ECONOMIC ANALYSIS OF PRODUCTION, MARKETING AND PRICES OF ARECANUT IN KASARAGOD DISTRICT OF KERALA

By

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(2015-11-080)

THESIS

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DECLARATION

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

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Dedicated to

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Introduction

1. INTRODUCTION

The Arecanut palm, (*Areca catechu L.*) *is* one of the important commercial plantation crop grown by small and marginal farmers in India. Arecanut is the seed of arecanut palm and is commonly known as betel nut or supari and it is a popular source of masticatory in India. It is a prerequisite for religious, social and cultural functions and economic life of the people in the country. Arecanut industry forms the economic backbone of nearly 16 million people in India and for many of them, it is the sole means of livelihood (Chowdappa and Cheriyan, 2016.)

The arecanut palm grows in different climatic and soil conditions and is grown in India, Bangladesh, Sri Lanka, Malaysia, Indonesia, China, Philippines and Myanmar. As per FAOSTAT (2014), total production of arecanut in the world from an area of 0.906 million hectares was about 1.104 million tonnes, with an average world productivity of 1.35 tonnes per hectare. India is the largest producer and consumer of arecanut and it continues to dominate the world in area, production and productivity. In India, arecanut was cultivated in 4.54 lakh ha in the Triennium Ending (TE) 2013-14 and the country accounted for about half of the world area and production in 2013-14 (www.faostat.com).

The area under arecanut in India increased from 0.948 lakh hectares in 1956-57 to 4.73 lakh hectares in 2015-2016, with a corresponding increase in production from 0.74 lakh Million Tonnes to 7.06 lakh Million Tonnes. The productivity almost doubled during the period 1956-57 – 2015-2016 from 788 kg/ha to 1491 kg/ha, which could be attributed to superior varieties, supply of quality planting materials, better agro-techniques and improved plant protection measures (Chowdappa and Cheriyan, 2016).

In India, arecanut is mainly grown in the states of Karnataka, Assam, Kerala, West Bengal, Meghalaya, Maharashtra, Tamil Nadu and Andaman and Nicobar Islands. Among the arecanut growing states in the country, Karnataka and Kerala together accounted for about 75 per cent of area and production of the crop

in TE 2014-15. Although the production of arecanut is localized in few states, the commercial products are widely distributed across the country and are being consumed by all classes of people. In spite of the government policy of discouraging the expansion of area under arecanut since 1970s, it increased in the country by about 70 per cent in the last two decades (CPCRI, 2015). The increase in production was mainly due to expansion of area under the crop, especially in non-traditional tracts such as cleared forest lands, converted paddy lands, plains and clayey soil belts.

The area under arecanut in Kerala has increased from 0.65 lakh ha in 1990-91 to one lakh ha in 2013-14, whereas the increase in production during the period was from 0.66 lakh tonnes to one lakh tonnes (GOK, 2015). In Kerala, during 2015-16, arecanut was cultivated in an area of 1,00,098 hectares with a production of 1,02,199 tonnes. The major arecanut producing districts in Kerala are Kasaragod, Malappuram, Kannur, Kozhikode and Wayanad. Kasaragod district ranks first in area and production of arecanut in Kerala and during 2015-16, arecanut was cultivated in an area of 19,488 hectares with a production of 33,901 tonnes. The arecanut is the backbone of the economy of Kasaragod district and could rightly be called the land of arecanut as most of the population is directly or indirectly depending on arecanut (CPCRI, 2015).

India is the largest consumer of arecanut in the world and the consumption is wide spread throughout the country, though production is specific to locations. Only a small quantity of domestic production of arecanut used to be exported which was mainly intended for the use of Indian settlers abroad. Recently, there is a gradual increase in demand for arecanut in the developed countries like USA, UK, Canada, Australia, Thailand, Singapore and France. Export of products such as ghutka and panmasala are also showing an increasing trend. India imported 67,824 tonnes of arecanut valued at $ 159 million in 2015-2016 (CPCRI, 2015).

Arecanut is marketed in India as unhusked fruits, dehusked and dried nuts, boiled, dried, whole and split kernels and value added products. There are no exclusive markets for the sale of arecanut in Kerala. More than 75 per cent of the domestic arecanut trade was controlled by private traders, wherein the

cooperatives have little bargaining power. This eventually results in frequent fluctuations in prices due to poor market intelligence, market hoarding and imperfect market information. Central Arecanut and Cocoa Marketing and Processing Cooperative Limited (CAMPCO) was formed on 11 July 1973 at Mangalore with an aim to mitigate the sufferings of arecanut and cocoa growers in Karnataka and Kerala. CAMPCO has extended its services to other states like Gujarat, Maharashtra, Utter Pradesh and New Delhi. The organization is mainly into procurement, marketing, selling and processing of arecanut and cocoa. CAMPCO has now entered in to the rubber and black pepper market. The organization also provides guidance and input to arecanut farmers. The arecanut purchased by various branches of CAMPCO are brought into the main centre where it is graded and processed as per the requirement of the consuming markets. The organization has appointed selling representatives for canvasing and arranging the supply of arecanut to the customers. CAMPCO had opened sales depots at various part of India for catering to the requirement of local customers.

In spite of the formation of CAMPCO to prevent market glut and keep the prices stable, the prices have been much volatile over the years. The price of arecanut varies from market to market according to the variety offered for sale. The wholesale price of arecanut dry in Kozhikode market during 2001-02 was ₹ 38 per kg which increased to as much as ₹ 186 per kg in 2014-15. Presently, more than 30 per cent of marketable surplus are dealt by cooperative societies like CAMPCO, Malnad Areca Marketing Co-operative Society Ltd (MAMCOS), Totegars Co-operative Sale Society (TSS) and other cooperatives in Kerala, Karnataka and Tamil Nadu (Chowdappa and Cheriyan, 2016).

Though arecanut is one of the important crops, farmers are losing interest in cultivation of the crop and diverting to many other crops. Labour scarcity creates severe problems for the arecanut farmers (Murthy, 2012). In particular, certain stages of the production process require very specialized and skilled labour that cannot be replaced with machinery. Any reduction in the supply of skilled workers could drive up wages leading to reduction in profits. Arecanut climbing

devices available in the markets have not gained popularity among farmers due to various reasons like drudgery, complicated design, high cost and requirement of prior experience. Even though several technologies are available for arecanut by-product utilization, there are only very few commercial small scale units making use of them.

The suspected health issues involving consumption of arecanut have also generated apprehensions for the farming community. Moreover, majority of the states in the country have banned the use of guktha, a product which is a blend of arecanut and tobacco (Cheriyan and Manojkumar, 2014). The major livelihood concerns for the arecanut farmers are increased import, limited export demand, extreme price fluctuations, diseases like yellow leaf disease and mahali, increasing cost of production, uneconomic size of holding and non-availability of viable technologies for value addition and alternative uses. The arecanut yield has also remained stagnant in the past two decades and since area expansion is not recommended, increasing the productivity is inevitable for meeting the demand (CPCRI, 2015).

Arecanut sector in India is facing severe crisis owing to policy level conflicts and is a matter of concern for millions of small and marginal farmers who are solely dependent on arecanut farming for their livelihood. The possible social cost of growing arecanut with all the existing institutional support on one hand and possible marginalization of millions of farmers in the event of threats of partial or complete ban on the cultivation and allied activities of the crop on the other, are the major issues to contemplate (CPCRI, 2015).

With the above background, the overall objective of the present thesis research was to analyse the economics of production and marketing of arecanut in Kasaragod district of Kerala. The study also identifies the existing marketing channels and the price spread in each of the identified channels. It also analyses the price behavior of arecanut, estimate the cost of cultivation and cost of production and identifies the major constraints in production and marketing of arecanut.

The specific objectives of the study are

1) To estimate the economics and efficiency of arecanut production.
2) To study the marketing practices and economics of marketing.
3) To analyze the time series properties of arecanut prices and price formation.
4) To determine the major constraints in production and marketing of arecanut in Kasaragod district of Kerala

LIMITATIONS OF THE STUDY

The study is based on the responses from farmers and market intermediaries in Kasaragod district of Kerala state and generalizations need not be completely accurate and are to be made with utmost care. The normal errors inherent in social surveys like bias in reporting the data, inadequacy of information and common limitations of statistical analysis might also have affected the study slightly, the effects of which have also been limited by cross checking. In spite of the above, maximum care has been taken to ensure that such limitations do not affect the authenticity of the findings or results of the study.

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 socio-economic background of the study, its relevance and significance, objectives and major limitations. The second chapter is intended for providing the theoretical and empirical back ground of the study by reviewing previous studies related to the present research. The third chapter describes the study area and methodology followed. 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

Review of past literature helps to identify the important methodologies that have been used by other researchers and also the findings from related studies. In this chapter, important past studies relevant to the present study have been reviewed and discussed. The reviews are arranged under the following headings.

2.1. Price behaviour

2.2. Economics of production

2.3. Marketing channels and price spread

2.4 Constraints in production and marketing

2.1 PRICE BEHAVIOR

Aravindakshan (1995) analyzed the prices of coconut oil and copra from 1988 to 1995 and found that there was considerable seasonality in the prices of coconut. The prices of coconut oil and copra increased up to the months of November and December and then exhibited a declining pattern up to May.

Hairdoss and Chandran (1997) studied the price behaviour of coconut and coconut oil by analyzing the variations in prices due to seasonal, cyclical, trend and irregular components. The results showed that the variation in prices of coconut and coconut oil due to the irregular components was only marginal. The seasonal indices for prices of coconut ranged from 90.98 to 121.22. The price index of coconut was found to vary between 90.98 and 102.57 during the period from January to June and was found to vary between 101.55 and 121.22 during the months from July to December.

Srinivasan *et al.*, (2001) determined the nature of the trend in prices of tapioca and tapioca products. The prices of tapioca, tapioca starch and sago were

2.2. ECONOMICS OF PRODUCTION

Santha (1990) analysed the trend in the area, production and productivity of arecanut in Kerala during the period from 1977-78 to 1986-87 and found that the area and production of arecanut showed a declining trend, whereas the productivity has increased during the period. It was concluded that the decline in area was mainly due to the substitution of arecanut with other cash crops like rubber and coconut which were considered to be more profitable than arecanut.

Ipe and Varghese (1990) analyzed the economic considerations in nutmeg cultivation mostly in low lands along the river banks of Kerala. Being a perennial crop with a gestation lag of 6-7 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 (NPW), Benefit-Cost Ratio (BCR) and Internal Rate of Returns (IRR) were 11 years, ₹ 122018, 1.89 per cent and 24.6 per cent respectively. Sensitivity analysis showed that the project remained viable even under conditions of adverse changes in costs and returns.

Joshi *et al.*, (1995) worked out the comparative economics in arecanut orchards of different sizes by classifying the sample orchards into small (0.22 ha), medium (0.58 ha) and large groups (1.10 ha). The maintenance cost of arecanut orchard was worked out by using the standard cost concepts. The gross return obtained from arecanut was ₹ 29,675 per hectare. The maximum yield of dried nuts was obtained in medium sized group (1239 kg per hectare), followed by small (1113 kg per hectare) and large (1059 kg per hectare) groups. Per hectare cost of maintenance of mixed arecanut orchard (cost C) was worked out as ₹ 36,444 at overall level, whereas cost A and cost B were ₹ 21,408 and ₹ 31,244 respectively.

Sairam *et al.*, (1997) estimated the cost of cultivation of coconut at 1995-96 prices and reported that under optimum management conditions in north Kerala, it ranges from ₹ 28,600 per hectare during the first year of planting to

₹ 23,450 per hectare during the stabilized bearing period. Under irrigated condition, the cost of cultivation ranged between ₹ 27,750 and 52,650 per hectare. The cost of production was estimated as ₹ 3.30 per nut and ₹ 2.60 per nut under rainfed and irrigated conditions respectively.

Sairam *et al.*, (1998) based on the study conducted in Kasargod district compared the cost of cultivation of coconut at different stages of growth under rainfed and irrigated conditions, with respect to three holding size classes such as marginal, small and large. It was found that the total cost under irrigated condition was almost double to that of rainfed coconut and the main reason for this was the cost incurred for labour, including the family labour charges, which accounted for about 60 to 70 per cent of total cost in all the stages of cultivation.

Korikanthimath (2000) analyzed 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 1775 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, the requirement for women labourers was higher. It was found that 57.8 per cent of the labour requirement was for picking only. In the total cost of cultivation, maximum share (69.45 per cent; ₹. 57,230.80/ha) was incurred for labour charges. A net income of ₹. 1,96,986.20/ha (average of five crop seasons) was obtained at a production cost of ₹ 130.97/kg of dry cardamom. The undiscounted measure of PBP 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, which clearly indicated that replanting of cardamom was an economically viable and financially feasible proposition.

A comparative study of the economics of coconut cultivation under micro irrigation and conventional system of irrigation was carried out by Thamban *et al.*, (2006). The results obtained after cash flow analysis showed that higher BCR and NPW were obtained by farmers adopting drip irrigation in their coconut garden than the farmers carrying out conventional basin method of irrigation. The BCR and NPW for the farms with drip irrigation ranged from 1.32 in marginal holdings to 1.71 in large holdings and ₹ 52,127 to ₹ 1,40,232 respectively, whereas in case of coconut cultivation with basin irrigation, BCR ranged between 1.29 in marginal holdings and 1.63 in large holdings and the NPW ranged between ₹ 49,087 and ₹ 1,32,684 respectively.

A comparative analysis of the cost of production among different categories of coconut holdings was done by Kalathiya *et al.*, (2007). They estimated the cost of production (including maintenance cost) of bearing coconut plantations as ₹ 7896, ₹ 7159, ₹ 8220, ₹ 6603 per hectare for marginal, small, medium and large farms respectively and the profit for the respective categories was worked out as ₹ 14,226, ₹ 13,066, ₹ 9372 and ₹ 13,414. They concluded that the average cost of cultivation was more in marginal farms as compared to small, medium and large farms.

Varghese (2007) studied the economics of cardamom cultivation in Kerala and stated that the cost of production per unit cost was very high in small sized farms as compared to medium and large sized farms. This was mainly due to the fact that small size cultivators were applying more manure and cow dung, but they obtained low yield per acre. Cardamom cultivation became an unprofitable venture in Kerala due to the inclusion of the imputed rental value of land to the comprehensive cost structure. Further, he suggested that government should provide a special package to support the small and marginal cardamom farmers who were continuing to cultivate the crop purely for survival.

Prashantha (2016) analysed the cost of cultivation of arecanut in malnad and non-malnad regions of Karnataka. The comparative study reveals that the

cost of cultivation is relatively more in Malnad area than in non-Malnad area because of the high cost involved in ground preparation for plantations and expensive land levelling operations. In addition to the cost of cultivation, it was found that maintenance cost, harvesting and post-harvest expenses, storage, transportation and marketing cost were also higher in Malnad areas compared to non- Malnad area.

2.3 MARKETING CHANNEL AND PRICE SPREAD

A study was conducted by Balachandra and Ramachandra (1994) to evaluate the market structure of arecanut by estimating the efficiency of marketing channels and the price spread between the producer-sellers and the final consuners. It was found that there were mainly three different channels through which arecanut reaches the traders from the producers. The 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) worked out the marketing costs, margins, price spread, effect of variation in the consumer's price on the share of the producers and the retailer and the efficiency of the marketing channels of coconut. Further, they identified problems confronted in the marketing of coconut by using Garrett's Ranking Technique. The results of the study showed 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. The major problems identified in marketing of coconut include the lack of finance, poor transportation facilities and deficient storage facility.

Ramakumar (2001) studied various aspects of marketing of coconut in Kerala by focusing on issues like persistence of middlemen in the marketing

channels and the margins obtained by them. The cost and margins in various channels were calculated and a composite index of marketing efficiency for each channel was estimated. The results revealed that the marketing costs as well as the producer's share in the final price were the highest in channel IV, whereas the marketing cost was the least in channel II, as the farmers themselves were carrying out most of the marketing operations in this channel.

Jayasekhar *et al.,* (2002) studied the marketing of arecanut 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 noticed that producer's share in consumer's price was the highest in the channel IV, whereas it was lowest for the channel III and hence, Channel IV could be identified as the most efficient channel.

Bastine and Narayanan (2004) conducted a study in the central region of Kerala to understand the nature of the marketing of coconut and found that the most common marketing channel was 'Producers-Copra makers-Oil millers-Wholesalers-Consumers'. The study revealed that the price spread in the above channel was ₹ 202 per 100 nuts and the producer's share in consumer's rupee was 61 percent of the price paid by the final consumer. They suggested the need for the producers to adopt value addition technologies, either at the individual level or on a collective/co-operative basis, so as to reduce the role of intermediaries and thereby decrease the price spread.

Deorukhakar *et al.,* (2005) reported that arecanut passed through two different channels i.e. direct sale to commission agent cum wholesaler and sale through village merchant as husked and unhusked nuts separately. The marketing

channels identified were (i) Producer - Commission agent cum wholesaler - Retailer - Consumer (ii) Producer - Village merchant (husked nut) - Commission agent cum wholesaler – Retailer - Consumer and (iii) Producer - Village merchant (unhusked nut) - Commission agent cum wholesaler - Retailer - Consumer. The maximum quantity was sold through village merchant (31.37 percent) and the least was direct sale to commission agent cum wholesaler (16.82 per cent).

Kumar and Kapoor (2010) conducted a study in five coastal districts of Orissa, namely, Puri, Cuttack, Khurda, Ganjam, and Jagatsinghpur to examine the marketing channels of coconut. Prices and marketing margins were computed at different stages of the chain in order to reflect value addition through various participants in the chain. Marketing channels were found to be well established in the state, particularly in the coastal areas. It was found that no major value addition was done by the players at any level. The existence of functional channels showed that production and marketing system of coconut in the state could manage both increased supply as well as demand. The study has observed a high ratio of vendors to farmers and aggregators to vendors in the channel. In spite of this high ratio, both vendors and aggregators were able to earn profit and hence continuing in the business.

Sidhu *et al.,* (2011) studied the marketing efficiency of green peas for different supply chains in Punjab. The study has revealed that the production of green peas in Punjab was 1.11 lakh tonnes in 2007-08, with per holding production of 106 quintals. The percentage of home consumption of green peas was found to be low (2.54 per cent) due to its perishable nature and hence the marketed surplus was very high. It was found that about 89 per cent of the produce was sold through wholesale market, while the rest was sold at the farm, in the village and Apni Mandi. The estimated price spread values of green peas in supply chain I (Producer - Wholesaler (through commission agent) - Retailer - Consumer) in the Hoshiarpur market has revealed that the net price received by the producer was about 67 per cent, expenses borne by the wholesaler were 7.52

per cent and by retailer were 7.36 per cent of the consumer's price (₹ 1250 per quintal). In this supply chain, the margin of the wholesaler (4.48 per cent) was found to be lesser than that of retailer (8.64 per cent) on account of high volume of business by wholesalers as compared to that of the retailers.

Karunakaran (2013) conducted a study on trend, cost of production and method of sale of arecanut in Kerala and reported that arecanut achieved the highest growth rate in production and productivity during the period from 1960 to 2010. The analysis of arecanut marketing revealed that there were six different methods of sale and marketing channels in Kerala. Among these channels, "Producer- Co-operative societies (CAMPCO) - Retailer - Final consumer" was identified as an efficient marketing channel as this channel provided a better price to arecanut producers than any other marketing channels and price spread was also minimum in this channel. Lower price spread and better price to the arecanut growers in co-operative marketing channel than any other marketing channel in Kerala indicates higher efficiency and need for establishment of more co-operative markets including CAMPCO throughout the state.

Hameedu (2014) conducted a study on the supply chain of cardamom in Kerala and reported that the farmers were not conscious about the quality of the product and marginal farmers were selling their produce, without sorting or drying to the local traders who gave them a reasonable price. The main problem in cardamom cultivation in Kerala was the absence of grading system at the producers' level. It was found from the study that the marginal farmers and traders were also not having access to market information.

Karunakaran (2014) investigated the impact of a Cooperative society on arecanut marketing in Kerala and found a lower price spread and better price in the co-operative marketing channel *vis-a-vis* any other marketing channel in Kerala and attributed this to the establishment of CAMPCO depots in the state

Basavanagowda *et al.*, (2015) studied the marketing of arecanut in Channagiri to understand the role of TUMCOS (Thota Uthpannagala Marketing Co-opreative Society) in marketing of arecanut. The study reported that marketing

of arecanut was mainly conducted through CAMPCO and there were other regional co-operative societies like MAMCOS and TUMCOS. It was found that TUMCOS played a vital role in the transaction of arecanut in the Channagiri taluk of Davangere district. Other than marketing, TUMCOS also provided various facilities like loans, share bonds, information on proper cultivation, prevalent diseases and the control of those diseases.

2.4 CONSTRAINTS IN PRODUCTION AND MARKETING

Rao (1995) in his study on problems and prospects of coconut marketing in Andhra Pradesh identified the marketing problems of coconut like lack of amenities at marketing yards and godowns, lack of transportation facilities, high degree of price fluctuations and improper working of existing market committees.

A study conducted by Nair *et al.,* (2001) on coconut production and productivity identified that the main constraints for production were poor quality planting materials, wide gap between demand supply of quality seedlings, small coconut holdings which lead to inadequate income, lack of input technologies for specific problems and locations and pest and diseases.

Chowdhury (2002) in his study on problems and prospects of coconut cultivation in Assam identified the following major constraints *viz.,* lack of awareness of the farmers on recent developments in crop protection and cropping systems, lack of quality planting materials, lack of proper management practices and attack of pest and diseases.

Anithakumari *et al.,* (2003) identified the constraints confronting coconut cultivation and classified them broadly under categories such as pests, diseases, socio-economic, technical, management and infrastructural problems.

Thyagarajan and Sivasubramanian (2004) reported that the major constraints experienced by coconut growers in Pondicherry region were heavy incidence of pests and diseases, wide price fluctuations, high cost of pesticides and high cost of fertilizers.

Sit and Ghosh (2005) conducted a study to identify the constraints associated with Arecanut cultivation in Sub-Himalayan Terrai region of West Bengal. Cultivation of poor yielding cultivars, poor quality planting materials, inappropriate spacing, inadequate fertilizer application, deficient irrigation, insufficient cultural operations and pests, mainly white grub, were identified as the important constraints in arecanut cultivation.

Chinnappa and Nagaraj (2009) reported that the major problems faced by arecanut farmers were the high transportation cost and shortage of transportation facilities. It was reported that transportation alone accounted for about 45 percent of the total marketing costs. Further, he suggested that join efforts should be made by different marketing agencies such as APMC'S and Co-operative marketing societies involved in the marketing of arecanut to ensure cheap and efficient transport facilities at the time of bumper production.

A study was conducted by Badhe and Tambat (2009) in Dapoli and Guhagar tahsils of Ratnagiri district of Konkan region. By surveying 100 arecanut growers drawn from 10 villages and an exploratory survey design was used for the study. The major problems faced by the respondents were 'decreased yield of the main crop due to intercropping','middle man refusing to provide the minimum price', 'transmission of diseases from intercrops to main crop' and 'lack of knowledge about pests and diseases'.

Prabakar *et al.*, (2011) assessed the impact of labour scarcity in agriculture and the reasons for non-adoption of labour-saving technologies using Garrett ranking technique. The higher wages in other locally available jobs ranked first among the various reasons quoted for labour scarcity, while in the case of non-adoption of labour saving technologies, the higher cost involved in the adoption of technology was ranked first by the respondents, followed by the lack of skill and smaller landholdings.

A study was conducted by Rangasamy (2011) to understand the different aspects of investment in agricultural marketing, market-related infrastructure and

agricultural marketing system in Kerala. The respondents selected were marketing department officials, 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 found that investment in agricultural marketing infrastructure in Kerala was influenced to a large extent by processing and value addition and it was 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.

Mahesh *et al.*, (2011) in their study on innovative payment options in agricultural marketing reported that limited access to market information, low literacy level among farmers and multiple channels of distribution were detrimental to both farmers and consumers. Farmers in turn, at the end of transaction do not get correct payment for their produce and there were illegal deductions, unauthorized commission charges, delayed payment as well as payment in long term instalments even running up to next season, and unauthorized deductions in the weight of the produce while making payments to farmers. An e-tendering model with online mode of payment that would help the farmers in receiving full and prompt payment for their produce was also recommended.

Jnanadevan (2013) examined the problems and prospects of coconut cultivation in Kerala and the major constraints identified were poor cultural management, slow spread of high-yielding hybrid and dwarf varieties, lack of diversity in product utilisation, high cost of production, low profitability and declining interest in farming. According to him, with the prevailing socioeconomic constraints, coconut farming was not attracting the attention of

many of the farmers even though the crop was so popular in the state. It was concluded that these constraints could be tackled by the adoption of technologies *viz.,* new cultivars, profitable production system and integrated pest and disease management.

Hedge and Deal (2014) in their study on arecanut farming in southern India found that in Karnataka half of the labour force was engaged in agriculture and arecanut farming was a major livelihood for many households in certain parts of the state. They concluded that the arecanut farmers were subjected to increased pressure of globalisation as well as growing emphasis on cash crop production, which would in turn increase the susceptibility of farmers to price or yield variability. Other than this, arecanut farmers face additional problems like the fixed nature of the asset (the arecanut tree) and lack of risk management options. They reported that these constraints might have been contributing to increased incidence of farmer suicides.

Bhoopathy (2016) examined the problems associated with the marketing of coconut in Coimbatore district by using Garrett Ranking technique. The results revealed that among the problems faced by the respondents, shortage of water due to failure of rainfall ranked first, followed by, more fluctuations in the price of the coconut, no subsidy from the government, more labour cost, power cut, no 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.

Materials and methods

3. METHODOLOGY

In this chapter, a brief description of the study area and the research design followed in the present study including the sampling procedure, the method of data collection and different tools of analysis are discussed. The section enables the readers to evaluate the work performed and permit them to replicate the study if needed.

3.1 AREA OF THE STUDY

The study was undertaken in Kasaragod district of Kerala state where there is large extent of area under arecanut cultivation. In the present study, the economic analysis of production and marketing of arecanut in Kasaragod district was attempted.

3.1.1 Kasaragod district

Kasaragod, known as the land of Gods and forts came into existence on 24th May 1984. As per 2011 census, the Kasaragod district accounts for about 7.56 per cent of the total population of the state. Kasaragod is the eleventh most urbanised district in Kerala, with an urban population of about 65 per cent of the total population in the district. Majority of the population in the district is dependent directly or indirectly on agriculture for their livelihood. The main crops grown in the district are arecanut, cashew, rubber, paddy, coconut, pepper, tapioca, tobacco etc.

3.1.1.1 Location

Kasaragod district is located in the northern tip of Kerala. It lies between 11° 18' and 12° 48' North latitude and 74° 52' and 75° 26' East longitude. The total geographical area of the district is 1992 sq. kms. Kasaragod is surrounded by Kannur district in the south, Mangalore is the north, Western Ghats in the west and Arabian Sea in the east.

The land utilization pattern of Kasaragod district in 2015-16 is presented in Table 3.1. The net area sown in the district was around 73 per cent of the geographical area and the area sown more than once was 4.73 per cent of the geographical area. While forests accounted for three per cent of the area of the district, the share of land put to non-agricultural uses was 12.9 per cent.

Table 3.1 Land utilization pattern of Kasaragod district in 2015-16

Particulars	Area in Hectares	Percentage to total geographical area
Total geographical area	199166	100.00
Forest land	5625	2.82
Land put to non-agricultural use	25611	12.86
Barren and uncultivable land	3588	1.80
Permanent pastures and grazing land	0	0.00
Land under miscellaneous tree crops	258	13
Cultivable wasteland	8806	4.42
Fallow other than current fallow	2160	1.09
Current fallow	2597	1.30
Marshy land	0	0.00
Still water	4336	2.18
Water logged area	22	0.01
Social forestry	105	0.05
Net area sown	146058	73.34
Area sown more than once	9440	4.73
Total cropped area	155497.59	78.07

Source: Agricultural Statistics 2015-16, Directorate of Economics and Statistics, Kerala.

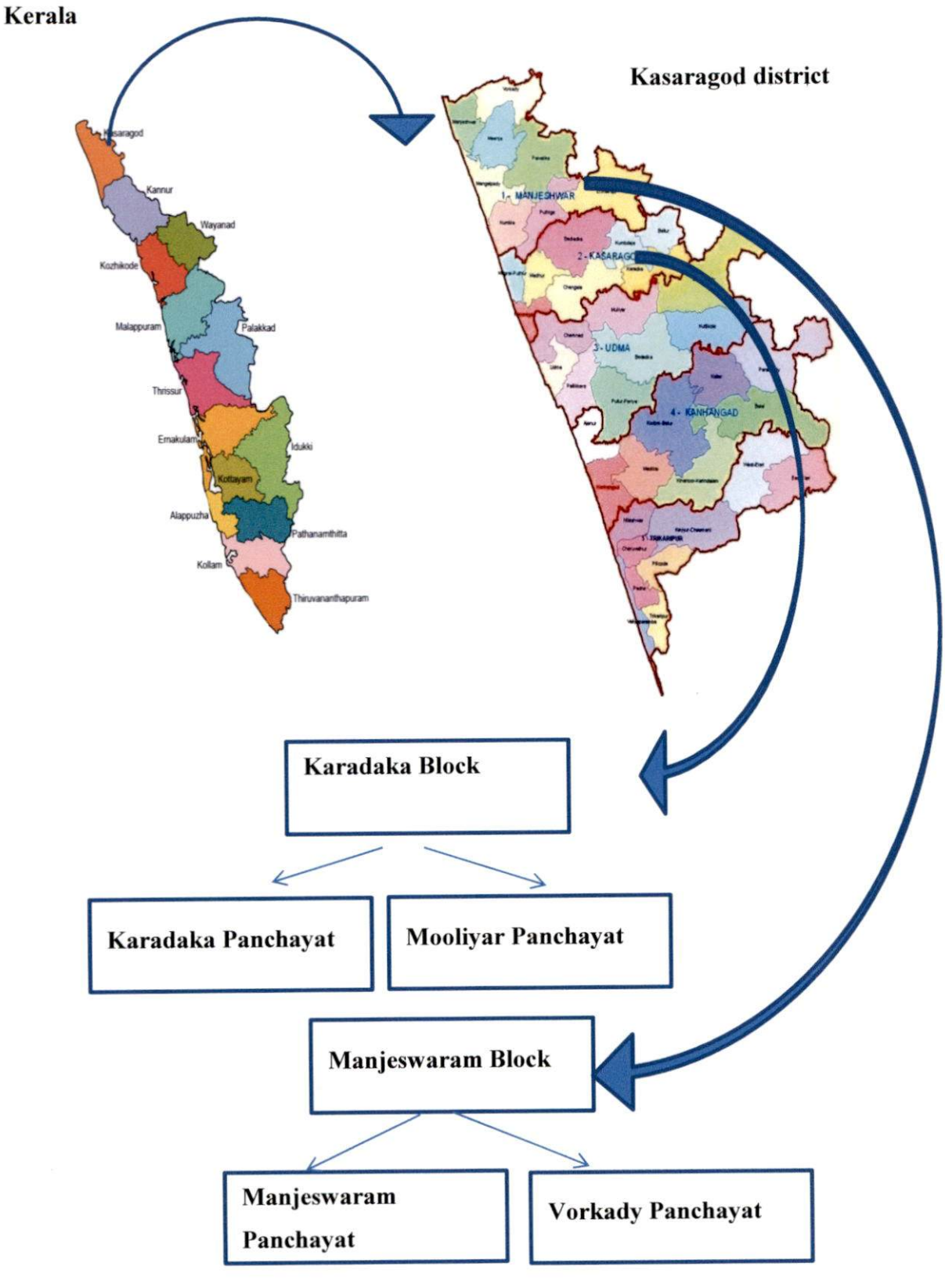

Figure 3.1 Map of the study area

3.1.1.2 Topography and Climate

Based on the physical features the district falls into three natural divisions (i) the low land bordering the sea, (ii) the midland consisting of the undulating land and (iii) the forest covered highland on the extreme east.

The diversity of the physical features results in diversity in climate. In the plains, the climate is generally hot. Though the mean maximum temperature is only around 32.2° Celsius, the temperature is high in the moisture laden atmosphere of the plains. Humidity is very high and rises to about 90 per cent. During the South-West monsoon, the annual variation of temperature is small. The South-West monsoon starts towards the end of May and continues till September, when the rain fades out. From the month of October, the North-East monsoon sets in. Dry weather prevails by the end of December, while January and February are the coolest months of the year. The months from March to May are generally very hot.

3.1.1.3. Demographic features

The population of Kasaragod district as per the 2011 census is 13,07,375. The density of population is 654 per square km and the sex ratio in the district is 1079 females per 1000 males. The literacy rate in the district has increased from 79 per cent in 2001 to 89.85 per cent in 2011. According to 2011 census data, the total number of workers in the district was 4, 62,998, comprising of 3,72,700 main workers and 9,02,98 marginal workers.

3.1.2. Description of selected Panchayats

The two blocks in Kasaragod district *viz.,* Manjeshwar and Karadaka which have maximum area under arecanut were selected for the study. From each of the blocks, two Panchayats having maximum area under arecanut were identified i.e., Manjeshwar and Vorkady panchayats from Manjeswaram block and Karadaka and Mooliyar panchayats from Karadaka block.

The panchayat-wise area according to the type of land is presented in Table 3.2. As evident from the table, dry land accounted for more than 80 per cent of the total area in panchayats of Karadaka, while in Manjeswaram block, it was more than 70 per cent.

Table 3.2 Panchayat-wise area according to type of land

Block	Panchayat	Area in cents			
		Wetland	Dry land	Others	Total
Karadaka	Karadaka	611.02 (13.23)	3873.02 (83.87)	133.82 (2.90)	4617.86 (100)
	Mooliyar	1282.33 (15.09)	7213.09 (84.90)	-	8495.42 (100)
Manjeshwar	Manjeshwar	144747 (26.49)	394394 (72.17)	7325 (1.34)	546,466 (100)
	Vorkady	261538 (22)	860925 (72.41)	66409 (5.59)	1,188,872 (100)

Source: Panchayat Level Statistics, 2011, Kasaragod

Note: Figures in parentheses indicate per cent to row total

The details of cropping pattern in the selected blocks are presented in Table 3.4. It could be observed from the table that coconut was occupying the highest area in both the blocks. Arecanut was the second most important crop in both the blocks, accounting for 25.97 per cent and 23.61 per cent of the total cropped area in Karadaka and Manjeswarm blocks respectively.

Table 3.3 Cropping pattern in selected Blocks (2015-16)

Crop	Area in Hectares	
	Karadaka	Manjeshwar
Rice	552.54 (2.75)	594.87 (2.68)
Arecanut	5206.65 (25.97)	5240.91 (23.61)
Black Pepper	1035.08 (5.16)	316.76 (1.42)
Coconut	9460.6 (47.20)	11775.1 (53.05)
Cashew	1641.22 (8.18)	1611.15 (7.25)
Papaya	76.96 (38.39)	136.43 (0.61)
Tamarind	43.96 (21.93)	29.35 (0.13)
Nutmeg	18.14 (9.05)	33.05 (0.14)
Cocoa	58.52 (29.19)	93.38 (0.42)
Banana and Plantain	515.28 (2.57)	536.79 (2.41)
Vegetables	142.46 (0.71)	204.74 (0.92)
Jack	343.99 (1.71)	399.2 (1.79)
Mango	303.46 (1.51)	376.5 (1.69)
Others	644.11 (3.21)	844.68 (3.80)
Gross Cropped Area	20042.97 (100)	22192.91 (100)

Source: Agricultural Statistics 2015-16, Directorate of Economics and Statistics, Kerala.

Note: Figures in parentheses indicate per cent to column total

3.2 Sampling design

The present study is based on both primary and secondary data. The micro-level study was conducted in Kasaragod district which is accounting for more than 50 per cent of the area under arecanut in Kerala State. Two blocks in the district namely, Karadaka and Manjeshwar were selected for the study. From each of the block, two Panchayats having maximum area under arecanut *viz.*, Karadaka and Mooliyar panchayats in Karadaka block and Manjeshwar and Vorkady panchayats from Manjeshwar blocks were selected. 25 farmers were selected from each of the Panchayat and therefore, 50 farmers were selected from each of the block. From the combined list of arecanut farmers obtained from CAMPCO dealers and Krishi Bhavans, respondents were randomly selected and data was collected using a pretested interview schedule.

3.2.1 Collection of data

Farm level data was collected from the respondents by personal interview method using a well-structured interview schedule. Information about socio-economic condition of the farmers, yield, cost and returns from arecanut, marketing details and problems encountered by farmers in production and marketing of arecanut were collected. Secondary data was also collected from various published and unpublished sources.

3.6.3 Analysis of price behaviour

Price behaviour of arecanut was studied using the technique of classical time series (Croxton *et al.*, 1979; Spiegel, 1992). Time series data on the prices of arecanut in different market of Kerala were decomposed into the trend, seasonal, cyclical and irregular components. A multiplicative model of the following form was used for the same.

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

Where,

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

T: Secular trend component

S: Seasonal component

C: Cyclical component

I: Irregular/ Random component

3.6.3.1 Estimation of trend value

Trend is a general tendency of the data to increase or decrease during a long period of time. The trend in arecanut price in major markets of Kerala was studied by fitting suitable trend equations.

Models:

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

$$Y_t = ab^t$$

3.6.3.2 Estimation of seasonal variation

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

3.6.3.3 Estimation of cyclical variation

The oscillatory movements in a time series with period of series of more than one year are referred as cyclical variation. Cyclical variations in the prices of arecanut in major markets of Kerala were studied using 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 components

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,

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

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.

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

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.

3.6.3.4 Estimation of irregular variation

Random or irregular 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,

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

3.6.3.5 Cointegration analysis

Cointegration is regarded as the empirical counterpart of the theoretical notion of a long run relationship between two or more variables. The relationship between the prices in two or more than two spatially separated markets can be explained using the concept of market integration. When the markets are integrated, they operate in unison, as a single market system.

For testing the presence of cointegration relationships among non-stationary variables many methods are available. Johansen developed Maximum Likelihood (ML) method of cointegration. To study specifically whether two markets are integrated and linked together into a single market, Johansen developed Maximum Likelihood (ML) method of cointegration. Time series data may contain a unit root (non-stationary), so that the data should be differenced to make it stationary before employing cointegration analysis. So there are two steps in performing cointegration,

1) Testing for stationarity
2) Testing for cointegration

1. Testing for stationarity

To ensure appropriate model specification and to reduce the possibility of arriving at misleading results, it is important to examine the characteristics of the time series data. This involves tests for establishing the order of integration of the variables.

The most widely used tests for unit roots are the Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) tests. These two methods tests the null hypothesis that the time series has a unit root or in other words, it is non-stationary. The DF test was applied by running the regression of the following form,

$$\Delta = \beta_1 + \delta P_{t-1} + u_t$$

Where,

$$\Delta P_t = (P_t - P_{t-1});\ Pt = \ln P_t$$

The ADF test was run with the equation,

$$\Delta Y_t = \beta_1 + \delta P_{t-1} + \sum_{i=1}^{P} \alpha_i \Delta P_{t-i} + \epsilon_t \qquad (1)$$

$$\Delta Y_t = \beta_1 + \delta P_{t-1} + \beta_2 t + \sum_{i=1}^{P} \alpha_i \Delta P_{t-i} + \epsilon_t \qquad (2)$$

Where,

$$\Delta P_{t-1} = (P_{t-1} - P_{t-2})$$

ϵ_t for t = 1, ... , N is assumed to be Gaussian white noise i.e., $\epsilon_t \sim (0, \sigma^2)$. The first equation is with a constant term and no trend whereas the second one is with constant and trend. The number of lagged terms p is chosen to ensure that the errors are uncorrelated. In all the tests, the null hypothesis was $\delta=0$ which implied that the time series Y_t was non-stationary. In the present study, ADF tests were used to ascertain the stationarity of the price variables.

AH

2. Testing for cointegration

The test for finding the order of integration of each variable in the model was to establish whether the time series was non-stationary and how many times the variable needs to be differenced to result in a stationary series. However, first differencing is not an appropriate solution to the non-stationarity problem and it prevents detection of the long-run relationship that may be present in the data, *i.e.* the long-run information is lost, which is precisely the question being addressed in this analysis.

The economic interpretation of co-integration is that, if two (or more) series are linked to form an equilibrium relationship spanning the long-run, then even though the series themselves may contain stochastic trends (i.e., be non-stationary) they will nevertheless move closely together over time and the difference between them will be stable (*i.e.*, stationary). The concept of co-integration mimics the existence of a long-run equilibrium to which an economic system converges over time and u_t defined above can be interpreted as the disequilibrium error (*i.e.*, the distance that the system is away from equilibrium at time t).

An approach to testing for co-integration is to construct test statistics from the residuals of a co-integrating regression in levels mostly using Engle Granger and Augmented Engle Granger tests. However, in the case of a system of variables, Johansen Maximum likelihood procedure (Johansen and Juselius, 1990), is the most applicable method, since it permits the existence of co-integration between the systems of variables without imposing any bias on the estimates. The Johansen test for co-integration is a multivariate unit root test which estimates the co-integrating rank 'r' in the multivariate case and is also able to estimate the parameters 'β' of these co-integrating relationships. This test procedure is most efficient because it identifies the number of co-integrating vectors between the non-stationary level variables in the context of a Vector Error Correction Model (VECM). Basically, this is a Vector Auto Regression (VAR)

model in error correction form. In a system with two or more variables, a VECM, like the VAR model, treats each variable as potentially endogenous and relates the change in one variable to past equilibrium errors and to past changes in all variables in the system.

Following Johansen and Juselius (1990), the maximum likelihood method of co-integration is explained as follows:

If Pt denotes (nx1) vector of I (1) prices, then the k-th order vector autoregressive (VAR) representation of Pt may be written as k.

$$Pt = \sum_{i=1} \Pi i \, Pt - i + \mu + \beta t + et \, (t = 1, 2 \ldots . t)$$

The procedure for testing co-integration is based on the error correction (ECM) representation of Pt given by

$$\Delta Pt = \sum_{i=1}^{K-1} \acute{\Gamma} i \Delta \, Pt - i + \Pi i \, Pt - k + \mu + \beta t + et$$

Where,

$$\Pi i = - (1 - \Pi_1 - \ldots\ldots - \Pi t); \; i = 1, 2 \ldots K-1; \; \Pi = - (1 - \Pi_1 - \ldots . - \Pi k).$$

Each of the Π_1 is an n x n matrix of parameters; e_t is an identically and independently distributed n-dimensional vector of residuals with zero mean and variance matrices. Ωe; μ is a constant term and t is trend. Since, P_{t-k} is I (1), but ΔP_t and ΔP_{t-1} variables are I (0). Equation will be balanced if Π Pt-k is 1(0). So, it is the Π matrix that conveys information about the long run relationship among the variables in Pt. The rank of Π, r, determines the number of co-integrating vectors, as it determines how many linear combinations of Pt are stationary. If r = n, the prices are stationary in levels. If r = 0, no linear combination of Pt is stationary. If 0< rank (Π) = r<n, and there are n x r matrices ά and β such that Π = άβ, then it can be said that there are r co-integrating relations among the elements of Pt. The co-integrating vector β has the property that βPt is stationary even though Pt itself is non-stationary. The matrix ά measures the strength of the co-

integrating vectors in the ECM as it represents the speed of adjustment parameters. Two likelihood ratio test statistics were proposed. The null hypothesis of at most 'r' co-integrating vectors against a general alternative hypothesis of 'more than r' co-integrating vectors was tested by

$$\text{Trace statistic } (\lambda\text{-trace}) = -T \sum \ln (1 - \lambda i)$$

The null hypothesis of 'r' co-integrating vector against the alternative of r + 1 is tested by the maximum Eigen value statistic (λ max) = -T ln (1- λr+1). $\lambda$is are the estimated Eigen values (characteristics roots) obtained from the Π matrix. T is the number of usable observations (Johansen and Juselius, 1990).The number of co-integrating vectors indicated by the tests is an important indicator for the co-movement of prices. An increase in the number of co-integration vectors implies an increase in the strength and stability of price linkages.

3.6.4.2 Granger Causality Test

Cointegration between two variables implies that the existence of causality between them in at least one direction (Granger, 1980). Cointegration itself cannot be used to make inferences about the direction of causation between the variables. The Granger Causality test provides additional evidence for the presence and as direction of price transmission occurring between two series. If two markets are integrated, the price in one market P_D would be found to Granger-Cause the price in the other market, P_I and/or vice versa. The test involves estimating the following pair of regressions

$$P_{Dt} = \sum^{n}{}_{i=1}\ \alpha i\ P_{It-i} + \sum^{n}{}_{j=1}\ \beta j\ P_{Dt-j} + u_{1t}\ (1)$$

$$P_{It} = \sum^{n}{}_{i=1}\ \lambda i\ P_{It-i} + \sum^{n}{}_{j=1}\ \delta j P_{Dt} - j + u_{2t}\ (2)$$

Unidirectional causality from P_{It} to P_{Dt} is indicated if the estimated coefficients on the lagged P_{It} in the first regression are statistically different from zero as a group and the set of estimated coefficients in lagged P_{Dt} in (2) is not statistically different from zero. Conversely, unidirectional causality from P_{Dt} to P_{It} exists if the set of lagged P_{It} in the first regression is not statistically different from zero

and the set of lagged P_{Dt} coefficients in (2) is statistically different from zero. Bilateral causality is suggested when the sets of P_{It} to P_{Dt} coefficients are statistically different from zero in both the regressions. When the sets of both the coefficients are not statistically significant in both the regressions, independence is suggested.

3.6.4 Economics of arecanut cultivation

Arecanut is a perennial crop with an economic life span of 50 years, which starts yielding or bearing from the 6th year onwards. The cost incurred in raising arecanut orchards can be classified into two categories *viz.*, (i) establishment cost and (ii) maintenance cost.

Establishment cost includes all the expenses incurred in the first year for establishment of arecanut gardens. Items like land preparation, digging of pits and filling, cost of manures, fertilizers, lime, plant protection chemical, expenditure incurred on different farm operations, *viz.*, terracing, weeding, irrigation, gap filling, watch and ward and repairs and maintenance cost from 2nd year to bearing stage were also considered as establishment cost.

Maintenance costs are the expenses incurred from the bearing year onwards and during the rest of the economic life period on input services like human labour utilized for laying of irrigation and drainage channels, clearing of basins, weeding, application of manures, fertilizers and lime, irrigation, channel maintenance, bullock labour and services of machinery and on material inputs *viz.*, manures, fertilizers, plant protection chemicals, lime and fuel and repairs and maintenance charges.

3.6.5 Resource use efficiency

Production function analysis was employed to evaluate the factors influencing coconut production and also to examine their relative influence. The Cobb-Douglas production function is one of the most widely used functions in the economic analysis of the problems relating to empirical estimation in agriculture

and industry (Sankhayan, 1988). The production function was estimated using Ordinary Least Square (OLS) method. The estimated values of the regression coefficients were tested for statistical significance.

The algebraic forms of Cobb-Douglas production function is given by,

$$Y = a0\ X1^{a_1} X2^{a2}\ X3^{a_3}\ X4^{a_4}\ X5^{a_5}\ X6^{a_6}$$

Where,

Y : Yield per ha

X_1 : Human labour (mandays/ha)

X_2 : Amount spent on manures (Rs/ha)

X_3 : Age of palms (years)

X_4 : Experience in farming (years)

X_5 : Amount spent on fertilizers (₹/ha)

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

The constants 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 this equation is,

$$\ln y = \ln a_0 + \ln X_1 + \ln X_2 = \ln X3 + \ln X4 + \ln X5 + \ln X6$$

Marketing channel

Marketing channel is the path through which the agricultural products move 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 and 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.

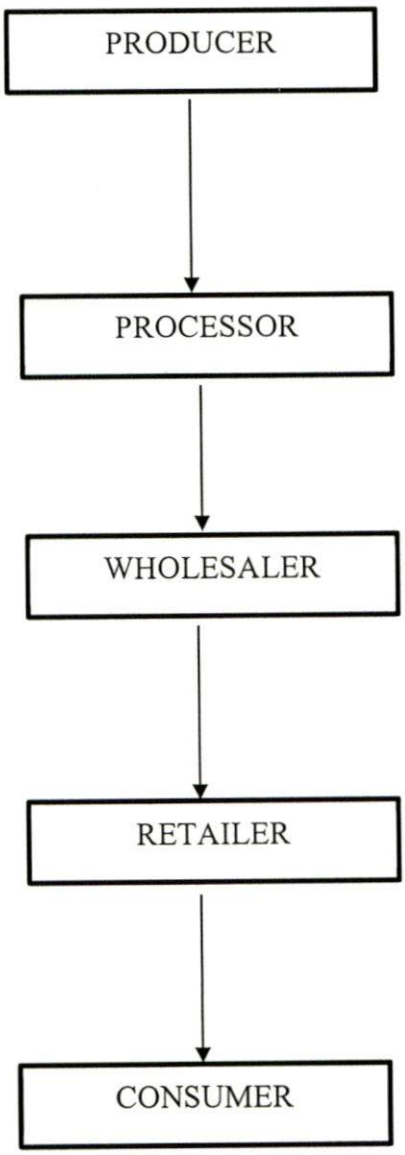

Figure 3.2 Marketing channel

Marketing cost

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

Marketing margin

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

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. The price spread includes the marketing cost and the marketing margin. In the present study, price spread in marketing of arecanut was estimated by the concurrent margin method.

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

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,

Ps = Producer's share in consumer's rupee (Percentage)

Pp = Producer's price

C_p = Consumer's price

Shepherd's formula

The economic efficiency of markets is 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. Constraints in production and marketing of arecanut

To identify the various constraints faced by arecanut farmers, Garrett ranking technique was used. As the first step in constraint analysis, major problems faced in production and marketing were identified. The respondents were then asked to rank the identified problems and the major constraints were identified by 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 "Economics of production, marketing and prices of arecanut in Kasaragod district of Kerala" was undertaken to estimate the economics and efficiency of arecanut production and to study the marketing and price behaviour of arecanut. The results are discussed under the following headings:

4.1 Area, production and productivity of arecanut

4.2 Export-Import scenario of arecanut

4.3 Price behaviour of arecanut

4.4 Socio-economic profile of sample farmers

4.5 Economics of arecanut cultivation

4.6 Resource use efficiency in cultivation

4.7 Marketing of arecanut

4.8 Constraints in arecanut cultivation

4.1 Area, production and productivity of arecanut

The growth patterns of arecanut cultivation in India and Kerala with respect to area, production and productivity from 1980 to 2016 were analysed and the results are explained in this section under two headings *viz*., Indian scenario and Kerala scenario

4.1.1 Indian scenario

The area, production and productivity of arecanut in India during the period from 1980-81 to 2014-15 is presented in Fig. 4.1. It could be observed from the figure that the area, production and productivity of arecanut have been increasing over the years. In India, arecanut was cultivated in an area of 4,68,000 hectares with an annual production of 7,26,000 tonnes during 2015-16.The

productivity of arecanut during 2015-16 was 1558 kg per hectare. During the period from 1980-81 to 2015-16, the area under arecanut increased from 1,85,000 hectares to 4,68,000 hectares and the production also increased from 1,96,000 tonnes to 7,26,000 tonnes. The productivity increased from 1058 kg per hectare to 1558 kg per hectare during the corresponding period. In India, a sudden increase in the production of arecanut could be observed from 4,78,100 tonnes in 2010-11 to 6,29,670 tonnes in 2011-12. Later, the area under arecanut crossed seven lakh hectare during 2014-15. The productivity also increased from 1058 kg per hectare to 1558 kg per hectare during the above period.

It could be observed from Fig. 4.2 4.4 and 4.5 that the area, production and productivity of arecanut in India during the period from 1980-81 to 2015-16 showed increasing trend.

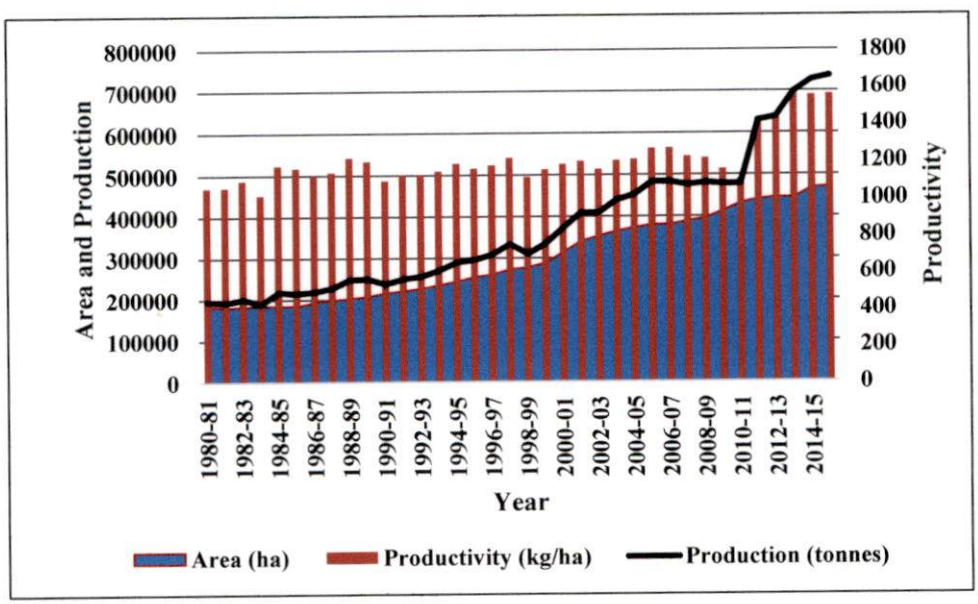

Fig. 4.1 Area, production and productivity of arecanut in India

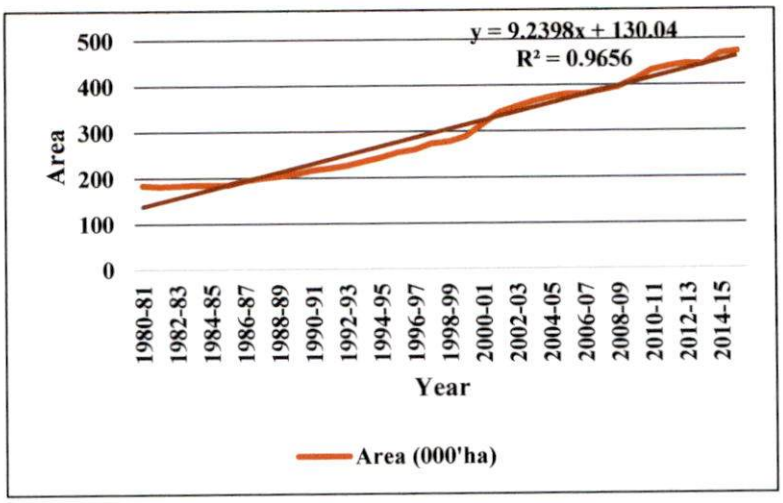

Fig. 4.2 Trend in area under arecanut in India

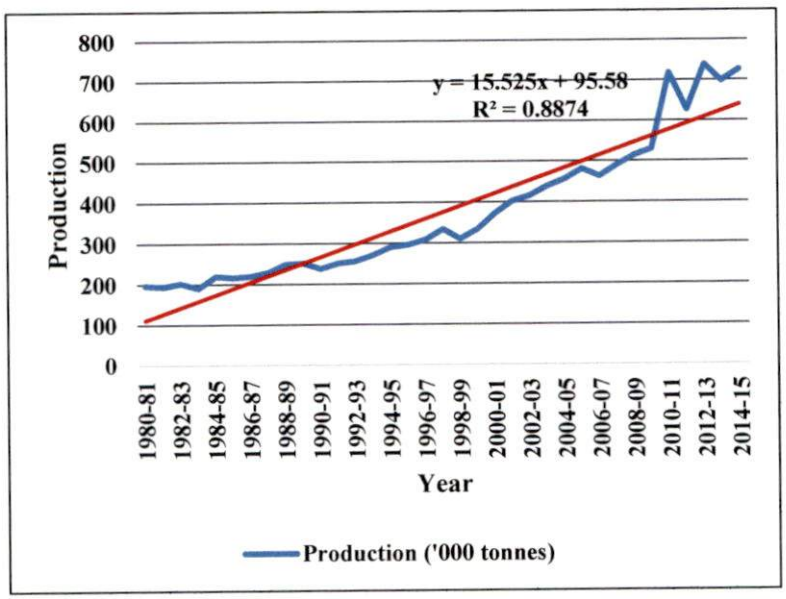

Fig. 4.3 Trend in production of arecanut in India

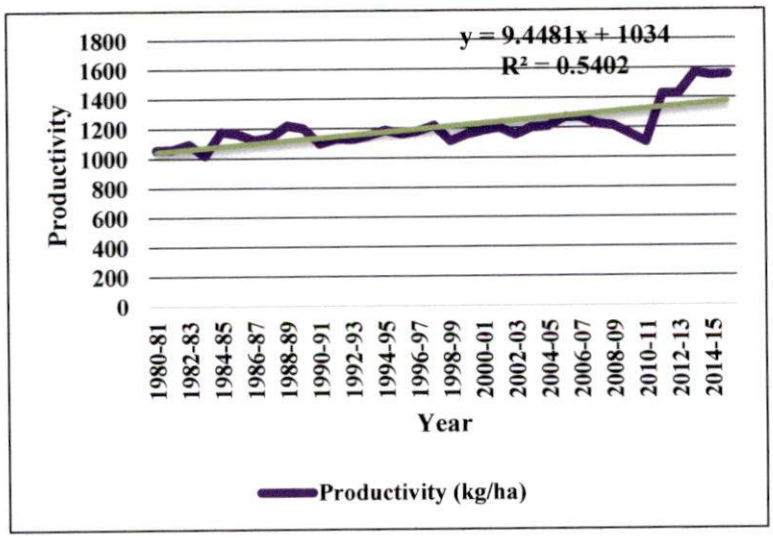

Fig. 4.4 Trend in productivity of arecanut in India

4.1.2 Kerala scenario

The trend in area, production and productivity of arecanut crop in Kerala over the years from 1980-81 to 2015-2016 is shown in Fig 4.5, 4.6, 4.7 and 4.8. Kerala is the second largest producer of arecanut in India, after Karnataka. Kerala occupies an area of 1,00,098 hectares under arecanut during 2015-2016, with a production of 1,02,199 tonnes of arecanut. The productivity of arecanut in Kerala during 2015-16 was 1020 kg per hectare. The share of Kerala in total area and production of arecanut in India during 2015-2016 was 24 and 23 per cent respectively.

The area under arecanut in Kerala has increased from 61,242 hectares during 1980-81 to 1,02,199 hectares during 2015-2016. The production and productivity also increased during the above period from 10,805 tonnes to 1,02,199 tonnes and 176.3 kg per hectare to 1020.99 kg per hectare respectively. The arecanut production in the state crossed one lakh tonne in 2002-03. From an area of 96,686 hectares and a production 1,25,926 tonnes, the maximum productivity of 1302 kg per hectare was observed during 2014-15.

The time series data on area, production and productivity of arecanut in Kerala over the years from 1980-81 to 2015-2016 showed increasing trend (Figures 4.6,4.7 and 4.8) with regular ups and downs.

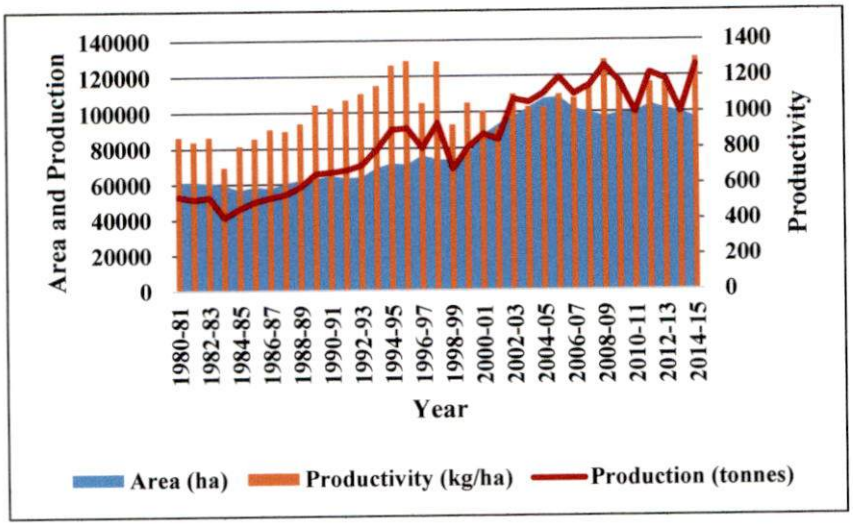

Fig. 4.5 Area, production and productivity of arecanut in Kerala

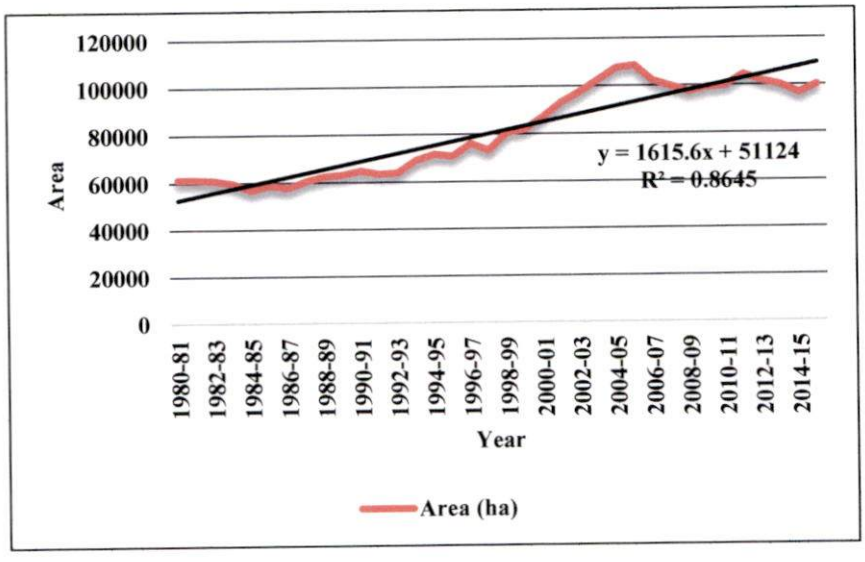

Fig. 4.6 Trend in area under arecanut in Kerala

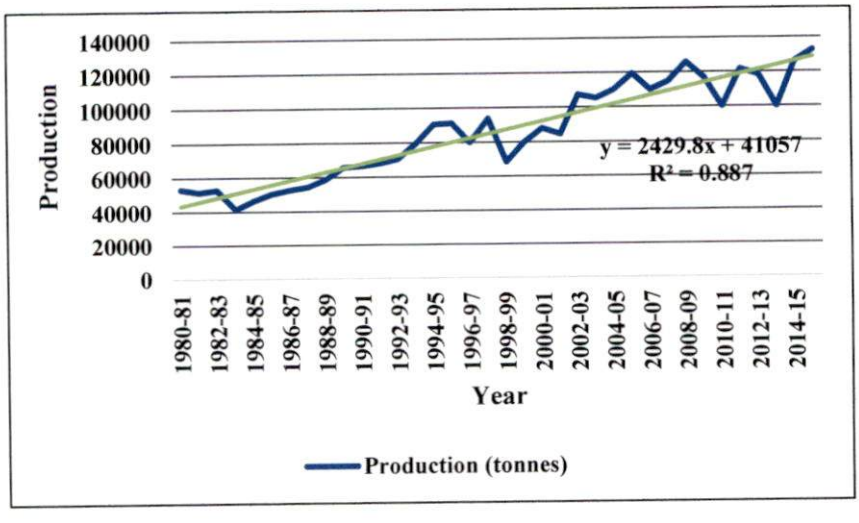

Fig. 4.7 Trend in production of arecanut in Kerala

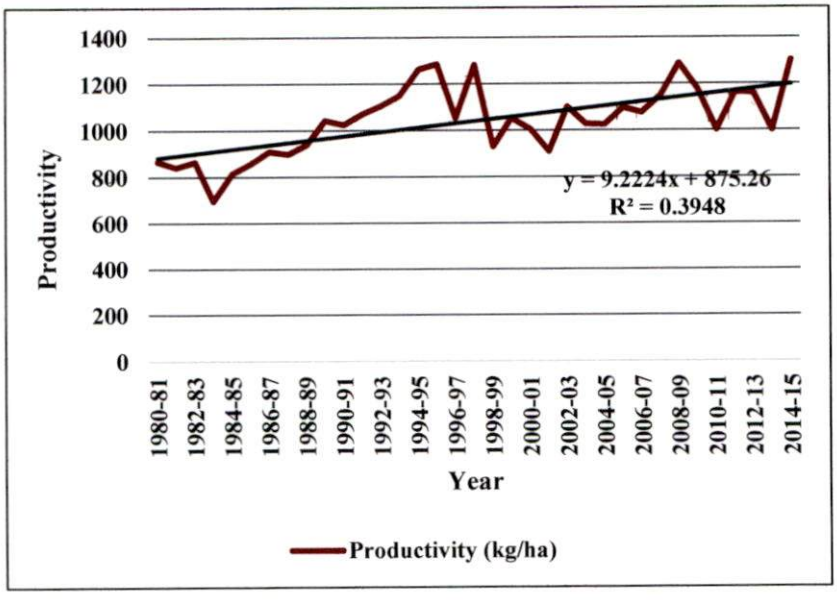

Fig. 4.8 Trend in productivity of arecanut in Kerala

4.2 Export-Import scenario of arecanut

Trend in export of arecanut from India over the years from 1980-81 to 2014-15 is presented in Fig. 4.9 Export potential of arecanut is limited as bulk of the production is consumed within the country and only a small portion of production is exported which is mainly meant for the Indian settlers abroad. During 1980-81, India exported 370 tonnes of arecanut which was valued at ₹ 73.65 lakhs. In 1995-96, the export was 406 tonnes and from then onwards the export of arecanut has increased to 5336 tonnes in 2006-2007. Subsequently, it has shown a declining trend and during 2014-15, exports was 8511 tonnes of arecanut, which was valued at ₹ 11182.81 lakhs.

From India, arecanut is exported to countries like Bangladesh, Hong Kong, Malaysia, Maldives, UAE, Nepal, UK, Sri Lanka, South Africa and Kenya. At present, the demand for Indian arecanut is gradually increasing in developed countries such as USA, Canada, Australia, Thailand, Singapore and France.

With the economic reforms of 1991 and subsequent WTO agreement of 1995 and proliferating Regional Trade Agreement along with increased domestic consumption, India has been importing arecanut since 1994-95 and subsequently import has been increasing at an alarming rate. Trend in import of arecanut to India from 1995-96 to 2014-15 is presented in Fig. 4.10. During the pre-WTO period (1980-81 to 1995-96), import of arecanut was negligible.

India is importing arecanut in different forms like whole, split, ground and other forms from countries like Sri Lanka, Indonesia, Bangladesh, Thailand and Myanmar. The quantum of import of arecanut varied from 5091 tonnes which was valued at ₹ 946.75 lakh to 53,275 tonnes which was valued at ₹ 72,228.10 in 2005-06. During 2014 -15 the imports were about 50036 tonnes which valued at ₹ 68,235 lakhs. CAMPCO is putting pressure on the Government to restrict the import of arecanut from other countries with a view to provide incentives to the farmers. The quality of imported arecanut is inferior to the domestic arecanut.

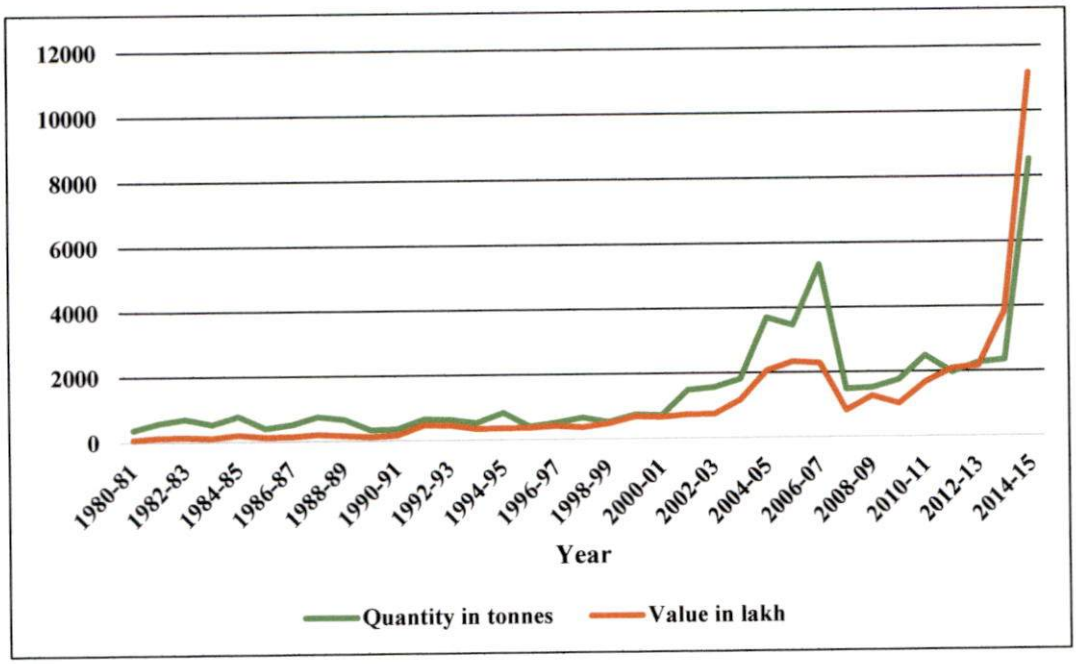

Fig. 4.9 Export of arecanut from India

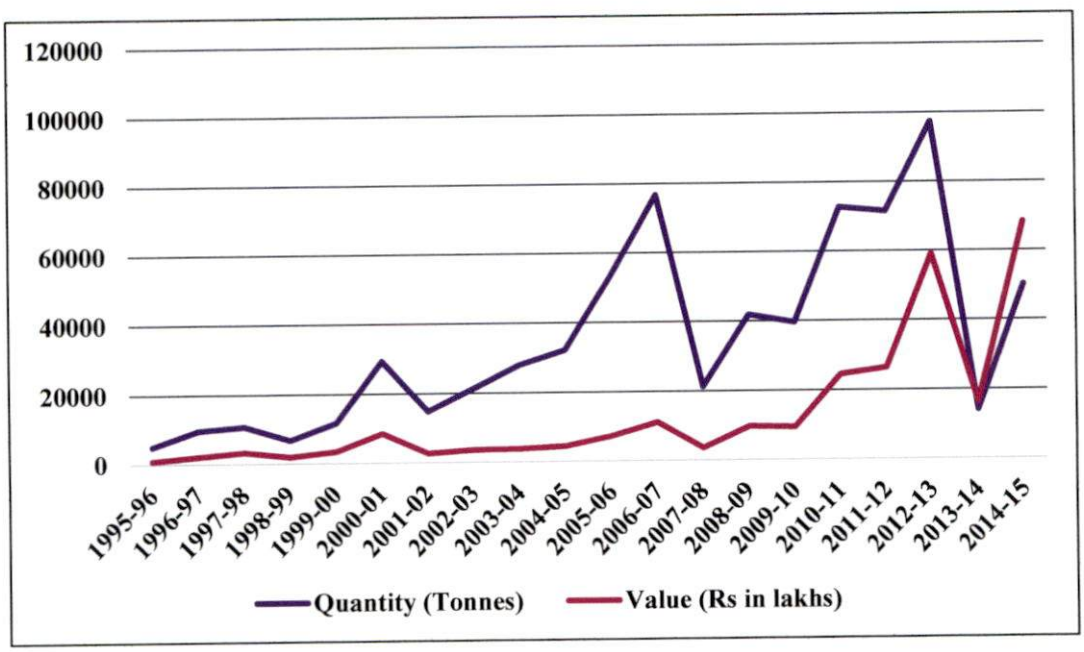

Fig. 4.10 Import of arecanut to India

4.3 Price behaviour of arecanut

Arecanut price have been fluctuating widely which is a matter of concern for farmers, cooperative societies and policy makers. The price falls are largely

contributed by market gluts and higher imports. Besides improving productivity of arecanut, remunerative and steady prices also play a crucial role in increasing production. Moreover, arecanut being a perennial crop which involves heavy initial investment when compared to seasonal and annual crops, price stability assumes more significance. In this context, an attempt was made to analyze the price behavior of ripe and dry arecanut in major markets of Kerala *viz.*, Nedumangad, Telicherry, Calicut and Kanhangad. WTO agreement of 1995 was assumed as significant factor determining the price behaviour of arecanut prices. The study period was divided into two sub-periods; Pre-WTO (from 1980 to 1994) and Post-WTO (from 1995 to 2015).

In order to analyse the price behavior, the monthly price data of arecanut were decomposed into four components *viz.*, secular trend, seasonal variation, cyclical variation and irregular variation assuming a multiplicative model of time series which is described below under appropriate headings for two sub-periods *viz.*, Pre-WTO and Post-WTO.

4.3.1 Trend analysis for prices of arecanut

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 behavior of arecanut, trend analysis was done separately for each of the product-market combination 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 results showed that the best fit trend for the price of Nedumangad Ripe was polynomial function whereas for Telicherry Ripe, exponential function formed the best fit during the pre-WTO period. In post-WTO period, the best fit for these two markets were polynomial functions. The price of ripe arecanut showed an increasing trend in both the markets in the long run.

The price of dry arecanut in Nedumangad, Calicut and Kanhangad markets showed an increasing trend in spite of regular ups and downs. Exponential function was found to be best fit for the above markets during the pre-WTO, period whereas polynomial function was found to be best fit for post-WTO period.

The trend in prices of arecanut in all product-market combinations as presented in Fig. 4.11 to 4.20 showed that there was steep increase in the prices of arecanut from 1980 onwards with regular ups and downs. Hence from this study it could be concluded that in spite of high fluctuations, arecanut price in domestic market was showing an increasing trend in the long-run, during pre-WTO as well as post -WTO periods.

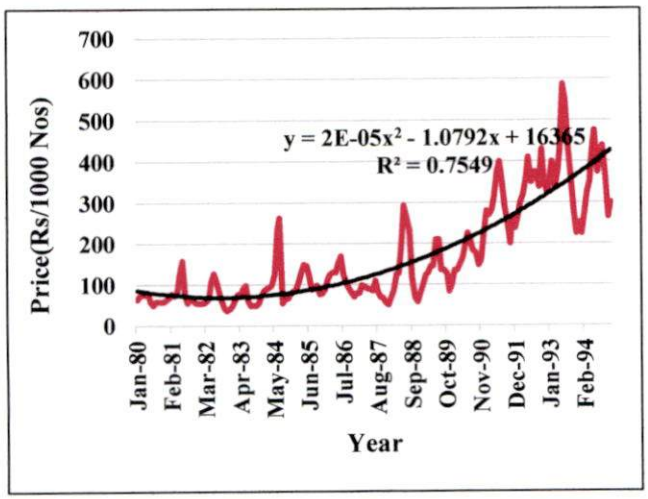

Fig. 4.11 Trend in Nedumangad ripe price – Pre-WTO

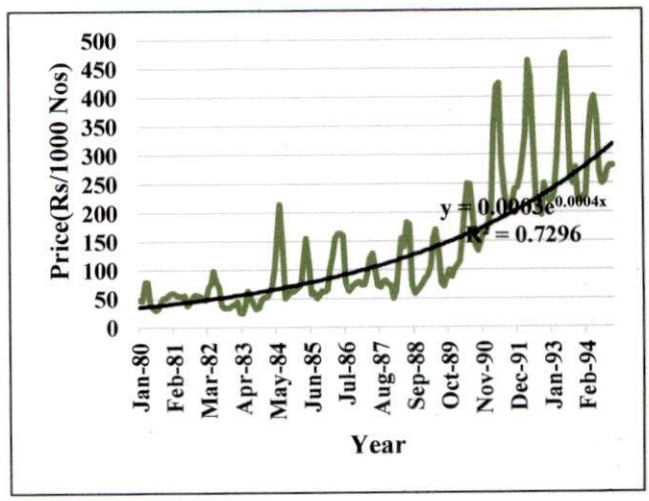

Fig. 4.12 Trend in Telicherry ripe price – Pre-WTO

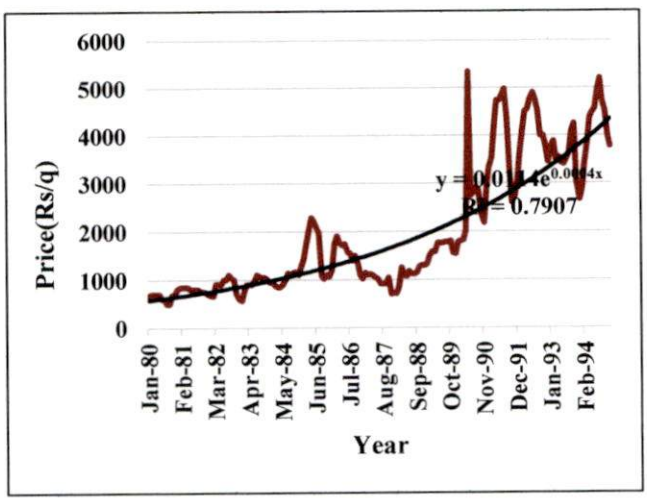

Fig. 4.13 Trend in Nedumangad dry Price- Pre-WTO

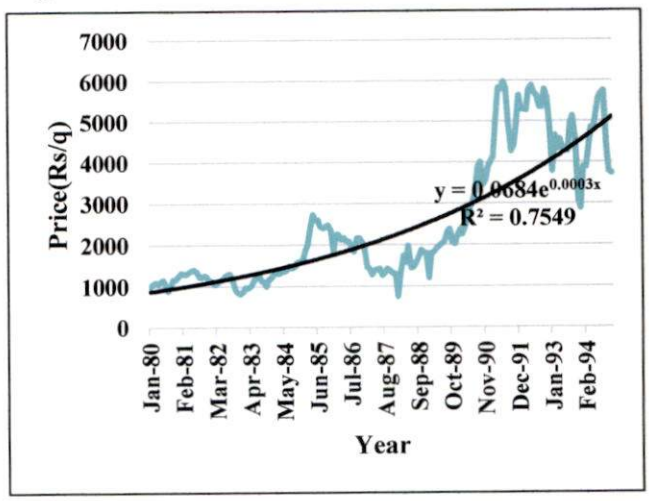

Fig. 4.14 Trend in Calicut dry price- Pre-WTO

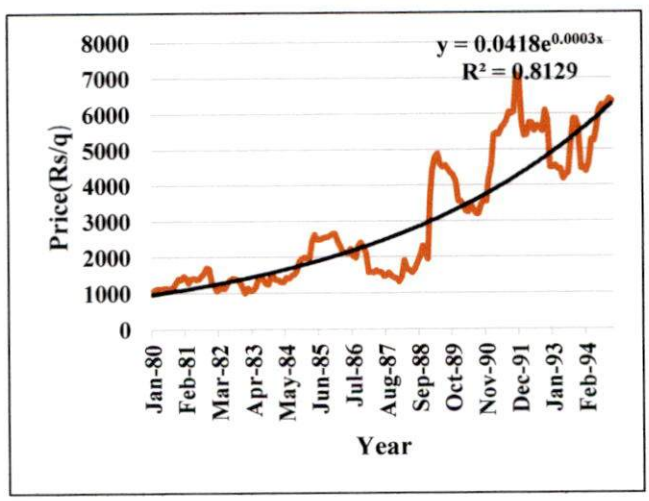

Fig. 4.15 Trend in Kanhangad dry price – Pre-WTO

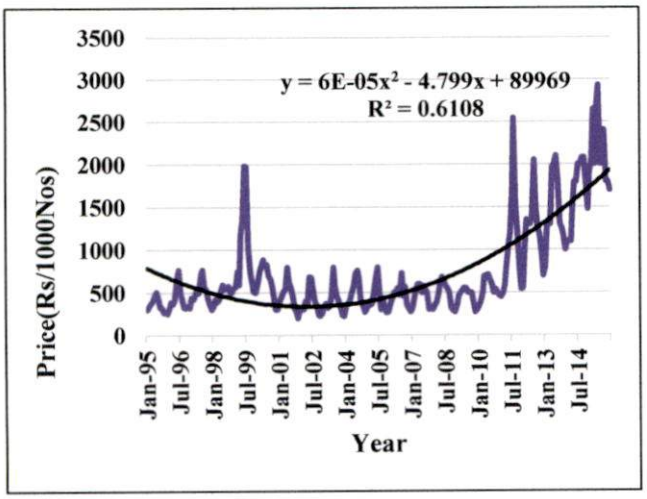

Fig. 4.16 Trend in Nedumangad ripe price- Post-WTO

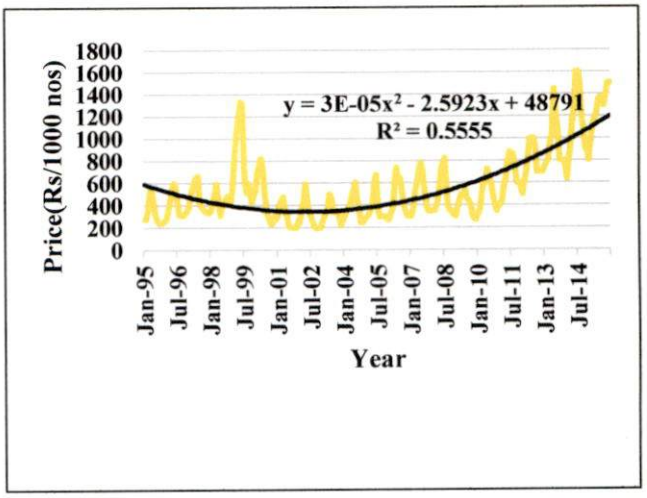

Fig. 4.17 Trend in Telicherry ripe price – Post-WTO

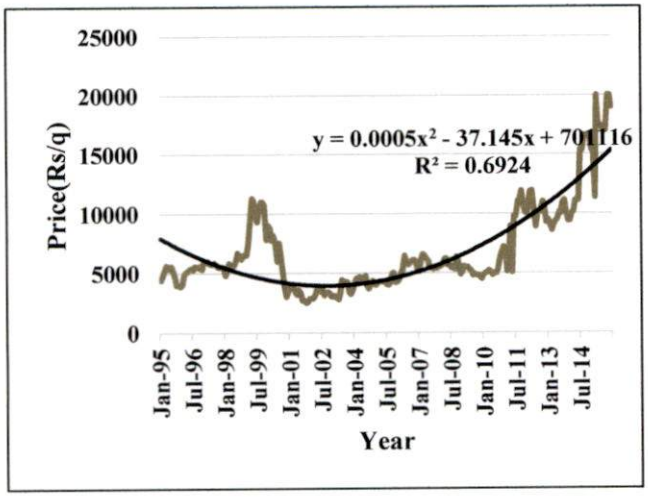

Fig. 4.18 Trend in Nedumangad dry Price- Post-WTO

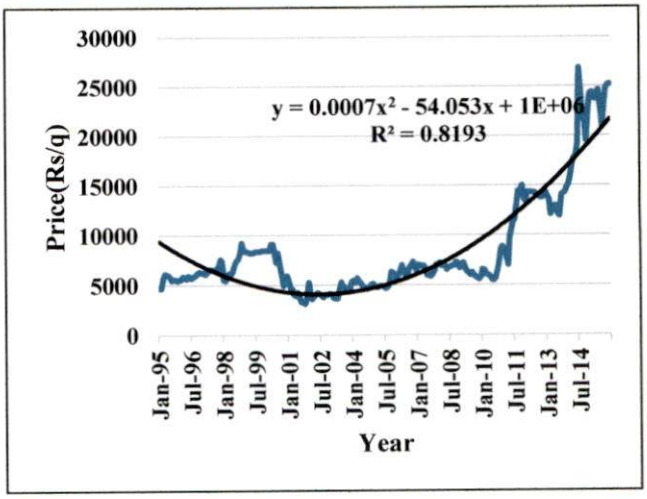

Fig. 4.19 Trend in Calicut dry price- Post-WTO

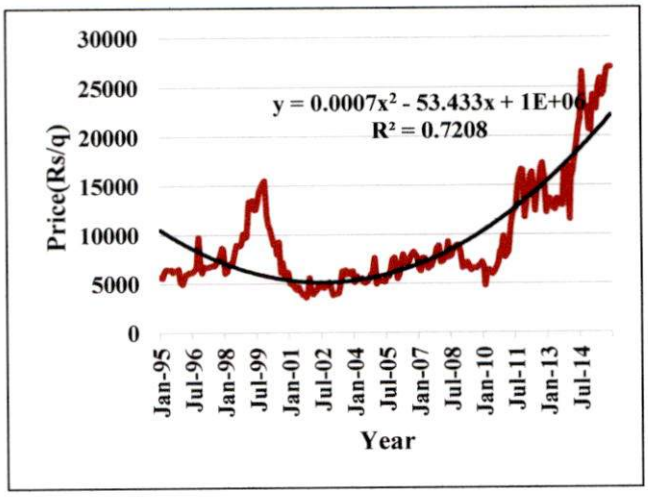

Fig. 4.20 Trend in Kanhangad Dry price – Post-WTO

4.3.2 Seasonality in the prices of arecanut

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. Since arecanut is a perennial crop and involves high initial investment, price fluctuation is an important factor to be considered while planning to raise this crop. The seasonal variations in the price of arecanut during the Pre-WTO and Post-WTO periods were analyzed using ratio to moving average method and the results are presented in Table 4.1.

From the table it could be observed that the prices of arecanut exhibit considerable seasonality. The increasing phase for ripe arecanut prices in both Nedumangad and Telicherry markets in the post-WTO period was observed from March to June with the peak price in May, while for dry arecanut prices, April, May and November showed the highest prices in Nedumangad Calicut and Kanhangad markets respectively. The fall in prices was found to occur from June. The coefficient of variation in seasonal indices has declined in the post-WTO period for ripe arecanut in both the markets, whereas in the case of dry arecanut in Nedumangad market, coefficient of variation has declined but it remained the same for Calicut and Kanhangad markets.

Table 4.1 Seasonal indices of arecanut (Ripe and Dry) in different market

Month	Pre-WTO					Post-WTO				
	Ripe Arecanut		Dry Arecanut			Ripe Arecanut		Dry Arecanut		
	Nedumangad Ripe	Telicherry Ripe	Nedumangad Dry	Calicut Dry	Kanhangad Dry	Nedumangad Ripe	Telicherry Ripe	Nedumangad Dry	Calicut Dry	Kanhangad Dry
January	98.12	85.21	94.21	92.20	96.26	97.81	79.42	93.52	100.32	90.82
February	102.21	89.81	97.87	96.22	95.06	99.23	88.84	98.07	98.54	93.16
March	102.30	115.07	106.18	98.55	93.72	100.62	109.21	103.70	99.72	94.94
April	102.96	141.11	106.88	103.34	98.36	100.95	136.10	105.53	100.12	97.81
May	104.47	154.85	107.54	105.21	98.82	100.44	147.80	103.49	101.29	99.23
June	103.30	136.10	108.84	104.05	101.40	104.17	140.14	104.19	100.25	98.51
July	104.41	88.13	106.39	102.65	98.01	102.72	104.74	104.43	100.58	98.22
August	98.86	75.48	104.83	100.59	103.26	101.44	83.97	103.02	100.08	101.77
September	96.96	73.17	98.74	102.80	103.93	96.67	80.86	99.34	100.04	104.39
October	95.20	80.13	100.21	102.19	106.04	97.77	78.21	100.23	100.42	107.91
November	94.89	80.21	83.84	96.15	108.74	98.29	74.45	95.37	99.56	108.73
December	96.25	80.66	84.41	96	96.34	96.83	76.61	89.06	98.83	104.46
CV of seasonal indices (%)	3.65	2.88	8.67	4.67	4.67	2.16	2.72	5.13	4.67	4.67

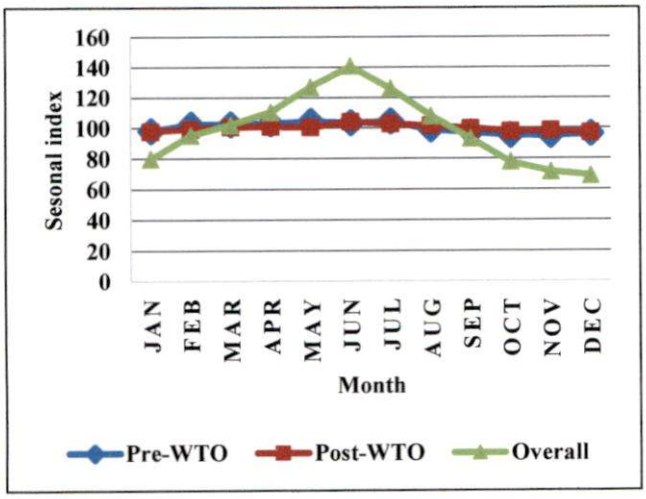

Fig. 4.21 Seasonal indices for Nedumangad ripe

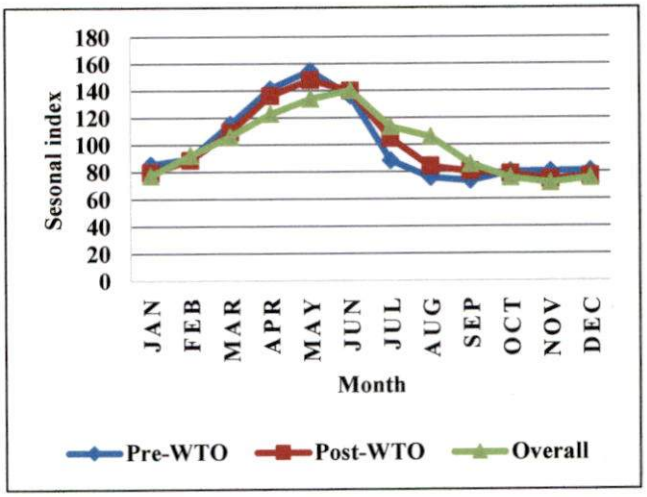

Fig. 4.22 Seasonal indices for Telicherry ripe

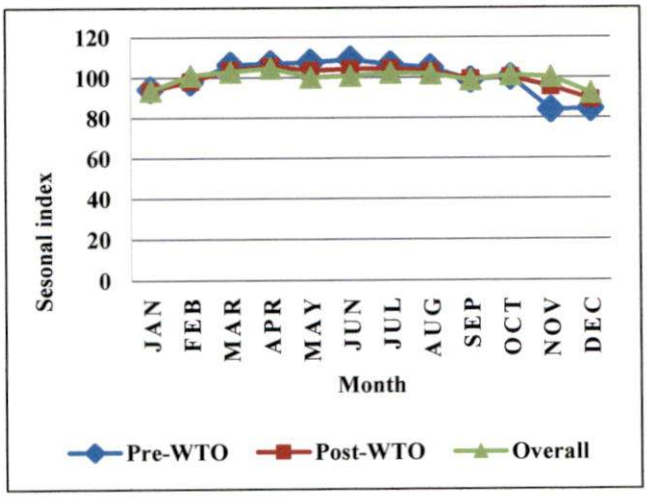

Fig. 4.23 Seasonal indices for Nedumangad dry

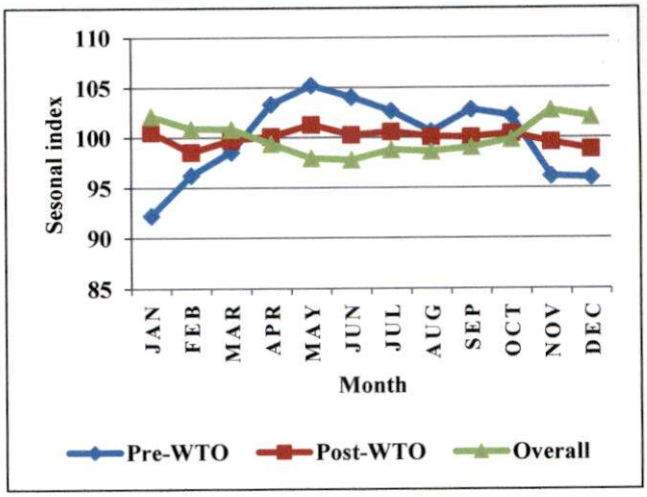

Fig. 4.24 Seasonal indices for Calicut dry

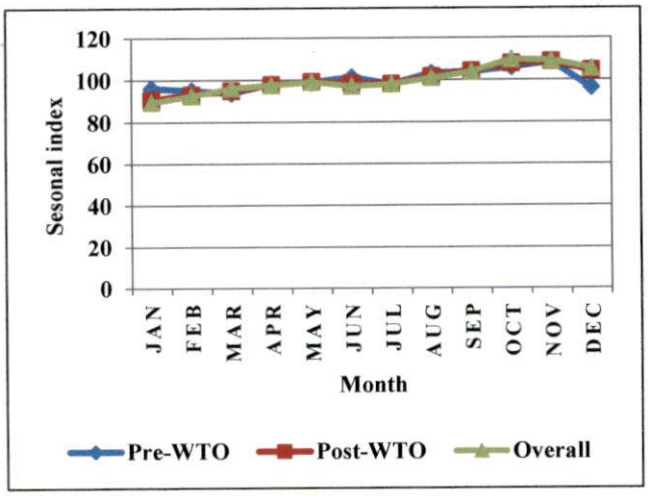

Fig. 4.25 Seasonal indices for Kanhangad dry

4.3.3 Cyclical variations

The oscillatory movements in a time series with the period of series of more than one year are referred as cyclical variation. The indices for the cyclical price variations in arecanut in different market were worked out by averaging the cyclical-irregular data after eliminating the trend and seasonal variations from the original data. The cyclical indices of arecanut in different market for different periods are presented in Fig. 4.26 to 4.30. It could be observed that the cyclical indices for arecanut prices exhibited similar pattern for Nedumangad ripe Nedumangad dry and Kanhangad dry prices, while the prices of Telicherry ripe and Calicut dry exhibited identical cyclical variations. Even though the cyclical pattern were similar for different prices the length of the cycles could not be clearly established with the given pattern of the cyclical variations

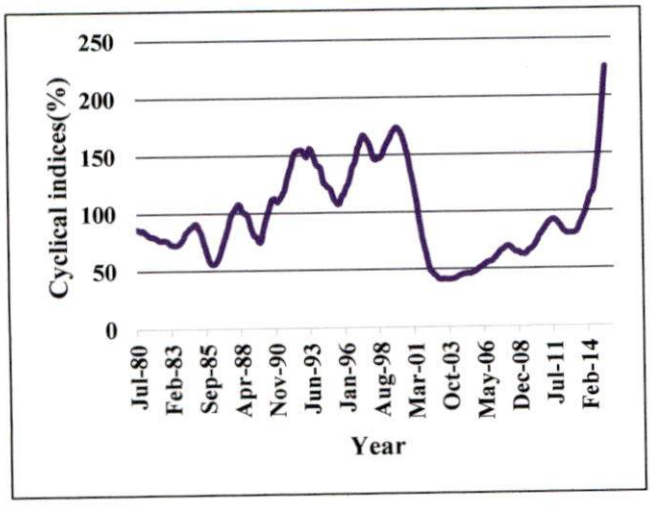

Fig. 4.26 Cyclical indices for Nedumangad ripe

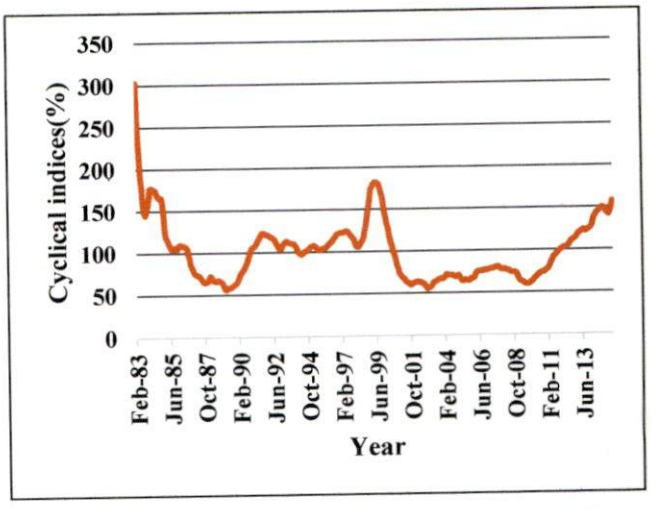

Fig. 4.27 Cyclical indices for Telicherry ripe

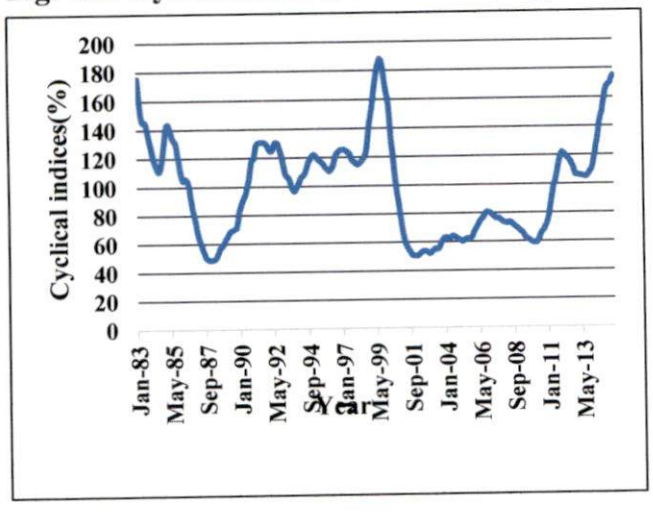

Fig. 4.28 Cyclical indices for Nedumangad

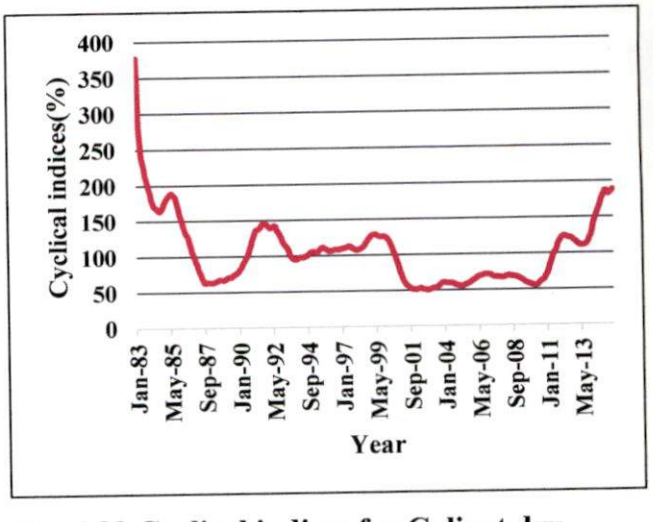

Fig. 4.29 Cyclical indices for Calicut dry

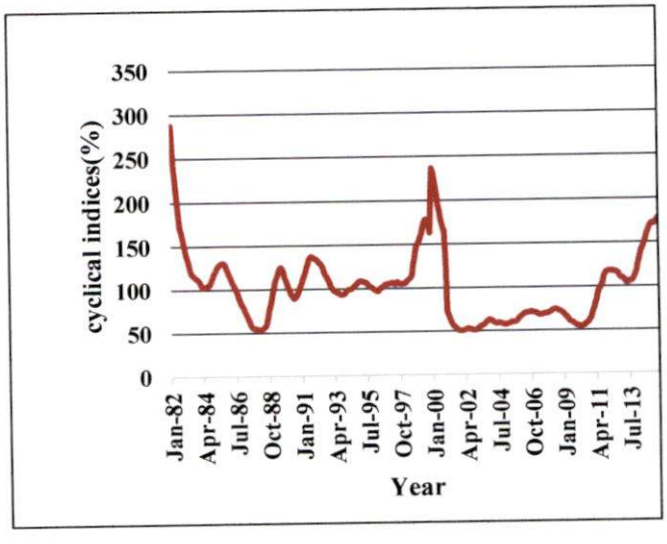

Fig. 4.30 Cyclical indices for Kanhangad dry

4.3.4 Irregular variations

Irregular variations in the prices of arecanut occurred due to numerous non-recurring and irregular circumstances which were beyond human control. The irregular variation in the price of arecanut in different markets during Period I and II separately depicted from Fig 4.31 to 4.40 Irregularity were pronounced in all the markets of arecanut. It was observed that the irregular variations in arecanut price were highly unpredictable and did not follow any uniform pattern over the period.

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 dry and ripe arecanut prices in different markets of Kerala.

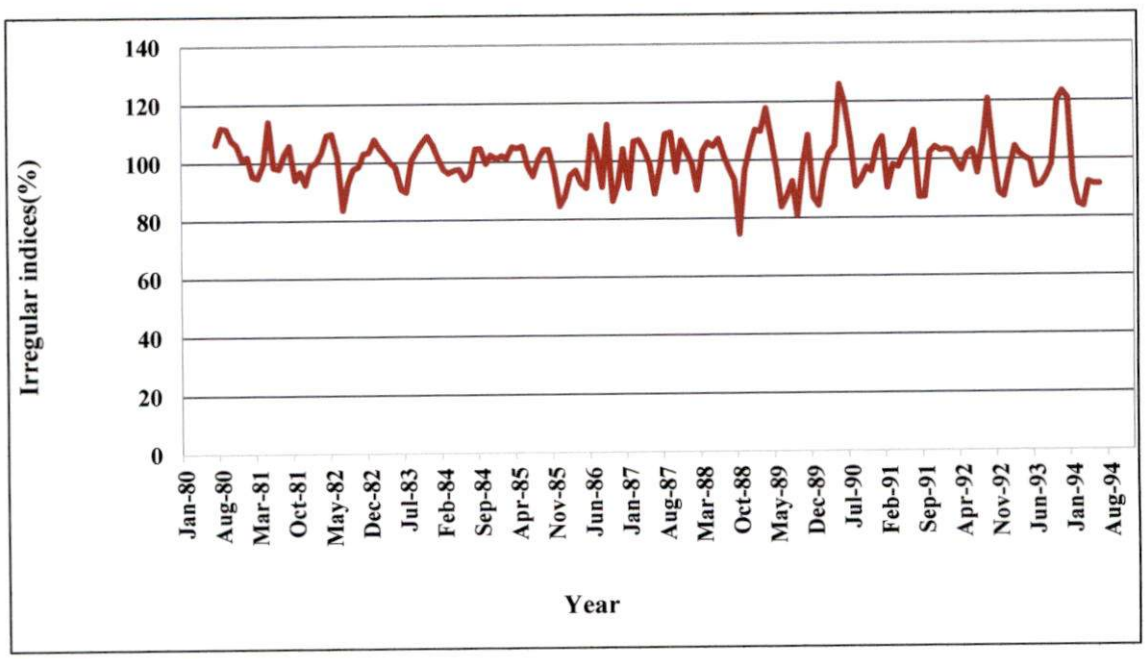

Fig. 4.31 Irregular indices for Nedumangad ripe-Pre-WTO

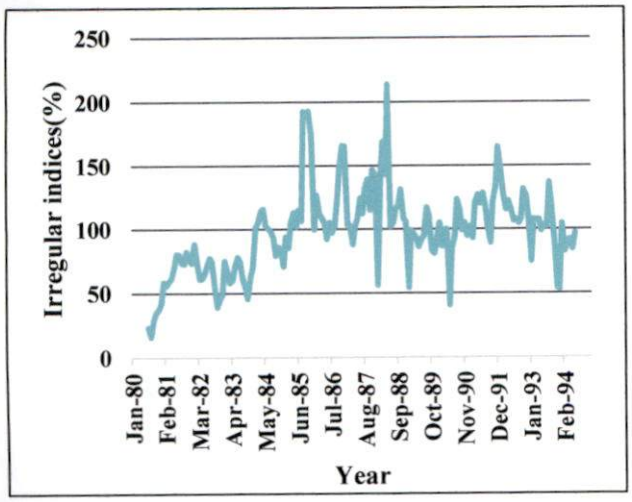

Fig. 4.32 Irregular indices for Telicherry ripe-Pre-WTO

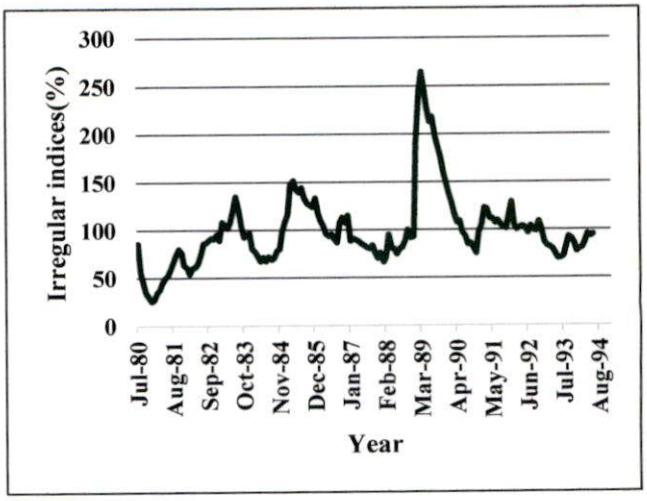

Fig. 4.33 Irregular indices for Nedumangad dry-Pre-WTO

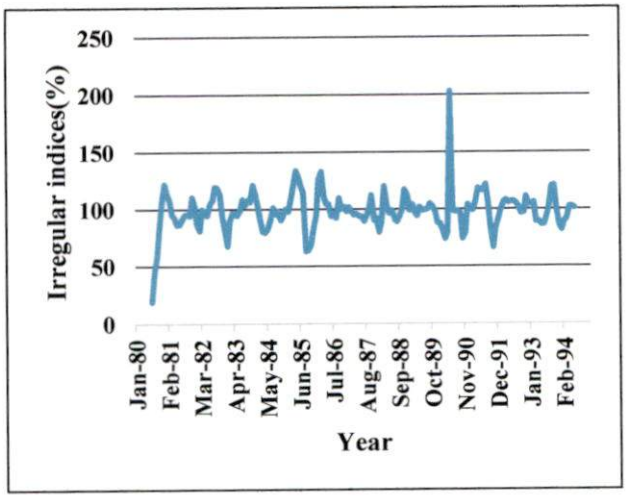

Fig. 4.34 Irregular indices for Calicut dry-Pre-WTO

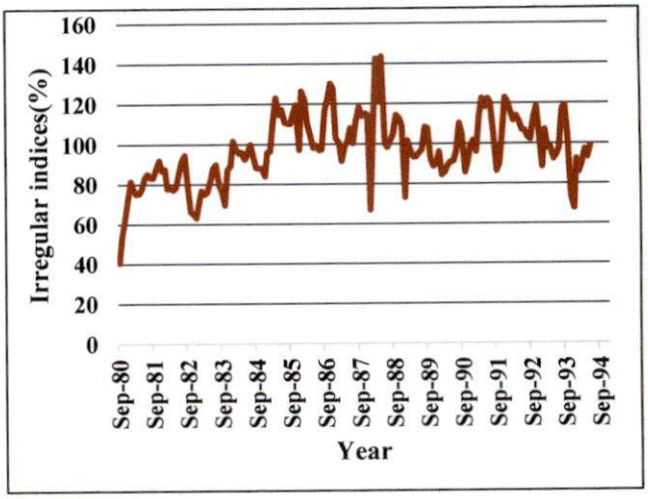

Fig. 4.33 Irregular indices for Kanhangad dry-Pre-WTO

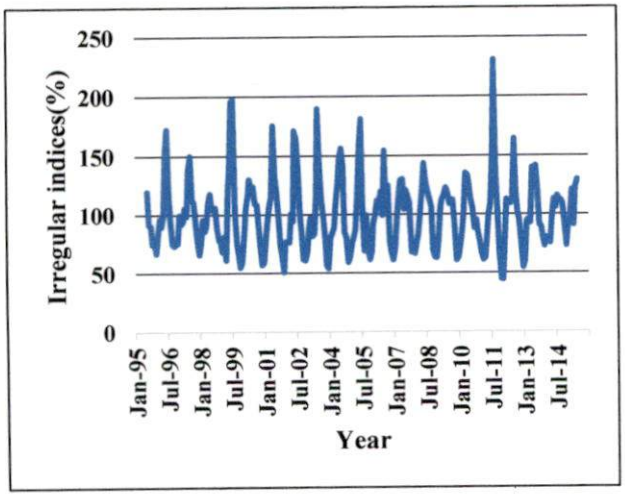

Fig. 4.36 Irregular indices for Nedumangad ripe –Post-WTO

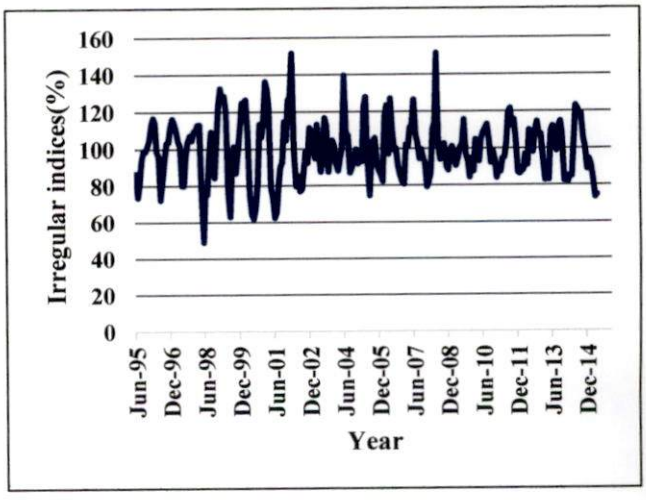

Fig. 4.37Irregular indices for Telicherry ripe-Post-WTO

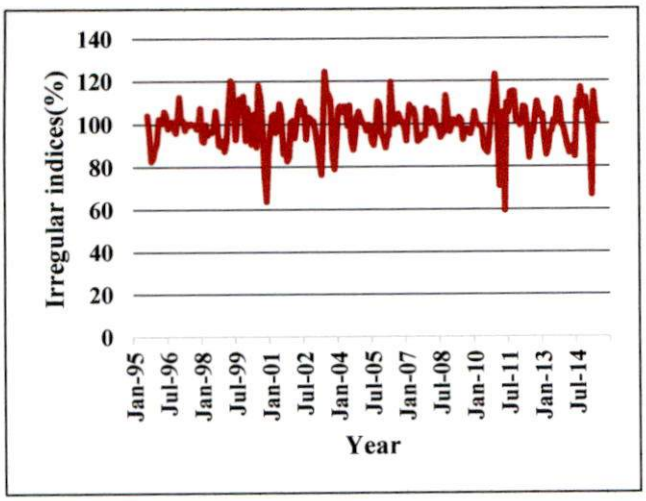

Fig. 4.38 Irregular indices for Nedumangad dry-Post-WTO

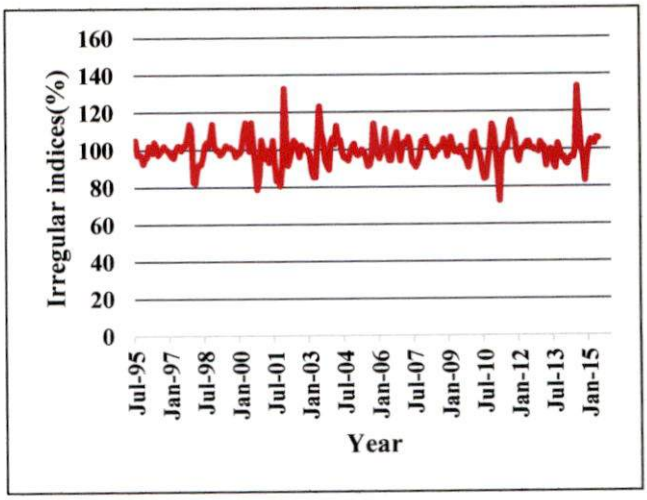

Fig. 4.39 Irregular indices for Calicut dry-Post-WTO

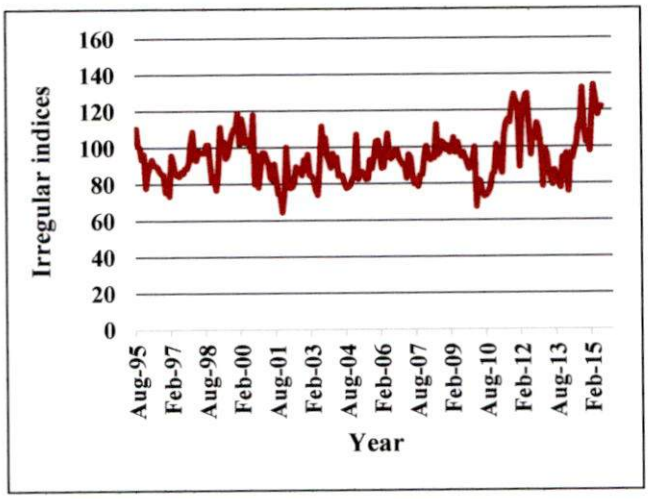

Fig. 4.40 Irregular indices for Kanhangad dry-Post-WTO

4.3.5 Market integration

4.3.5.1 Cointegration analysis using monthly prices

Cointegration is an econometric technique for testing the correlation between two or more variables. Integration among different arecanut markets in Kerala were analysed in both pair-wise and multiple cointegration frameworks. In order to understand whether different arecanut prices in different markets have a long run relationship, cointegration analysis was done for Pre-WTO, Post-WTO and overall periods using the monthly price data. Before attempting cointegration tests, Augmented Dickey Fuller (ADF) tests were employed to confirm non-stationarity of the data at levels and stationarity after first differencing. A time

series exhibits stationarity if the underlying generating process is based on a constant mean or a constant variance. All the price series in rupee were transformed into natural logarithms before testing for stationarity as well as cointegration. The estimated test statistics from the ADF tests for arecanut prices in different markets in Kerala, at levels and first difference, in different time periods are presented in Table 4.2

The null hypothesis of non-stationarity could be rejected for all the price series after first differencing. Cointegration analysis was carried out for the price series which were of the same order of integration. The results of cointegration analysis for different market prices of arecanut in rupee are furnished in Table 4.3. The null hypothesis of no cointegration (r = 0) was rejected for Pre-WTO, Post-WTO and overall periods on the basis of confirmation of the null hypothesis of r <= 1 (presence of cointegration). Similarly, all the pair-wise cointegration using arecanut price series *viz.,* Nedumangad ripe, Telicherry ripe, Nedumangad dry, Calicut dry and Kanhangad dry proved that one cointegration relationship existed between all the markets in all the time periods at five per cent level of significance, with the critical values of 15.49 for r = 0 and 3.84 for r <= 1, which proved the co-movement of arecanut prices in different markets within the state.

Three market price series for arecanut, *viz.,* Nedumangad dry, Calicut dry and Kanhangad dry, were integrated of the same order and hence, the test for co-integration among multiple markets was attempted using the Maximum Likelihood Estimation procedure. In this case, the null hypothesis of no cointegration and at least one cointegration (r=0, r=1) could be rejected at one per cent level of significance for all the periods. But the null hypothesis of r<=2 was accepted confirming that there are two or less than two cointegrating vectors among the different price series in all the periods. The results revealed that arecanut prices in all the markets under the study were integrated with each other, indicating that the variation in the arecanut prices in one market influences the prices in all other markets in Kerala.

Table 4.2 Results of stationarity tests for monthly price of arecanut

Market/price series		Pre-WTO (1980-1994)	Post-WTO (1995-2015)	Overall period (1980-2015)
Levels	Nedumangad ripe	-2.79	0.26	-0.26
	Telicherry ripe	-0.65	0.39	-0.81
	Nedumangad dry	-1.51	-0.87	-1.54
	Calicut dry	-1.52	0.18	-1.01
	Kanhangad dry	-1.11	-0.76	-1.06
First difference	Nedumangad ripe	-8.81*	-11.70*	-13.88*
	Telicherry ripe	-9.55*	-12.62*	-15.71*
	Nedumangad dry	-13.00*	-18.39*	-21.96*
	Calicut dry	-14.04*	-13.33*	-13.35*
	Kanhangad dry	-11.17*	-15.74*	-18.52*

Note: * denotes significance at five per cent level

Table 4.3 Results of pair-wise cointegration tests between monthly arecanut prices in Kerala

Market/Price series	Pre-WTO (1980 - 1994)			Post-WTO (1995 - 2015)			Overall period (1980 - 2014)		
	Eigen value	Null	Trace statistics	Eigen value	Null	Trace statistics	Eigen value	Null	Trace statistics
Nedumangad ripe and Telicherry ripe	0.199 0.02	r = 0 r<=1	43.12 3.80	0.207 0.05	r = 0 r<=1	72.10 14.12	0.168 0.013	r = 0 r <= 1	84.91 5.67
Nedumangad dry and Calicut dry	0.144 0.009	r = 0 r<=1	29.19 1.65	0.092 0.000	r = 0 r<=1	24.30 0.06	0.101 0.001	r = 0 r<=1	46.56 0.71
Nedumangad dry and Kanhangad dry	0.122 0.004	r = 0 r<= 1	23.95 0.80	0.28 0.00	r = 0 r<=1	82.11 0.30	0.142 0.002	r = 0 r<=1	67.13 1.20
Calicut dry and Kanhangad dry	0.072 0.005	r = 0 r<=1	14.24 0.91	0.21 0.00	r = 0 r<=1	61.83 0.03	0.119 0.001	r=0 r<=1	54.97 0.56

Note: Critical value for r = 0 is 15.49 and r <= 1 is 3.84 at five per cent level of significance

Table 4.4 Results of multiple cointegration tests between monthly arecanut prices in Kerala

Market/Price series	Pre-WTO (1980 - 1994)			Post-WTO (1995 - 2015)			Overall period(1980 2014)		
	Eigen value	Null	Trace statistics	Eigen value	Null	Trace statistics	Eigen value	Null	Trace statistics
Nedumangad dry, Calicut dry and Kanhangad dry	0.164 0.075 0.003	r = 0 r<=1 r<=2	46.058 14.461 0.681	0.222 0.044	r = 0 r<=1 r<=2	74.12 11.433 0.005	0.174 0.109 0.008	r = 0 r <= 1 r <=2	93.94 37.10 2.598

Note: Critical value for r = 0 is 29.9, r <= 1 is 15.49 and r = < 2 is 3.84 at five per cent level of significance

4.3.5.1 Cointegration analysis using weekly prices

The integration between prices in different arecanut markets in Kerala was also analysed using weekly price data for the period from 1991 to 2015. The univariate time series properties of the price data were examined using Augmented Dickey Fuller (ADF) tests and they were performed to confirm that all the price series in rupee were non- stationary at levels and integrated of the same order. All the price series were transformed to natural logarithm before testing for stationarity as well as cointegration. The estimated test statistics from the ADF tests for arecanut prices in different markets in Kerala at levels and first difference in above time periods are presented in Table 4.5. The null hypothesis of non-stationarity could be rejected for most of the prices after first differencing. Cointegration analysis was carried out for the price series which were of the same order of integration. The results of cointegration analysis of different market prices for arecanut in rupee are furnished in Table 4.6. The null hypothesis of no cointegration ($r = 0$) was rejected for the above periods on the basis of confirmation of the null hypothesis of $r <= 1$ (presence of cointegration). The pairwise cointegration analysis between Nedumangad ripe and Telicherry ripe, Nedumangad dry and Calicut dry, Calicut dry and Kanhangad dry, Nedumangad dry and Kanhangad dry, showed that one cointegration relationship existed between all markets in the above time periods, at 5 per cent level of significance, with critical values of 15.49 for $r = 0$ and 3.84 for $r <= 1$.

Table 4.5 Results of stationarity tests for weekly prices of arecanut

Market/price series		Period (1991-2015)
Levels	Nedumangad ripe	-3.49
	Telicherry ripe	-3.41
	Nedumangad dry	-1.52
	Calicut dry	-2.18
	Kanhangad dry	-1.76
First difference	Nedumangad ripe	-25.60*
	Telicherry ripe	-35.05*
	Nedumangad dry	-38.91*
	Calicut dry	-22.79*
	Kanhangad dry	-37.33*

Table 4.6 Results of pair-wise cointegration tests between weekly arecanut prices in kerala

Market/Price series	Period (1991 - 2015)		
	Eigen value	Null Hypothesis	Trace statistics
Nedumangad ripe and Telicherry ripe	0.067 0.009	r = 0 r <= 1	103.51 12.86
Nedumangad dry and Calicut dry	0.057 0.001	r = 0 r<=1	78.77 1.89
Nedumangad dry and Kanhangad dry	0.046 0.001	r = 0 r<=1	63.84 2.18
Calicut dry and Kanhangad dry	0.073 0.001	r=0 r<=1	98.44 1.88

4.3.5.2 Granger Causality Tests

The cointegration analysis proved that the arecanut prices moved together and there is transmission of price signals between the selected domestic markets and that there is causality at least in one direction. But it does not provide information regarding the direction of flow of prices, i.e. whether it is from Nedumangad to Telicherry market or from Telicherry market to Nedumangad market or in both

directions. The Granger causality tests provide additional evidences as to whether and in which direction, price transmission is occurring. The tests carried out on monthly prices (Table 4.7) proved that Telicherry ripe caused the Nedumangad ripe, Nedumangad dry caused Calicut dry and Kanhangad and Calicut dry caused Kanhangad dry during both pre-WTO and post-WTO periods, thus suggesting unidirectional causality.

Table 4.7 Results of the Granger causality test for monthly price of arecanut

Null hypothesis	Pre WTO		Post WTO		All periods	
	F Stat	Probability	F Stat	Probability	F Stat	Probability
Nedumangad ripe does not granger cause Telicherry ripe	0.144	0.845	0.412	0.586	0.312	0.732
Telicherry ripe does not granger cause Nedumangad ripe	9.84*	0.008	12.8*	0.005	22.93	3.598
Nedumangad dry does not granger cause Calicut dry	3.62*	0.028	55.75*	0.001	53.318	2.521
Calicut dry does not granger cause Nedumangad dry	0.897	0.409	3.47	0.032	25.777	0.080
Calicut dry does not granger cause Kanhangad dry	23.37*	0.001	10.48*	0.004	35.388	6.52
Kanhangad dry does not granger cause Calicut dry	1.04	0.352	0.799	0.450	0.818	0.441
Nedumangad dry does not granger cause Kanhangad dry	6.87*	0.001	4.5*	0.011	22.180	7.08
Kanhangad dry does not granger cause Nedumangad dry	0.691	0.501	17.9	0.005	6.084	0.002

Note: * denotes significance at one per cent level

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 two blocks of Kasaragod district are discussed. The socio-economic characteristics provide better understanding of the financial and social status of the respondents.

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 4.8. It could be observed from the table that majority of sample farmers in both the blocks 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 any of the two blocks selected, which was a clear indication of the lack of interest among the youngsters in taking up farming as a profession, which is one of the challenging issues faced by the agricultural sector in Kerala.

Table 4.8 Age-wise distribution of the sample respondents

Age profile (years)	Karadaka Block	Manjeswar Block	Total Sample
>30	0 (0.0)	0 (0.0)	0 (0.0)
30-45	5 (10)	9 (18)	14 (14)
45-60	21 (42)	19 (38)	40 (40)
>60	24 (48)	22 (44)	46 (46)
Total	50 (100)	50 (100)	100 (100)

Note: Figures in parentheses indicate per cent to column total

4.4.2 Gender

The gender-wise classification of the sample farmers are presented in Table 4.9. It could be observed from the table that majority of the respondents in the two blocks were male farmers *i.e.*, 92 percent of farmers were male and only eight percent of the respondents were female farmers.

Table 4.9 Gender-wise distribution of sample respondents

Gender	Karadaka Block	Manjeswar Block	Total Sample
Male	47 (94)	45 (90)	92 (92)
Female	3 (6)	5 (10)	8 (8)
Total	50 (100)	50 (100)	100 (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 4.10. Even though all the farmers were literates, it could be observed that majority (40 percent) were having only primary education and about 34 percent were having education up to SSLC. Nearly, seven per cent and 12 percent of the sample farmers had graduation and post-graduation respectively.

Table 4.10 Educational status of sample respondents

Education	Karadaka Block	Manjeswar Block	Total Sample
Primary	20 (40)	20 (40)	40 (40)
Up to SSLC	15 (30)	19 (38)	34 (34)
HSE	5 (10)	2 (4)	7 (7)
Degree	3 (6)	4 (8)	7 (7)
PostGraduation	7 (14)	5 (10)	12 (12)
Total	50 (100)	50 (100)	100 (100)

Note: Figures in parentheses indicate per cent to column total

4.4.4 Experience in farming

The details on the experience of sample respondents in farming are presented in Table 4.11. Generally, age decides the experience of the farmers in cultivation of crops and sample respondents were post stratified into three categories based on 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 57 per cent of the farmers were having more than 30 years of experience in farming and nearly 34 and nine per cent were having experience between 10 and 30 years and less than 10 years respectively.

Table 4.11 Distribution of sample farmers according to farming experience

Year of experience	Karadaka Block	Manjeswar Block	Total Sample
<10	3 (6)	6 (12)	9 (9)
10-30	14 (28)	20 (40)	34 (34)
>30	33 (66)	24 (48)	57 (57)
Total	50 (100)	50 (100)	100 (100)

Note: Figures in parentheses indicate per cent to column total

4.4.5 Family size

The classification of sample respondents on the basis of their family size is presented in Table 4.12. The availability of family members for farming operations could be assured with the increase in size of the family. 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 (70 per cent or more) 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 4.12 Distribution of sample farmers based on family size

Family size	Karadaka Block	Manjeswar Block	Total Sample
One to three	5 (10)	2 (4)	7 (7)
Four to six	37 (74)	35 (70)	72 (72)
Greater than seven	8 (16)	13 (26)	21 (21)
Total	50 (100)	50 (100)	100 (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 4.13. It could be observed from the table that majority of the farmers were small i.e., having holdings of one to two hectares and 29 per cent of them were marginal farmers with farms of less than one hectare. 28 per cent of respondents were large sized land holders, among whom 12 per cent possessed more than four hectares and 16 per cent own two to four hectares. Small and marginal farmers accounted for nearly 72 per cent of the sample farmers.

Table 4.13 Distribution of sample respondents according to size of land holding

Area in hectares	Karadaka Block	Manjeswar Block	Total Sample
Less than1	12 (24)	17 (34)	29 (29)
1 to 2	24 (48)	19 (38)	43 (43)
2 to 4	9 (18)	7 (14)	16 (16)
Greater than 4	5 (10)	7 (14)	12 (12)
Total	50 (100)	50 (100)	100 (100)

Note: Figures in parentheses indicate per cent to column total

4.4.7 Annual income

Distribution of sample respondents according to their annual income is presented in Table 4.14. The table reveals that 40 per cent of the sample respondents had income between rupees two lakhs and five lakhs, while 28 per cent had income between one lakh and five lakhs. It could be observed that in the study area, 25 per cent of farmers were having annual income above five lakh rupees.

Table 4.14 Distribution of sample respondents based on their annual income

Annual income (rupees)	Karadaka Block	Manjeswar Block	Total Sample
<50,000	-	-	-
50,000 to lakh	5 (10)	2 (4)	7 (7)
1 lakh to 2 lakh	20 (40)	8 (16)	28 (28)
2 lakh to 5 lakh	15 (30)	25 (50)	40 (40)
Greater than 5 lakh	10 (20)	15 (30)	25 (25)
Total	50 (100)	50 (100)	100 (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 4.15. From the table it is clear that out of the 100 respondents in Kasaragod district, farming was the primary occupation for 73 per cent of the respondents. Agriculture was the secondary occupation for 27 per cent of the farmers and they were employed in public sector as teachers, advocates and engineers. Some of them were doing business and some were self-employed as drivers, only five per cent of the farmers were self-employed and nearly 10 and 12 per cent were working in the public sector and private sector undertakings respectively.

Table 4.15 Distribution of sample respondents based on their occupation

Occupation	Karadaka Block	Manjeswar Block	Total Sample
Agriculture	38 (76)	35 (70)	73 (73)
Public sector	5 (10)	5 (10)	10 (10)
Private sector	7 (14)	5 (10)	12 (12)
Self employed	-	5 (10)	5 (5)
Total	50 (100)	5 (100)	100 (100)

Note: Figures in parentheses indicate per cent to column total

4.5 Economics of Arecanut cultivation in Kasaragod district

The economics of cultivation of arecanut in Kasaragod district of Kerala was studied by estimating the cost of cultivation of arecanut using different concepts like establishment cost, maintenance cost etc. Annual amortization of establishment cost was done and added to the average annual maintenance cost to estimate the cost of cultivation of arecanut per hectare. Arecanut is a perennial commercial crop with an economic life span of 50 to 60 years. An arecanut palm takes almost five years to establish and starts yielding from the sixth year onwards. Even though it starts bearing from the sixth year, economic yields are obtained only from the eighth year. Hence, in this study, the arecanut palms grown by sample farmers were grouped into different categories based on the age of the palm as (i) Gestation period (1st year to 5th year), (ii) Period of increasing yield (6th to 25th year) (iii) Period of stable yield (26th to 40th year) and (iv) Period of declining yield (41st to 50th year and above).

The costs incurred for input and input services during the first year of establishing the arecanut garden at current prices, along with annual the maintenance cost in the non-bearing stage of the palm were considered as the establishment cost. The establishment cost consists of 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 sixth years onwards, including the expenditure on manures, inter-cultural operations, plant protection, harvesting, dehusking and drying cost. The costs incurred during the period of increasing yield followed by the period of stable and declining yields, accounted for the average annual maintenance cost in the yielding stage of the palms.

4.5.1 Cost structure of arecanut gardens during establishment phase

4.5.1.1 Operation-wise cost

The details furnished in Table 4.16 shows the operation-wise cost of arecanut cultivation in Kasaragod district during the establishment phase. The operation-wise cost incurred during first year of establishment of arecanut was ₹ 1,82,005 per hectare. The highest share in operation-wise cost was accounted by land preparation, which included operations like levelling or terracing according to the topography of land owned by the farmers. Cost incurred for land preparation was ₹ 60,000, which formed 32.5 per cent of total cost during the first year. Digging and filling of pits accounted for 11.35 percent of the operation-wise cost. Cost of planting materials and planting, which were only incurred in the year of establishment, worked out to 9.46 per cent of the total cost of cultivation. The average number of arecanut seedlings planted per hectare in the sample farms was found to be 1300 per hectare, as against the recommended of 1200 seedlings per hectare.It could be observed from the table that weeding (19.11 per cent), land preparation (17.47 per cent) and irrigation (12.34 per cent) were the major components of the establishment cost. Nearly 80 per cent of arecanut farmers in Kasaragod district made use of sprinkler irrigation for almost six months. The lowest shares in operation-wise cost were observed for the application of lime (5 per cent) and ash (3.56 per cent). The farmers in Kasaragod district were not using chemical fertilizers, as it was declared as an organic district in 2010.

Table 4.16 Operation-wise cost of arecanut garden in the establishment phase (₹ per hectare)

SI.NO	Particulars	Establishment cost of arecanut garden					
		First year	Second year	Third year	Fourth year	Fifth year	Total
1	Land preparation	60000 (32.50)	-	-	-	-	60000 (17.47)
2	Digging and filling	39000 (21.12)	-	-	-	-	39000 (11.35)
3	Seedlings and planting	32500 (17.60)	-	-	-	-	32500 (9.46)
4	Organic manures	11280 (6.11)	-	11280 (20.45)	-	11280 (16.17)	33840 (9.85)
5	Ash	-	-	5033 (9.12)	-	7200 (10.68)	12233 (3.56)
6	Green manuring	-	-	15138 (27.45)	-	24850 (36.88)	39988 (11.64)
7	Liming	5550 (3.00)	-	5550 (10.06)	-	5900 (8.75)	17000 (4.95)
8	Weeding	21875 (11,84)	10937 (60.30)	10937 (19.85)	10937 (60.30)	10937 (16.32)	65623 (19.11)
9	Irrigation	14400 (7.80)	7200 (39.70)	7200 (13.05)	7200 (39.70)	7200 (10.68)	43200 (12.34)
10	Total cost	184605 (100)	18137 (100)	55138 (100)	18137 (100)	67367 (100)	343386 (100)

Note: Figures in parentheses indicate per cent to column total

4.5.1.2 Input-wise cost

The input-wise cost incurred during the establishment phase of an arecanut garden is presented in Table 4.17. It could be observed from the table that about 80 per cent of the total input cost was accounted by the wage component incurred for human labour, followed by organic manures, accounting for about 8 per cent. The cost incurred on planting material was 6 per cent of the total input cost, as the cost of arecanut seedling on an average was ₹ 15. The inputs that contributed least to the total cost of cultivation were ash (3 per cent) and lime (5 per cent). The input-wise analysis showed that the cost incurred for human labour included labour charges incurred for preparatory cultivation, digging and filling, planting, application of lime, ash and manures, irrigation and weeding.

Table 4.17 Input-wise establishment cost of arecanut garden (₹ per hectare)

SI.NO	Particulars	Cost (per hectare)					
		First year	Second year	Third year	Fourth year	Fifth year	Total
1	Human labour	151225 (81.91)	18137 (100)	36926 (66.96)	18137 (100)	46988	271413 (79.04)
2	Planting materials	19500 (10.56)	–	–	–	–	19500 (5.67)
3	Manure	8680 (4.70)	–	8680 (15.74)	–	8680 (12.88)	26040 (7.58)
4	Lime	5200 (2.81)	–	5200 (9.43)	–	5200 (7.71)	15600 (4.54)
5	Ash	–	–	4333 (7.85)	–	6500 (9.64)	10833 (3.15)
6	Total input cost	184605 (100)	18137 (100)	55139 (100)	18137 (100)	67368 (100)	343386 (100)

Note; Figures in parentheses indicate per cent to column total

4.5.3 Cost structure for maintenance of arecanut garden during yielding phase

4.5.3 .1 Operation-wise cost

In the case of arecanut palms in the yielding phase, plant protection, harvesting, drying and dehusking were the additional cultural operations carried out. When compared to the establishment phase the results furnished in Table 4.18 indicate the operation-wise costs incurred by the farmers towards maintenance of arecanut gardens during the yield increasing, yield stabilising , yield declining phases and the weighted mean operation-wise costs. The average annual cost of maintenance was estimated as ₹ 2,130,75, ₹ 2,06,925, ₹ 1,58,608 and ₹ 2,01,522 per hectare for the yield increasing phase, yield stabilising phase, yield declining phase and the weighted mean for yielding phase respectively. The annual maintenance cost during yield declining phase showed a tendency to decline from the 41st year onwards. The decline in total annual cost in this phase was due to the reduction in yields with the age of palms and hence the farmers were found to pay less attention towards the maintenance of palms by reducing the quantity of input use as well as input services, which contributed to reduction in annual maintenance cost of the gardens.

Plant protection accounted for about 18 per cent of the total cost during all the phases which could be attributed to increased the occurrence of mahali disease and yellowing in the region which warranted increased spending on plant protection operations. On an average, plant protection chemicals were sprayed three to four times according to the duration and intensity of rainfall in the region. The next major share was contributed by green manures (about 13 per cent) in all categories, followed by organic manures (11.42 per cent) in both yield increasing and yield stabilising phases. The share of these inputs have increased when compared to pre-bearing period as farmers thought that it was necessary to apply higher quantities during yield increasing phase to get higher yields. Harvesting cost which contributed about eight per cent of the total cost, included the wage bill for skilled climbers and other labourers, who help in collection and transportation of arecanut from the gardens to the drying yards. The post-harvest practices like drying and dehusking together accounted for about 15 per cent of the total cost. Dehusking of dried nuts was done at the rate of ₹ 12 per kg, while the share of basin formation was around eight per cent. The cost

incurred on weeding and irrigation accounted for about 10 and seven per cent respectively. Cost of liming and ash application together accounted for 10 per cent of the annual maintenance cost.

Table 4.18 Average Operation-wise Cost of Cultivation of arecanut garden

Sl.No.	Particulars	Yield increasing phase (6 to 25 years)	Yield stabilizing phase (26 to 40 years)	Yield declining phase (41 to 50 years)	Weighted mean for yielding phase
1	Basin formation	15600 (7.32)	15600 (7.53)	15600 (9.83)	15600 (7.74)
2	Organic manures	24350 (11.42)	24350 (11.76)	9533 (6.01)	22127 (10.98)
3	Green manures	28350 (13.30)	28350 (13.70)	24850 (15.66)	27825 (13.80)
4	Ash	10100 (4.74)	10100 (4.88)	7200 (4.53)	9665 (4.79)
5	Cost of liming	11100 (5.20)	11100 (5.36)	5900 (3.71)	10320 (5.12)
6	Weeding	21875 (10.26)	21875 (10.57)	21875 (13.79)	21875 (10.85)
7	Irrigation cost	14400 (6.75)	14400 (6.95)	14400 (9.07)	14400 (7.14)
8	Cost of Plant protection	38700 (18.16)	38700 (18.70)	27000 (17.02)	36945 (18.33)
9	Gap filling	2250 (1.05)	2250 (1.08)	-	2250 (1.11)
10	Harvesting charges	18750 (8.79)	15000 (7.24)	11250 (7.09)	15562.5 (7.72)
11	Drying cost	2400 (1.12)	2400 (1.15)	1800 (1.13)	2310 (1.14)
12	Dehusking cost	25200 (11.82)	22800 (11.01)	19200 (12.10)	22980 (11.40)
13	Total cost	213075 (100)	206925 (100)	158608 (100)	201522 (100)

Note: Figures in parentheses indicate per cent to column total

A comprehensive analysis of the cost structure of the arecanut gardens revealed that the total annual maintenance cost of arecanut garden was the highest during the yield increasing phase which extends almost 20 years. The expenditure on inputs was higher during this phase of the arecanut garden, whereas the annual maintenance cost was found to be the lowest during the yield declining phase as farmers were reducing the application of inputs, which was in turn cutting down the expenditure in this phase.

4.5.3 .1 Input-wise cost

The inputs required for maintenance of arecanut gardens are human labour, organic manures, plant protection chemicals, ash and lime. The details of the input-wise cost incurred for various operations are presented in Table 4.19. It could be observed from the table that among the above said inputs, wages for human labour constituted about 75 per cent of the total input-wise cost. As the operations in arecanut gardens were not mechanized, human labour was the major component in the input-wise cost of cultivation. Even though sprayers, climbing machines and weed cutters were available in the market, farmers did not prefer them because of high cost and drudgery involved in the use of these machines. Organic manures formed the second major input, which accounted for about 10 per cent of the total cost, followed by plant protection chemicals. The share of organic manures in the total input cost has decreased in the yield declining phase when compared to the other two yielding phases. The inputs like ash and lime contributed less than five per cent of the total cost.

Table 4.19 Average Input-wise Cost of Cultivation of arecanut garden during the yielding phase (₹ per hectare)

SI. NO	Particulars	Yield increasing phase (6 to 25 years)	Yield stabilizing phase (26 to 40 years)	Yield declining Phase (41 to 50 years)	Weighted mean for yielding phase
1	Human labour	158150 (74.22)	152000 (73.45)	129175 (81.44)	150421 (75.33)
2	Organic manures	20800 (10.05)	20800 (10.05)	6933 (4.37)	18719 (9.37)
3	Ash	8700 (4.20)	8700 (4.20)	6500 (4.09)	8370 (4.19)
4	Lime	10400 (5.02)	10400 (5.02)	5200 (3.27)	9620 (4.81)
5	Plant protection chemicals	14400 (6.95)	14400 (6.95)	10800 (6.80)	13860 (6.94)
6	Gap filling	625 (0.30)	625 (0.30)	-	531 (0.26)
7	**Total cost**	**213075 (100)**	**206925 (100)**	**158608 (100)**	**199677 (100)**

4.5.4 Cost of cultivation of arecanut

Table 4.20 Cost of cultivation of arecanut garden (₹ /ha)

Sl. No	Particulars	Cost (₹ /ha)
1	Establishment cost (₹/ha)	343386
2	Amortized value (₹/ha)	41459
3	Annual maintenance cost (₹/ha)	201522
4	Interest on working capital@12 %	24182
5	Total cost(₹/ha)	267164

Note: Figures in parentheses indicate per cent to column total

Cost of cultivation refers to the total expenses incurred by the farmers, in cultivating one hectare of the crop. Being a perennial crop, the costs of cultivation

of arecanut are incurred over a period of time. The total cost for cultivating one hectare of arecanut is presented in Table 4.20. The establishment cost of arecanut garden up to the bearing stage was estimated as ₹ 3,43,386 per hectare, which was then amortized to ₹ 41,459 per hectare per year. The total cost was ₹ 2,67,164.28 per hectare which include the annual share of establishment cost, annual maintenance cost and interest on working capital at 12 per cent.

4.5.5 Cost of production of arecanut

Table 4.21 Cost of production of arecanut (₹/kg).

Sl .No.	Particulars	Increasing yield stage	Stabilising yield stage	Declining yield stage	Aggregate
1	Establishment cost (₹/ha)	343386	343386	343386	343386
2	Amortized value (₹/ha)	41459	41459	41459	41459
3	Annual maintenance cost (₹/ha/year)	213075	206925	158608	201522
4	Interest on annual maintenance cost (₹/ha)	25569	24831	19032.96	24183
5	Total cost (₹/ha/year)	280103	273215	219100	267164
6	Average production (kg/ha)	2100	1750	1600	1783
7	Cost of production (₹/kg)	133	156	137	150

Cost of production of arecanut is the cost incurred in producing one quintal of arecanut kernel (kottadakka).The economic lifespan of an arecanut palm was considered as 45 years, with the yielding phase from sixth year onwards. The cost of bringing one hectare of arecanut garden up to the bearing stage and the average annual maintenance cost was found to be ₹ 3,43,386 and ₹ 2,01,522 respectively. The establishment cost was then amortised at 12 per cent to get an amortized or

annualised value ₹ 41,459 which was added to the overall annual maintenance cost of cultivation of the arecanut farm during yielding phase to arrive at the cost of production. To this interest on annual maintenance cost @12 per cent was added to get total cost of cultivating one hectare of arecanut garden. This total cost was divided by the average production of nuts per hectare in kilograms to arrive at the cost of production per kg of arecanut. Here, the cost of production in aggregate was worked out to be ₹ 150 per kg where as the cost of production was worked out to be ₹ 133, ₹ 156 and ₹ 137 per kg for yield increasing, yield stabilising and yield declining phases respectively.

4.5.6 Gross and net returns

The details of the arecanut yield in physical units (kg), the gross returns and net returns from arecanut gardens are presented in Table 4.18. The average yield in the sample farms was 1750 kg per hectare per annum and price per kg observed during the study period was ₹. 227 per kg .The gross return per hectare obtained by multiplying average yield with average price was ₹ 3,97,250. The net returns was worked as ₹ 1,30,086 after deducting total cost from gross return.

Table 4.22 Yield and Income (₹/ha)

Particulars	Quantity/Value
Average yield (kg/ha)	1750
Average price (₹/kg)	227
Gross returns	397250
Total cost	267164
Net returns	**130086**

4.6 Resource use efficiency in arecanut cultivation

To evaluate the resource use efficiency in arecanut cultivation in relation to factors influencing the yield, 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 estimates of the fitted Cobb-Douglas production function are furnished in Table 4.24.

Table 4.23. Mean values of the variables used in Cobb-Douglas production function fitted for arecanut

Sl.no	Variables	Mean value
1	Yield (kg/ha)	1750
2	Human labour charges (₹/ha)	1,287,01
3	Age of grove (year)	32
4	Experience (year)	36
5	Manures (₹/ha)	17410
6	Plant protection chemical (₹/ha)	12274

Table 4.24 Estimates of the fitted Cobb-Douglas production function for arecanut

Sl.no	Explanatory variable	Parametric values	Standard error	t-ratio
1	Constant	0.10	1.47	1.74
2	Human labour charges (₹/ha)	-0.13**	0.05	-1.62
3	Manures (₹/ha)	0.33	0.04	1.00
4	Age of grove (Years)	0.09	0.03	1.83
6	Experience in farming (Years)	0.3	0.03	1.46
7	Plant protection (₹/ha)	0.01**	0.14	2.80
8	**R^2**	**0.55**		
9	Adjusted R^2	0.38		

Note: Dependent variable is yield in kg/ha, *** denotes significance at one per cent level and ** denotes significance at five per cent level

The coefficient of multiple determination (R^2) for the fitted Cobb Douglas production function for arecanut was 0.38 indicating that the selected variables could explain 38 per cent variation in the yield of arecanut. The regression coefficients of independent variables are the production elasticities of the respective factors. The elasticity coefficients of all the selected variables with the exception of human labour were found to be positive indicating positive effect of these inputs on the yield per hectare. The independent variables *viz.*, human labour charges and expenditure on plant protection chemicals were found to be significant at five per cent level. It could be inferred from the table that one percent increase in the expenditure on plant protection chemicals from the mean level keeping other things constant, would increase the yield of arecanut by 0.01 percent from the mean level. The elasticity coefficient for human labour charges was -0.13 indicating that the increase in expenditure on labour by one per cent from the mean level, would decrease the arecanut yield by 0.13 per cent from the mean level. About 80 per cent of the total input cost was accounted by the wage component incurred for human labour. The average expenditure on human labour was ₹ 1,28,701 per hectare. The increase in the expenditure on human labour might not have caused corresponding increase in yield and that could be the reason for the negative elasticity coefficient for this variable.

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 ratio. 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 is found to be 0.59 which is significantly different from one indicating decreasing returns to scale.

4.7 Marketing of Arecanut

Agricultural Marketing involves all the activities concerned with the movement of produce from the farm to the ultimate consumer through different marketing channels. Intermediaries or persons involved in the marketing process fix profit or margin according to the cost incurred during different stages of marketing

The marketing of arecanut plays a crucial role in the arecanut economy as its production is concentrated in few states and consumption is spread all over the country. In Kerala, there are no exclusive markets for arecanut and previously the marketing of arecanut was monopolistic in nature which changed with the formation of Central Arecanut Marketing and Processing Co.operative Limited (CAMPCO) in mid-seventies. There are many intermediaries in the marketing channel of arecanut in the state.

4.7.1 Selling behaviour of farmers in Kasaragod district

Table 4.25 throws light on the selling behaviour of arecanut farmers in Kasaragod district. It is clear from the table that majority (45 per cent) of the sample farmers in Kasargod district sell their produce in form of dehusked dried nuts to the village traders or itinerant merchants who are near to their arecanut gardens. Majority of farmers were dependent on local or village traders as they were making immediate cash payment, whereas CAMPCO was providing the payment as cheque and in order to sell their produce to CAMPCO the farmers had to take membership in the Cooperative. Exactly 40 per cent of sample farmers were dependent on CAMPCO for selling their produce and CAMPCO had various purchase depots in different parts of Kerala. As CAMPCO was providing scientific grading on the basis of size and quality of the produce, the farmers were being paid higher price than what they could earn while marketing the commodity through village traders. About 13 percent of sample farmers relied on wholesalers for selling their produce and while marketing through the wholesalers, the farmers had to bear only the storage cost, while the costs incurred for all other operations

like transportation, loading and unloading were borne by the wholesalers. It was also found that only two per cent of the total sample respondents sold their produce directly to the consumer through small shops owned by them. In the case of direct selling, arecanut was sold in fully ripe form and price was paid per arecanut.

Table 4.25 Distribution of sample farmers based on selling behavior

SI. No	Particulars	No of farmers	Parentage to total
1	Local traders	45	45
2	CAMPCO	40	40
3	Wholesalers	13	13
4	Consumer	2	2
5	Total	100	100

4.7.2 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, the form of consumer demand and degree of regional specialization in production. It could be understood from Figure 4.41 that the intermediaries functioning in marketing of arecanut in Kasaragod district were village level traders or itinerant merchants, wholesalers and retailers. Cooperative society like CAMPCO also facilitates the marketing of arecanut by serving as an institution with formal rules and regulations. In the study region, about four marketing channels of arecanut were identified and they were,

Channel I : Producer → Village trader → Wholesalers → Retailers → Consumers

Channel II : Producer → Wholesalers → Retailers → Consumers

Channel III: Producer → CAMPCO → Retailers → Consumers

Channel IV: Producer → Consumers

4.7.2 Marketing channels for Arecanut in Kasaragod region

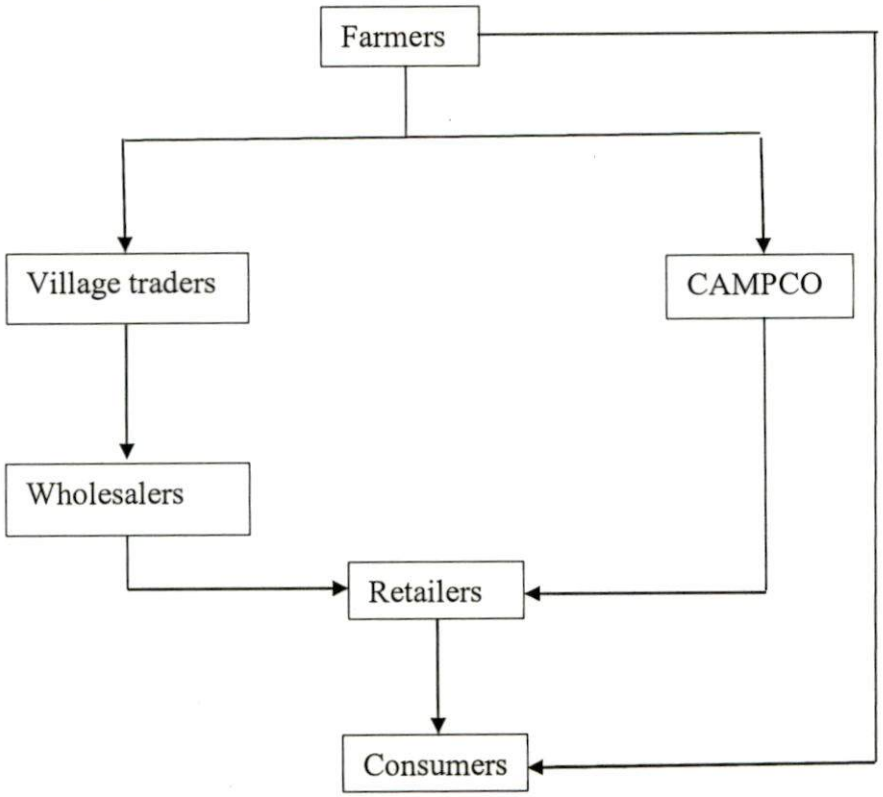

Fig.4.41 Marketing channels for arecanut in Kasaragod region

Among the four marketing channels identified in the study area, the first three were found to be important and hence these three were compared on the basis of marketing cost incurred, profits or margin earned by the major intermediaries, price spread, producers share in consumer's rupee and efficiency.

4.7.3 Marketing costs

Marketing costs is the expense incurred towards the operations carried out by the farmers and intermediaries at different stages of marketing and it is one of the important component of the price spread. Marketing cost of arecanut includes

expenditure incurred in performing various market functions such as transporting, storing, grading, fumigation *etc.*

From Table 4.26 it is evident that the channel I has the highest marketing cost of ₹ 33.9 while it was ₹ 28.44 in channel III. The higher cost in channel I could be attributed to the higher number of intermediaries including village traders, wholesalers and retailers in this channel. Marketing cost in channel II was ₹ 29.44. Even though channel III had the lowest marketing cost, channel I was the most common channel seen in study area because farmers preferred this channel as the village traders provided immediate cash payment. Nearness of the village traders to the arecanut gardens was also one of the important factors which made many of the farmers in the study area to choose channel I for marketing arecanut. Grading is an expensive process during marketing and scientific grading was carried out by CAMPCO and hence the marketing cost was more for CAMPCO.

Table 4.26 Marketing costs in different marketing channels of arecanut (in ₹ /kg)

Market functionaries	Items	Channel I	Channel II	Channel III
Farmer	Transportation	2.2	-	2.2
	Loading and unloading	0.34	-	0.34
	Storage cost	1.4	2.4	1.4
Village trader	Transportation	10	-	-
	Loading and unloading	2.5	-	-
	Storage cost	-	-	-
CAMPCO	Transportation	-	-	6
	Loading and unloading	-	-	4
	Storage cost	-	-	2.5
	Grading cost	-	-	4
	Fumigation cost	-	-	1.5
Wholesalers	Transportation	3.1	11	-
	Loading and unloading	2.4	3.55	-
	Grading	2.5	3.5	-
	Storage cost	1.5	2.45	-
Retailers	Transportation	4.2	3.5	3.5
	Loading and unloading	1	1	1
	Storage cost	2	2	2
Total		**33.9**	**29.4**	**28.44**

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 arecanut per kg in three major marketing channels identified in the study area are presented in Table 4.27. From the table it could be understood that the marketing margin was highest in channel I (₹.25 per kg), whereas it was ₹ 19 and ₹ 16.5 per kg in channel II and channel III respectively. The share of marketing margin in consumer price ranged from 6.15 per cent in channel III to 9.09 per cent in channel I.

4.7.4 Price spread

Price spread refers to the difference between the price paid by the ultimate 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 for movement of the product from point of production to the point of consumption, whereas margins include the profit of 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 arecanut in the study area are furnished in Table 4.27.While comparing the price spread in different channels, it was found to be highest in Channel I, while it was lowest in Channel III, Price spread in channel I was estimated as ₹ 58.9 (21.41 per cent of the consumer's price) and hence the producer's share in consumer's rupee was 78.54 per cent. The price spread in channel II was less than the price spread in channel I and was ₹ 48.4 (17.92 per cent of the consumer's price), while it was ₹ 44.94 (16.76 per cent of the price paid by the consumer) in channel III. The producer's share in consumer's rupee was found to be 82 per cent and 83.20 per cent in channel II and channel III respectively.

Table 4.27 Price spread of in different marketing channels of arecanut (₹/kg)

Sl.No	Price spread	Channel I	Channel II	Channel III
1	Farmer's selling price	220	224	227
	Marketing cost	3.9	2.4	3.94
	Net price received by farmer	216	221.4	223
2	Village trader's selling price	244.5	-	-
	Marketing cost	12.5	-	-
	Marketing margin	12	-	-
3	CAMPCO selling price	-	-	258
	Marketing cost	-	-	18
	Marketing margin	-	-	13
5	Wholesaler's sales price	261.5	259	-
	Marketing cost	9.5	20.5	-
	Marketing margin	7.5	14.5	-
6	Retailer's sales price	275	270	268
	Marketing cost	8	6.5	6.5
	Marketing margin	5.5	4.5	3.5
7	Consumer's purchase price	275	270	268
Total marketing cost		33.9 (12. 32)	29.4 (10.88)	28.44 (10.61)
Total marketing margin		25 (9.09)	19 (7. 03)	16.5 (6.15)
Price spread		58.90 (21.41)	48.40 (17.92)	44.94 (16.76)
Producer's share in consumer's rupee		**78.54**	**82.00**	**83.02**

4.7.5 Marketing efficiency

Marketing efficiency of various channels was computed using Shepherd's index according to which marketing efficiency is the ratio of total value of goods marketed to the sum of total marketing costs and margins. Marketing efficiency of three major marketing channels in study area are presented in Table 4.28.

From the table it could be observed that the channel III had the highest marketing efficiency of 9.42, while it was lowest for channel I. Marketing efficiency of channel I and channel II were estimated to be 8.11 and 9.35 respectively. Marketing cost which usually increases with the length of the marketing channel and hence the number of intermediaries, is one of the important determinants of efficiency. Of the three major marketing channels of arecanut identified in the study region, channel III was the most efficient owing to lower marketing cost in the channel. Even though only 40 per cent of sample farmers were selling their produce through CAMPCO, still it was the most efficient one and the producers were getting the highest price while marketing through this channel.

Table 4.28 Marketing efficiency in different marketing channels of Arecanut

Sl.No	Channel	Marketing cost	Marketing margin	Price spread	Producer's share in consumer's rupee	Marketing efficiency
1	Channel I	33.9	25.0	58.9	78.54	8.11
2	Channel II	29.4	19.0	48.4	82.00	9.35
3	Channel II	28.44	16.5	44.94	83.20	9.42

4.8 Constraints in arecanut cultivation

The arecanut farmers of Kasaragod district confront several constraints in production and marketing of arecanut. The important constraints as indicated by farmers were listed and then ranked based on the responses of the sample farmers. For getting a real picture of the identified constraints prevailing in Kasaragod district, ranks were converted to mean score using Garret ranking technique.

4.8.1 Constraints faced by arecanut farmers in production and marketing

The major constraints confronted by arecanut farmers in the production and marketing of arecanut were identified and are listed in Table 4.29 The scarcity of skilled climbers for harvesting and spraying plant protection chemicals were identified as the major constraint for arecanut cultivation in Kasaragod district. The mean score for the constraint 'scarcity of skilled climbers' was 65.55. Due to the scarcity of skilled climbers and escalating labour charges for climbing operations, timely spraying of plant protection chemicals and harvesting have become difficult task for the arecanut farmers of the district. Even though several models of spraying and climbing devices are available in the market, the popularity of these among the farmers were very limited due to high cost, complicated designs, drudgery, difficulty in reaching the crown with the device and requirement of prior experience in the use of these machines.

The second major constraint faced by farmers was water shortage, especially for irrigating arecanut gardens during the peak summer months. The mean score for the constraint 'water scarcity' was 64.5. Water scarcity in the study area was either due to deficieny of rain or depletion of ground water. In the case of arecanut it has been found that water stress for about 30 days results in a reduction of yield up to 75 per cent.

Table 4.29 Constraints faced by arecanut farmers in production and marketing

Sl.No	Constraints/ Category	Garret score	Rank
1	Scarcity of skilled labourers	65.55	1
2	Water scarcity	64.5	2
3	Pests and diseases	56.1	3
4	Wild animal attack	49.25	4
5	High wage rate	45	5
6	Climate change	29.95	6
7	Wind and lightening	28.7	7
8	Price fluctuations	25.4	8

The occurrence of diseases like mahali is a challenging problem in the arecanut growing belt. Currently, the most important yield limiting factor in arecanut are diseases like mahali and Yellow Leaf Disease (YLD). Farmers were of the opinion that the mahali disease is causing a huge loss and the major constraints in managing the disease were heavy rainfall, non-availability of skilled climbers for spraying during the rainy season and the absence of machinery for effective spraying of fungicides. Other diseases seen in the area were inflorescence die back, foot rot and sun scorching.

The other constraints identified in the study area were wild animals' attack, high wage rate, climate change and wind and lightning with Garret scores of 49.25, 45, 29.95, and 28.7 respectively. In the district, most of the arecanut plantations were lying near dense forest and hence there was increased attack of

wild animals like pig, monkey and birds like peacocks. The arecanut farmers were very much constrained by the high wage rate for climbers prevalent in the district. A Number of bearing arecanut palms were also getting damaged every year due to heavy wind and lightening in the region.

With respect to problems in marketing, most of the respondents were concerned about the price fluctuations of arecanut, which was reported by them as very high in arecanut. The farmers were afraid of sudden drop in prices of arecanut even though they were getting a better price for the recent harvests. Most of the farmers opined that if the present price continues, the arecanut garden could be managed profitably. They were also concerned, about the banning of arecanut cultivation in India in the long run.

Summary

5. SUMMARY AND CONCLUSIONS

The present study was entitled "Economic analysis of production, marketing and prices of arecanut in Kasaragod district of Kerala". The objectives of the study were to analyze the time series properties, estimate the economics and efficiency of arecanut production, study the marketing practices and economics of marketing and to determine the major constraints in production and marketing of arecanut in Kasaragod district of Kerala.

Kasaragod district was purposively selected for the study since the district had maximum area under the arecanut in Kerala. Two blocks *viz.,* Karadaka and Manjeswar blocks were selected for the study. From each of the block, two panchayats having maximum area under arecanut *viz.,* Mooliyar and Karadaka from Karadaka block and Manjeswar and Vorkady from Manjeswar block were selected. From each of the panchayat, 25 farmers were randomly selected, making a total sample size of 100 respondents. The information regarding marketing of arecanut was gathered from 20 intermediaries including wholesalers, retailers, village traders and CAMPCO.

The socio-economic characteristics of the sample farmers with respect to age, gender, education, experience, family size, land holdings, occupational status and annual income were analysed. Majority of farmers in each of the block were in the age group of more than 60 years. In the overall sample of 100 farmers, 92 per cent was male farmers, whereas female farmers formed only eight per cent. Even though majority of the farmers were literates, most of them were having only primary education.57 per cent of sample farmers were having more than 30 years of experience in farming. Family size of majority of the farm families was between four and six members and hence the availability as well as utilization of family labour for farm operations as a substitute for hired labour was high in the selected area. Majority of the farmers were having small land holdings. Agriculture and allied activities formed the major source of income for the

farmers in the district. The average annual income of sample farmers were between 2 lakhs to 5 lakhs.

The area, production and productivity of arecanut in India showed an increasing trend during the period from 1980-81 to 2015-16. As compared to the Indian scenario, the increase in area, production and productivity of arecanut in Kerala was more discernible after 1990s. Export potential of arecanut was limited as bulk of the quantity was consumed within India. The import of arecanut to India showed an increasing trend especially after 1990s, which could be attributed to the economic reforms of 1991, subsequent WTO agreement of 1995 and other proliferating Regional Trade Agreements.

The price behaviour of ripe arecanut in Nedumangad and Telicherry markets and dry arecanut in Nedumangad, Calicut and Kanhangad markets were analysed by decomposing the monthly price data into four time series components *viz.*, secular trend, seasonal variation, cyclical variation and irregular variation, assuming a multiplicative model of the time series. The price of ripe and dry arecanut in these markets showed an increasing trend in the long run. While analysing the seasonal variation, it was noticed that arecanut prices shows considerable seasonality. Three to four cycles were seen in both the markets but the length of cycle was observed to be varying. Pair-wise cointegration analysis of arecanut price in the above said markets were carried out in the following combinations; Nedumangad ripe and Telicherry ripe, Nedumangad dry and Calicut dry, Nedumangad dry and Kanhangad dry and Calicut dry and Kanhangad dry, which revealed that all the markets prices were co-integrated. This proved that there is strong co-movement of prices between the markets of arecanut within the state.

The establishment cost of arecanut garden for the first year was worked out as ₹ 1,84,605 per hectare and land preparation accounted for the major share of the cost during the first year. The total establishment cost up to the bearing stage was estimated as ₹ 3,43,386.

The cost of maintenance for yielding categories in aggregate was worked out as ₹ 2,01,522 per hectare. The cost of maintenance per hectare worked out for yield increasing, yield stabilising and yield declining stages was ₹ 2,13,075, ₹ 2,06,925 and ₹ 1,58,608 respectively. The cost of cultivation per hectare was estimated as ₹.2,67,164, with a net return of ₹ 1,30,085.

During the entire economic life span of arecanut palms, human labour contributed the major share in the input-wise cost. Plant protection accounted for major share of the total cost during the yielding phase of arecanut palms and was followed by expenditure on green manure.

The cost of production of arecanut was worked out as ₹ 133, ₹ 166 and ₹ 137 per kg for yield increasing, yield stabilising and yield declining stages respectively. The cost of production in aggregate was estimated as ₹ 150 per kg in Kasaragod district. To evaluate resource use efficiency in arecanut cultivation, Cobb-Douglas production function was fitted. Plant protection chemicals were found to be significantly contributing towards the yield per hectare while expenditure on human labour was found to be negatively contributing to yield per hectare.

About 45 per cent of the total sample farmers sell their produce in the form of dehusked dried nut to the village traders as they get immediate payment in cash, while 40 per cent of sample farmers was found to depend on CAMPCO for selling their produce. Exactly 13 per cent of farmers sold the produce to wholesalers for selling their produce and the rest two per cent of total sample respondents were selling arecanut directly to the consumers in fully ripe form.

The four marketing channels identified were, (i) Producer-village trader-wholesaler-retailer-consumer, (ii) Producer-wholesaler-retailer-consumer (iii) Producer-CAMPCO-retailer-consumer and (iv) Producer- consumer. Among the different marketing channels identified in the study area, the first three were found to the important ones. The marketing cost was highest in channel I (₹ 33.9), while it was lowest in channel III (₹ 28.44). The marketing margin ranged from ₹ 25 per

kg in channel I to ₹ 16.5 per kg in channel II and the share of marketing margin in consumer's prices were from 9.09 per cent and 6.15 per cent respectively. Price spread was highest (₹ 58.90) in channel I and lowest in channel III (₹ 16.76). The producer's share in consumer's rupee was 83.02 per cent in channel III, while it was 78.54 per cent in channel I. The marketing efficiency was highest in channel III (9.42 per cent) and it was lowest in channel I (8.11 per cent).

Various constraints faced by farmers in production and marketing of arecanut were identified using Garret ranking technique. Scarcity of skilled climbers for harvesting and spraying of plant protection chemicals were identified as the major constraint, followed by water scarcity. The major constraints faced by sample farmers in production were occurrence of diseases and pests, wild animal attack, high wage rate, climate change and wind and lightning. Fluctuation in prices was the foremost constraint faced by the farmers in marketing of arecanut.

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

1. The major constraint faced by arecanut farmers in the study area was the unavailability of skilled labour for timely spraying of chemicals and climbing operations. Hence, efforts should be made for mechanization of operations by developing efficient sprayers for spraying on arecanut bunches from the ground and self-operated climbing devices.

2. As arecanut sector experiences high price volatility, the urgent need is to frame measures for ensuring a stable and remunerative price to the farmers for their produce. One of the main reasons for price volatility is increased import of arecanut in recent years. Hence, necessary steps should be taken by the government to implement a workable price stabilization mechanism and manage the import of arecanut.

3. As arecanut is a storable commodity, farmers should be encouraged to avail the warehousing facilities to store their product and use the warehouse receipt as a

negotiable instrument to avail loans. Which will in turn help to prevent distress sales during market glut.

4. Value addition and product diversification of raw arecanut need to be encouraged by finding alternative uses for arecanut, which would also help the farmers to move up in the value chain.
5. As instability in prices was a major problem in marketing market intelligence and extension approaches should be strengthened to help the farmers in making decisions on timely harvesting, storage and sales.
6. As water scarcity is the second major constraint faced by farmers they need to pay immediate attention for utilizing the available water through revitalizing traditional irrigation sources, resorting to rain water harvesting and adopting water conservation as the government has banned digging of bore wells in the district. Hence, efforts are needed to strengthen and restructure the existing water harvesting schemes initiate by NABARD and other government agencies.

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Appendices

Appendix I

Survey questionnaire for farmers

KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF HORTICULTURE, VELLANIKKARA, THRISSUR
DEPARTMENT OF AGRICULTURAL ECONOMICS

Economic analysis of production, marketing and price of arecanut in Kasaragod district of Kerala

Interview schedule

District: Block: Panchayath:

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, E- Employed, SE- Self-employed, NE- Non employed, S- Student

3. Land details:

Particulars	Owned (ha)	Leased in (ha)	Leased out (ha)	Total (ha)
Wet land				
Garden				
Permanent fallow				
Total (ha)				

4. Crop details:

Sl. No	Crop	Variety	Cropped area (acres)	Main product		By-product	
				Qty(Kg)	Value(Rs)	Qty(Kg)	Value(Rs)

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:

Age of plantation: Area:

No. of trees: No. of yielding trees:

No. of harvesting per year:

Main product yield (Kg/hectare): Price/Kg:

By product yield (if any): Price/unit:

Wage rate (Rs/man days):

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 equipments	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) 6.machete(No)					

	Year 1	Year 2	Year 3	Year 4 onwards
Variable inputs				
Seedlings (No)				
FYM (kg/palm)				
Urea (g/palm)				
SSP (g/palm)				
MOP (g/palm)				
Other fertilizers(g/palm)				
Plant protection chemicals (Rs)				
Soil ameliorants (Rs)				
Irrigation cost (Rs)				
Labour cost				
Land preparation				
Digging, filling and planting				
Manure and fertilizer application				
Pesticide application				
Intercultural operations				
Irrigation				
Harvesting				
Collection & handling				
Post-harvest operations(processing if any)				

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

7. Details of marketing of arecanut:

Total quantity produced:

Quantity retained for on-farm uses:

Total marketed quantity:

Name of the nearest primary market:

Distance:

Name of the nearest wholesale or secondary market:

Distance:

Method of sale:

Sl.No	Method of sale	Quantity	Price/unit
1	Village trader		
2	Commission agent/brokers		
3	Primary/retail market		
4	Secondary/wholesale market		
5	Direct sale to consumers		
6	Other modes (specify)		

Do you know through which channel your produce will reach to ultimate consumers?

a. Channel 1 – Producer – village trader – wholesaler – retailer – consumer
b. Channel 2 – Producer – wholesaler – retailer – consumer
c. Channel 3 – Producer – village trader – retailer – consumer
d. Specify any channels, if any?

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

Price received per unit:

Mode of payment:

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

Marketing cost incurred

a. Transportation cost:
b. Commission/brokerage:
c. Storage cost:
d. Loading and unloading:
e. Other costs of marketing:
f. Total marketing cost:

In which form do you mostly market the produce (arecanut with husk/without husk)?

Price difference between the two nuts (nuts with husk/without husk)

Cost of de husking (Rs/Kg):

Do you engage in storing of the produce?

Time period of storage:

Do you have any pre contract tie up with any agencies for marketing the produce? (Yes/No)

If yes, since which year? Mention the amount of produce sold to agencies and the price per unit?

Sources of information on price data?

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

Do you have any contact with development agencies?

Sl. No	Agencies	Type of assistance			
		Planting material	Technology	Subsidy	Marketing
1	CDB				
2	Department of Agriculture				
3	KAU				
4	Co-operatives				
5	NGO				
6	Others				

8. Constraints in production and marketing:

Production constraints:

Sl. No	Problem	Occurrence of problem(Yes/No)	Extent of problem	Rank

Marketing constraints:

Sl. No	Problem	Occurrence of problem(Yes/No)	Extent of problem	Rank

Appendix II

Survey questionnaire for market intermediaries

KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF HORTICULTURE, VELLANIKKARA, THRISSUR
DEPARTMENT OF AGRICULTURAL ECONOMICS

Economic analysis of production, marketing and price of arecanut in Kasaragod district of Kerala

District: Block: Panchayath:

1. Name :
2. Address:
3. Age:
4. Gender:
5. Type of market intermediary
   (Village merchant/ commission agents/wholesalers/retailer/exporter)
6. No of years of experience in arecanut trading:
7. Main product(s) dealt with:
8. Quantity(volume) of transaction/year:
9. Transactions made:

Sl. No	Place		Distance	Total quantity transacted	Purchase price	Remarks
	From	To				

10. Expenditure:

Sl. No	Particulars	Amount (Rs)	Remarks
1	Transport cost		
2	Loading and unloading charges		
3	Drying charges if any		
4	Other processing expenses, if any		
5	Storage cost		
6	Brokerage		
7	Other expenses		

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. Constraints faced in buying it from producers/traders:
16. Problems faced in marketing of arecanut:
17. Give suggestions to overcome the problems:

ECONOMIC ANALYSIS OF PRODUCTION, MARKETING AND PRICES OF ARECANUT IN KASARAGOD DISTRICT OF KERALA

By

JANEESA K.P.

(2015-11-080)

ABSTRACT OF THE THESIS

Submitted in partial fulfillment of the requirement for the degree of

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ABSTRACT

Arecanut is an important plantation crop grown in India, mainly by the small and marginal farmers. India is one among the leading producers of arecanut with an area of 4.55 lakh hectares and a production of 7.25 lakh tonnes in 2016-17.

The study entitled "Economic analysis of production, marketing and prices of arecanut in Kasaragod district of Kerala" was conducted with the objectives of analysing the time series properties and formation of prices, estimating the economics and efficiency of arecanut production, identifying the marketing channels and the price spread in different channels and finding out the major constraints in production and marketing of arecanut in Kasaragod district of Kerala.

The study was based on both primary and secondary data. The study was conducted in Kasaragod district, which has the largest area under arecanut cultivation in Kerala. Primary data was collected from 100 farmers, randomly selected from two blocks in the district. The data was also collected from 20 market intermediaries including wholesalers, retailers and Central Arecanut Marketing and Processing Co-operative Society (CAMPCO).

Trend analysis revealed that area, production and productivity of arecanut in India exhibited increasing trend during the period from 1980-81 to 2015-16. Time series data on area, production and productivity of arecanut in Kerala over the years from 1980-81 to 2015-16 showed an increasing trend with regular ups and downs. Export and import of arecanut have also shown an increasing trend, both in quantity and value terms.

The price behavior of ripe and dry arecanut in major markets of Kerala *viz.,* Nedumangad, Telicherry, Kanhangad and Kozhikode were analyzed by decomposing the monthly prices into four components *viz.,* trend, seasonal, cyclical and irregular variations, assuming a multiplicative model of time series. The prices of arecanut showed increasing trend in these markets. While analysing the seasonal variation, it was noticed that arecanut prices showed considerable

seasonality. The increasing phase for ripe arecanut prices was observed from March to May, while for dry arecanut, the highest price was observed during April, May and November in Nedumangad, Calicut and Kanhangad markets respectively. Co-integration analysis of arecanut prices in the above markets revealed that the markets were cointegrated.

Since arecanut is a perennial crop, its yielding phase was assumed to be 50 years, with a non-bearing phase of five years. The costs and returns were estimated by accounting the establishment and maintenance costs separately. The establishment cost was found to be ₹3,43,386 per hectare and the annual maintenance costs were ₹ 2,13,075, ₹ 2,06,925 and ₹1,58,608 per hectare in yield increasing, yield stabilising and yield declining phases respectively. The cost of cultivation per hectare of the crop was estimated as ₹ 2.67 lakh, while the net return was ₹ 1.30 lakh. It was found that human labour contributed 75 per cent of the total cost of cultivation. The average cost of production in the yielding phase was estimated as ₹ 150 per kg. To evaluate the resource use efficiency in arecanut cultivation, Cobb-Douglas production function was fitted. Plant protection chemicals and human labour were found to be significantly contributing towards the yield. The elastic coefficient for women labour charges was -0.13 indicating that the increase in expenditure on labour by one percent from the mean level. Moreover, a decreasing returns to scale in arecanut production was observed in the study area.

The most common marketing channel identified in the study area was channel I (Producer- village trader- wholesaler- retailer- consumers). Even though marketing efficiency was highest in channel III (Producer- CAMPCO- retailers - consumers), farmers preferred channel I over channel III because of the immediate payment. Marketing costs were found to be ₹ 33.9, ₹ 29.44 and ₹ 28.44 per kg in channel I, II and channel III respectively. The highest price spread of ₹ 58.9 per kg was estimated in channel I, while it was lowest (44.94 per kg) in Channel III.

Various constraints in production and marketing of arecanut were identified and ranked using Garret's ranking technique. Among the various constraints faced by farmers in production, scarcity of skilled labour for harvesting and spraying, water scarcity, occurrence of pests and diseases were the major ones. Price fluctuation was the foremost constraint faced in marketing of arecanut. In order to tackle these constraints, mechanization of operations, value addition through product diversification, promoting the use of warehousing facilities and warehouse receipts as negotiable instruments for getting credit and strengthening market intelligence were recommended for ensuring better and stable prices for farmers.