the Coimbatore district of Tamil Nadu using Garrett ranking technique. The results revealed that shortage of water due to failure of rainfall ranked first, followed by price fluctuations, lack of subsidy from the government, increased labour cost, power cut, lack of storage facility, inadequate price for coconut, shortage of labour, lack of knowledge about diseases and pests, delay in collecting the amount from the merchants and transportation respectively.

Juwita and Tsuchida (2017) analyzed the present conditions and profitability of the nutmeg industry in Bogor regency, Indonesia and found that lack of management during every stage of cultivation and processing have led to serious problems like scarcity of raw material, product rejection, and extreme price variations. Hence, they suggested emphasis on the product quality and safety for the sustenance of the nutmeg industry in Bogor Regency.

Methodology

3. METHODOLOGY

This chapter deals with the methodology used for the present study including the types of price data and other secondary data, details of the study area, sampling procedure, method of data collection and different tools of analysis.

3.1 AREA OF THE STUDY

The study was conducted in Thrissur and Ernakulam districts, as these districts were having the largest area under nutmeg cultivation in Kerala. In the present study, production and marketing aspects of nutmeg in Thrissur and Ernakulam districts were studied.

3.1.1 Thrissur district

Thrissur, known as 'cultural capital of Kerala' came into existence on July 1st 1949. According to the 2011 census, Thrissur district had 9.34 per cent of the total population in the state. Thrissur is the third most urbanised district in Kerala, with an urban population of about 67 per cent of the total population in the district. Majority of the population is dependent directly or indirectly on agriculture for their livelihood. The major crops grown in the district are paddy, coconut, nutmeg, arecanut, banana, tapioca, etc.

3.1.1.1 Location

Thrissur district is located in the central part of Kerala, with a total geographical area of 3029 sq.kms. It lies between 10° 10' and 10° 46' North latitude and 75° 57' and 76° 54' East longitude. Thrissur district borders with Malappuram district in the north, Ernakulam district in the south, Palakkad district in the east and Arabian Sea on the west.

The land utilization pattern in Thrissur district for the year 2016-17 is presented in Table 3.1. The net sown area in the district was around 42.4 per cent of the geographical area, whereas area sown more than once was around 14.03 per

cent. 34 per cent and 12.8 per cent of the district area were forest coverage and land put to non-agricultural uses, respectively.

Table 3.1 Land utilization pattern of Thrissur district in 2016-17

Particulars	Area in Hectares	Per cent to total geographical area
Total geographical area	302919	100.0
Forest land	103619	34.20
Land put to non-agricultural use	39026	12.88
Barren and uncultivable land	91	0.03
Permanent pastures and grazing land	0	0
Land under miscellaneous tree crops	201	0.66
Cultivable wasteland	10170	3.35
Fallow other than current fallow	6031	1.99
Current fallow	9813	3.23
Marshy land	0	0
Still water	5034	1.66
Water logged area	318	0.10
Social forestry	147	0.04
Net area sown	128469	42.41
Area sown more than once	42509.05	14.03
Total cropped area	170978.05	56.44

Source: Agricultural Statistics 2016-17, Directorate of Economics and Statistics, Kerala.

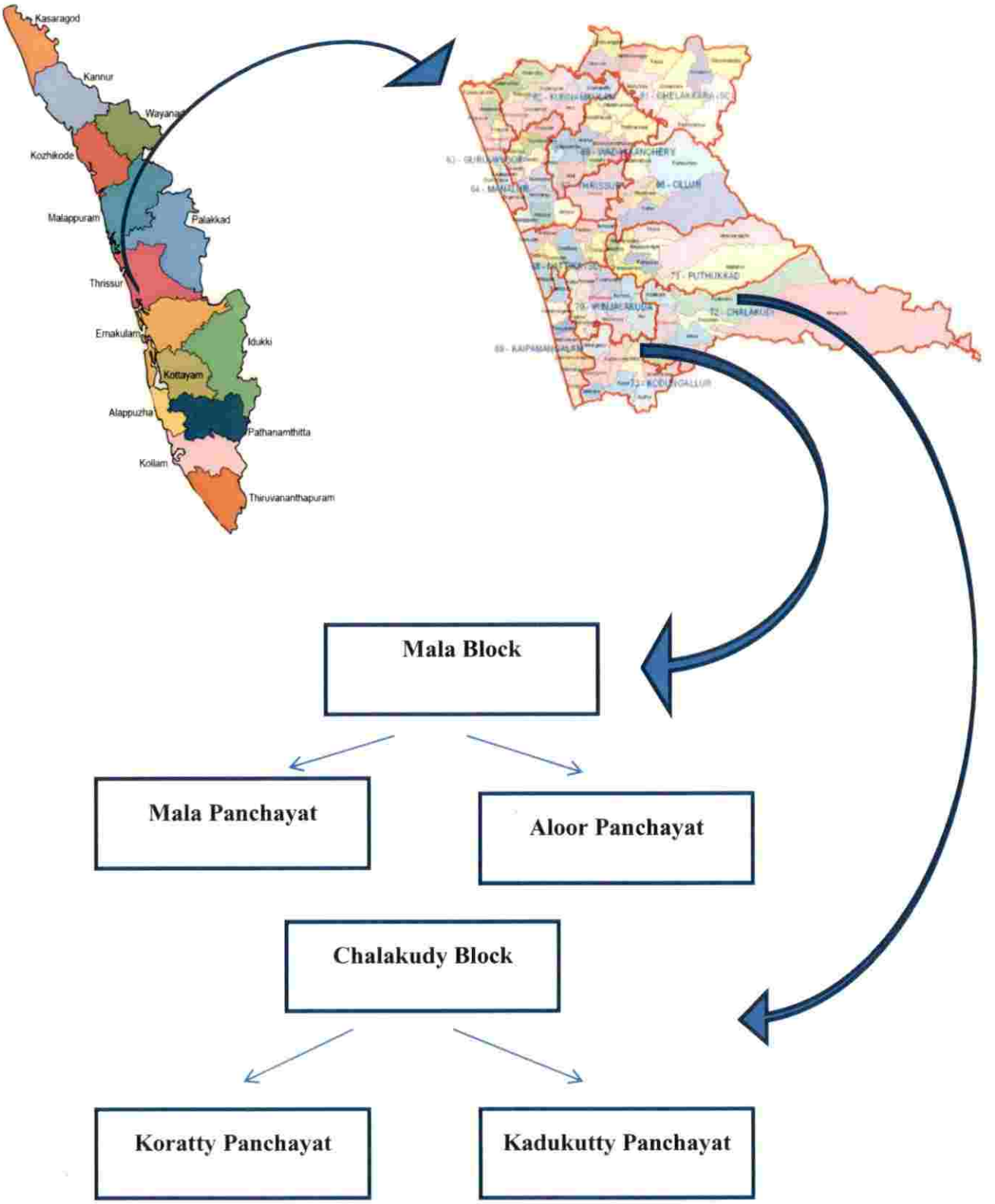

Figure 3.1 Map of the study area – Thrissur district

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3.1.1.2 Topography and Climate

Thrissur district extending from the Western Ghats in the east to the land slopes in the west, forms three distinct natural divisions (i) the thickly forest high lands, (ii) the fertile plains and (iii) the sea-board.

The district has a tropical humid climate with a hot season, and assured seasonal precipitation. The hot season starts in March and ends in May, followed by the South-West monsoon season from June to September. The October and November months account for the post-monsoon season. The monsoon stops by the end of December and the following period is generally dry. The maximum average temperature in summer season is 35° Celsius, while the minimum temperature is 22.5° Celsius. The winter season experiences a maximum average temperature of 32.3° Celsius and a minimum average of 20° Celsius. The air is highly humid throughout the year and relative humidity is generally over 70 per cent. The mean annual rainfall of the district is 3198 mm.

3.1.1.3. Demographic features

According to the 2011 census, the total population in Thrissur district was 31,21,200. The density of population was 1,031 per square km and the sex ratio in the district was 1108 females per 1000 males. The literacy rate in the district has increased from 92.27 per cent in 2001 to 95.08 per cent in 2011.The total number of workers in the district was 10,95,727, comprising of 9,29,506 main workers and 1,66,221 marginal workers.

3.1.1.4. Description of the selected Panchayats

The two blocks with maximum area under nutmeg cultivation in Thrissur district *viz.,* Mala and Chalakudy were chosen for the study. From each of the block, two Panchayats having maximum area under nutmeg were identified i.e., Mala and Aloor Panchayats from Mala block and Koratty and Kadukutty Panchayats from Chalakudy block.

The Panchayat-wise area according to the type of land is presented in Table 3.2. Dry land accounted more than 60 per cent of the total area in Mala, Aloor and Chalakudy Panchayats, while in Kadukutty Panchayat, it was about 48 per cent.

Table 3.2 Panchayat-wise area according to type of land in Trichur District

Block	Panchayat	Area in cents			
		Wetland	Dry land	Others	Total
Mala	Mala	235560 (33.62)	438433 (62.57)	26610 (3.79)	700603 (100)
	Aloor	260441 (30.68)	5121689 (60.34)	76172 (8.97)	848781 (100)
Chalakudy	Koratty	120386 (20.79)	354418 (61.21)	104187 (17.99)	578991 (100)
	Kadukutty	176414 (40.48)	209971 (48.18)	49364 (11.32)	435749 (100)

Note: Figures in parentheses indicate per cent to row total

Source: Panchayat Level Statistics, 2011, Thrissur

Table 3.3 Cropping pattern in selected blocks of Thrissur District (2016-17)

Crop	Area in Hectares	
	Mala	Chalakudy
Rice	868.5 (8.86)	187.87 (1.80)
Arecanut	412.84 (4.21)	543.55 (5.21)
Black Pepper	217.72 (2.22)	227.77 (2.18)
Coconut	4544.03 (46.40)	3826.7 (36.68)
Cashew	152.1 (1.55)	101.2 (0.97)
Papaya	102.14 (1.04)	126.6 (1.21)
Tamarind	66.99 (0.68)	61.43 (0.58)
Nutmeg	1408.55 (14.38)	2062.02 (19.76)
Banana and Plantain	474.7 (4.84)	1071.75 (10.27)
Tapioca	180.75 (1.84)	416.2 (3.99)
Vegetables	232.55 (2.37)	242.02 (2.32)
Jack	444.18 (4.53)	490.93 (4.70)
Mango	489.53 (4.99)	595.09 (5.70)
Others	610.59 (6.23)	477.41 (4.57)
Gross Cropped Area	9792.33 (100)	10430.54 (100)

Source: Agricultural Statistics 2016-17, Directorate of Economics and Statistics, Kerala.

Note: Figures in parentheses indicate per cent to column total

The details of the cropping pattern in selected blocks of Thrissur district are given in Table 3.3. It could be observed from the table that in both the selected blocks of Thrissur district, coconut accounted for the highest share in gross cropped area. It was followed by nutmeg, which accounted for about 14 per cent

and 20 per cent of the gross cropped area in Mala and Chalakudy blocks respectively.

3.1.2 Ernakulam district

Ernakulam district is located in the central part of Kerala and it came into existence on April 1st 1949. The district headquarters is at Kochi, known as the Queen of the Arabian Sea. According to 2011 census, the district has 9.82 per cent of the total population of the state. Ernakulam is the first most urbanised district in Kerala, with an urban population of about 68 per cent of the total population in the district. Main crops grown in the district are paddy, coconut, arecanut, tapioca, cashew, cocoa, black pepper and banana .

3.1.2.1 Location

Ernakulam stands fourth in total geographical area among the districts of Kerala with 3058 sq.kms. It lies between 9° 42' 30" and 10° 46' 00" North latitude and 76° 12' and 76° 36' East longitude. The district has forest area of 706 sq.kms. The district shares its boundaries with Thrissur district in the north, Idukki district in the east, Arabian sea in the west, Kottayam and Alleppy districts in the south.

The land utilization pattern in Ernakulam district for the year 2016-17 is presented in Table 3.1. The net area sown in the district was around 48.5 per cent of the geographical area and 10.66 per cent of the geographical area was sown more than once. While 23 per cent of the district area was under forest coverage and 14.5 per cent of the land was put to non-agricultural use.

Table 3.4 Land utilization pattern of Ernakulam district in 2016-17

Particulars	Area in Hectares	Per cent to total geographical area
Total geographical area	305826	100.00
Forest land	70617	23.09
Land put to non-agricultural use	44330	14.49
Barren and uncultivable land	404	0.13
Permanent pastures and grazing land	0	0
Land under miscellaneous tree crops	160	0.05
Cultivable wasteland	13455	4.39
Fallow other than current fallow	8031	2.62
Current fallow	8899	12.35
Marshy land	0	0
Still water	11171	11.35
Water logged area	290	9.03
Social forestry	105	4.10
Net area sown	148364	48.51
Area sown more than once	17721	10.66
Total cropped area	166085.61	54.30

Source: Agricultural Statistics 2016-17, Department of Economics and Statistics, Kerala.

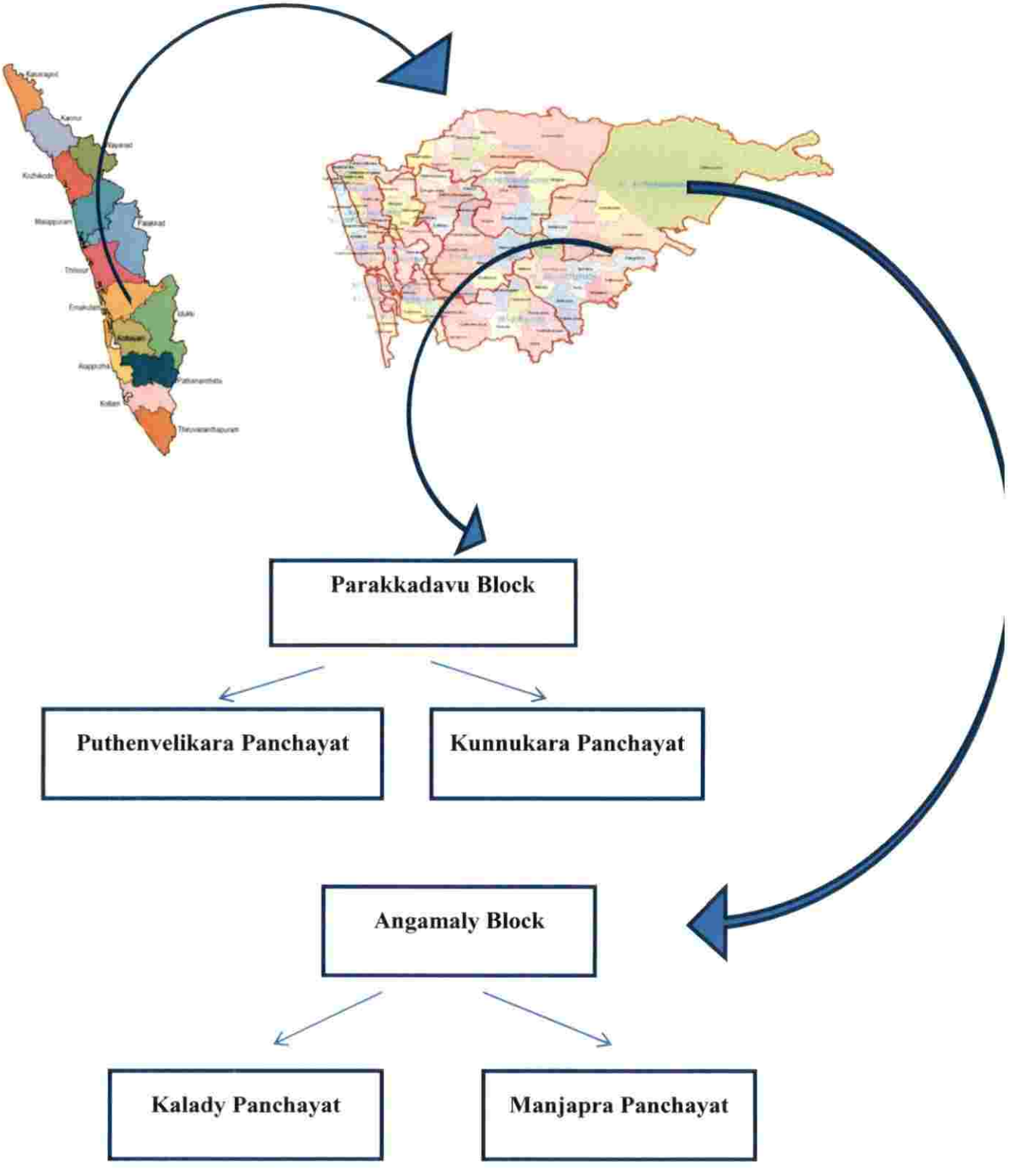

Figure 3.2 Map of the study area – Ernakulum district

3.1.2.2 Topography and climate

Based on the geographical features, the district can be divided into three parts (i) the low land which constitutes 20 percent of the total area, (ii) the midland consisting mainly of the plain land and group of islands and (iii) the highland with seaboard, hills and forests. The hilly or eastern portion of the district is formed by a section of Western Ghats.

The district has a tropical monsoon climate. There are only minor differences in temperatures between day and night, as well within a year as it lies along the south western coastal line of Kerala. Summer season is hot and extends from March to May, followed by the South-West monsoon from June to September. October and November months are the post-monsoon or retreating monsoon period. Winter season is from December to February, which is slightly cool and windy, due to winds from the Ghats. The average annual rainfall of the district is 3,099 mm, with 132 average annual rainy days. The maximum average temperature during the summer season is 33° Celsius, while the minimum temperature recorded is 22.5° Celsius. The winter season records a maximum average temperature of 29° Celsius and a minimum average temperature of 20° Celsius.

3.1.2.3 Demographic features

According to the 2011 census, the total population in the Ernakulam district was 32,82,388. The density of population was 1,072 per square km and the sex ratio in the district was 1027 females per 1000 males. The literacy rate in the district has increased from 93.20 per cent in 2001 to 95.89 per cent in 2011.The total number of workers in the district was 12,49,343, comprising of 10,61,388 main workers and 1,87,955 marginal workers.

3.1.2.4 Description of selected Panchayats

The two blocks in Ernakulam district *viz.,* Parakkadavu and Angamaly, with maximum area under nutmeg cultivation were selected for the study. From

each of the block, two Panchayats with maximum area under nutmeg were identified i.e., Puthenvelikara and Kunnukara Panchayats from Parakkadavu block and Kalady and Manjapra Panchayats from Angamaly block.

The Panchayat-wise area according to the type of land is presented in Table 3.5. From the table it could be observed that the dry land accounted for more than 50 per cent of the total area in Puthenvelikara, Kalady and Manjapra Panchayats, while in Kunnukara Panchayat, it accounted for about 27 per cent of the total area.

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

Block	Panchayat	Area in Hectares			
		Wetland	Dry land	Others	Total
Parakkadavu	Puthenvelikara	887.35 (42.49)	1093.34 (52.36)	107.68 (5.15)	2088.37 (100)
	Kunnukara	1309.66 (72.47)	497.32 (27.52)	0 (0)	1806.98 (100)
Angamaly	Kalady	616.08 (36.94)	870.68 (52.20)	1799.66 (10.84)	1667.69 (100)
	Manjapara	377.62 (35.73)	600.55 (56.83)	78.55 (7.43)	1056.73 (100)

Note: Figures in parentheses indicate per cent to row total

Source: Panchayat Level Statistics, 2011, Ernakulam

Table 3.6 Cropping pattern in selected blocks of Ernakulam district (2016-17)

Crop	Area in Hectares	
	Parakkadavu	**Angamaly**
Rice	318.32 (3.68)	478.74 (3.94)
Arecanut	405.53 (4.69)	645.62 (5.32)
Black Pepper	172.86 (2.00)	180.01 (1.48)
Coconut	2956.68 (34.26)	4840.66 (39.89)
Papaya	115.42 (1.33)	152.60 (1.25)
Nutmeg	951.86 (10.61)	1553.64 (12.80)
Banana and Plantain	1257.07 (14.56)	1773.01 (14.61)
Tapioca	792.46 (9.18)	468.45 (3.86)
Vegetables	417.40 (4.83)	462.68 (3.81)
Jack	395.56 (4.58)	547.2 (4.5)
Mango	416.31 (4.82)	508.12 (4.18)
Others	429.91 (4.98)	990.44 (8.16)
Gross Cropped Area	8629.38 (100)	12132.72 (100)

Note: Figures in parentheses indicate per cent to column total

Source: Agricultural Statistics 2016-17, Directorate of Economics and Statistics, Kerala.

The details of the cropping pattern in selected blocks of Ernakulam district are given in Table 3.6. It could be observed from the table that in both the selected blocks of Ernakulam district, coconut accounted for the highest share in gross cropped area. The second most important crop in both the blocks was accounted by banana and plantain. It was followed by nutmeg, which accounted for about

10.6 per cent and 12.8 per cent of the gross cropped area in Parakkadavu and Angamaly blocks respectively.

3.2 SAMPLING DESIGN

The present study was based on both primary and secondary data. The micro-level study was conducted in Thrissur and Ernakulam districts, which accounted for about 33 per cent and 30 per cent of the area respectively and 28 per cent and 39 per cent of the production respectively of nutmeg in Kerala in 2016-17. Two blocks from each district with maximum area under nutmeg namely, Chalakudy and Mala in Thrissur district and Angamaly and Parakkadavu in Ernakulam district were purposively selected. The list of nutmeg farmers was obtained from Krishi Bhavans and Spices board. From each of the selected block, two Panchayats having maximum number of nutmeg farmers were selected. From each of the Panchayat, 15 farmers with nutmeg as the major crop in the gross cropped area were selected, making a total sample size of 120. Data was also collected from 15 village traders, 10 wholesalers, two processors and five exporters. The time series data on prices of nutmeg were also collected for studying the price behaviour.

3.2.1 Collection of data

Data on production and marketing aspects of nutmeg was collected from these farm households using a using a structured and pre-tested interview schedule. Details on socio-economic profile of the farmers, cost of cultivation, yield and returns from nutmeg, marketing aspects, and production and marketing constrains of nutmeg were collected. Secondary data was also collected from various published and unpublished sources.

3.3 ANALYSES OF DATA

Different analytical tools were used to analyze both the primary and secondary data, which are explained below.

3.3.1 Primary data

The primary data collected from the sample respondents in the study area was tabulated and expressed in averages and percentages.

3.3.2 Trend and growth rate analyses

Trend in area, production and productivity of nutmeg in Kerala were analysed using the time series data collected from the Spices Board, Kochi and Directorate of Arecanut and Spices Development, Kozhikode. The Compound Annual Growth Rates (CAGR) of area, production and productivity of nutmeg in Kerala were worked out by fitting an exponential function of the form,

$$Y_t = ab^t$$

Where,

Y_t : Area/production/productivity of nutmeg in Kerala

a : Intercept

b : Regression coefficient

t : Number of years

Taking logarithms on both sides,

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

$$Y_t' = A + Bt$$

Where,

Y_t' : $\ln Y_t$

A : $\ln a$

B : $\ln b$

Compound growth rate of a variable is the rate of change per unit time, usually a year. The method of Ordinary Least Squares was adopted to estimate the co-efficient (b). CAGR in percentage was calculated using the relationship,

Compound Annual Growth Rate (CAGR) = (Antilog B – 1) X 100

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3.3.3 Analyses of price behaviour

Price behaviour of nutmeg was studied using the techniques of classical time series (Croxton *et al*., 1979; Spiegel, 1992). A multiplicative model was used to analyse the price behaviour, by which the time series data on price of nutmeg with shell, nutmeg without shell and mace in Kochi market of Kerala were decomposed into different components such as trend, seasonal, cyclical and irregular variations.

The multiplicative model is of the form,

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

Where,

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

T : Secular trend

S : Seasonal variation

C : Cyclical variation

I : Irregular variation

3.3.3.1 Estimation of trend value

Trend is a general tendency of a time series data to increase or decrease during a long period of time. The trend in nutmeg with shell, nutmeg without shell and mace in Kochi market of Kerala was studied by fitting different trend equations. The following models were used and the best fit was selected:

Linear trend:

$$Y_t = a + bt$$

Quadratic trend

$$Y_t = a + bt + ct^2$$

Cubic trend

$$Y_t = a + bt + ct^2 + dt^3$$

Exponential trend

$$Y_t = ab^t$$

3.3.3.2 Estimation of seasonal variation

Seasonal variations in a time series are due to the rhythmic forces that operate in a regular and periodic manner within a period of 12 months. Seasonal indices were estimated by employing 12 point centered moving average method after removing the effects of other components *viz*., trend, cyclical and irregular variations, to obtain a statistical measure of the pattern of seasonal variations in the time series.

3.3.3.3 Estimation of cyclical variation

Cyclical variations are the oscillatory movements in a time series, with a period of the series of more than one year. Cyclical variations in the prices of nutmeg and mace in the Kochi market were studied using a multiplicative model of time series. The estimation of cyclical variations was 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 effect of trend component was removed from the time series data by dividing each of the original values by the corresponding trend values and expressing the same as percentage. That is,

$$(T \times S \times C \times I)/ T = (S \times C \times I) \times 100$$

Hence, this data consists of seasonal, cyclical and irregular components.

2. Removal of seasonal effect

The trend eliminated data for each month is divided by the corresponding seasonal index and the result is multiplied by 100.

$$(S \times C \times I) / S = (C \times I) \times 100$$

3. Removal of Irregular components

Removal of irregular variation is very difficult because it is highly entangled with cyclical movements. To get cyclical variations clearly, the data has to be smoothened by using short period moving averages.

3.3.3.4 Estimation of irregular variation

Random fluctuations in a time series which are not accounted for estimating seasonal, cyclical and secular variations are referred to as irregular variations. These fluctuations are purely random, erratic and unpredictable and this occurs due to numerous non-recurring and irregular circumstances which are beyond the human control. Irregular indices are obtained by dividing the cyclical-irregular indices by the cyclical indices. Symbolically,

$$(C \times I) / C = I$$

3.3.4 Economics of nutmeg cultivation

Nutmeg being a perennial crop, starts yielding or bearing from the 4th year onwards, and the economic life span is considered as 60 years. The cost incurred in raising nutmeg plantation could be classified into two categories *viz.*, (i) establishment cost, and (ii) maintenance cost.

All the expenses incurred in the first year for the establishment of a nutmeg garden and those in the subsequent years upto bearing are considered as the establishment costs. It includes the cost of land preparation, digging and filling of pits, planting material, manures, fertilizers, plant protection chemicals, expenditure incurred on different farm operations, *viz.*, weeding, irrigation, gap filling, watch and ward and repairs.

Maintenance costs include the expenses incurred on input services like human labour for irrigation, weeding, application of manures, fertilizers, and services of machinery and on material inputs *viz.*, manures, fertilizers, plant

protection chemicals, and repairs and maintenance charges from the year of first bearing and during the remaining period of the economic life span.

3.3.5 Resource use efficiency

Production function analysis was used to evaluate the factors influencing nutmeg production and to study their relative influence on yield. Cobb-Douglas production function is the most widely used functions in the economic analysis of the problems relating to empirical estimation in agriculture and industry (Sankhayan, 1988). Ordinary Least Square (OLS) method was used to estimate the production function. The estimated values of the regression coefficients were tested for statistical significance.

The algebraic form of the Cobb-Douglas production function was given by,

$$Y = a_0 \, X_1^{a_1} X_2^{a_2} X_3^{a_3} X_4^{a_4} X_5^{a_5} X_6^{a_6} \qquad (1)$$

Where,

Y : Returns per ha

X_1 : Human labour (mandays/ha)

X_2 : Amount spent on manures (₹/ha)

X_3 : Age of the tree (years)

X_4 : Experience in farming (years)

X_5 : Amount spent on fertilizers (₹/ha)

X_6 : Amount spent on plant protection (₹/ha)

The constant a_0 and a_i (i= 1, 2 . . . 6) represent the efficiency parameters and the production elasticities of the respective input variables. The estimated form corresponding to equation no. 1 is,

$$\ln y = \ln a_0 + \ln X_1 + \ln X_2 = \ln X_3 + \ln X_4 + \ln X_5 + \ln X_6 \qquad (2)$$

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3.3.6 Economics of Marketing

3.3.6.1 Marketing channel

Marketing channel is the path through which the agricultural product moves from the producer to the final consumer through different intermediaries. Intermediaries may be village merchants, brokers, traders, processors, wholesalers, commission agents, retailers etc. For the estimation of marketing cost, marketing margin, price spread, producer's share in consumer's rupee and efficiency of the marketing channel, the methodologies described by Acharya and Agarwal (1987) were used.

3.3.6.2 Marketing cost

Marketing cost is the expense incurred towards the operations or functions carried out by the farmer and the intermediaries involved in moving the produce from the producer to the consumer.

3.3.6.3 Marketing margin

It is the profit of various intermediaries or middle men involved in moving the produce from the producer to the consumer.

3.3.6.4 Price spread

Price spread is defined as the difference between the price paid by the consumer and the price received by the producer for an equivalent quantity of the commodity expressed as a percentage of the consumer's price. It includes the marketing cost and the marketing margin. In the present study, price spread in marketing of nutmeg was estimated by the concurrent margin method.

Price spread is calculated as, Price spread= Consumer price - Producer price.

3.3.6.5 Producer's share in consumer's rupee

The farmer's share in consumer's price was calculated with the help of the formula,

$$Ps = \frac{Pp}{Cp} x100$$

Where,

P_s - Producer's share in consumer's rupee (Percentage)

P_p - Producer's price

C_p - Consumer's price

Shepherd's formula

The economic efficiency in marketing was calculated using the marketing costs, margins and price spread by employing the Shepherd's formula as follows

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

Where

ME = Marketing efficiency

V = Consumer's price

I = Total marketing cost

3.3.7 Constraints in production and marketing of nutmeg

Garrett ranking technique was used to identify the various constraints faced by nutmeg farmers. Identifying the major problems faced by farmers in production and marketing was the first step in constraint analysis. The respondents were then asked to rank the identified problems and the major constraints were identified by the Garrett ranking technique. In this method, the rank assigned to different constraints were transformed into percentage using the formula,

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

Where,

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

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

Here 0.5 is subtracted from each rank because the 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 referring to the table given by Garrett and Woodworth (1969). From the scores so obtained, the mean score level was derived and 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 nutmeg in Kerala" was undertaken to estimate the economics and efficiency of nutmeg production and to study the marketing and price behaviour of nutmeg. The results of the study are discussed under the following headings:

4.1 Trend in area, production and productivity of nutmeg

4.2 Growth rate in area, production and productivity of nutmeg

4.3 Price behaviour of nutmeg

4.4 Socio-economic profile of sample farmers

4.5 Economics of nutmeg cultivation

4.6 Resource use efficiency in nutmeg cultivation

4.7 Marketing of nutmeg

4.8 Constraints in production and marketing of nutmeg

4.1 Trend in area, production and productivity of nutmeg in Kerala

The trend in area, production and productivity of nutmeg crop in Kerala for the years from 2006-07 to 2017-18 is shown from Figure 4.1 to Figure 4.4. Kerala is the largest producer of nutmeg in India, with an area of 22,701 hectares during 2017-2018 and a production of 14,682 tonnes. The productivity of nutmeg in Kerala during 2017-18 was 646 kg per hectare.

The area under nutmeg in Kerala has increased from 13,494 hectares during 2006-07 to 22,701 hectares during 2017-2018. The production during the above period also increased from 11,361 tonnes to 14,682 tonnes per hectare. The productivity of the crop declined from 841 kg per hectare in 2006-07 to 646 kg per hectare in 2017-18 and between these periods the productivity has shown a varying pattern.

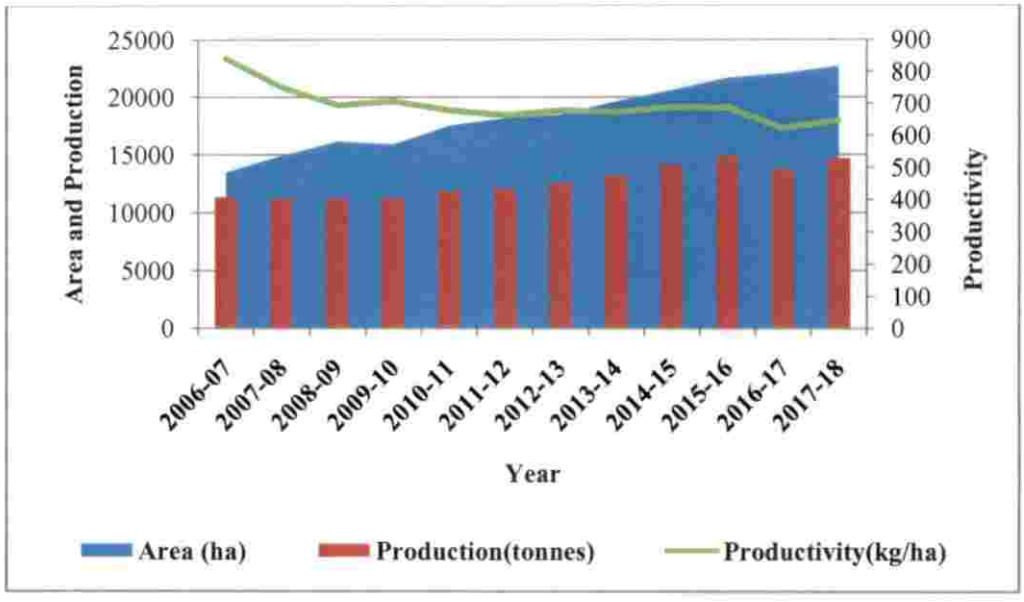

Fig. 4.1 Area, production and productivity of nutmeg in Kerala

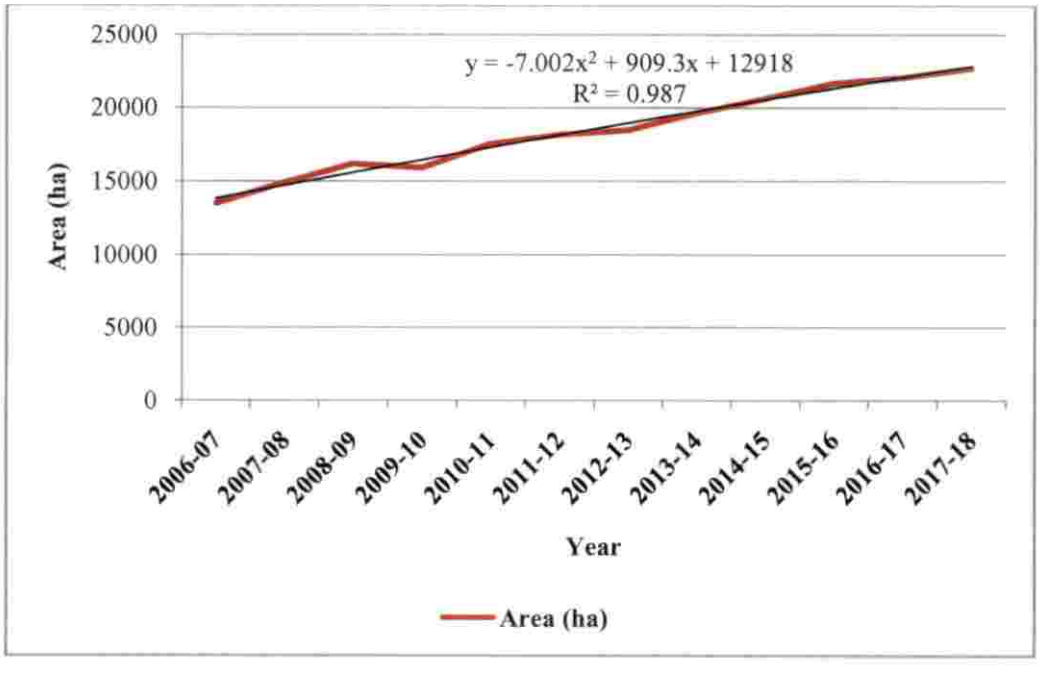

Fig. 4.2 Trend in area under nutmeg in Kerala

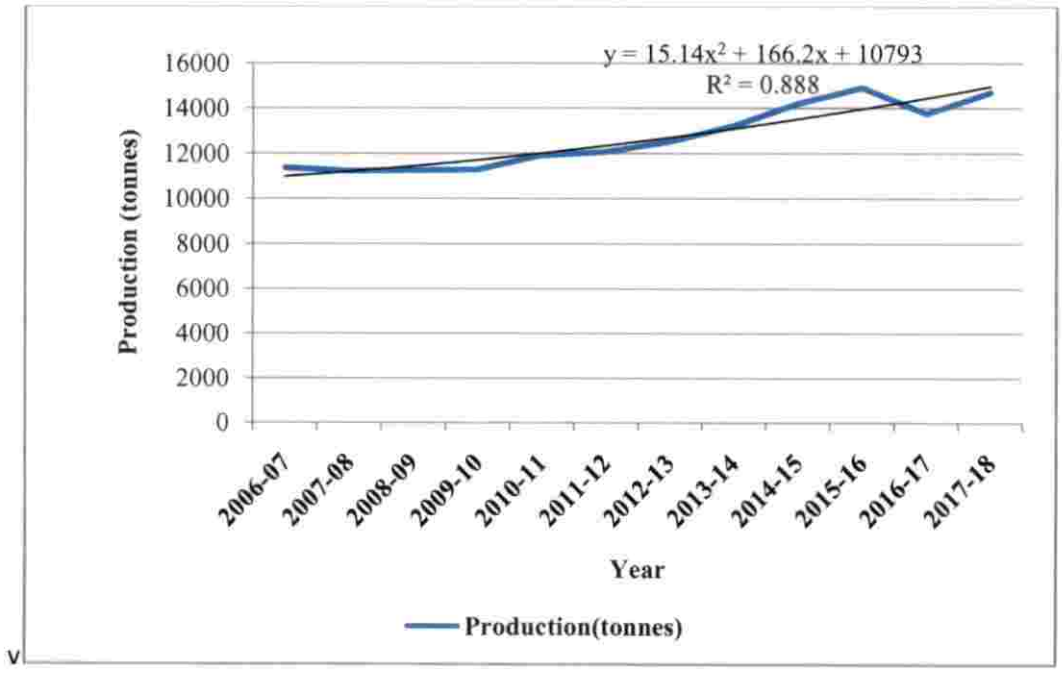

Fig. 4.3 Trend in production of nutmeg in Kerala

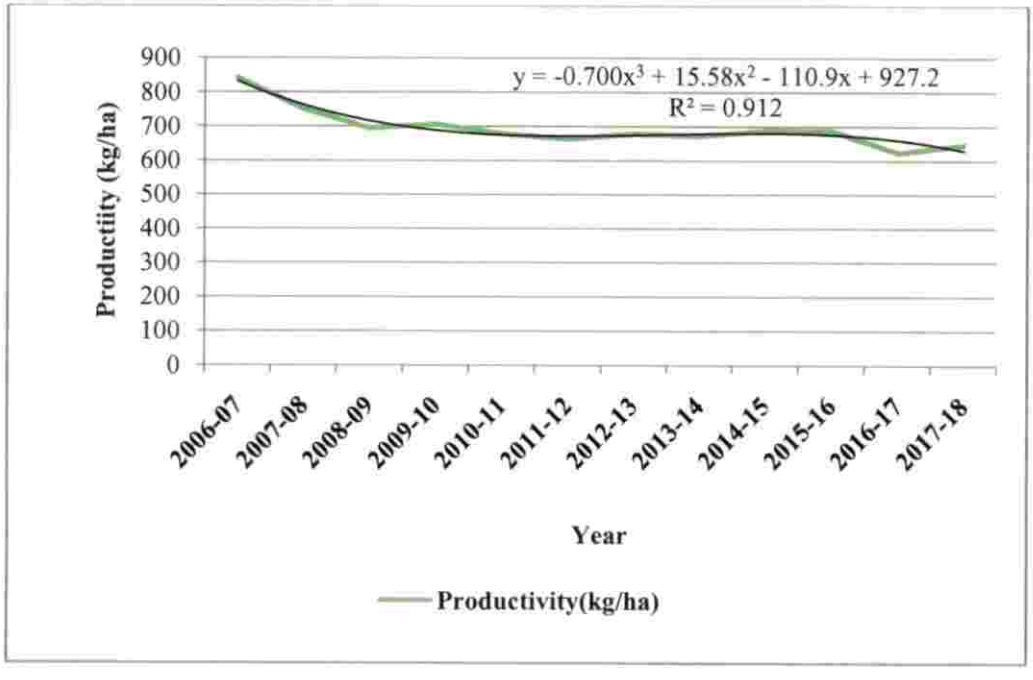

Fig. 4.4 Trend in productivity of nutmeg in Kerala

It could be inferred from the fitted trend equations that with the exception of productivity, area and production have exhibited discernibly increasing trend.

4.2 Growth rates in area, production and productivity of nutmeg

Table 4.1 Compound growth rate of area, production and productivity of nutmeg in Kerala

Period	Growth rate (per cent per annum)		
	Area	Production	Productivity
2006-07 to 2017-18	4.43	2.15	-2.17

The annual growth rates in area, production and productivity of nutmeg in Kerala during the period from 2006-07 to 2017-18 were estimated using an exponential model and the results are presented in Table 4.1. During the period, the growths in area and production were positive (4.43 per cent and 2.15 per cent respectively), while the productivity showed a negative growth rate of -2.17 per cent per annum. Even though the area has grown at 4.43 per cent per annum, the production has increased only by 2.15 per cent due to the decline in productivity by 2.17 per cent. The productivity was not moving in tune with the increasing area and production. This may be due to the perennial nature of the crop. As more and more area was brought under cultivation of nutmeg, many of the newly planted areas were under the pre-bearing and the yield increasing stage. Hence, the increased area was not being reflected as increase in production and consequently, the productivity exhibited decline or fluctuating pattern during recent years. The farm level yield was also fluctuating and could be attributed to changing climatic conditions in recent years.

4.3 Price behaviour of nutmeg

The prices of nutmeg have shown considerable volatility over the years, which is a matter of concern for farmers and policy makers. The decline in prices have been largely attributed to market gluts and increased imports. Besides improving productivity of nutmeg, remunerative and steady prices also play a crucial role in increasing production. Moreover, nutmeg being a perennial crop which involves heavy initial investment when compared to seasonal and annual

crops, price stability assumes more significance. In this context, the price behaviour of nutmeg with shell, nutmeg without shell and mace in the Kochi market were studied. In order to analyse the price behaviour, the monthly prices of nutmeg were decomposed into four time series components *viz*., secular trend, seasonal variation, cyclical variation and irregular variation, assuming a multiplicative model of time series.

4.3.1 Trend analysis for prices of nutmeg

Trend is the general tendency of the data to increase or decrease over a long period of time. In order to understand the long run price behaviour of nutmeg, trend analysis was done separately for each of the product by applying the method of least squares. Different functional forms were attempted to explain the underlying trend in the price behaviour and the model having the highest R^2 value was taken as the best fit.

The trend in prices of nutmeg with shell, nutmeg without shell and mace are presented from Figure 4.5 to Figure 4.7. The results showed that the power function gave the best fit for the trend in the prices of nutmeg with shell, nutmeg without shell and mace. The prices of nutmeg showed an increasing trend in the long run, in spite of regular ups and downs in the short run. During the year 1999-2000, the prices of all the three products increased considerably because of the increase in exports of both nutmeg and mace by almost 840 per cent, even when the import of nutmeg reduced by 17 per cent, while that of mace increased by 28 per cent. In 2005-06, nutmeg price showed an increasing pattern because of the increase in export of nutmeg and mace by 22 per cent. The prices of mace did not increase during 2005-06 even with an increase in exports and could be attributed to the rising imports of mace, which increased by 74 per cent during the year.

The prices of nutmeg with shell and without shell showed an increasing pattern during 2008-09, as the combined effect of the increase in exports by 65 per cent and decrease in imports of nutmeg to India by 39 per cent. During the period from 2010-11 to 2013-14, the increase in prices of nutmeg with shell and

without shell could again be attributed to the 112 per cent increase in exports and a decrease in imports by 55 per cent. In the later years, nutmeg price has fallen because the export growth was not so pronounced, while there was considerable rise in imports. In the case of mace, a similar export growth as that of nutmeg was observed and imports also decreased by 30 per cent from 2010-11 to 2012-13, which in turn was reflected as higher prices. The price of mace showed a decreasing pattern from 2013-14 to 2015-16 mainly because of the increase in imports by 50.71 per cent. There was a discernible increase in the prices of all the three products in 2018 because the production was almost lower by 40 per cent over the previous year.

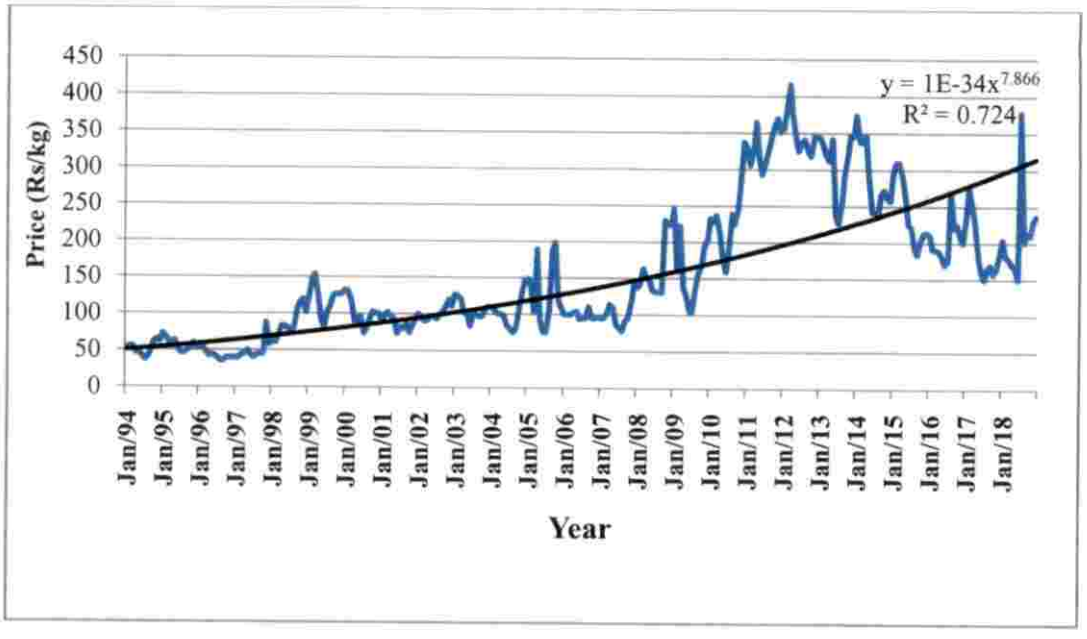

Fig 4.5 Trend in prices of nutmeg with shell

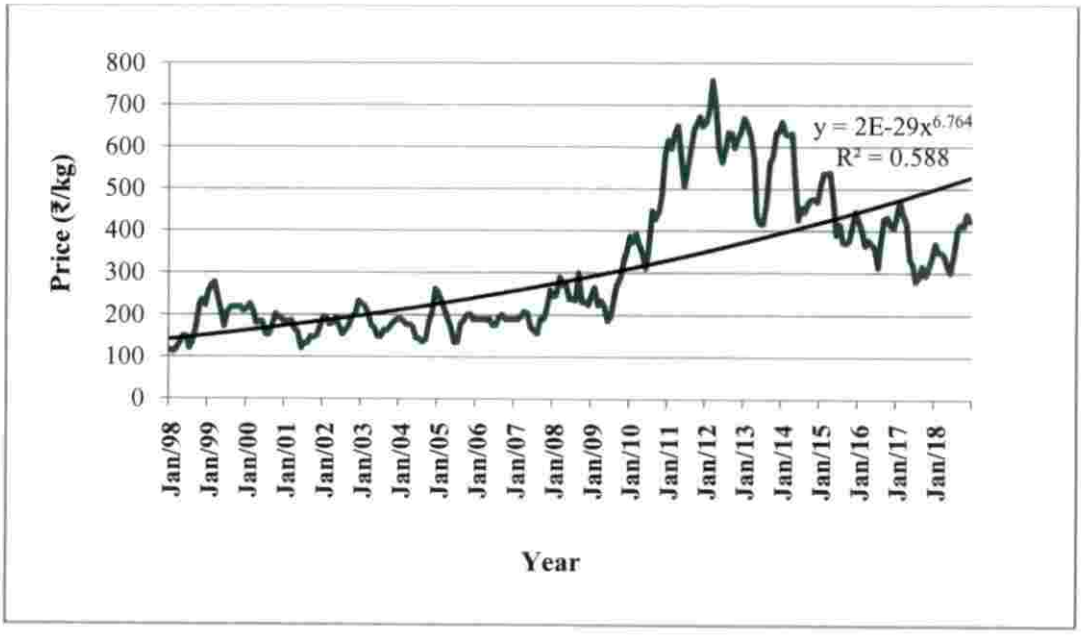

Fig 4.6 Trend in prices of nutmeg without shell

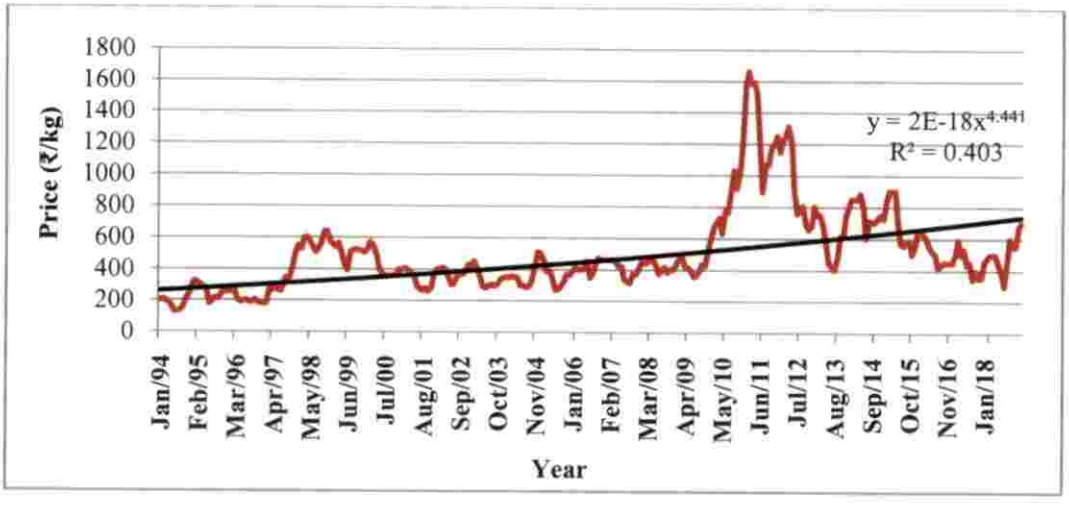

Fig 4.7 Trend in prices of mace

4.3.2 Seasonality in the prices of nutmeg

Seasonal variations are the periodic and regular movements in a time series within a year (Croxton *et al.* 1979). Seasonality in the production of agricultural commodities is the main reason for seasonal price fluctuations. The seasonal variations in the prices of nutmeg with shell, without shell and mace were analyzed separately using ratio to moving average method and the results are given in Table 4.2. From the table, it could be observed that the prices of nutmeg

exhibited considerable seasonality. In Kerala, the harvest season of nutmeg starts from May and extends up to July. The increasing phase in the prices of nutmeg with shell, without shell and mace were observed from August to January with the peak price in January. The fall in price occurs from February to July, coinciding with the harvesting and months of peak arrivals. The lowest prices for nutmeg with shell and without shell were observed in the month of July, while for mace, the month of June recorded the lowest price. The highest prices for nutmeg were observed in the month of January, while for mace the price was found to be highest in February.

Table 4.2 Seasonal indices for prices of nutmeg with shell, without shell and mace

Month	Nutmeg with shell	Nutmeg without shell	Mace
January	110.6	111.7	112.6
February	108.7	111.2	115.1
March	107.4	111.0	112.7
April	106.2	104.2	106.6
May	99.1	96.0	98.1
June	85.6	84.2	83.3
July	83.4	83.8	84.4
August	86.6	89.2	89.4
September	95.9	96.1	92.3
October	100.3	99.6	94.5
November	107.5	105.2	102.1
December	108.7	107.8	108.9

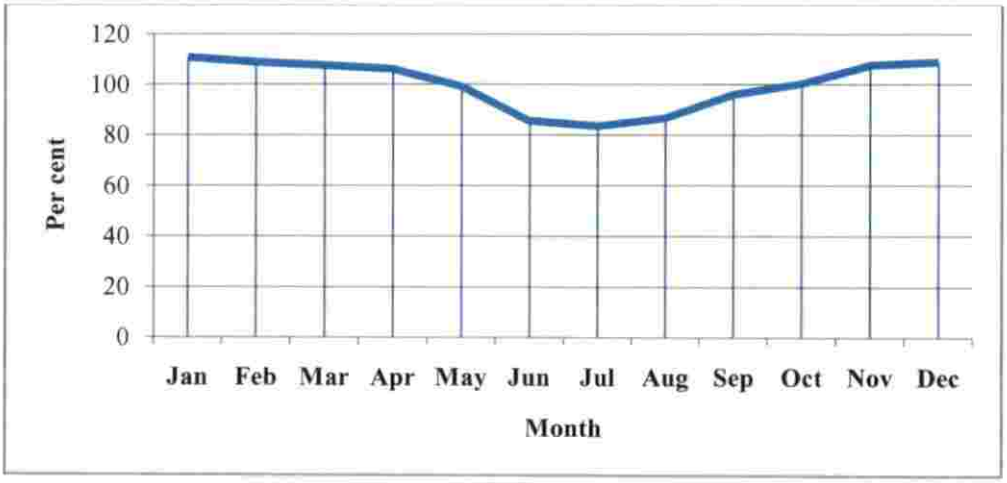

Fig. 4.8 Seasonal indices for prices of nutmeg with shell

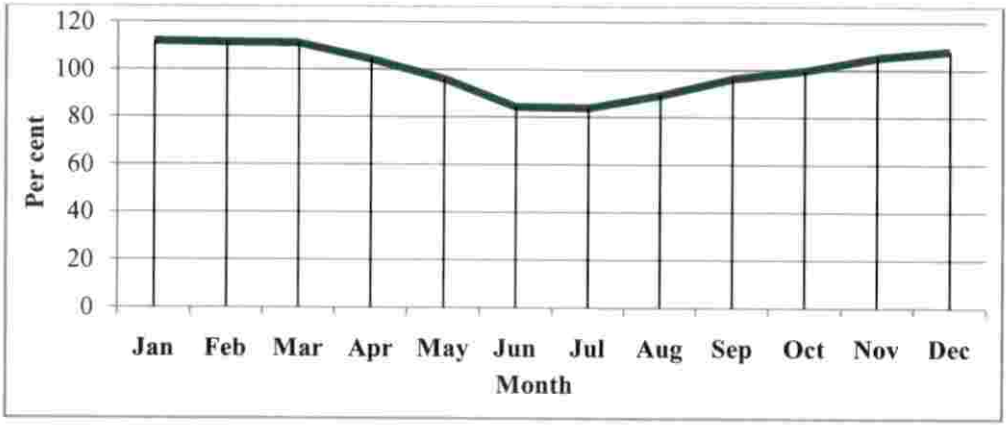

Fig. 4.9 Seasonal indices for prices of nutmeg without shell

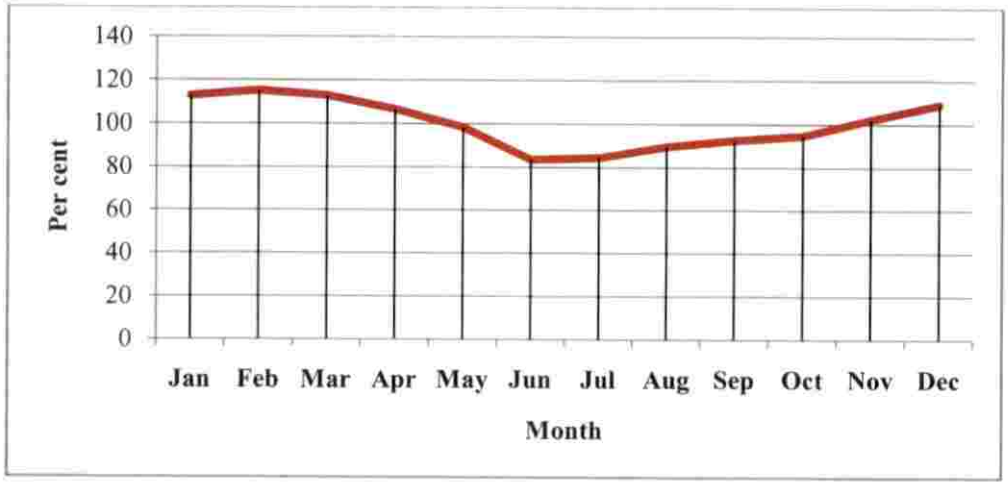

Fig. 4.10 Seasonal indices for prices of mace

4.3.3 Cyclical variations

The oscillatory movements in a time series with a period of more than one year are referred to as cyclical variations. Cyclical movements are of longer duration, usually extending to a few years and are of different periodicity. The cyclical indices of nutmeg with shell, nutmeg without shell and mace in different periods were worked out and are presented from Figure 4.11 to Figure 4.13.

It could be observed that the cyclical pattern of prices of nutmeg with shell and without shell showed considerable similarity. In the case of nutmeg with shell, one large cycle was observed in the prices from July 1994 to July 2001 and was followed by a short cycle upto May 2007. The next large cycle which commenced from May 2007 reached the trough in November 2017 and thereafter started increasing. A six year cycle from July 1998 to July 2004 was observed in the prices of nutmeg without shell. A short cycle was also observed after July 2004 upto January 2009. Next large cycle started from January 2009 and reached the peak in July 2012 and reached the lowest value in January 2018 and thereafter started increasing. The length of the cycles could not be clearly established with the given pattern of the cyclical variations in case of mace.

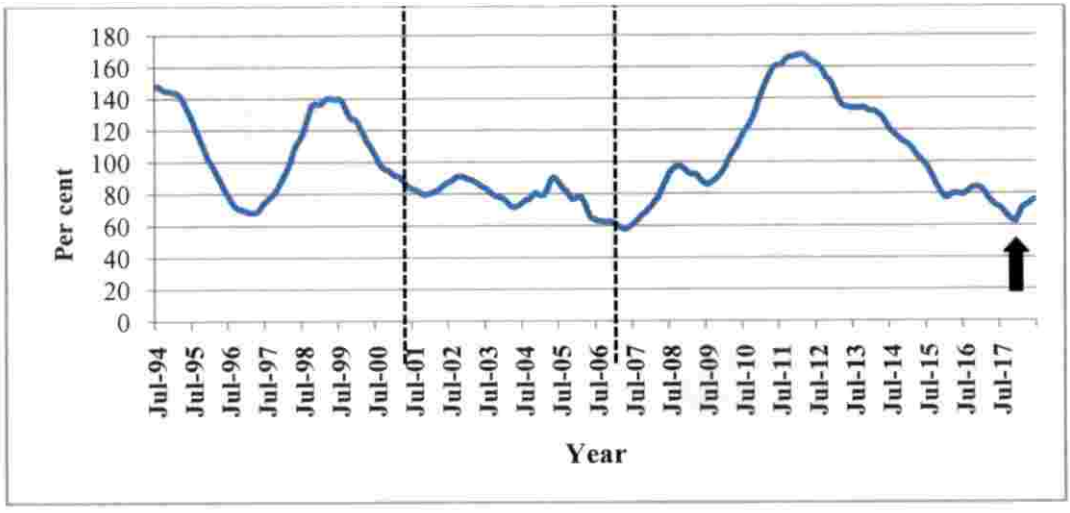

Fig. 4.11 Cyclical indices for prices of nutmeg with shell

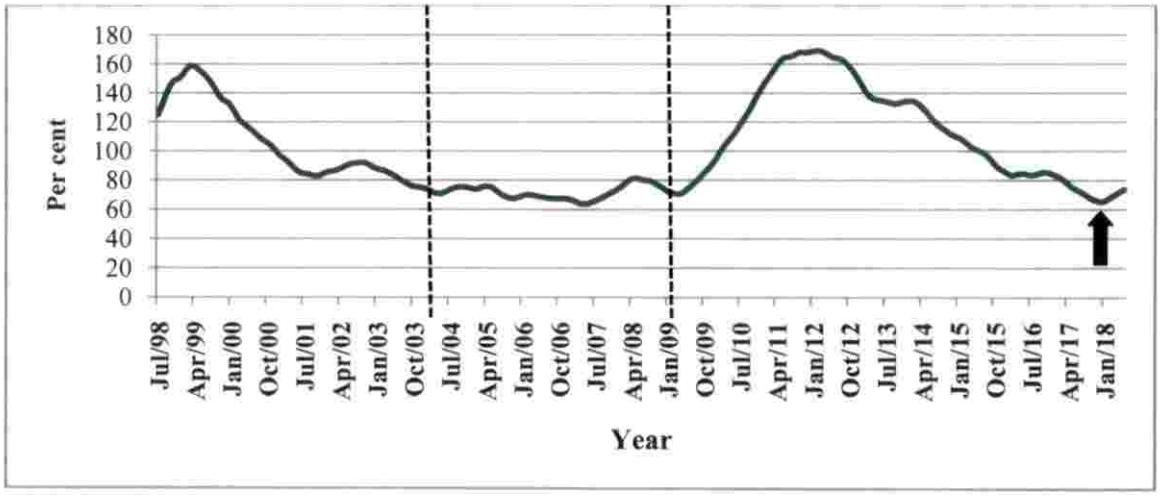

Fig. 4.12 Cyclical indices for price of nutmeg without shell

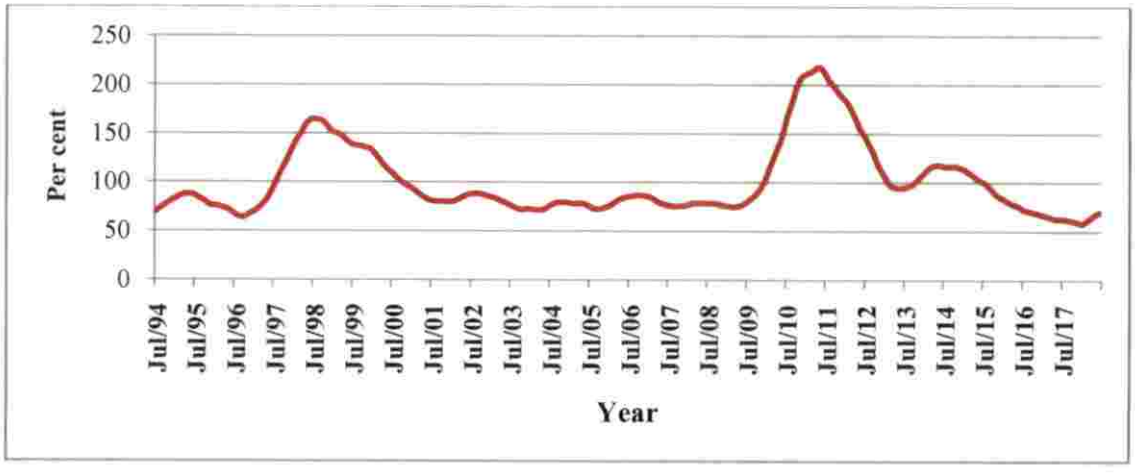

Fig. 4.13 Cyclical indices for prices of mace

4.3.4 Irregular variations

Irregular variations in the prices of nutmeg occurred due to numerous non-recurring and irregular circumstances which were beyond human control. The irregular variations in the prices of nutmeg with shell, without shell and mace are depicted from Figure 4.14 to 4.16. Irregularity was pronounced in the prices of all the three products. It was observed that the irregular variations in nutmeg price were highly unpredictable and did not follow any uniform pattern over the years.

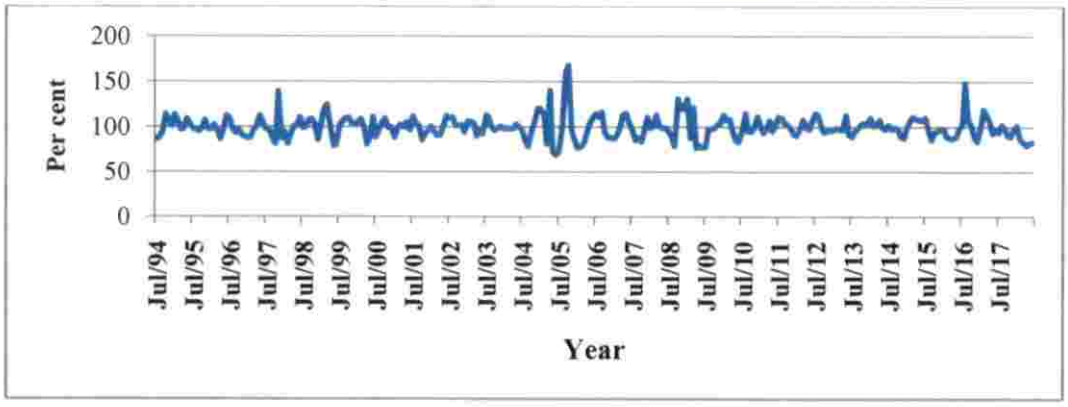

Fig. 4.14 Irregular indices for prices of nutmeg with shell

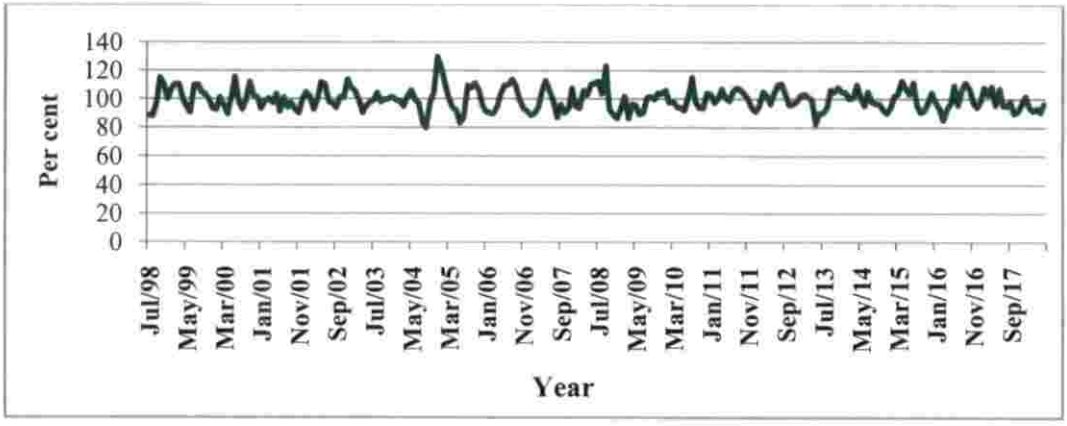

Fig. 4.15 Irregular indices for prices of nutmeg without shell

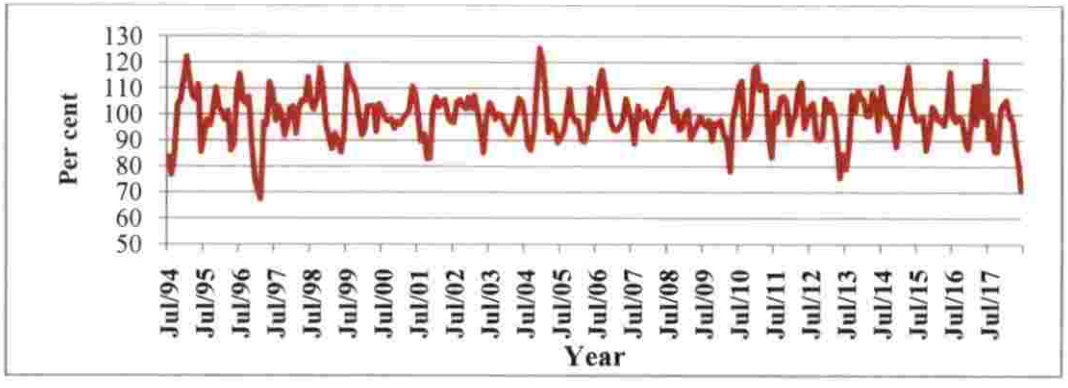

Fig. 4.16 Irregular indices for prices of nutmeg without shell

To sum up the discussion on price behaviour, it could be concluded that secular trend, seasonal variation, cyclical variation and irregular variation were observed in prices of nutmeg with shell, nutmeg without shell and mace in Kochi market of Kerala.

4.4 Socio-economic profile of sample respondents

In this section, general characteristics like age, gender, educational level, experience, family size, land holdings, annual income and occupational status of the sample farmers selected for the study from four blocks, two each from Thrissur and Ernakulam districts are discussed.

4.4.1 Age

The sample farmers were stratified into four groups based on their age and the age-wise distribution of the respondents are presented in Table 4.3. It could be observed that majority of sample farmers in both the districts were in the age group of more than 60 years and 40 per cent of the farmers were in the group of 45-60 years. There were no farmers aged less than 30 years in both the selected districts, clearly indicating the of lack of interest among the youngsters in taking up farming as a profession, which is one of the major challenges for agricultural development in Kerala.

Table 4.3 Age-wise distribution of the sample respondents

Age profile (years)	Thrissur		Ernakulam		Total Sample
	Mala	Chalakudy	Parakkadavu	Angamaly	
< 30	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
30 - 45	4 (13.34)	0 (0.0)	1 (3.34)	2 (6.66)	7 (5.84)
45 - 60	11 (36.66)	13 (43.34)	15 (50)	9 (30)	48 (40.0)
> 60	15 (50)	17 (56.66)	14 (46.6)	19 (63.34)	65 (54.16)
Total	30 (100)	30 (100)	30 (100)	30 (100)	120 (100)

Note: Figures in parentheses indicate per cent to column total

4.4.2 Gender

The gender-wise categorization of the sample farmers are presented in Table 4.4. It could be noted from the table that majority of the respondents from the four blocks were male farmers *i.e.*, 88 per cent of farmers were male and 12 per cent of the respondents were female farmers.

Table 4.4 Gender-wise distribution of sample respondents

Gender	Mala Block	Chalakudy Block	Parakkadavu Block	Angamaly Block	Total Sample
Male	28 (93.34)	23 (76.66)	29 (96.66)	26 (86.66)	106 (88.34)
Female	2 (6.66)	7 (23.34)	1 (3.34)	4 (13.34)	14 (11.66)
Total	30 (100)	30 (100)	30 (100)	30 (100)	120 (100)

Note: Figures in parentheses indicate per cent to column total

4.4.3 Educational background

The details on the literacy level of the sample farmers are presented in Table 4.5.

Table 4.5 Educational status of sample respondents

Education	Mala Block	Chalakudy Block	Parakkadavu Block	Angamaly Block	Total Sample
Primary	7 (23.34)	6 (20)	9 (30)	10 (33.34)	32 (26.66)
Up to SSLC	11 (36.66)	6 (20)	5 (16.67)	6 (20)	28 (23.34)
Pre-degree	5 (16.66)	3 (10)	3 (10)	7 (23.33)	18 (15)
Diploma	4 (13.34)	5 (16.66)	6 (20)	4 (13.33)	19 (15.83)
Degree	2 (6.66)	9 (30)	5 (16.66)	3 (10)	19 (15.83)
Post Graduation	1 (3.34)	1 (3.34)	2 (6.67)	0 (0.0)	12 (3.34)
Total	30 (100)	30 (100)	30 (100)	30 (100)	120 (100)

Note: Figures in parentheses indicate per cent to column total

Even though all the farmers were literates, it could be observed that majority (about 27 per cent) were having only primary education and about 23 per cent were having education up to SSLC. Nearly, 16 per cent and 3 per cent of the sample farmers were graduates and post-graduates respectively.

4.4.4 Experience in farming

The information on the experience of sample farmers is presented in Table 4.6. Generally, age decides the experience of the farmers in cultivation of crops and sample respondents were classified into three categories based on the number of years of experience in farming, as having less than 10 years, 10 to 30 years and greater than 30 years. It could be observed from the table that 81.66 per cent of the farmers had more than 30 years of experience in farming, while about 18 per cent had experience between 10 and 30 years and there were no farmers with less than 10 years of experience.

Table 4.6 Distribution of sample farmers according to farming experience

Year of experience	Mala Block	Chalakudy Block	Parakkadavu Block	Angamaly Block	Total Sample
<10	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
10-30	8 (26.66)	5 (16.6)	5 (16.66)	4 (13.34)	22 (18.34)
>30	22 (73.34)	25 (83.34)	25 (83.34)	26 (86.66)	98 (81.66)
Total	30 (100)	30 (100)	30 (100)	30 (100)	120 (100)

Note: Figures in parentheses indicate per cent to column total

4.4.5 Family size

The classification of sample farmers based on their family size is presented in Table 4.7. The availability of family labour for farming operations is expected to increase with the increase in family size. The respondents were categorized into three groups *viz*; family consisting of one to three members, four to six members and greater than seven members. It could be observed from the

table that the size of the family of majority (62 per cent) of the sample respondents were between four and six members. Hence, it could be inferred that the availability as well as utilization of family labour for farm operations as a substitute for hired labour was comparatively higher in the selected area.

Table 4.7 Distribution of sample farmers based on family size

Family size	Mala Block	Chalakudy Block	Parakkadavu Block	Angamaly Block	Total Sample
1 to 3	11 (36.66)	16 (53.33)	6 (20)	10 (33.34)	43 (35.84)
4 to 6	18 (60)	13 (43.33)	23 (76.66)	20 (66.66)	74 (61.66)
> 6	1 (3.34)	1 (3.34)	1 (3.34)	0 (0.0)	3 (2.5)
Total	30 (100)	30 (100)	30 (100)	30 (100)	120 (100)

Note: Figures in parentheses indicate per cent to column total

4.4.6 Land holding pattern

The classification of sample farmers based on the size of their operational holdings is presented in Table 4.8.

Table 4.8 Distribution of sample respondents according to size of land holding

Area in hectares	Mala Block	Chalakudy Block	Parakkadavu Block	Angamaly Block	Total Sample
<1	26 (86.66)	21 (70)	19 (63.33)	22 (73.34)	88 (73.33)
1 to 2	4 (13.34)	6 (20)	7 (23.34)	5 (16.66)	22 (18.33)
2 to 4	0 (0.00)	1 (3.34)	4 (13.33)	2 (6.66)	7 (5.84)
>4	0 (0.00)	2 (6.66)	0 (0.00)	1 (3.34)	3 (2.5)
Total	30 (100)	30 (100)	30 (100)	30 (100)	120 (100)

Note: Figures in parentheses indicate per cent to column total

It could be observed from the table that majority of the farmers were marginal i.e., having holdings with size of less than one hectare (73 per cent) and 18 per cent were small famers with holdings of size ranging from one to two hectares. It was observed that about eight per cent of the respondents had land holdings above two hectares, among whom three per cent possessed more than four hectares and five per cent owned holdings with size from two to four hectares. Small and marginal farmers accounted for nearly 92 per cent of the sample farmers.

4.4.7 Annual income

The distribution of sample respondents on the basis of their annual income is shown in Table 4.9. It was found that about 12 per cent of the sample farmers earned a high income of above two lakh per annum. Out of the total sample farmers, 24 per cent had income below ₹25,000 and 64 per cent belonged to the income group ranging from ₹25,000 and ₹2,00,000 lakh.

Table 4.9 Distribution of sample respondents based on their annual income

Annual income (rupees)	Mala Block	Chalakudy Block	Parakkadavu Block	Angamaly Block	Total Sample
<25,000	13 (43.33)	3 (10)	2 (6.66)	11 (36.66)	29 (24.16)
25,000-50,000	7 (23.34)	8 (26.66)	3 (10)	4 (13.34)	22 (18.34)
50,000-75,000	4 (13.34)	10 (33.34)	3 (10)	7 (23.34)	24 (20)
75,000-1,00,000	2 (6.66)	5 (16.67)	8 (26.67)	2 (6.66)	17 (14.16)
1,00,000-2,00,000	3 (10)	2 (6.67)	6 (20)	3 (10)	14 (11.67)
>2,00,000	1 (3.33)	2 (6.66)	8 (26.67)	3 (10)	14 (11.67)
Total	30 (100)	30 (100)	30 (100)	30 (100)	120 (100)

Note: Figures in parentheses indicate per cent to column total

4.4.8 Occupation

The distribution of sample respondents based on their occupation is given in Table 4.10. As it is evident from the table, agriculture formed the major source of income for about 62 per cent of the respondents and remaining 38 per cent was distributed as employed in public sector (10.84 per cent), private sector (12.5 per cent) and self-employed (15 per cent).

Table 4.10 Distribution of sample respondents based on their occupation

Occupation	Mala Block	Chalakudy Block	Parakkadavu Block	Angamaly Block	Total Sample
Agriculture	16 (53.34)	18 (60)	21 (70)	19 (63.34)	74 (61.66)
Public sector	5 (16.66)	2 (6.66)	2 (6.66)	4 (13.33)	13 (10.84)
Private sector	3 (10)	5 (16.67)	3 (10)	4 (13.33)	15 (12.5)
Self employed	6 (20)	5 (16.67)	4 (13.34)	3 (10)	18 (15)
Total	30 (100)	30 (100)	30 (100)	30 (100)	120 (100)

Note: Figures in parentheses indicate per cent to column total

4.5 Economics of Nutmeg cultivation

The economics of nutmeg cultivation in Thrissur and Ernakulam districts of Kerala was studied by estimating the cost of cultivation using different concepts like establishment cost and maintenance cost. Annual amortization of establishment cost was calculated and added to the average annual maintenance cost to estimate the cost of cultivation of nutmeg per hectare. Nutmeg is a perennial commercial crop with an economic life span of 50 to 60 years. All the plants in the establishment stage were budded and in the yielding stage there were both budded plants and seedlings. A nutmeg tree takes almost three years to establish and starts yielding from the fourth year onwards. Hence, in this study, the nutmeg tree grown by sample farmers were grouped into different categories based on the age of the plants as (i) Gestation period (1st year to 3rd year), (ii)

Period of increasing yield (4th to 15th year) (iii) Period of stable yield (16th to 50th year) and (iv) Period of declining yield (51st to 60th year and above).

The costs incurred for input and input services during the first year of establishing the nutmeg garden at current prices, along with the annual maintenance cost in the non-bearing stage of the tree (up to the third year) were considered as the establishment cost. It included the expenditure on land preparation, digging and filling of pits, planting materials and planting, cost of nutrients and nutrient application.

The maintenance cost consists of the costs which are incurred from the fourth year onwards, including the expenditure on manures, inter-cultural operations, plant protection, harvesting and drying. The costs incurred during the period of increasing yield followed by the period of stable and declining yields, together accounted for the average annual maintenance cost in the yielding stage of the nutmeg trees.

4.5.1 Cost structure of nutmeg gardens during establishment phase

4.5.1.1 Operation-wise cost

The operation-wise cost of nutmeg cultivation during the establishment phase in Thrissur and Ernakulam districts and the aggregate costs were worked out and are presented in Table 4.11 and Table 4.12. The total establishment cost in Thrissur and Ernakulam districts was worked out as ₹1,71,055 and ₹1,77,795 respectively. In Thrissur district, the cost of land preparation, digging and filling, planting material, manures, weeding, and irrigation were ₹45,000, ₹8930, ₹17,500, ₹50,125, ₹36,000, and ₹13,500 respectively. In Ernakulam district, the costs incurred for land preparation, digging and filling, planting material, manures, weeding, and irrigation were ₹46,500, ₹9,270, ₹18,750, ₹51,525, ₹37,500, and ₹14,250 respectively. The operation-wise cost was found to be higher in Ernakulam district as compared to Thrissur district, due to higher labour charges and increased use of inputs.

The aggregate operation-wise cost incurred for both the districts during the first year of establishment of nutmeg was ₹1,08,475 per hectare. The highest share in operation-wise cost was accounted by manures ₹50,825, which formed 29.23 per cent. This was followed by land preparation (26.31 per cent), weeding (21.14 per cent), planting material (10.42), irrigation (7.98 per cent) and digging and filling of pits (5.23 per cent). The farmers in both the districts did not use plant protection chemicals and fertilizers during the establishment stage of nutmeg gardens. The aggregate establishment cost was estimated as ₹1,74,425.

Table 4.11 Operation-wise cost of nutmeg gardens in the establishment phase for Thrissur and Ernakulam districts

(₹ per hectare)

Sl. No.	Particulars	Thrissur district				Ernakulam district			
		First year	Second Year	Third year	Total	First year	Second Year	Third year	Total
1	Land preparation	45000 (42.33)	-	-	45000 (26.30)	46500 (42.02)	-	-	46500 (26.15)
2	Digging and filling	8930 (8.4)	-	-	8930 (5.23)	9270 (8.38)	-	-	9270 (5.25)
3	Planting material	17500 (16.47)	-	-	17500 (10.23)	18750 (16.95)	-	-	18750 (10.54)
4	Manures	18375 (17.28)	15875 (49.04)	15875 (49.04)	50125 (29.30)	18875 (17.05)	16325 (48.63)	16325 (48.63)	51525 (28.96)
5	Weeding	12000 (11.29)	12000 (37.06)	12000 (37.06)	36000 (21.04)	12500 (11.30)	12500 (37.23)	12500 (37.23)	37500 (21.09)
6	Irrigation	4500 (4.23)	4500 (13.90)	4500 (13.90)	13500 (7.90)	4750 (4.30)	4750 (14.14)	4750 (14.14)	14250 (8.01)
7	Total cost	106305 (100)	32375 (100)	32375 (100)	171055 (100)	110645 (100)	33575 (100)	33575 (100)	177795 (100)

Note: Figures in parentheses indicate per cent to column total

Table 4.12 Aggregate operation-wise cost of nutmeg gardens in the establishment phase (₹ per hectare)

Sl. No.	Particulars	Establishment cost of nutmeg garden			
		First year	Second Year	Third year	Total
1	Land preparation	45750 (42.17)	-	-	45750 (26.31)
2	Digging and filling	9100 (8.38)	-	-	9100 (5.23)
3	Planting material	18125 (16.70)	-	-	18125 (10.42)
4	Manures	18625 (17.16)	16100 (48.82)	16100 (48.82)	50825 (29.23)
5	Weeding	12250 (11.29)	12250 (37.14)	12250 (37.14)	36750 (21.14)
6	Irrigation	4625 (4.26)	4625 (14.02)	4625 (14.02)	13875 (7.98)
7	Total cost	108475 (100)	32975 (100)	32975 (100)	**174425 (100)**

4.5.1.2 Input-wise cost

The input-wise costs incurred during the establishment phase of nutmeg garden in Thrissur and Ernakulam districts are presented in Table 4.13. It was found that the human labour contribution to the total establishment cost was highest (69.53 per cent), followed by organic manure (23.17 per cent) and planting material (7.30 per cent) in Thrissur district. A similar pattern was observed in Ernakulam district, with human labour, organic manure and planting material accounting for 69.20 per cent, 23.07 per cent and 7.73 per cent of the total establishment cost respectively.

The aggregate input-wise cost of establishment for both the districts is represented in Table 4.14. The human labour accounted for the highest share (69.35 per cent) in the aggregate input-wise cost of establishment, followed by organic manure (23.12 per cent) and planting material (7.53 per cent). The cost incurred for human labour included labour charges incurred for preparatory cultivation, digging and filling, planting, application of manures, irrigation and weeding.

Table 4.13 Input-wise establishment cost of nutmeg gardens in Thrissur and Ernakulum districts (₹ per ha)

SI. No.	Particulars	Thrissur				Ernakulam			
		First year	Second year	Third year	Total	First year	Second year	Third year	Total
1	Human labour	78930 (74.24)	20000 (61.78)	20000 (61.78)	118930 (69.53)	81520 (73.68)	20750 (61.80)	20750 (61.80)	123020 (69.20)
2	Planting materials	12500 (11.7)	–	–	12500 (7.30)	13750 (12.43)	–	–	13750 (7.73)
3	Manure	14875 (13.99)	12375 (38.22)	12375 (38.22)	39625 (23.17)	15375 (13.89)	12825 (38.20)	12825 (38.20)	41025 (23.07)
4	Total input cost	106305 (100)	32375 (100)	32375 (100)	171055 (100)	110645 (100)	33575 (100)	33575 (100)	177795 (100)

Note: Figures in parentheses indicate per cent to column total

Table 4.14 Aggregate input-wise establishment cost of nutmeg gardens in the establishment phase (₹ per ha)

Sl. No.	Particulars	Cost (per hectare)			
		First year	Second year	Third year	Total
1	Human labour	80225 (73.96)	20375 (61.79)	20375 (61.79)	120975 (69.35)
2	Planting materials	13125 (12.09)	-	-	13125 (7.53)
3	Manure	15125 (13.95)	12600 (38.21)	12600 (38.21)	40325 (23.12)
4	Total input cost	108475 (100)	32975 (100)	32975 (100)	174425 (100)

Note: Figures in parentheses indicate per cent to column total

4.5.3 Cost structure for maintenance of nutmeg garden in the yielding phase

4.5.3.1 Operation-wise cost in Thrissur and Ernakulam districts

In the yielding phase of nutmeg gardens, additional cultural operations like plant protection, harvesting, drying were carried out when compared to the establishment phase. The results furnished in Table 4.15 indicate the operation-wise costs incurred by the farmers of Thrissur and Ernakulam districts towards maintenance of nutmeg gardens during the yield increasing, yield stabilising, yield declining phases and the weighted mean of the operation-wise costs in three phases. The average annual cost of maintenance of nutmeg gardens in Thrissur district was estimated as ₹64,778, ₹80,845 and ₹46,910 per hectare for the yield increasing phase, yield stabilising phase and yield declining phase respectively. The weighted mean for the yielding phase was estimated as ₹74,801 per hectare. In Ernakulam district, the average annual cost of maintenance of nutmeg gardens was estimated as ₹65,820, ₹85,380 and ₹49,625 per hectare for the yield increasing, yield stabilising and yield declining phases respectively and the weighted mean for the yielding phase was estimated as ₹79,737 per hectare.

The annual maintenance cost during yield declining phase showed a tendency to decline from the 50th year onwards. The size of nutmeg starts

shrinking leading to reduction in yields and with the age of trees the farmers were found to pay less attention towards the maintenance of trees by reducing the quantity of input use as well as input services, which contributed to reduction in annual maintenance cost of the gardens. As size of the trees increased, farmers found it difficult to carry out the intercultural operations, including the spraying of Bordeaux mixture.

The aggregate operation-wise cost of maintenance for both the districts is represented in Table 4.16. The aggregate annual cost of maintenance of nutmeg gardens in Thrissur and Ernakulam districts was worked out as ₹65,299, ₹83,113, ₹48,268 and ₹77,269 per hectare for the yield increasing phase, yield stabilising phase, yield declining phase and the weighted mean for yielding phase respectively. The organic manures contributed highest share of 45.18 per cent of the total operation-wise cost. This was followed by basin formation, weeding, irrigation, fertilizers, plant protection chemicals, harvesting and drying, which accounted for 13.76 per cent, 13.08 per cent, 12.34 per cent, 5.06 per cent, 5.05 per cent and 3.39 per cent of total operation-wise cost respectively. The major plant protection chemical used was Bordeaux mixture and farmers applied only potash as fertilizer for the trees. With decreasing prices of nutmeg and mace, farmers were found to reduce the input use.

Table 4.15 Operation-wise maintenance cost of nutmeg garden for Thrissur and Ernakulam districts (₹ per ha)

Sl. No.	Particulars	Thrissur				Ernakulam			
		Yield increasing phase (4-15 yr)	Yield stabilizing phase (16-50yr)	Yield declining phase (51-60 yr)	Weighted mean for yielding phase	Yield increasing phase (4-15 yr)	Yield stabilizing phase (16-50yr)	Yield declining phase (51-60 yr)	Weighted mean for yielding phase
1	Basin formation	9642 (14.89)	10941 (13.53)	8260 (17.60)	10458 (13.99)	9500 (14.44)	11315 (13.25)	8000 (16.13)	10792 (13.54)
2	Organic manures	27625 (42.64)	37332 (46.18)	24000 (51.17)	34280 (45.83)	26800 (40.72)	38152 (44.69)	27500 (55.41)	35550 (44.58)
3	Fertilizers	1600 (2.47)	5200 (6.43)	-	4046 (5.40)	1400 (2.12)	4600 (5.39)	-	3760 (4.72)
4	Plant protection chemicals	5857 (9.04)	6833 (8.46)	-	6068 (8.12)	5625 (8.55)	5357 (6.27)	-	5044 (6.33)
5	Weeding	12292 (18.97)	8430 (10.42)	8200 (17.49)	9183 (12.28)	14500 (22.02)	10576 (12.39)	7750 (15.61)	11042 (13.85)
6	Irrigation	6662 (10.29)	8872 (10.98)	5600 (11.93)	8157 (10.90)	7030 (10.68)	12228 (14.32)	5500 (11.08)	10913 (13.68)
7	Harvesting and drying	1100 (1.70)	3235 (4.00)	850 (1.81)	2609 (3.48)	965 (1.47)	3152 (3.69)	875 (1.77)	2636 (3.30)
8	Total cost	64778 (100)	80845 (100)	46910 (100)	74801 (100)	65820 (100)	85380 (100)	49625 (100)	79737 (100)

Note: Figures in parentheses indicate per cent to column total

Table 4.16 Aggregate operation-wise maintenance cost of nutmeg garden (₹ per ha)

Sl. No.	Particulars	Yield increasing phase (4-15 yr)	Yield stabilizing phase (16-50yr)	Yield declining phase (51-60 yr)	Weighted mean for yielding phase
1	Basin formation	9571 (14.66)	11128 (13.39)	8130 (16.85)	10625 (13.76)
2	Organic manures	27212.5 (14.68)	37742 (45.41)	25750 (53.35)	34915 (45.18)
3	Fertilizers	1500 (2.30)	4900 (5.90)	-	3903 (5.06)
4	Plant protection chemicals	5471 (8.79)	6069 (7.33)	-	5556 (7.19)
5	Weeding	13396 (20.51)	9503 (11.43)	7975 (16.52)	10112.5 (13.08)
6	Irrigation	6846 (10.48)	10550 (12.70)	5550 (11.49)	9535 (12.34)
7	Harvesting and drying	1032.5 (1.58)	3194 (3.84)	862.5 (1.79)	2622.5 (3.39)
8	Total cost	65299 (100)	83113 (100)	48267.5 (100)	77269 (100)

Note: Figures in parentheses indicate per cent to column total

4.5.3 .1 Input-wise cost

The inputs required for maintenance of nutmeg gardens are human labour, organic manures, plant protection chemicals and fertilizers. The details of the input-wise cost incurred for various operations in Thrissur and Ernakulam districts are presented in Table 4.17. In Thrissur district, the human labour accounted for the highest share of 48.86 per cent, followed by organic manure (38.69 per cent), fertilizers (6.38 per cent) and plant protection chemicals (6.07 per cent). In Ernakulam district, human labour accounted for the highest share of 52.33 per cent followed by organic manure (37.38 per cent), plant protection chemicals (5.11 per cent) and fertilizers (4.88 per cent). The input-wise costs in both the districts were averaged for different yielding phases of the crop and are presented in Table 4.18. It could be observed from the table that human labour accounted for the highest share of 50.65 per cent, followed by organic manure, fertilizers and plant protection chemicals which accounted for 38.18 per cent, 5.6 per cent and 5.57 per cent of the total input-wise cost respectively.

Table 4.17 Average input-wise maintenance cost of nutmeg gardens in Thrissur and Ernakulam districts (₹ per ha)

SI. No.	Particulars	Thrissur				Ernakulam			
		Yield increasing phase (4-15 yr)	Yield stabilizing phase (16-50yr)	Yield declining phase (51-60 yr)	Weighted mean for yielding phase	Yield increasing phase (4-15 yr)	Yield stabilizing phase (16-50yr)	Yield declining phase (51-60 yr)	Weighted mean for yielding phase
1	Human labour	35996 (55.57)	37880 (40.07)	26410 (56.30)	36545 (48.86)	38395 (58.34)	43671 (45.44)	27625 (55.66)	41722 (52.33)
2	Organic manures	22125 (34.15)	31832 (44.96)	20500 (43.70)	28946 (38.69)	21300 (32.36)	32652 (42.72)	22000 (44.34)	30050 (37.38)
3	Plant protection chemicals	5457 (8.42)	4800 (6.55)	-	4532 (6.07)	5125 (7.78)	4200 (5.49)	-	4074 (5.11)
4	Fertilizers	1200 (1.86)	6333 (8.42)	-	4778 (6.38)	1000 (1.52)	4857 (6.35)	-	3891 (4.88)
5	Total cost	64778 (100)	80845 (100)	46910 (100)	74801 (100)	65820 (100)	85380 (100)	49625 (100)	79737 (100)

Note: Figures in parentheses indicate per cent to column total

Table 4.18 Aggregate input-wise maintenance cost of nutmeg garden (₹ per ha)

Sl. No.	Particulars	Yield increasing phase (4-15 yr)	Yield stabilizing phase (16-50yr)	Yield declining phase (51-60 yr)	Weighted mean for yielding phase
1	Human labour	37195.5 (56.96)	40775 (46.16)	27017.5 (55.97)	39134 (50.65)
2	Organic manures	21712.5 (33.26)	32242 (40.99)	21250 (44.03)	29498 (38.18)
3	Plant protection chemicals	5291 (8.10)	4500 (5.73)	-	4303 (5.57)
4	Fertilizers	1100 (1.68)	5595 (7.12)	-	4334 (5.60)
5	Total cost	65299 (100)	83112 (100)	48267.5 (100)	77269 (100)

Note: Figures in parentheses indicate per cent to column total

4.5.4 Cost of cultivation of nutmeg

Table 4.19 Cost of cultivation of nutmeg (₹ /ha)

Sl. No.	Particulars	Cost (₹ /ha)
1	Establishment cost (₹/ha)	174425
2	Amortized value (₹/ha)	17519
3	Annual maintenance cost (₹/ha)	77269
4	Interest on working capital @ 7 %	5408
5	Total cost (₹/ha)	101196

Cost of cultivation is the total expenses incurred by the farmers for cultivating one hectare of the crop. Being a perennial crop, the costs of cultivation of nutmeg are incurred over a period of time. The total cost incurred for cultivating one hectare of nutmeg is presented in Table 4.19. The establishment cost of nutmeg gardens upto the bearing stage was estimated as ₹1,74,425 per hectare, which was then amortized to ₹17,519 per hectare per year. The total cost

was estimated as ₹1,01,196 per hectare, which includes the annual share of establishment cost, annual maintenance cost and interest on working capital at seven per cent.

4.5.5 Cost of production of nutmeg

Table 4.20 Cost of production of nutmeg (₹/kg)

Sl. No.	Particulars	Increasing yield stage	Stabilising yield stage	Declining yield stage	Aggregate
1	Establishment cost (₹/ha)	174425	174425	174425	174425
2	Amortized value (₹/ha)	17519	17519	17519	17519
3	Annual maintenance cost (₹/ha/year)	65299	83112	48267.5	77269
4	Interest on annual maintenance cost (₹/ha)	4570	5817	3378	5408
5	Total cost (₹/ha/year)	87388	106448	69164.5	100196
6	Average production – nutmeg (kg/ha)	330	490	275	444
7	Cost of production (₹/kg)	264	217	251	225

The economic lifespan of a nutmeg was considered as 60 years, with the yielding phase from fourth year onwards. The cost of bringing one hectare of nutmeg garden up to the bearing stage and the average annual maintenance cost was found to be ₹1,74,425 and ₹77,269 respectively. The establishment cost was then amortised at 10 per cent to get an amortized or annualised value of ₹17,519 which was added to the overall annual maintenance cost of cultivation of the nutmeg farm during yielding phase to arrive at the cost of production. To this value, the interest on annual maintenance cost at seven per cent was added to get that total cost incurred for cultivating one hectare of nutmeg garden. This total cost was divided by the average production of nutmeg per hectare in kilograms to

arrive at the cost of production per kg of nutmeg. Here, the cost of production in aggregate was worked out to be ₹255 per kg, whereas the cost of production was worked out to be ₹264, ₹217 and ₹251 per kg for yield increasing, yield stabilising and yield declining phases respectively.

4.5.6 Gross and net returns

The details of the nutmeg and mace yield in physical units (kg), the gross returns and net returns from nutmeg gardens are presented in Table 4.21. The average returns from the sample farms in both the districts were collected during the survey. The net returns were worked as ₹44,447 after deducting the total cost from gross returns.

Table 4.21 Net returns from nutmeg cultivation (₹/ha)

Particulars	Value
Gross returns	1,44,643
Total cost	1,00,196
Net returns	44,447

4.6 Resource use efficiency in nutmeg cultivation

To evaluate the resource use efficiency in nutmeg 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 empirical estimation of production in agriculture was fitted. The production function was estimated using Ordinary Least Square (OLS) method and the estimated coefficients were tested for statistical significance using t-test. The overall significance of the fitted model or equation was tested with the help of F-test. The mean value of the variables used in Cobb-Douglas function fitted for returns from nutmeg are presented in Table 4.22 and elasticity estimates from the fitted Cobb-Douglas production function are furnished in Table 4.23.

Table 4.22 Mean values of the variables used in Cobb-Douglas production function fitted for returns from nutmeg

Sl. No.	Variables	Mean value
1	Returns (₹/ha)	144643
2	Human labour charges (₹/ha)	37732
3	Age of tree (year)	28
4	Experience (year)	44
5	Manures (₹/ha)	29944
6	Fertilizers (₹/ha)	2840
7	Plant protection chemical (₹/ha)	5623

Table 4.23 Estimates of the fitted Cobb-Douglas production function for returns nutmeg

Sl. No	Explanatory variable	Parametric values	Standard error	t-ratio	Significance
1	Constant	3.308	0.69	4.76	5.681E-06
2	Human labour charges (₹/ha)	0.324	0.046	7.01	1.788E-10***
3	Manures (₹/ha)	0.479	0.055	8.68	3.343E-14***
4	Age of tree (Years)	0.045	0.035	1.26	0.209
5	Experience in farming (Years)	0.019	0.040	0.49	0.623
6	Plant protection (₹/ha)	0.00035	0.004	2.80	0.939
7	Fertilizers (₹/ha)	0.0023	0.008	0.28	0.774
8	R^2	0.58			
9	Adjusted R^2	0.56			

Note: Dependent variable is returns in Rs/ha, *** denotes significance at one per cent level

The coefficient of multiple determination (R^2) for the fitted Cobb Douglas production function for nutmeg was 0.58, which implies that the selected variables could explain 58 per cent variation in the returns of nutmeg crop. The

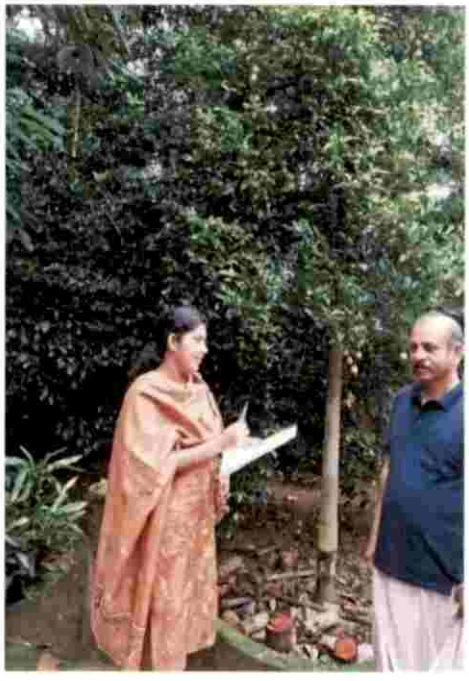

Plate 1: Survey of the farmers

regression coefficients of independent variables are the production elasticities of the respective variables. The elasticity coefficients of all the selected variables were found to be positive indicating positive effect of these inputs on the returns per hectare of nutmeg. The independent variables *viz*., human labour charges and expenditure on manures were found to be significant at one per cent level. It could be inferred from the table that one per cent increase in the expenditure on manure from the mean level keeping other things constant, would increase the nutmeg returns by 0.47 per cent from the mean level. The elasticity coefficient for human labour charges was indicated that the increase in expenditure on labour by one per cent from the mean level would increase the nutmeg returns by 0.32 per cent from the mean level.

Returns to scale

Returns to scale means the behaviour of production or returns when all the productive factors are increased or decreased simultaneously in the same proportion. In Cobb-Douglas production function, regression coefficients are the production elasticities of each variable input. Therefore, the sum of regression coefficients (b_i) of all the input variables provides a ready estimate of returns to scale. If the sum of b_i is not significantly different from one, constant returns to scale is indicated. If sum of b_i is less than one, decreasing returns to scale is indicated and if it is greater than one, increasing returns to scale is indicated. Here, the returns to scale was estimated as 0.87, indicating decreasing returns to scale.

4.7 Marketing of Nutmeg

Agricultural marketing involves all the activities aimed at movement of the produce from the farm to the ultimate consumer through different marketing channels. Intermediaries or middlemen involved in the marketing process make profit or margin by purchasing the produce at low prices and selling at higher prices.

The marketing of nutmeg plays an important role in the nutmeg economy of the country as 98.5 per cent of the nutmeg production in TE 2015-16 was from Kerala. The consumption of nutmeg is spread all over the country, in the raw form or as different value added products. In Kerala, there are no exclusive markets for nutmeg. There are many intermediaries in marketing of the nutmeg like village traders, wholesalers, processors and exporters.

1) Village trader

Village traders often visit the farms and purchase the produce and they bear the harvesting cost and transportation cost. Mostly they will purchase the produce from farmers at the prevailing market price and sell on the same day or once in two days. In many farms, the crop was harvested by the village traders as the farmers found it difficult to harvest.

2) Wholesalers

Wholesalers purchase nutmeg and mace directly from the farmers or from village traders and they sell to the retailers. Some of the nutmeg farmers prefer selling to the wholesalers because they experienced malpractices by the village traders while weighing the produce and they offer higher price.

3) Retailers

Retailers are the most common and important market intermediary in the study area who purchased nutmeg and mace from the wholesalers and sell to consumers located at local markets.

4) Exporters

Nutmeg and mace have greater demand in the international market. The exporters follow stringent rules to ensure specified quality of the produce. Exporting nutmeg ensures assured and higher price, and were not much affected by the prevailing low price in the domestic market.

4.7.1 Marketing channels

Marketing channels are the chain of intermediaries through whom the commodity moves from the producer to the consumer. The length of the channel varies from commodity to commodity, depending upon the quantity of commodity to be moved, consumer demand and degree of regional specialization in production. Due to lack of storage facilities and chances of storage losses most of the farmers sell the produce within a week of harvest. Majority of the farmers sell nutmeg without separating the kernel (nutmeg with shell). Wholesalers and exporters carry out the processing of nutmeg. The nutmeg and mace is separated and dried to reduce the moisture content. The nutmeg has to be deshelled to separate the kernel. Wholesalers and exporters use mechanical dryers for reducing the moisture content to 10 per cent. When dried, the weight of the nutmeg without shell (kernel) reduces by 25 per cent and that of mace by 40 per cent. The wholesalers sell the produce to different parts of the country and the exporters surveyed during the study were exporting mostly to European countries.

In the study region, about three marketing channels of nutmeg were identified and they were,

Channel I: Producer → Village trader → Wholesalers → Retailers → Consumers
Channel II: Producer → Wholesalers → Retailers → Consumers
Channel III: Producer → Village trader → Exporter

Table 4.24 Distribution of sample farmers based on selling behaviour

Market functionaries	Thrissur	Ernakulam	Total
Village traders	9 (15)	14 (23.33)	23 (19.17)
Wholesalers	51 (85)	46 (76.67)	97 (80.83)
Total	60 (100)	60 (100)	120 (100)

Distribution of sample farmers based on selling behaviour are presented in table 4.24.It is evident from that about 80 per cent of the farmers were selling their produce to wholesalers and rest to the village traders.

4.7.2 Marketing costs

Marketing costs are the expenses incurred towards the operations carried out by the farmers and intermediaries at different stages of marketing and it is one of the important components of the price spread. Marketing cost of nutmeg includes expenditure incurred in performing various market functions such as transportion, storage, deshelling, grading and fumigation.

Most of the farmers choose channel II, as they can get higher price when sold to wholesalers directly. There is no marketing cost involved when sold to village traders because they procured the produce directly from the farm. Most of the village traders offered the prevailing price in the wholesale market to the farmers. The farmers with comparatively lower quantity of the produce sold directly to the village traders. Farmers often sold their produce at a price higher than that was published in the newspaper.

Plate 2: Survey of the market intermediaries

Table 4.25 Marketing costs in different marketing channels of nutmeg (₹ /kg)

Market functionaries	Items	Channel I		Channel II		Channel III	
		Nutmeg	Mace	Nutmeg	Mace	Nutmeg	Mace
Farmer	Transportation	-	-	6	4	-	-
	Loading and unloading	-	-	2	2	-	-
	Storage cost	-	-	2	2	-	-
Village trader	Transportation	20	18	-	-	25	24
	Loading and unloading	2	2	-	-	3	2
	Storage cost	-	-	-	-	3	2
Wholesalers	Transportation	15	14	16	15	-	-
	Loading and unloading	3	3	2.5	2.5	-	-
	Storage cost	1.5	1.5	1	1	-	-
	Processing cost	5	2	4	2	-	-
	Fumigation cost	1.5	1.5	1.5	1.5	-	-
Exporter	Transportation	-	-	-	-	30	30
	Loading and unloading	-	-	-	-	5	5
	Processing cost	-	-	-	-	14	10
	Storage cost	-	-	-	-	-	-
Retailers	Transportation	10	10	10	10	-	-
	Loading and unloading	2	2	1	1	-	-
	Storage cost	2	2	1	1	-	-
Total		**62**	**52**	**47**	**42**	**79**	**73**

4.7.3 Marketing margin

Marketing margins are the profits of various intermediaries or middlemen involved in moving the produce from the producer to the final consumer. Marketing margins of nutmeg and mace per kg in three major marketing channels identified in the study area are presented in Table 4.25. Marketing cost of nutmeg was found to be higher when de-shelling was done. Wholesalers opined that marketing of mace earns them more margin when compared to nutmeg.

4.7.4 Price spread

Price spread refers to the difference between the price paid by the consumer and the price received by the producer for an equivalent quantity of a commodity. The price spread includes the costs incurred and margins taken by different agencies while marketing the produce. The marketing cost include the costs incurred in movement of the product from point of production to the point of consumption, whereas marketing margins include the profit taken by the village traders, cooperative society, wholesalers and retailers involved in various stages of marketing.

Details of cost incurred, profit earned by different intermediaries, producer's share in consumer's rupee and price spread for nutmeg and mace in the study area are furnished in Table 4.26. It could be observed from the table that Channel II had the highest value for producer's share in consumer's rupee and it was 83.58 per cent and 94.02 per cent for nutmeg and mace respectively. This could be attributed to the absence of village traders in channel II and also the lower values of marketing cost and marketing margin reported in this channel.

Table 4.26 Price spread in different marketing channels of nutmeg (₹/kg)

Sl. No	Price spread	Channel I		Channel II		Channel III	
		Nutmeg	Mace	Nutmeg	Mace	Nutmeg	Mace
1	Farmer's selling price	250	970	280	1008	220	950
	Marketing cost	0	0	10	8	0	0
	Net price received by farmer	250	970	270	1000	220	950
2	Village trader's selling price	279	1006	-	-	265	1000
	Marketing cost	22	20	-	-	30	28
	Marketing margin	7	16	-	-	15	22
3	Wholesaler's sales price	318	1046	315	1050	-	-
	Marketing cost	26	22	25	22	-	-
	Marketing margin	13	18	10	20	-	-
4	Exporter's sales price	-	-	-	-	346	1100
	Marketing cost	-	-	-	-	49	45
	Marketing margin	-	-	-	-	32	55
5	Retailer's sales price	342	1078	335	1072	-	-
	Marketing cost	14	14	12	12	-	-
	Marketing margin	10	18	8	10	-	-
6	Consumer's purchase price	342	1078	335	1072	346	1100
Total marketing cost		62	52	47	42	79	73
Total marketing margin		30	49	18	30	47	77
Price spread		92	109	67	72	126	150
Producer's share in consumer's rupee (in %)		**73.09**	**89.98**	**83.58**	**94.02**	**63.5**	**86.36**

4.7.5 Marketing efficiency

Marketing efficiency of different channels of nutmeg and mace was computed using Shepherd's index and are presented in Table 4.27. Marketing efficiency is calculated as the ratio of total value of goods marketed to the sum of total marketing costs and margins.

Table 4.27 Marketing efficiency of different marketing channels of nutmeg and mace

Sl. No	Channel	Channel I		Channel II		Channel III	
		Nutmeg	Mace	Nutmeg	Mace	Nutmeg	Mace
1	Marketing cost (₹/kg)	62	52	47	42	79	73
2	Marketing margin (₹/kg)	30	49	18	30	47	77
3	Price spread (₹/kg)	92	109	67	72	126	150
4	Producer's share in consumer's rupee (%)	73.09	89.98	83.58	94.02	63.5	86.36
5	Marketing efficiency	3.71	9.88	5.00	14.88	2.74	7.33

It is evident from the table that the channel II for both nutmeg and mace had the lowest marketing cost and marketing margin than the other two channels (Channel I and Channel II) showing highest efficiency in marketing.

4.8 Constraints in nutmeg cultivation

The nutmeg farmers of Kerala were facing several constraints in production and marketing of the commodity. The important constraints were identified and listed, and were ranked based on the responses of the sample farmers. The responses were analysed using Garrett ranking technique by converting ranks into mean scores.

4.8.1 Constraints faced by nutmeg farmers in production and marketing

The major constraints confronted by nutmeg farmers of Thrissur and Ernakulam in the production and marketing of nutmeg were identified and are listed in Table 4.28

Table 4.28 Constraints faced by nutmeg farmers in production and marketing

Sl. No	Constraints/ Category	Garret score	Rank
1	Low price of produce	72.67	1
2	Occurrence of diseases	57.43	2
3	High wage rate	48.46	3
4	Non availability of drying and storage facilities	44.28	4
5	Climate change	39.96	5
6	Difficulty in harvesting	37.22	6

The major constrain faced by the farmers in nutmeg cultivation was the low price of the produce. In 2011-12, prices of nutmeg with shell, without shell and mace were ₹348 per kg, ₹632 per kg and ₹1190 per kg respectively, which has decreased to ₹217 per kg, ₹375 per kg, ₹520 per kg respectively in 2018-19. Due to the prevailing low price farmers were reluctant to carry out the

intercultural operations like spraying of bordeaux mixture and application of manures and fertilizers.

The other constraints identified in the study area were occurrence of diseases, high wage rate, non-availability of drying and storage facilities, climate change and difficulty in harvesting with Garrett scores of 57.43, 48.46, 44.28, 39.96, and 37.22 respectively.

Leaf fall, fruit rot and drying of branches were the major diseases observed in the nutmeg farms. Occurrence of fruit rot severely affected the quality of nutmeg and mace, and making them unsuitable for consumption. Nutmeg crop is largely influenced by climatic factors and being a shallow rooted crop it is also susceptible to heavy winds. The tree does not tolerate dry spell and waterlogged conditions. In the year 2018, farmers reported about 40 per cent of the yield loss in nutmeg due to flower and fruit drop in the heavy rains, even before the floods which occurred in Kerala in August 2018.

Nutmeg cultivation requires labour for carrying out different intercultural operations like weeding, spraying of plant protection chemicals, irrigation and harvesting. Higher labour cost made the farmers reluctant to carry out some of the intercultural operations which adds to the cost of production. Farmers in the aged group opined the difficulty in hand picking the fruits fallen on the ground. Many farmers in Thrissur district gave the nutmeg garden on contract to traders and they carried out all the operations from harvesting onwards. The contractors pluck fruits from the tree, which in turn ensured the quality of the nutmeg and mace.

In Kerala, the main harvesting period of nutmeg coincides with the southwest monsoon. Hence, farmers found it difficult to sun dry inorder to reduce the moisture content in the nutmeg and mace. Most of the large farmers have etablished mechanical dryers to ensure quality product, whereas small and marginal farmers were facing difficulty in this aspect. As a result of improper drying, there are chances for development of fungal infection leading to aflatoxin and presence of aflatoxin in nutmeg is a major challenge in its export. In order to

address the quality issue of nutmeg, drying should be done uniformly and hygienically.

Among the small and marginal farmers there is a practice to add napthalene balls or other adultrants in nutmeg and mace during storage as they can keep the produce for longer period to fetch higher price in the market, but this severely affected the quality of the produce. Even traders practice sulphur fumigation of the nutmeg and mace in their godowns. Sulphur fumigation is practised when sold in the domestic market, while this will be easily rejected in the international market. Nutmeg is also cultivated in the neighbouring state, Tamil Nadu and there are godowns for storage with drying facilities. When the produce from neighbouring states comes to Kerala market and farmers here become less competitive in terms of quality of the produce. Hence, there is an immediate need to form Farmer Producer Companies among the nutmeg farmes of Kerala so that they can set up dryers and storage facilities on collective basis, which requires adequate support from the government of Kerala.

Summary and Conclusions

5. SUMMARY AND CONCLUSIONS

The present study was entitled "Economic analysis of production, marketing and price behaviour of nutmeg in Kerala". The overall objective of the study was to analyse the economics of production and marketing of nutmeg in Thrissur and Ernakulam districts of Kerala. The specific objectives of the study were to analyze the trend in area, production and productivity of nutmeg; study the price behaviour of nutmeg with shell, nutmeg without shell and mace; estimate the economics and efficiency of production of nutmeg; study the marketing practices and economics of marketing of nutmeg and to determine the major constraints in production and marketing of nutmeg in Kerala.

The study was conducted in Thrissur and Ernakulam districts, which had the maximum area under nutmeg cultivation in Kerala. Two blocks from each district, with maximum area under nutmeg namely, Chalakudy and Mala in Thrissur district and Angamaly and Parakkadavu in Ernakulam district were purposively selected for the study. From each of the selected block, two Panchayats having highest number of nutmeg farmers were selected. In the Chalakudy block, Koratty and Kadukutty Panchayats and in Mala block, Mala and Aloor Panchayats were selected. In the Angamaly block, Kalady and Manjapra Panchayats and in Parakkadavu block, Puthenvelikara and Kunnukara Panchayats were selected for the study. From each of the Panchayat, 15 farmers having nutmeg as the major crop in the gross cropped area were selected, making a total sample size of 120. The information on marketing of nutmeg was obtained from 32 intermediaries including village traders, wholesalers, processors and exporters.

Socio-economic characteristics of the respondent farmers were analysed with respect to family size, age, education, occupation, landholding and experience in farming and annual income. Majority of the sample farmers were in the age group of more than 60 years and none of the farmers were in the age group of less than 30 years. In the overall sample of 120 farmers, 88 per cent was male farmers, whereas the female farmers formed only 12 per cent. Majority of

the sample farmers had only primary education. 82 per cent of sample farmers were having more than 30 years of experience in farming. Majority of the farmers had a family size between four and six numbers which indicates the possibility for the use of family labour for farm operations. Agriculture was the major occupation for 62 per cent of the sample farmers. Three-fourth of the sample farmers had land holding size of less than one hectare and one-fourth of the sample farmers had annual income of less than ₹25,000.

The area and production of nutmeg in Kerala had an increasing trend, but the productivity exhibited a varying pattern during the period from 2006-07 to 2017-18. The growth rates in area and production were 4.43 and 2.15 per cent respectively, whereas the productivity exhibited a negative growth rate of 2.17 per cent.

The price behaviour of nutmeg with shell, nutmeg without shell and mace in Kochi market were analysed by decomposing the monthly prices into four time series components *viz.,* trend, seasonal variation, cyclical variation and irregular variation, assuming a multiplicative model of the time series. The prices of all the three products of nutmeg showed an increasing trend and considerable seasonality. Prices of nutmeg with shell and without shell showed similar cyclical pattern.

The aggregate operation-wise cost of establishment of nutmeg gardens was estimated as ₹1,08,475 per hectare and land preparation accounted for the major share of the total cost incurred during the first year. The total establishment costs in Thrissur and Ernakulam districts were worked out as ₹1,71,055 and ₹1,77,795 respectively. The aggregate establishment cost for both the districts was worked out as ₹1,74,425. The aggregate annual maintenance costs were ₹65,299, ₹83,112 and ₹48,268 per ha in the yield increasing, yield stabilizing and yield declining phases respectively. The cost of cultivation per hectare of the crop was estimated as ₹1,01,196 and the net return per hectare was ₹44,447. Throughout the economic life span of nutmeg gardens, human labour contributed the major

share in the total input cost. Cost for manures accounted for the major share in the total cost during the yielding phase of nutmeg gardens.

The cost of production of nutmeg was worked out as ₹264, ₹217 and ₹251 per kg for the yield increasing, yield stabilising and yield declining phases respectively. The cost of production in aggregate for the yielding phase was estimated as ₹255 per kg. Cobb-Douglas production function was fitted to evaluate the resource use efficiency in nutmeg cultivation. Expenditure on human labour and manures were found to be significantly contributing towards the returns from nutmeg gardens. Moreover, a decreasing returns to scale in nutmeg production was observed in the study area.

About 81 per cent of the total sample farmers sold their produce to the wholesalers as they get immediate payment in cash, while 19 per cent of sample farmers sold to village traders. The most common marketing channel identified in the study area was Channel II (producer-wholesaler- retailer-consumer) with the highest marketing efficiency of five for nutmeg and 14.88 for mace.

The constraints faced by farmers in production and marketing of nutmeg were identified using Garrett ranking technique. The major constraint faced by farmers in nutmeg cultivation was low price of the produce, followed by occurrence of diseases, high wage rate, non-availability of drying and storage facilities, climate change and difficulty in harvesting.

Based on the above findings the following policy interventions are recommended:

1. As low price of nutmeg is the major production constraint faced by the farmers, there is immediate need to frame measures that ensure stable and remunerative price to the farmers. As the main reason for low price is increasing imports and declining exports, the government should take necessary actions to implement price stabilization mechanisms, manage the import and improve the export competitiveness of nutmeg. The market intelligence should be strengthened and information on the current and

forecasted pries, production and demand should be disseminated to the farmers.

2. Nutmeg being an export oriented crop, maintenance of quality of the produce is important. As farmers used to add adulterants to increase the storage life of nutmeg they have to be made aware about the importance of maintaining the quality of the produce for competing in the world market.
3. Mechanical dryers should be made available to the farmers on a collective basis because of the difficulty in sun drying the produce during the peak harvesting period of nutmeg which coincides with the South-West monsoon. This could also help in increasing the storage life and maintaining the quality of the produce.
4. Formation of Famer Producer Companies (FPCs) should be encouraged so that they can organise and collectively carry out activities like application of Bordeaux mixture, harvesting, drying, packaging and finding out buyers, resulting in economics of scale in transactions.
5. As nutmeg is a storable commodity and the quality of the produce has to be maintained, government should initiate warehousing facilities for the farmers to store the produce and allow them to use the warehouse receipt as a negotiable instrument to avail loans.
6. Value addition and product diversification of nutmeg has to be promoted among the farmers and entrepreneurs, as this would help the farmers to move up in the value chain. Comparatively low value addition is carried out in Kerala and there is scope for the production of a number of processed products from nutmeg rind, which is often thrown away after harvest.

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Appendices

Appendix I

Survey questionnaire for farmers

KERALA AGRICULTURAL UNIVERSITY

COLLEGE OF HORTICULTURE

KAU (P.O)

Vellanikkara, Thrissur

Department of Agricultural Economics

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

Survey-questionnaire for farmers

District: Block: Panchayat:

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 9th	SSLC	Pre-degree	Graduate	Diploma	Post graduate	Others
Code	1	2	3	4	5	6	7

7. Experience in farming (years):

8. Annual income:

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

2. Family details

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

*A- Agriculture, P- Public sector, PE- Private Sector, SE- Self-employed

3. Land details:

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

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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 / Peak-bearing / Over-aged – 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: Area:

No. of trees: No. of yielding trees:

No. of harvesting per year:

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Operations	Qty	Rate/unit	Human labour					
			Hired labour		Family Labour		Total labour cost	
			No.	Amount	No.	Amount	No.	Amount
Land preparation								
Digging of pits, Filling up of pits								
Planting material								
Planting								
Mulching								
Weeding								
Manures								
Fertilizers								
Plant protection measures								
Irrigation cost								
Intercultural operation								
Others/Intercropping								
Harvesting								
Cleaning, drying, packing								
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 2017				Previous Year 2016				Year before previous 2015			
	Qty (Kg)	Average Price	Peak Price	Lowest Price	Qty (Kg)	Average Price	Peak Price	Lowest Price	Qty (Kg)	Average Price	Peak Price	Lowest Price
Nutmeg(with shell) Nutmeg(without shell) Mace (full) Mace (broken)												

By products yield (if any):

7. Details on contact with developmental agencies

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

8. Details of credit:

Have you availed any credit? Yes / No (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) – Shift to other crops				
Land improvement (area)				
Irrigation (area)				
Farm machinery				
Any other investment				

10. Details on Marketing:

I **Farm Level Details**		
1	Total Marketed Quantity	
2	When do you sell the produce?	
3	To whom do you sell the produce? (Code)	
4	Reason for sales to local dealer (Code)	
5	Distance to the market	
6	Any market charges	
7	Mode of Transport	
8	Price received per kg:	
9	Mode of Payment	
10	Storage	
(i)	Time period of storage	

(ii)	Method of storage	
(iii)	Cost of Storage	
(iv)	Other remarks	
11	Loading and unloading charges	
12	Transport charges	
13	Commission/brokerage	
14	Other charges if any	
15	Source of information on price	

Code for 3			Code for 4
Method of sale	Quantity	Price/unit	
1. Local dealer			1. Advance taken 2. Low marketable surplus 3.To obtain high price for the produce 4. No transport facility 5.Transportation cost 6. Immediate cash payment 7. Traditional practice 8. Minimal procedures in selling the produce 9. Lack of awareness about other opportunities 10. other reasons (specify)
2. Primary market			
3. Secondary wholesale market			
4. Cooperative Marketing Society			
5. Other modes (specify)			

Reasons for sales to the local leader/wholesaler/consumer/commission agents/agencies?

Do you know the price at which final intermediary sells the produce to ultimate consumers?

Sources of information on price data?

Are you member of any producer organization / Cooperative / SHG (PDS)
Any contractual agreement of selling of the produce
If yes, since which year?
How the price is determined.

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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	Occurrence of diseases			
2	Climate change			
3	Low price			
4	High labour charges			
5	Occurrence of diseases			
6	Difficulty in harvesting			
7	Others if any			

Appendix II

Survey-questionnaire for market intermediaries

KERALA AGRICULTURAL UNIVERSITY

COLLEGE OF HORTICULTURE

KAU (P.O)

Vellanikkara, Thrissur

Department of Agricultural Economics

Economic analysis of production, marketing and price behaviour of nutmeg

District: Block: Panchayath:

Name :

1. Gender 2. Age

3. Type of market intermediary 4. Address

(Village trader/wholesalers/exporter)

5. No of years of experience in nutmeg trading:

6. Main product(s) dealt with:

7. Quantity (volume) of transaction/year:

8. Transactions made:

a. Purchase of produce : Time:

b. Sale of produce : Time:

9. Nutmeg transacted during the year:

Sl.No.	Season	Place		Distance	Total quantity transacted	Purchase price	Remarks
		From	To				
1.							
2.							
3.							

10. Expenditure:

Sl. No	Particulars	Amount (Rs)	Remarks
1	Transport cost		
2	Loading and unloading charges		
3	Weighing and watching 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)		

11. Do you have any shop or stall for marketing the produce?

12. If yes, mention the location, size and number of stalls:

13. From whom you mostly purchase?

14. To whom the product sold?

15. Storage of nutmeg:

    a) Quantity stored:
    b) Method of storage:

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

17. Problems faced in marketing of nutmeg:

18. Give suggestions to overcome the problems:

Appendix III

Survey-questionnaire for processors

KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF HORTICULTURE
KAU (P.O)
Vellanikkara, Thrissur
Department of Agricultural Economics

Economic analysis of production, marketing and price behaviour of nutmeg

Nutmeg processing – unit level survey

1. Name of the person :

2. Name of the unit :

3. Address for communication :

Phone number

4. Ownership pattern;

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

IV. Government Owned V. Cooperative

5. Year of establishment :

6. Location of the unit from, city (Kms) :

7. Processing capacity of unit/day :

8. Nature of the unit

I. Processor II. Processor cum distributor

9. What is the outrun of your factory?

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

11. 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

12. How many labours are employed in your unit?

    Male: Female:

13. Wage rate of labourers of various categories in your firm.

14. What is the processing method followed

15. Details on purchase of nutmeg

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

16. Which parameter you look for in the purchase of nutmeg? (Specify quality characteristics)

17. Give details of the transportation charges incurred

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

18. Any loss during transportation (Quantity and value) :

19. Do you have storage facility?

20. What is the method of storage being followed?

21. What is the storage expense incurred?

22. Is there any loss during storage? (Quantity)

23. Is there any loss during processing? (Quantity)

24. What is the processing cost incurred (Rs./ Qtl of nutmeg)?

25. To whom you sell nutmeg Wholesale /Retail/Others

28. Nutmeg with shell (Kgs) Price:

29. Nutmeg without shell (Kgs) Price:

30. Mace (Kgs) Price:

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

By

RESHMA SARA SABU

(2016-11-046)

ABSTRACT OF THE THESIS

Submitted in partial fulfillment of the requirement for the degree of

Master of Science in Agriculture

(Agricultural Economics)

Faculty of Agriculture

Kerala Agricultural University, Thrissur

DEPARTMENT OF AGRICULTURAL ECONOMICS

COLLEGE OF HORTICULTURE

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2019

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ABSTRACT

Nutmeg is an important spice crop cultivated for its two distinct products, nutmeg and mace. India is one of the largest producers of nutmeg in the world, with an area of 21,456 ha and production of 14,280 tonnes in Triennium Ending (TE) 2016-17. Kerala accounts for 97.2 per cent of the area and 98.2 per cent of the total production of nutmeg in India. During the period from 2000-01 to 2016-17, the area and production of nutmeg in Kerala increased by 217.5 per cent and 619.4 per cent respectively.

The objectives of the present study were to analyse the trend in area, production, productivity and price behaviour of nutmeg; estimate the economics and resource use efficiency of nutmeg production; study the marketing practices and economics of marketing, and determine the major constraints in production and marketing of nutmeg in Kerala.

The study was based on both primary and secondary data. The time series data on area, production and productivity of nutmeg in Kerala for the period from 2006-07 to 2017-18 were collected to study the trend and growth rates. Monthly average prices of nutmeg in Kochi market of Kerala for the period from 1993 to 2018 were collected to analyse the price behaviour of nutmeg. Primary data was collected from 120 selected farmers of Thrissur and Ernakulam districts using a pretested interview schedule by personal interview method.

It was evident from the trend analysis that the area and production of nutmeg in Kerala has shown an increasing trend, while the productivity exhibited a varying pattern. The price of nutmeg with shell, without shell and mace were analyzed by decomposing the monthly prices into four components *viz.*, trend, seasonal, cyclical and irregular variations, assuming a multiplicative model of the time series. The prices of all the three products of nutmeg showed an increasing trend and considerable seasonality. The declining phase of nutmeg prices was observed from March to July, coinciding with the pre-harvest and peak harvesting months. The prices of nutmeg with shell and without shell showed considerable similarity in cyclical variations. One large cycle was observed in the prices from July 1994 to July 2001 and was followed by a

short cycle upto May 2007. The next large price cycle which commenced from May 2007 reached the trough in November 2017 and thereafter started increasing.

Since nutmeg is a perennial crop, its yielding phase was assumed to be 60 years, with a non-bearing period of three years. The cost and returns were estimated for both the districts and also for the overall sample by separately working out the establishment and maintenance costs. The cost of establishment and maintenance were found to be higher in Ernakulam district. The aggregate establishment cost was estimated as ₹1,74,425 and the aggregate annual maintenance cost were ₹65,299, ₹83,112 and ₹48,268 per hectare in the yield increasing, yield stabilizing and yield declining phases, respectively. Human labour contributed about 50 per cent of total maintenance cost and was followed by manures accounting for about 38 per cent. The cost of cultivation per hectare of the crop was estimated as ₹1,00,196 and the net return was ₹44,447. The average cost of production in the yielding phase was estimated as ₹225 per kg. To estimate the resource use efficiency in nutmeg cultivation, Cobb-Douglas production function was fitted. Human labour and manures were found to be significantly contributing towards the returns. Moreover, a decreasing returns to scale in nutmeg production was observed in the study area.

The most common marketing channel identified in the study area was Channel II, comprising of the producer, wholesaler, retailer and consumer, with the highest marketing efficiency of five for nutmeg and 14.88 for mace. The major constraints faced by the farmers in nutmeg cultivation were low price of the produce, occurrence of diseases, high wage rate, non-availability of drying and storage facilities, climate change and difficulty in harvesting.

In order to overcome these constraints, strengthening the market intelligence, formation of Farmer Producer Companies, provision of assistance for mechanical dryers, training the farmers on improving the quality of produce, product diversification and value addition, promotion of warehousing and use of warehouse receipts as negotiable instrument for availing credit were recommended.