Chapter - 1
INTRODUCTION
The Backdrop

Agriculture enjoys a predominant position in the development agenda of the Indian economy. It continues to be the same even with the remarkable and commendable strides in the non-agricultural sectors of the nation. Coconut occupies an important position in the agricultural arena of the nation. With an area of 1.89 million hectares and production of 12,988 million nuts, coconut contributes over Rs.7,000 crores annually to the GDP of the country and India has become the largest producer of coconut in the world in the year 1996, with the percentage share of 26.06, surpassing the production levels of other major global players like Indonesia (25.36 percent) and Philippines (22.27 percent) (Singh and Markose, 1999). About 10 million people in the country are engaged in coconut cultivation, processing, marketing and trade related activities. It is an important source of edible oil and the contribution of the crop to the edible oil pool in India is around 6 percent. (Singh, 1998). The crop is the only one in the lauric oil groups produced in the country, and provides about 75 percent of the lauric oils (Green, 1991). As per the 1991 estimates (Shenoi, 1991) there are about 5 million coconut holdings in India.

Kerala, the land of coconuts, assumes a unique domain in the coconut map of the country. The state, which accounts for 1 percent of the land area
India, contributes about 57 percent of the coconut area and 47 percent of coconut production. The other southern states of Tamil Nadu, Karnataka and Andhra Pradesh together account for 34 percent of the area under coconut but contribute 44 percent of production (George et al. 1991). Out of the total net sown area of Kerala, 41.31 percent (9,25,035 hectare) has been occupied by coconut and she is the largest supplier of coconut (GOK, 2001b) towards the nation. Coconut accounts for about 15 percent of the annual income and 35 percent of the agricultural income of the state (GOK, 1997).

1.1 The Problem

Though area under coconut cultivation and coconut output in Kerala have increased in absolute terms, there is a sharp decline in the percentage contribution of area and production of coconut by Kerala towards the nation. Kerala’s share in the all-India production that was hovering around 70 percent through the fifties has declined from the mid-sixties and the decrease has been sharp during the seventies and eighties. By 1986-88, the share of Kerala had come down to 49.36 percent (Narayana et al. 1991). Output growth in coconut could be achieved either by bringing more land under the cultivation of the crop or with increased productivity or by a combination of both. When growth of net sown area in Kerala began to decline or remained stagnant after 1974-75, more and more area could be attributed to the cultivation of coconut only at the expense of some other crops. Thus, with land use intensities remaining stagnant or even falling, the impetus to growth is entirely dependent upon yield increase.
Productivity of coconut in Kerala is fluctuating very much over the years and is now the lowest among major coconut cultivating states of India (6180 nuts per hectar for Kerala, 11470 nuts for Tamil Nadu and 19220 nuts for Andhra Pradesh in the year 1998-99 (GOK, 2001a). Moreover, average per-palm yield is also at its lowest ebb in Kerala with 33 nuts per palm per year, as against that of the neighbouring states of Karnataka and Tamil Nadu having 44 and 54 nuts per palm per year respectively (Ohler, 1999). In spite of the various favourable factors like, rich natural endowments conducive to the cultivation of the crop, the tradition and affinity of Keralites towards the cultivation of coconut and unfailing consumption behaviour of Keralites of raw coconut, coconut oil and palm by-products, Kerala is far behind the neighbouring states with respect to per- hectare as well as per-palm yield levels. While the potential production, with the then existing technology, estimated during the triennium ending 1994-95, was as high as 9000 nuts per hectare (GOK, 1997), the achieved production level during the same period was just 5872 nuts, proclaiming the need to improve the performance of the crop.

Though a number of studies on coconut have already been made, comprehensive studies analysing various economic aspects of coconut cultivation in Kerala are very much limited in number. The existing studies concentrate, by and large, on the trends in area cultivated, production and productivity of coconut. Many of them lack a definite methodology and are micro-level studies. Thus, an analytically rigorous study of coconut cultivation, covering a larger geographical area of Kerala remains an urgent
necessity. The study assumes added importance in the context that Kerala is purportedly having the most conducive conditions and high potential for coconut cultivation, and has the capacity to change the crop as the most profitable and productive one.

It would be appropriate at this juncture, to review the literature on agricultural productivity, to gain an insight into the theory, methodology of such studies and the variables they considered for measuring productivity, as well as to review the literature on coconut cultivation so as to assess the current status and set down the research gaps on coconut cultivation in Kerala.

1.2. Review of Literature

1.2.1. Studies on agricultural productivity in India

Systematic and comprehensive studies have been made in the Indian agricultural scenario to assess and compare the productivity of different crops between different periods of time and at different places. Most of the studies measure productivity using different statistical tools. A review of such productivity studies applying various statistical tools in measuring productivity and the findings emerged, are being reviewed in this section.

Agricultural productivity is very much related to the size of land holdings. A study by Bardan (1973) on nearly 1000 Indian farms at Andhra Pradesh, Orissa, Madhya Pradesh, Tamil Nadu, Punjab and Uttar Pradesh producing wheat and paddy, based on secondary data, revealed the
relationship between farm size, productivity and returns to scale. Cobb-Douglas production function was fitted to the data for analysing productivity. The major result of the study was that, while predominantly wheat areas showed constant returns to scale, diminishing returns prevailed in predominantly paddy areas. Both in paddy and wheat the observed negative relation between output per acre and farm size is likely to be the result more of an inverse relation between size and other inputs than of scale diseconomies.

Dadibhavi (1985) examined the extent and sources of regional variations in agricultural productivity in Karnataka state for the periods 1960-61 and 1975-76, covering all 19 districts of Karnataka state. Multiple regression between labour productivity and some selected variables have been done and found that only three variables were significantly related with labour productivity. 32 percent, 36 percent, and 51 percent of inter-district variations in agricultural labour productivity was explained by area under cash crops, literacy rate and concentration ratio (cropping intensity) respectively during 1975-76.

A study (Sain and Singh, 1988) which concentrated on the nature and pattern of technical change in Punjab agriculture using secondary data on the cost of cultivation of principal crops for two periods, 1971-72 and 1980-81 divided Punjab into three agro-climatic homogeneous zones known as wheat–paddy zone (zone1), wheat–maize–ground nut zone (zone2) and wheat–cotton–bajra zone (zone3).
Cobb-Douglas production function has been used to decipher the nature of technology. Co-efficient of production elasticity for human labour registered a decline in zone 1, while for zones 2 and 3, it was positive and improved in magnitude over the study period. Study results highlighted the fact that zone 1 continued with the capital using technology while zones 2 and 3 had bias in favour of labour using technology over the period 1971-72 to 1980-81. Zone 1 recorded the highest contribution of technical change in comparison to other zones of the state through improving its efficiency parameter.

While estimating the productivity of inputs and the rate of technological change in Nepalese agriculture during the period 1965-80, Shrestha (1992) fitted the Cobb-Douglas and translog production functions to the secondary data. Output elasticities were found to be positive and high in the case of land, negative and high with regard to labour and low but negative with regard to capital. Negative output elasticity of labour showed that increase of labour force and population on land by itself added nothing to agricultural output. Contribution of technological change to the increase in agricultural production was estimated by following the method of Solow and Intriligator. Findings revealed that only 4 percent of the average annual growth in agricultural production could be attributed to technological change.

Measurement and analysis of Total Factor Productivity growth in wheat in the major states of India have been undertaken by Kumar and Mruthyunjaya (1992). Data on total output, total input and input price indices for wheat, based on micro-level farm data was collected under the
comprehensive scheme for the study of cost of cultivation of principal crops by Government of India. Inputs included in the input index were land, seed, manure, pesticides/herbicides, human labour, animal labour, machine labour and irrigation.

Results revealed that Total Factor Productivity growth rates in the wheat sector in Punjab, Haryana, Uttar Pradesh and Rajasthan were very high. Productivity growth or technological change contributed 37 to 53 percent towards total output growth in the frontline states, around 17 percent in Madhya Pradesh and almost all the output growth in Rajasthan. Notable productivity gains have come from more efficient use of existing inputs of land and labour but fertiliser productivity declined in all states.

Job (1992) analysed the productivity variation and input use efficiency in the homesteads of the southern zone of Kerala. A stratified multistage random sampling procedure was adopted for the selection of sample. Data was collected from 172 homesteads. The inter-farm variations in productivity in terms of income were studied size-category-wise for the sample. Cobb-Douglas form of production function taking total value of crop output of the homestead farms as the dependant variable and area in cents, cost of manure including fertilizers and miscellaneous expenditures including cost of seed, plant protection and other costs were used for the analysis of input productivity. The Cobb-Douglas model was transformed to a linear form by logarithmic transformation. A step-wise regression analysis was used to estimate the parameters.
R² value was found to be significant at 1 percent level and showed that 61 percent of the variation in income was explained by the specified independent variables in the model. Labour was found to be the most determining factor of crop output followed by manure components.

Resource use efficiency in tea plantations has been examined (Misra, 1992) in two distinct tea producing regions of West Bengal, a) Terai–Dooars and b) Darjeeling, using secondary data, in 1989. Cobb–Douglas production function was used to express the input-output relationship. Value of marginal products is obtained from the production function by differentiating the function with respect to a particular variable. Output elasticities with respect to labour, intermediate material inputs and capital were positive and less than one indicating decreasing marginal productivity of factor inputs. An input factor is considered to be used efficiently if its marginal value product is sufficient to offset its acquisition cost. Marginal value product of labour was found to be less than the wage rate in small and Darjeeling plantations, whereas, Terai–Dooars plantations have got marginal value product of labour higher than the wages paid to the labourers. Low marginal value productivity of labour suggests that the employment of resource has already reached a point at which additional unit yields very little output and so indicated excess employment of human labour. On the other hand, marginal value products of intermediate material inputs and capital appeared to be significantly higher, which shows the scope to divert investment from excessive use of human labour to intermediate material inputs and capital.
The study on the growth of Total Factor Productivity in Indian Agriculture, covering comparatively a longer period from 1950-51 to 1988-89 by Dholakia and Dholakia (1993) estimated the sources of growth of Indian agriculture for three sub-periods of pre-green revolution period, initial phase of green revolution and modernization phase. Total Factor Productivity is defined as the growth of net output per unit of total factor input. To estimate Total Factor Productivity growth in Indian agriculture, time-series data on net output, factor inputs and relative factor shares in Indian agriculture were used. Study was completely based on secondary data.

The study revealed the fact that Total Factor Productivity growth has contributed significantly to the acceleration of agricultural growth. Total Factor Productivity was found to be the prime driving force behind the acceleration of overall growth in the Indian economy achieved during the 1980s. Major determinants of Total Factor Productivity Growth have been found to be the use of modern inputs like fertilizers, High Yielding Variety seeds and irrigation.

In another region-specific study at Andhra Pradesh, Reddy (1993) tested the hypothesis, that farm size–productivity relationship has weakened with the advent of green revolution and analysed the factors responsible for the existing size-productivity relationship. The study was confined to two periods, 1966-67 and 1977-78, on irrigated paddy using secondary data. Productivity equations of the log-linear form observed inverse relationship between farm size and productivity. The then existing relationship between farm size and
productivity was explained mainly by the high labour intensity on small farms in addition to the intensity of material inputs. It was also observed that the advent of new technology had weakened the inverse relationship to some extent in the early years when its spread was limited. But it appeared to be re-establishing with the spread of new technology in the later period.

The micro-level study (Mishra and Sahu, 1994) covering two agro-climatic regions namely Vindhyan and Malwa Plateau in Madhya Pradesh, analysed the costs and returns, estimated resource use efficiency and optimum level of resource allocation on gram cultivation for two years from 1985-87. Both secondary and primary data were used for the study. Cobb-Douglas production function was fitted to the data to study the resource use productivity in gram. Difference in the resource use pattern in the cultivation of gram was identified between the two regions. The relative shares of human labour, bullock labour and purchase of inputs in the total cost were higher in Vindhyan Plateau than those in Malwa Plateau. But fixed cost’s share in total cost was found to be higher in Malwa plateau (44 per cent). Yield performance of the crop was inferior in Vindhyan Plateau (6.04 quintals per hectare) in comparison to the average yield of 7.16 quintals per hectare in Malwa plateau.

Functional analysis for estimating the productivity of resources indicated that despite very high value of $R^2$ most of the coefficients were found to be not significant in both the regions. Only fixed costs were found to have significant impact on yield performance of the crop.
A detailed analysis of the resource productivity in paddy farms of Andhra Pradesh was undertaken by Rao et al. (1994) in the year 1988-89. Primary data from watershed areas which were termed as adopters and non-watershed areas, termed as non-adopters (of technology) of Rangareddy district of Andhra Pradesh was used for identifying the above factors. Cobb–Douglas production function was used to estimate resource productivity and returns to scale. Individual production elasticities were summed up to find out the returns to scale. The ratios of marginal value product to opportunity cost were worked out to estimate the resource use efficiency. Analysis was made for different sizes of farms namely small, medium and large and also for whole sample.

Variables in the adopter farms explained seventy seven percent of the variations in gross output. Regression co-efficient of human labour was found to be statistically significant and positive. On the non-adopter farms cattle labour and seed were found to influence the output. Constant returns to scale were operating in both adopter and non-adopter farms. Results of resource use efficiency indicated that the expenditure on cattle labour and fertilizer has to be curtailed on adopter farms, while the expenditure on cattle labour, seed and fertilizer has to be increased in the case of non-adopter farms to increase the gross returns.

Economics and Resource Use efficiency of paddy cultivation in Ludhiana, a district of Punjab was analysed by Singh and Grover (1997) pertaining to the year 1993-94. Factors affecting the value productivity of
paddy crop under different situations/ blocks were examined by fitting the Cobb-Douglas production function. Marginal value productivities of various inputs were estimated directly from the regression estimates at arithmetic mean level of inputs.

Cost of cultivation was found to be high in the least productive block because of the increased use of most of the conventional inputs in this block. Gross returns as well as returns over variable costs per hectare in the highest productive block were higher than that of the least productive block. It was partly because of the lower operational cost and corresponding higher yield per hectare in the highest productive block. Marginal Value Productivity co-efficient for nitrogenous fertilizers was found to be statistically significant under all situations, showing the scope of additional use of this input.

While analysing the resource use in small rubber holdings in Assam, Maibangsa and Subramanian (2001) analysed the resource use and labour requirement during the establishment and tapping stage of rubber. It was found that labour was the most important item of resource used for establishment constituting more than fifty percent of total expenditure. Manure and fertiliser were the next important resources used in rubber plantation accounting for 36.65 per cent and 12.72 percent of total expenditure during the establishment and tapping periods respectively. For establishing one hectare of rubber plantation 637.29 man-days were required and 240.67 man-days were required for maintenance from the tapping stage onwards.
Recently attention has been devoted to the study of human resource variables like education, age etc. of the farmer and their impact on yield in agriculture. A study on 150 farmers with different size holdings (Randhawa 1983) selected randomly from Amritsar district hypothesized that the incidence of education of farmer and agricultural yield are independent of each other. Chi-square method was used to test the data. To estimate and test the effects of education in the presence of other explanatory variables, different regression models such as linear regression, semi-log regression and double-log regression were tried. The study showed that the level of farmer's education had a very significant impact on both per-worker and per-acre yield. The significance of the co-efficient of education level in the presence of all other variables affecting yield further underlined the importance of farmer's education.

A micro-level study focusing the relationship of age, education and experience of the farmer and its impact on fertilizer use and yield in Pudukkottai district of Tamilnadu (Narayananamoorthy, 1994) covered the borewell owning farmers alone. Data generated from a random sample of 100 bore well farmers were taken for the study. To know the impact of education on yield, averages and standard deviations were calculated. Mean was tested by using 't' to know the level of significance. Though the rate of use of fertilizer was found to be higher for low educated farmers than that of the higher educated farmers, it did not reflect on the productivity of the crop. Analysis of farming experience on the yield of crop showed that though, the rate of yield in terms of actual is slightly higher for low
experienced farmers than the medium and high-experienced farmers statistically no difference was found in the rate of yield between the different groups of farmers. The impact of the age of the farmers on fertilizer use and yield shows a mixed trend among the different age groups. Though, low and high aged group of farmers use more fertilizer than medium aged group of farmers, no significant difference was observed in the yield between low and medium groups. Moreover, yield rate was significantly higher for medium aged farmers than that of the higher aged groups.

Thus, it could be summed up that most of the studies on agricultural productivity reviewed, examined both single and total factor productivity measures, resource use efficiency and returns to scale. Among the various production functions, Cobb-Douglas production function is fitted in a majority of the studies reviewed. Inputs selected in different studies for determining the productivity of the crops are different. However, some variables like land, labour, capital, manure and fertilizer are found to have been selected in almost all the studies. Variables like density of planting, plant protection measures, irrigation, seeds and some other human resource variables as age of the farmer, level of education etc. are also taken into consideration in some of the studies reviewed.

1.2.2. Studies on coconut cultivation

There exists a plethora of literature analysing various aspects of coconut cultivation. Several government level studies have been made
to identify the various issues related with coconut cultivation, production and profitability (Nelliat and Shama Bhatt, 1979; CPCRI, 1985; KAU, 1988; GOK, 1997). These studies are rich with reliable statistical data about the coconut sector.

Among the individual level studies on various aspects of coconut cultivation, the studies of P.K.Thampan is remarkable. His innovative contributions towards the crop are scattered in the form of books, project reports and a number of articles in some important journals especially in the official journal of the Coconut Development Board.

The peculiar characteristic feature observed in coconut cultivation throughout the coconut growing areas is the predominance of smallholdings. As per the estimates of the World Bank, nearly 96 percent of the total world production of coconut is coming from smallholdings of 0.5 to 4.0 ha. (World Bank, 1991). Country-wise statistics also support the predominance of smallholdings all over the world. In Philippines, the largest producer of coconut, 65 percent of the total holdings fall under the category of small farms of less than four hectare (Eleazar et al. 1980). Seventy five percent of the total number of holdings in Sri Lanka are having an extent of only eight hectare or less. Though in India, there is no size class grouping as small or large, 98 percent of the coconut holdings (5 millions) in India and Indonesia are with less than two hectare (Liyanage, 1974).
1.2.2.1. Trends in coconut cultivation

Observations made by Das (1985) on coconut cultivation showed that the first incentive to large-scale production of coconut was the great demand for coconut for soap manufacturing. Another incentive was the use of coconut oil for margarine, as a result of which, vast areas of new coconut plantations were planted by the end of the 19th century. Data relating to world area under coconut cultivation speaks of the vast increase in area from 3.2 million hectare in 1938 to 8.3 million hectare in 1980.

Though coconut has a documented history in India of some 3000 years Chhabra’s (1991) analysis of the per capita nut availability among the four major coconut-producing countries is quite disappointing. He identified Philippines as the country getting the highest nut per capita of 282, followed by Sri Lanka 156, Indonesia 53, and the lowest nut available country per capita turned out to be India, having only 10 nuts.

Analysis of trends in area cultivated, production and productivity have become common in almost all the studies on coconut. (Kuttappan, 1981; Narayana and Narayanan Nair, 1989). Narayana et al. (1991) has presented a detailed picture of the production and productivity trends of coconut in India from 1950-86. According to him coconut production showed a 70 percent increase over the 20 year period from 1950-70 practically no increase during 70’s and partly 15 percent increase till 1986. He decomposed the changes in production in terms of area effect and productivity effect and came to the conclusion that productivity of coconut palm has not shown
any systematic increase over this period. He supported his inference with the data on area increase, which has increased by 68 percent between 1950 and 1970 and 20 percent between 1980 and 1987.

Aravindakshan (1995) analysed the impact of the formation of the Coconut Development Board on the area, production and productivity of coconut among the Indian states using time series data from 1983-84 to 1993-94. He had disclosed the positive response of coconut cultivation due to the formation of Coconut Development Board by area as well as production increase. Area under coconut registered a growth rate of 3.4 percent and production recorded a growth rate of 7.8 percent and productivity 4.2 percent. During that decade India produced 11.2 billion nuts from 1.5 million hectare and surpassed all other premier coconut growing countries in the case of productivity.

1.2.2.2. Coconut production and productivity

Technological yield constraint on coconut cultivation in Kerala has been analysed by Thampan (1980) using data from secondary sources. Region-wise analysis showed that there was a decrease in production in Thiruvananthapuram district by 10 percent against 45 percent area increase and only 9 percent increase in production as against 56 percent area increase in northern districts for the period from 1955-56 to 1978-79. The reason found by him for this is that the efforts taken by the state since 1955-56 for the expansion of area under the crops would have resulted in the cultivation of unsuitable land for coconut culture.
An earlier academic level research on coconut cultivation in Kerala by Kuttappan (1981) hypothesized that coconut producers in Kerala respond favourably to changes in prices and profitability. Study was mainly based on secondary data from 1952-53 to 1972-73 and supplemented by a field survey of coconut cultivators. Hypothesis was found to be valid and survey results highlighted the factors influencing the yield per-palm as manures, density of palms, disease, age composition, variety of palms, types of intercrops, rainfall and irrigation.

Almost all the studies on productivity of coconut cultivation explain the varying productivity of coconuts in Kerala in the light of some dreaded diseases. Central Plantation Crop Research Institute (1985) estimated the annual loss due to root (wilt) in Kerala as 968 million nuts leading to a monetary loss of about Rs.3000 million per year. When decline in yield in West Coast Tall variety was found to be 45 percent, yield decline in D x T hybrids was to the tune of 60 percent (Mathew and Cecil 1993). Yield loss due to leaf-rot was computed and estimated (since leaf rot is always associated with root-wilt) as 461 million nuts annually (Joseph and Rawther, 1991).

Findings of a micro-level study (Santha and Shylaja, 1991) to identify the constraints responsible for the non-adoption of seedling practices recommended by Kerala Agricultural University (KAU) are quite interesting. A survey has been conducted with a sample size of 241 coconut holdings in Thiruvananthapuram district during 1984. Lack of knowledge regarding the recommended seedling practices was primarily found to be
the handicap to the farmer, apart from the non-availability of seedlings in time. When 28 percent of the farmers were not aware about the need for selection, 24 percent were not convinced about the beneficial effects of selection. Moreover 17.33 percent planted all seedlings that germinated and 20 percent was found to be not interested.

Singhal (1996) has rightly commented upon coconut cultivation in Kerala as one, which is beset with a number of problems. According to him out of a palm population of 16 crores, more than 2 crores are uneconomic due to old age and diseases like root (wilt). Available data on cultivation practices of coconut shows that the input use in Kerala is very low. As per the KAU (1989) study in the southern zone, only 30 percent of the coconut cultivators were found to be applying cow dung annually to coconut basin, and though 50 percent of the coconut farmers in Kollam district applied fertilizers in their coconut gardens, only less than 10 percent of farmers followed the recommended level of fertilizer (GOK, 1997a).

The attitude of the coconut farmer towards coconut cultivation has been analysed by many (GOK, 1997a; Pankajakshan, 1986) and it was found that small farmers preferred to continue to obtain low yields from uneconomic palms than to replant and wait for few years for the new plants to start bearing. Poor agronomic practices of coconut cultivation were found to be the result of the perennial nature of the crop and long time lag between manuring and manifestation of increased yield, which may extend up to even two years.
1.2.2.3. Economics of coconut cultivation

Various studies have been conducted to test the social and economic efficiency of coconut cultivation. A number of other crops are being inter/mixed-cropped in the coconut garden. Economic viability of such Coconut Based Farming System (CBFS) has been identified by many.

Inter/mixed-cropping possibilities of coconut cultivation are not unknown to the farmers of Kerala. In a study in 1964, Marar estimated the extent of inter/mixed-cropping in coconut gardens of Kerala as 78 percent. In a study (Krishnaji et al. 1976) conducted in two villages in Kasaragod taluk analysing the physical magnitudes of incremental benefits that could be derived and additional costs to be incurred in the process of changing to new technology (inter/mixed-cropping) showed that the returns from inter and mixed cropped coconut land was found to be increasing.

Kannan and Nambar (1976) reported the result of experiment on intercropping conducted at the Central Research Station, Pilicode, in coconut stands aged about 50 years during 1967-75, with tapioca, colocasia, rice, raggi and groundnut. They observed increased production of nuts and enhanced overall returns from the coconut garden due to intercropping. The increase in nut yield ranged from 2.7 per cent in groundnut-intercropped plots to 30.3 per cent in colocasia-intercropped plants.

While analysing the economics of coconut cultivation, Job and Prakash (1990) conducted a survey among 75 farmers having local varieties
of coconut aged between 15 and 25 years during 1988-89 in Athiyannor block of Thiruvananthapuram district. Analysis of the figures of cost of cultivation of coconut revealed that major operation in terms of cost was found to be manures and manuring and input human labour which accounted to about 34 percent and 38 percent respectively of the cost of maintenance. But, still, maintenance cost per hectare per year amounted to Rs. 4976 where as total returns to Rs. 12569.

In order to make an analysis of the economic benefits derived from coconut farming in Anaimalai Block of Coimbatore district of Tamilnadu Jaganathan (1992) examined the resource use efficiency in terms of coconut productivity and productivity of capital investment in coconut farming. Study revealed the fact that farmers shifted their cropping pattern towards coconut farming since it (with intercrops) has given more benefit cost-ratio through more resource efficiency. The functional analysis indicated that the number of bearing trees, organic manures and irrigation contributed more for productivity.

The social and economic efficiency of coconut cultivation in different countries were studied by using various efficiency indicators like IRR by Silva (1993). The analysis revealed that intercropping under coconut increased the land use factor to 100, crop intensity factor to 2.21 and employment generation potential to 148 man-days per year. Under monoculture land use factor was found to be 25 percent, crop intensity factor 1.0, and employment generation potential was 80 man-days per year.
This demonstrates the possibility of increasing economic gains through inter/mixed-cropping coconut lands.

Economics of coconut cultivation in relation to that of paddy in Kanyakumari district was examined by Raj (1997), with a view to discerning the extent to which the increase in area under coconut is due to economic factors such as relative productivity. For this purpose, study estimated the cost of production and returns on capital investment of coconut and paddy in the district.

Major results were a) average gross income of paddy per acre was found to be more than that of coconut b) the net income at cost C of coconut was higher than that of paddy c) income at cost D from coconut was found to be two times higher than that of paddy d) on the basis of farm business income, profit from coconut cultivation was more than that from paddy cultivation and e) on the basis of family labour income, coconut cultivation earned a profit of nearly two times more than paddy cultivation.

The analysis thus revealed that relative profitability was an important factor influencing the farmer in his decision to allocate his land under different crops. Alternatively, the relatively high profitability of cash crops was a major cause of commercialization in agriculture in Kanyakumari district of Tamilnadu, as has been illustrated by the shift from paddy to coconut.

Economic benefits of coconut cultivation in the Central State farm at Aralam in Cannanore district of Kerala, which is a Government of
India undertaking has been rigorously examined by Remold (1999, 2000) under rain-fed and irrigated conditions. Average data of 24 to 90 year old coconut palms for the period from 1974-1998 in terms of labour and other input requirements were used for the study. Cost-benefit analysis was also done under these varying conditions in order to analyse the economics of coconut cultivation. Cost-benefit ratio of coconut cultivation under irrigated condition was worked out to be 1:1.5 and under rain-fed condition it was found to be 1:1.02.

A micro-level study by Thampan and Venkitachalam (2000) focused on the economic costs and benefits of coconut, based on farm activities comprising inter-cropping, mixed-cropping, toddy tapping, tender coconut production and handicrafts. The study was confined to Kumbalam panchayat in Ernakulam district and used a sample of 150 households, with different coconut related activities. Feasibility and profitability of different activities were analysed with the help of BCR, NPV and IRR. The study has revealed that in the inter-cropping models, the average contribution of inter-cropping to the total income in a holding of less than 0.04 hectare was 61 percent and in the mixed farming units the average contribution of mixed farming was found to be as high as 87 percent of the total income in small holdings of size 0.1 hectare and below, where as this contribution of mixed-cropping came to nearly 91 percent of the total income in a 0.04 hectare holding. The study, thus, made recommendations for promoting coconut based production systems.
Summarising these studies, evidence on the following observations on coconut are available. Coconut is a small-holder’s crop. Increase in the production of coconut in India is much due to increased area under cultivation rather than increased productivity. Coconut cultivation in Kerala is beset with a number of problems. A number of variables such as manure, density of palm, age composition, disease, variety, irrigation and quality of seedling are identified as influencing the yield of palm. However, coconut cultivation with inter-cropping, mixed-cropping etc., has proved to be more economical than mono-crops in the studies reviewed with more benefit-cost ratio and more employment generation potential.

1.3. Research gaps emerging from the literature review

A detailed and thorough scan of the available literature shows that most of the studies made use of the Cobb-Douglas production function for analysing the resource productivity. Studies on agricultural productivity highlights the fact that most of the studies pertain to the assessment of resource productivity of crops other than coconut.

Few studies that explain the coconut scenario, themselves lack a definite methodology. Almost all the studies on coconut are micro-level studies (except a very few) confined to one or two villages. Though all the studies on coconut sought to analyse the trends in coconut area, production and productivity, they can not be regarded as complete and currently valid since
they do not encompass a larger spatial (covering all districts of Kerala) and temporal span. Farming behaviour of the coconut cultivators in Kerala had been the nucleus of many studies. But a study aiming to sketch the current farming pattern of different coconut growing regions of Kerala and to have a relative assessment of these regions seems a potential area yet to be explored. Moreover, the fewness of reliable studies relating to coconut productivity and profitability is a significant lacuna in the existing literature of coconut.

Under these circumstances, there is an urgent need for a detailed economic analysis of coconut cultivation, covering the state of Kerala as a whole. Present study however, attempts to fill in some of the gaps in the literature and tries to overcome some of the limitations of the previous studies. Thus, the relevance of an aggregate level study on a broader perspective of this nature cannot be undermined.

With this backdrop, following objectives are set for the study on the productivity of coconut cultivation in Kerala.

1.4. Objectives

1. Analyse the trends in area, production and productivity.
2. Study the farming behaviour of coconut farmers.
3. Assess the costs, returns and profitability of coconut cultivation.
4. Estimate the resource productivity and productivity indices.
5. Identify the constraints in coconut productivity in the state.
1.5. Theoretical framework

The work is in the neo-classical perspective, analysing the economic aspects of coconut cultivation. This involves a detailed analysis of profitability and productivity aspects. Understanding and recognizing the importance of measuring agricultural productivity, productivity of coconut cultivation is analysed by using appropriate models. The study draws from the works of J.W.Kendrick.

1.6. Methodological Framework

Present study defines a coconut cultivator as a person, who is having at least 20 cents of land under coconut cultivation, with not less than 10 coconut palms. Both secondary as well as primary data are utilized to have a deeper analysis of the coconut sector. A complete and exhaustive assessment of the performance of coconut in Kerala for the last 40 years, using various statistical tools, has been made. Secondary data has been analysed by fitting different trend equations so as to throw light on growth rates in area, production and productivity of coconut. Magnitude of variability of different parameters is gauged using MacBean Instability Index. Output growth in Kerala is partitioned into area effect and yield effect using the Decomposition model. Kinked Exponential Model is employed to estimate the period-wise growth rates in coconut cultivation.

However, since secondary data is insufficient to explain the economic aspects of coconut cultivation, a primary survey is found essential.
Primary survey is conducted through a properly designed interview schedule. Relevant information on various aspects of cultivation of the crop are collected from 300 coconut cultivators, hundred each from three different agro-climatic regions.

Cost of cultivation of coconut and returns from coconut cultivation are collected for four different age-groups of the palm. After computing the per-acre costs and returns with and without inter/mixed-cropping, net returns based on various costs, namely, cost A, cost B, cost C and cost D are worked out for each region. Regional profitability of coconut cultivation is assessed with benefit-cost ratio also.

Productivity of coconut cultivation is measured by using the Total Factor productivity measures. Resource productivity and returns to scale are worked out for different agro-climatic regions. Productivity index of different regions is also computed using Kendrick's Total Factor productivity Index.

Finally a constraints analysis is employed to identify the major constraints observed by the coconut cultivators.

1.7. Scheme of the thesis

The study has been structured in six chapters. After introducing the topic in the leading section of this chapter, a thorough scan on the available literature is also made in order to fix the gap in the literature. While second chapter presents an analysis of the secondary data, to judge
the performance of the crop over the years, chapter three makes a cross sectional analysis of coconut cultivation in Kerala through the primary data collected. Costs, returns and profitability of coconut cultivation are dealt with in chapter four. Chapter five discusses the productivity aspects of coconut cultivation and the last chapter summarises major findings and recommendations of the study.