ECONOMICS OF COCONUT CULTIVATION IN CALICUT DISTRICT

By

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THESIS

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D E C L A R A T I O N

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

Vellanikkara,

4-12-1987

PREMAJA.P.

C E R T I F I C A T E

Certified that this thesis entitled "Economics of Coconut Cultivation in Calicut district" is a record of research work done independently by Km. Pramaja.P., under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

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C E R T I F I C A T E

We, the undersigned members of the Advisory Committee of Kum. Premaja.P., a candidate for the degree of Master of Science in Agriculture with major in Agricultural Economics, agree that the thesis entitled "Economics of Coconut Cultivation in Calicut district" may be submitted by Kum. Premaja.P. in partial fulfilment of the requirement for the degree.

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INTRODUCTION

Perhaps no other crop plant in the tropics has so much to offer to mankind as the coconut palm. Equally great are the scientific challenges that this palm poses. It is one of the fine crops, the usefulness of which cannot be over-exaggerated. Every part of the tree is put to economic use. For Kerala which has the major share of the total coconut area in India, coconut cultivation is both a way of life and a means of livelihood. The palm supports a vast multitude of people through its varied uses and ancillary cottage and small scale industries. No wonder the palm is aptly referred to as the 'Kalpa Vriksha'.

Coconut grows ideally in humid tropical regions. It adapts itself to a very wide range of soil conditions from littoral sand to clayey soils, ill-drained low lying marshes to well drained hill slopes, strongly acidic peaty soils to alkaline calcerous soils.

India isthe third laryest coconut producing country in the world. In India, the west coast belt accounts for more than 80% of the area under this crop. Though the per hectare productivity of coconuts in India is comparable to that of other major producing countries,

the per palm productivity and the unit output of copra are comparatively low. To some extent, this is compensated by the quality of copra in terms of oil output. Coir and coir products, milling copra and coconut oil are the major commercial products produced in the country.

Kerala traditionally has accounted for the largest share in coconut production in India. But of late, its share has been on the decline. Tamil Nadu, Karnataka and Andhra Pradesh are taking to coconut cultivation in a big way. Nearly 85% of the production in India is accounted for by Kerala, Karnataka and Tamil Nadu, as is evident from table 1.1, which presents the area and production of coconuts in the different states of the country. Although Kerala accounts for 58.6% of the area under coconut in India, it contributes only 45.9% of the output. On the other hand, Tamil Nadu with 12.2% share in area, accounts for 23.9% of the production and Karnataka for 16.5% of output from a similar share in All-India acreage (Indian Coconut Journal, 1985).

In Kerala, coconut is mainly a small holders' crop. Over 90% of the holdings are less than one hectare in area. The crop is grown in homestead gardens and small holdings. Coconut is grown in all the districts of Kerala. Most of the crop is grown under rain-fed condition.

Table 1.1 All India Estimate of Coconut (1983-84)

State/Union Territories	Area (Thousand hectares) 1982-83	1983-84	Production (Million nuts) 1982-83	1983-84
Andhra Pradesh	44.7	46.5	184.9	192.4
Assam	6.5	7.5	45.9	47.9
Karnataka	182.6	186.2	950.3	966.5
Kerala	674.4	676.4	3184.0	2694.7
Maharashtra	11.2	11.2	61.1	61.1
Orissa	23.3	23.3	97.9	97.9
Tamil Nadu	143.9	140.6	1434.6	1402.2
Tripura	1.4	1.4	1.7	1.7
West Bengal	14.4	14.9	157.4	167.7
Andaman & Nicobar islands	20.8	20.8	96.6	96.6
Goa,Daman & Diu	21.6	21.6	105.5	106.0
Lakshadweep	2.8	2.8	21.8	22.2
Pondicherry	1.6	1.6	14.4	14.1
All India	1149.2	1154.8	6356.1	5871.0

Source : Indian Coconut Journal, 1985. 15 (12) : 25.

The district-wise area and production of coconuts in Kerala for the year 1983-84 is given in table 1.2 (Fig.1) Calicut district takes pride in being first both in production and acreage, closely followed by Cannanore and Quilon, as is evident from the table. With coconut occupying the maximum area under crops covering 49.55% of the total cropped area, it is one of the major sources of income to the cultivators in Calicut district (Farm Guide, 1986). A notable feature is that the area under coconut increased slowly from 96,900 hectares in 1973-74 to 104,885 hectares in 1977-78 in this district. (Status paper, Calicut district, 1980). It came down to 100,164 hectares by 1983-84, with a productivity of 5481 nuts per hectare, the highest among all the districts in Kerala.

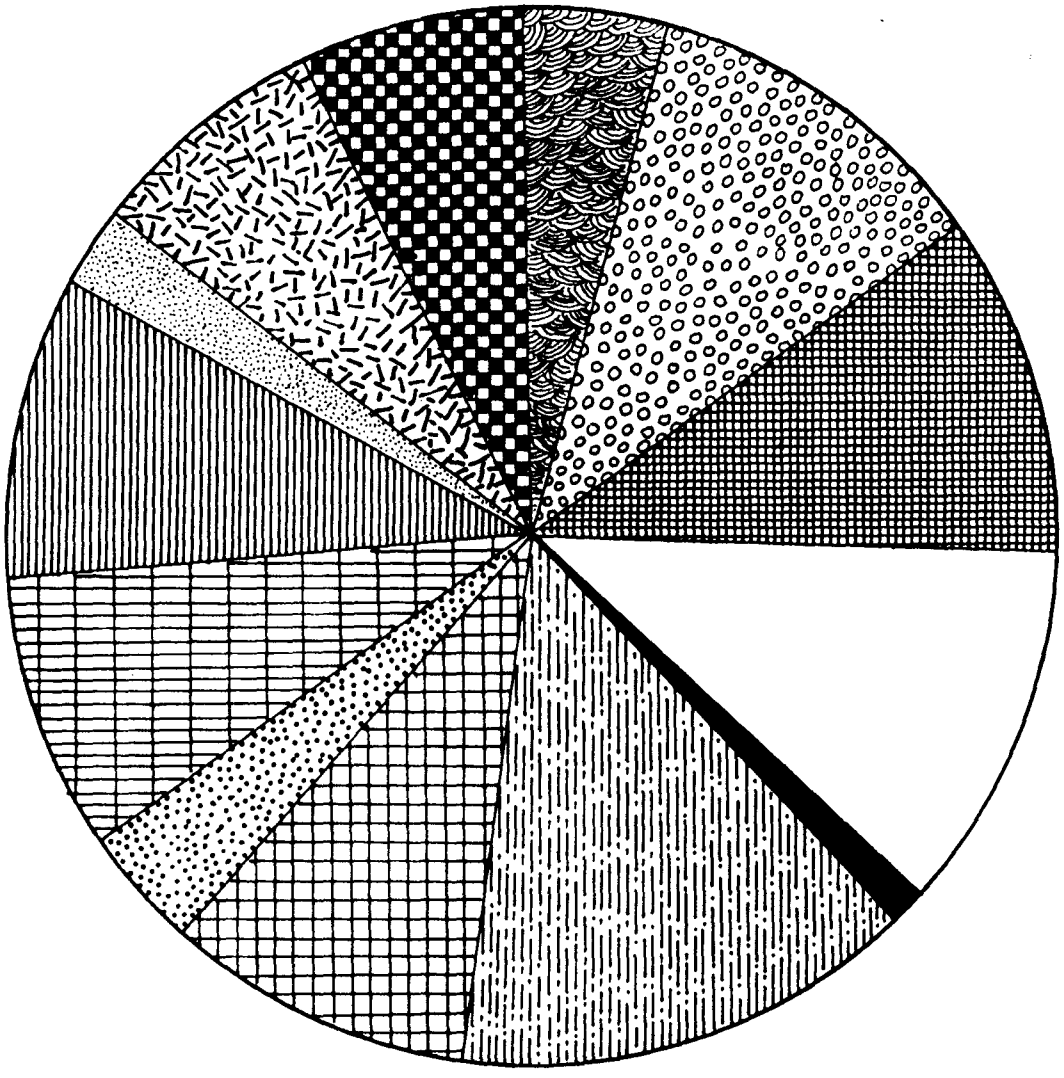
The importance of coconuts in the agricultural economy of Kerala needs no emphasis. Kerala's economy is closely woven with the fortunes in coconut trade since coconut and its subsidiary coir industry is the main stay of the economy as it generates a variety of employment. With coconut having become a part and parcel of one's daily life, a study of the economics of its cultivation has great relevance. The fact that Calicut district ranks first in Kerala, with regard to acreage, production and productivity of coconuts, upholds the significance of selection

Table 1.2. District-wise Area and production of Coconut in Kerala(1983-84)

District	Area (Hectares)	Percentage	Production (Million nuts)	Percentage
Trivandrum	73568	10.78	220	8.46
Quilon	75018	11.00	223	8.67
Pathanamthitta	28807	4.22	79	3.03
Alleppey	46907	6.88	180	6.91
Kottayam	50914	7.46	223	8.57
Idukki	16523	2.42	40	1.53
Ernakulam	62038	9.09	264	10.15
Trichur	58929	8.64	322	12.38
Palghat	23186	3.40	63	2.42
Malappuram	60739	8.90	162	6.23
Calicut	100164	14.68	549	21.10
Wynad	3612	0.53	2	0.08
Cannanore	81876	12.00	275	10.57
	682281	100.00	2602	100.00

Source : Farm Guide, 1986. Farm Information Bureau, Government of Kerala. PP. 12,18.

FIG. 1. DISTRICT WISE AREA UNDER COCONUT IN KERALA (1983-'84).



DISTRICT	PER CENTAGE
TRIVANDRUM	10·78
QUILON	10·99
PATHANAMTHITTA	4·22
ALLEPPEY	6·87
KOTTAYAM	7·46
IDUKKI	2·42
ERNAKULAM	9·09

DISTRICT	PER CENTAGE
TRICHUR	8·67
PALGHAT	3·39
MALAPPURAM	8·90
KOZHIKODE	14·68
WYNAD	0·53
CANNANORE	12·00

climatic and economic aspects of Calicut district is given in chapter-2. The relevant literature has been reviewed in chapter-3 chapter-4 deals with the method of analysis followed in the study. The results of the study and the discussions thereon are dealt with in chapter-5, which is divided into 7 sections. In the first section, an account of certain general socio-economic features of the sample farmer house holds is given. The cost of cultivation of coconut, cost of production, capital productivity, resource-use efficiency, general problems faced by the sample farmers and the impact of incentives given by different agencies are dealt with in the sections that follow. Chapter-6 deals with the summary of the major findings of the study.

of this particular district for the present study. The specific objectives of the study are indicated below:

1. To estimate the costs and returns in coconut cultivation.
2. To evaluate the resource use efficiency of yielding coconut plantation.
3. To identify the problems of coconut cultivators.
4. To examine the impact of incentives given by different agencies for coconut cultivation.

A study to fulfill these objectives needs data on various items of costs, and relating to all aspects, as they occur at different stages. The data collected from coconut growers by personal interview method were used for the purpose of the study.

The results obtained from the study would be useful in locating weak-spots in the various aspects of coconut cultivation. The data on cost structure and returns would be of use in formulating policies. The problems of the coconut cultivators could be identified and remedial measures suggested. The economic evaluation can thus pave way for the rapid progress of the agricultural economy of Kerala.

This thesis is divided into six chapters including the introductory chapter. A brief description of the agro-

climatic and economic aspects of Calicut district is given in chapter-2. The relevant literature has been reviewed in chapter-3 chapter-4 deals with the method of analysis followed in the study. The results of the study and the discussions thereon are dealt with in chapter-5, which is divided into 7 sections. In the first section, an account of certain general socio-economic features of the sample farmer house holds is given. The cost of cultivation of coconut, cost of production, capital productivity, resource-use efficiency, general problems faced by the sample farmers and the impact of incentives given by different agencies are dealt with in the sections that follow. Chapter-6 deals with the summary of the major findings of the study.

AREA OF STUDY

In this chapter a brief description of the study area is attempted. It is hoped that itwill provide a useful background information to the details that follow.

Calicut district is located towards the northern and of the state of Kerala. The district is bounded on the north by Cannanore district, on the east by Wynad, district, on the south by Malappuram district and on the west by Arabian sea. It is situated between north latitudes 11° 08' and 11° 58' and east longitudes 75° 30' and 76° 20'.

The headquarters of the district is Calicut. There are 3 taluks in the district,viz, Calicut, Badagara and Quilandy. The whole district is also dividedinto 12 community development blocks each consisting of a number of Panchayats. The total geographical area of the district is 233330 ha which forms 6% ofthe total area of the state. Based on the physical features, the entire district can be divided into three natural divisions:

(1) The mountainous region - high land, 250 ft above MSL,
(2) The flat coastal belt - low land falling below 25 ft and
(3) The undulating area in between the above two regions- the mid land.

The district has a coastal length of about 80 Km. It has a fairly salubrious climate. The high land region has bracing cold climate for the most part of the year whereas the other regions enjoy a temperate climate. The most important rainy season in the district is the South-West Monsoon commencing from June and ending in September. The other rainy season is the North-east monsoon which generally lasts from October to November. Compared to the other districts, Calicut district has more rainfall. Monthly distribution of rainfall in Calicut district is furnished in Table 2.1.

Humidity isvery high in the Coastal region. It is maximum during July-August and is minimum during January.

The soils of this district are of three major types: Sandy loam, loam with laterite sub soil and virgin forest soils. In the narrow coastal belt the soil is sandy while laterite soil occurs in the major part of the district. The beach sands are reported to contain elements of monazite and ilmenite. The mid land region containg mostly laterite soil and only in some parts forest soil is found. The high land is covered by forest soil, very rich in organic compounds. The laterite soil found in the mid land region is soft and suitable for garden/plantation crops like coconut, arecanut and fruit crops. The forest soil is very rich in organic matter and is particularly

Table 2.1 Average monthly rainfall for Calicut district - 1984

Month	Rain fall (in mm)
January	24.2
February	25.1
March	54.7
April	250.0
May	31.0
June	724.1
July	641.3
August	381.8
September	-
October	275.0
November	76.6
December	12.7
Annual	2496.5

Source : Farm Guide, 1986. Farm Information Bureau, Government of Kerala. Pg. 31.

suitable for crops like rubber, tea, cardamom, coffee and cocoa.

The district is blessed with a number of rivers. The important rivers in the district are Kuttiadi, Kerapuzha, Kallai, Chaliyar and Kadalundi.

The total population of the district as per 1981 census was 22.45 lakhs with 72.99% of the population living in rural areas and the rest 27.01% in urban areas. Calicut district has a high literacy rate of 70.12% with 68.59% in rural areas and 74.22% in urban areas. Density of population for the district is 957 persons per Sq.Km, with 748 per Sq.Km in rural areas and 3821 persons per Sq.Km in urban areas. The total number of workers in the district is 491966 of which 27437 are cultivators, 70516 are agricultural labourers, 14233 are household industry workers and 379780 employed in other sectors.

The land use pattern of Calicut district as shown in table 2.2 reveals the total cropped area as 202148 ha which was 86.63% of the total geographical area during the year 1983-84. The distribution of operational holdings in the district during 1976-77 is given in table 2.3. Out of a total number of 3.17 lakh holdings, 87.77% were below 1 ha in area. The cropping pattern for the year 1982-83, showing the area under different crops and their percentages to total is given in table 2.4. Coconut is the predominant perennial crop with an area of 100164 ha. The major food crop grown is rice.

Table 2.2 : Total area and classification of area (in ha) in Calicut district during the year 1983 - 84

		Percentage
Total geographical area	233330	100.00
Area under Forest	41386	17.74
Land put to non-agricultural uses	18437	7.90
Barren and uncultivable lands	2412	1.03
Permanent pastures and other grasing lands	166	0.07
Land under miscellaneous tree crops	3816	1.64
Cultivable waste land	3717	1.59
Fallow other than current fallow	1539	0.66
Current fallow	2480	1.06
Net area sown	159377	68.31
Area sown more than once	42771	18.33
Total cropped area	202148	86.63

Source : Farm Guide, 1986. Farm Information Bureau, Government of Kerala. PP. 8.

Table 2.3 : Operational holdings in Calicut district according to size - 1976 - 77 (Size of holding/ha)

Size of holding	Number of holdings	Percentage of total
0.02 - 0.99	278339	87.77
1.00 - 1.99	24710	7.79
2.00 - 3.99	10371	3.27
4.00 - 9.99	3221	1.02
10.00 & above	487	0.15
Total	317128	

Source : Agriculture Census, 1976 - 77. Directorate of Economics and Statistics, Kerala.

Table 2.4 : Cropping pattern in Calicut district during the year 1982 - 83

Crop	Area in ha	Percentage
Rice	23155	11.45
Jowar	10	0.005
Ragi	10	0.005
Other cereals	14	0.01
Pulses	1361	0.67
Sugar crops	368	0.18
Pepper	12753	6.31
Arecanut	5834	2.89
Tamarind	544	0.27
Other spices & condiments	2710	1.34
Mango	5878	2.91
Jack	5967	2.95
Banana	1073	0.53
Pineapple	319	0.16
Other fruits	4023	1.99
Cashew	4599	2.28
Tapioca	3361	1.66
Vegetables	5337	2.64
Cocorut	100164	49.55
Other oil seed crops	150	0.07
Drugs & Narcotics	865	0.43
Rubber	18765	9.28
Other plantation crops	989	0.49
Fodder crops	87	0.04
Green manure crops	909	0.45
Other non food crops	2903	1.44
Total cropped area	202148	100.00

Source : Farm Guide, 1986. Farm Information Bureau, Government of Kerala. PP. 9 - 13.

Spices and condiments occupy an area of 21,841 ha and fruit crops an area of 17260 ha.

The area under irrigation (Crop - wise) in the district during 1982-83 is given in table 2.5. The total area under irrigation was 7619 ha of which 168 ha was under coconut. The net area irrigated (Source-wise) during 1982-83 is given in table 2.6. The major source of irrigation in the district is government canal which catered to the irrigation of an area of 3382 ha during 1982 - 83.

The areas covered in the study are shown in the map of Calicut district (Fig.2).

Table 2.5 : Area under irrigation (Crop-wise) in Calicut district during 1982 - 83

Crop	Area in ha.	Percentage to the area under the crop
Paddy	3761	16.24
Tubers	29	1.25
Vegetable	160	2.99
Coconut	168	0.17
Arecanut	44	0.75
Cloves, Nutmeg	3	4.84
Other spices and condiments	4	0.03
Banana	721	67.19
Betel leaves	22	48.89
Others	2707	5.62
Total	7619	3.77

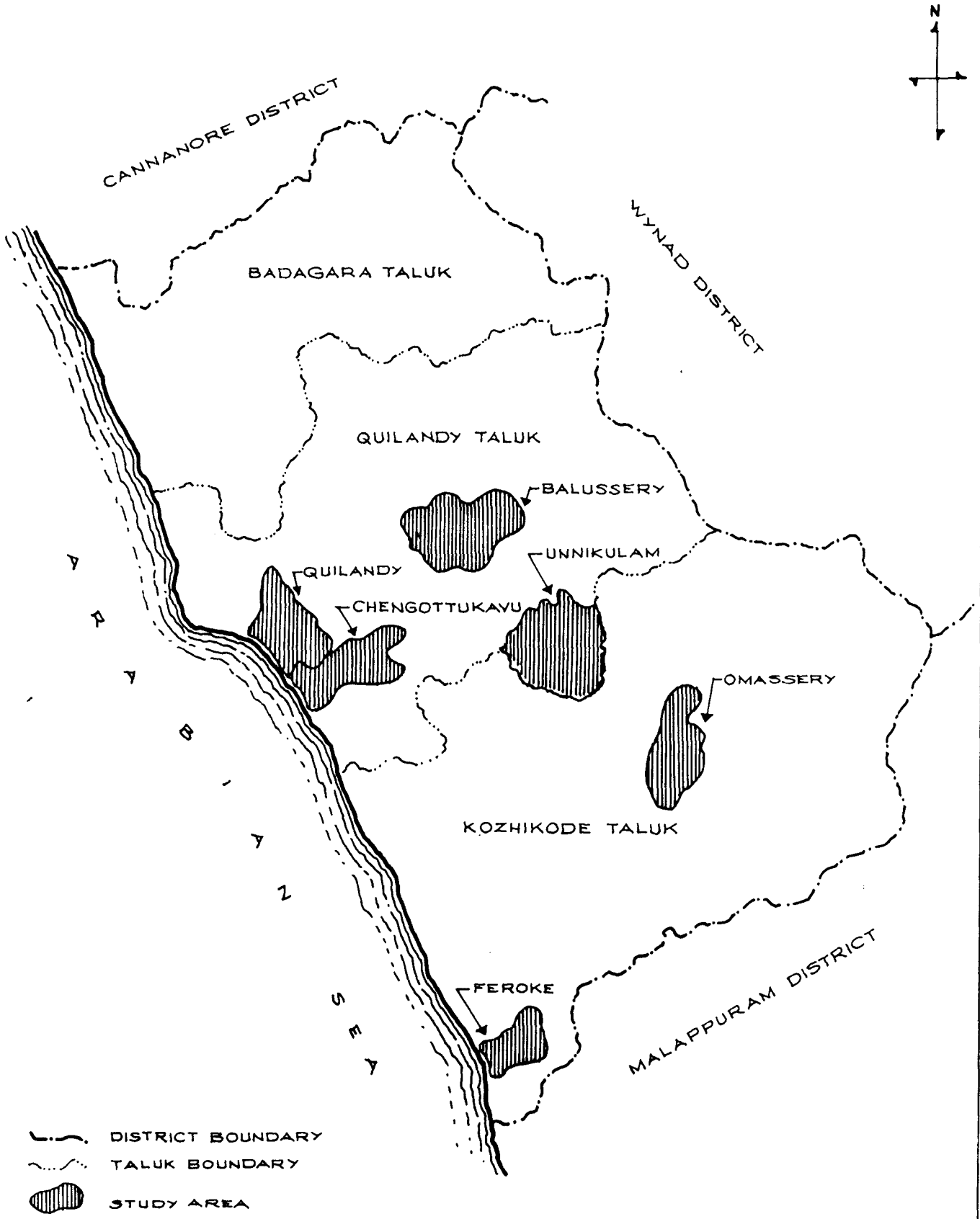
Source : Farm Guide, 1986. Farm Information Bureau, Government of Kerala. PP. 35.

Table 2.6 : Net area irrigated (source - Wise) in Calicut district during 1982 - 83.

Source	Area in ha
Government canal	3382
Private canal	144
Government tanks and wells	138
Private tanks and wells	764
Minor & lift Irrigation	1733
Other sources	1311
Total	7472

Source : Farm Guide, 1986. Farm Information Bureau, Government of Kerala. PP. 36.

FIG.2. MAP OF CALICUT DISTRICT
SHOWING STUDY AREA



REVIEW OF LITERATURE

Review of studies on cost of cultivation of coconuts, resource use efficiency, credit and other economic problems faced by coconut cultivatory are presented in this chapter.

Cheyne(1952) made a revised estimate of expenditure on replanting of coconuts in Ceylon. Based on the cost of materials, seedlings, transport and labour at the time of compilation,1952, the first year total expenditure was Rs. 642/- per acre. The second year, third year, fourth year, fifth year, sixth year and seventh year expenditures were Rs. 157.50, Rs. 122.50, Rs. 71.50, Rs. 115.50, Rs.114.50 and Rs. 107.50 respectively, the total for six years coming to Rs. 689/-. The total estimated cost per acre for seven years equalled Rs. 1331/-.

Reporting on the credit requirements of coconut cultivators in Kerala, Mathew (1960) said that the typical coconut cultivator was a small man who had very little income to lay by for the purpose of fertilising his garden of a few trees. In such a situation it was necessary that he should be supplied with adequate credit to purchase all the fertilisers required for his coconut trees for two

years at a stretch.

Gregory(1962) in his editorial on credit facilities tc Kerala coconut growers said that the Kerala Government had implemented several schemes under which inducements in the form of subsidies and loans were given to coconut growers for bringing under coconut, additional area and for increasing the production of existing coconut stands. Some of the important inducements were 1) supply of spraying equipments to coconut growers at half the cost;(2) loans at Rs. 3000/- per acre for reclamation of 'Kayal lands' fit for coconut cultivation; (3)loans for fitting up filter pumps at Rs. 2000/- per pump and filter points at subsidised rates to develop irrigation facilities in the coastal coconut areas; (4) supply of filter points and engines to work them in sandy and other experiencing drought conditions on loan basis and (5) distribution of coconut manure loans repayable in easy instalments. Besides these, coconut growers in the state could also get credit facilities for coconut improvement, under the 'General Land Improvement Loans'Programme.

Based on the results of a long range experiment laid down at Central Coconut Research Station,

Kasaragod Marar (1963) reported the profitable nature of improved practices in coconut cultivation. The increase in yield got per tree per year from the regularly manured and cultivated plot over the completely neglected plot averaged to 42.3 nuts which, on the basis of 60 trees per acre worked out to an extra yield of 2538 nuts per acre for an additional expenditure of Rs. 126 only per acre.

According to Lakshmanachar(1964), demonstration in 180 fields dotted over 350 miles from Tellicherry to Kanyakumari for 8 years proved beyond doubt to coconut cultivators that balanced N P K manuring is the key to increased coconut production. It was found that in red loam soil, it was possible to increase the production of nuts by nearly 35% and copra out turn by 44% by regular manuring and interculturing operations. Such manuring resulted in a net profit of Rs. 88 per acre based on nut yields and Rs. 130 per acre based on quantity of copra.

In an economic analysis of production and marketing of coconuts in Tiptur Taluk of Tumkur district of Mysore States, Alikhan(1972) reported that the average cost per acre to establish a coconut

plantation upto bearing stage was Rs. 1,533.43 in the small and Rs. 1491.94 in the large farms. The average total cost of cultivation per acre of coconut was Rs. 623.62 and Rs. 656.05 in small and large farms respectively, excluding market charges. The cost of production of 1000 nuts was Rs. 358.97 in small farms and Rs. 309.94 in large farms. Net income per acre exclusive of direct and indirect costs was Rs.541.26 and Rs. 891.10 in the small and large farms respectively. In small farms, tillage practices, farmyard manure, addition of new soils and age of the garden were found to contribute significantly to gross income and their resepective elasticity coefficients were 0.6743, 0.9124 and 0.1917. In the large size group, tillage practices and manures were found to be significant and their respective elasticity coefficients were 1.775 and 0.3666.

Kunhiraman et al (1974) calculated the cost of production of coconuts from a 0.62 hectare plot at the Central Plantation crops Research Institute, Kasaragod, planted with the West Coast Tall variety and managed under recommended dose of fertilisers and cultural operations. The total cost of cultivation

for the entire plot during 1972-73 was Rs. 770. This worked out to Rs. 1243.55 per hectare of a plantation that just commenced bearing. Based on the yield of nuts from palms of stabilised yield, the annual cost of cultivation worked out to Rs. 156.15 for producing 1000 nuts.

Reporting on coconut production in Srikanka, Abeywardena (1975) said that an economic anlysis of fertiliser use based on local costs and prices indicated that the local grower could expect a return on investment in fertilisers of 107% after the first year, rising to 447% in the tenth year. An analysis based on export prices of coconut products and full import prices of fertilisers indicated that returns to the Government could rise to 624% by the tenth year.

The Directorate of Agriculture, Government of West Bengal (1976) reported that the annual expenditure for a bearing palm in the State worked out to Rs. 12 on account of manuring and dressing, spraying, cleaning, irrigation and harvesting. The annual gross income from such a well managed bearing palm was expected to be Rs. 32 being sale proceeds of 40 mature nuts. Thus the net profit was expected to Rs. 20 from

one bearing palm. As 225 palms comprised one hectare of land, the net income from one hectare was likely to be Rs. 4500.

An annual yield increase of 31 nuts per palm due to supplementary basin irrigation given during the summer to coconuts grown in red sandy loam soil was reported by Bhaskaran and Leela (1978) based on a study at the Central Plantation Crops Research Institute, Kasaragod. About 50 percent of the yield increase was achieved during the transit period of production, comprising the first 3 years. The cost-benefit ratio of irrigation was estimated at 1 : 3.

Margate et al (1978) in a long-term KCl fertilisation study of bearing coconuts in an inland-upland area of Davao, Philippines reported that a maximum net return of ₱ 26.52 per tree per year was realised when KCe fertiliser of 2 Kg per tree per year was applied which also gave the highest return of ₱ 2.47 per peso invested. Based on the price situation of 1977, the 2 Kg KCl rate was the most economical treatment which gave the highest return per peso invested.

In a report on the coconut-industry of Sri-Lanka in the year 1978, De' Silva (1979) said that the estimated total production of coconut during the year was 2,207 million nuts. The cost of production of a

coconut amounted to Rs. 0.25 during the year.

Joseph (1980) in an economic evaluation of three major plantation crops namely cashew, rubber and coconut in Kerala reported that the net present value for coconut was equal to Rs. 4758. The internal rate of returns was worked out to be 17% and the benefit-cost ratio equal to 2 : 1.

Thampan (1980) discussed the productivity limiting factors in coconut culture in Kerala as unfavourable rainfall patterns, inadequate irrigation facilities, prevalence of root wilt disease, low levels of mineral nutrition and use of unsuitable lands. Rehabalitation of root wilt areas, varietal improvements, optimum fertiliser use and scientific cultural management are discussed as means of combating the present situation.

Magat et al (1981) in an economic analysis of fertiliser usage in inland coconuts grown under the dark brown clay loam soil of Davao, Philippines, concluded that the application of 1.8 Kg Ammonium sulphate and 2 Kg Sodium chloride per palm per year gave the highest net profit of ₱ 4519 per hectare followed by 1.8 Kg Ammonium sulphate, 2 Kg sodium chloride and 4 Kg Dolomite with a net profit of

₹ 4,446 per hectare.

The cost of establishing a One hectare West Coast Tall coconut plantation under rainfed condition in Kerala, into stabilised bearing excluding cost of land was furnished by Nelliat (1981). He reported that during the first year the expenses would be high amounting to Rs. 10,630. The annual recurring expenses would increase gradually because of theincreasing does of fertiliser in the early years and later due to increasing harvest charges. From twelth year, a steady average yield of 50 nuts per palm was expected giving a gross return of Rs. 10,500. On the basis of 1980 prices, annual expenditure worked out to be Rs. 3,560 thus net profit per hectare came to Rs. 6,940 per year. The gross cost of establishing a one hectare coconut plantation upto the end of ninth year under rainfed condition was Rs. 33,180. The gross investment for establishing one hectare of irrigated coconut plantation upto the end of sixth year would be Rs.40,510. Stablised yield was expected from tenth year of planting and the annual net profit was Rs. 13,165.

Patel (1981) considered coconut production in India to be highly rewarding and reported that total

production of about 5000 million nuts in the Country was of the value of over Rs. 600 crores at prevailing market price. The total value of the coconut oil produced in the country was over Rs. 200 crores. The coir and coir products exports was of the value of Rs. 19.4 crores in 1975-76. Value of shells in the country was estimated as Rs. 120 million.

The results of fertiliser trials conducted by Pillai et al (1981) on adult and young West Coast Tall palms grown in sandy soils of root (wilt) affected areas at the Central Plantation Crops Research Institution, Regional Station, Kayangulam, indicated that for adult palms the lowest dose tried namely 350 gm N, 300gm P2 05, 600gm K2 O and 500gm MgO per palm per year could be taken as an economic dose. Even though increased yield was obtained at higher levels of fertilisation, the lowest dose in the trial namely 500gm N, 300gm P205, 1000gm K20 with 500 gm MgO which gave an average yield of 140 nuts per palm per year could be taken as the economic dose in the early bearing periods.

Smith and Allen (1981) reviewed the future for coconutas a World crop and concluded that the key was a well funded and internationally coordinated

net work of research and development. Constraints at farm level included the lack of short-term capital for improvements and unwillingness to risk increased costs. In small holder systems, efficient marketing presented a problem. Labour was frequently scarce, because of rural-urban migration.

A study of the economics of coconut cultivation in Irinjalakuda block in the command area of Peechi irrigation project in Kerala, without taking into account costs incurred during the pre-bearing stage was made by Bastine (1982). The following conclusions were arrived at average cost of maintenance per hectare was Rs. 6330.79. Average main product value obtained per hectare was Rs. 12,107.23. On an average the net income at cost C worked out to Rs. 7,560.98 and benefit cost ratio at cost C was 2.19. Analysis of resources use showed that family labour decreased with the size of holding, both for male and female labour, the average being 40.56 hours and 3.06 hours respectively. Quantity of NP and K applied per hectare on an average were 5.20Kg, 6.49kg and 17.34kg which was only 7.65%, 19% and 12.75% of the recommended quantities of 68:34:136.

Reporting on the development of small coconut

holdings in Sri Lanka, Liyanage (1982) said that amongst the many constraints that the farmers are faced with, the unremunerative prices, sometimes deliberately kept down in the interests of the consumer do not leave any surplus for re-investment.

Mandal and Metha (1982) in a case study of the performance of coconut cultivar (Benaulim) in Goa, reported that the net income per hectare during pre-irrigation period of 3 years, post-irrigation period of 5 years and integrated use of manuring, irrigation and other cultural care for 5 years was estimated at Rs. 774, Rs. 5800 and Rs. 14,120 respectively. The study revealed that irrigation alone increased the yield per hectare by 12.9% and irrigation-cum-manuring by 24.5% over no manuring and no irrigation. Further irrigation-cum-manuring could increase yield per hectare by 50.5% over irrigation alone. Thus coconut cultivation adopting proper management practices would be a very profitable proposition in Goa region, using the local cultiver 'Benaulim'.

From a survey of coconut farms in Bolol, Quiccy and Caintic (1982) reported that the most common

problems encountered were low productivity, high labour costs, poor transport facilities, pests, thieves and lack of capital.

Rao (1982) studied the economics of coconut cultivation in Ollukkara block in the command area of Peechi irrigation project in Kerala, without taking into account costs incurred during the pre-bearing stage. The average total cost (cost C)was worked out as Rs. 5184.86 per hectare. The average gross returns per hectare was Rs. 10,953.15. Benefit-cost ratio was 4.838 at cost A and 2.425 at cost B.

The economics of coconut cultivation in Pushakkal block in the command area of Peechi irrigation project in Kerala was studied by Santha (1982) without taking into account costs incurred during the pre-bearing stage. The average cost of maintenance per hectare was calculated as Rs. 9,029.81. On an average gross returns from coconut was Rs. 14,289.32 per hectare of which 89.15% was through sale of coconut. Overall net income per year at total cost was Rs. 5,261.49 per hectare.

Mustapha (1983) in his preliminary exposition

on the effects of subsidy policies on small-holder coconut sector in Sri Lanka said that the production and income small holders had increased as a result of Government intervention and support through replanting and rehabilitation subsidies and grants. This implied that subsidies and grants to a certain extent, had provided incentive benefit in the cultivation of coconut among small holders. In general, it could be said that the provision of subsidies and grants had increased the small holder's production efficiency and income, though to a certain extent, the latter may had also been influenced by market forces, that is prices.

A spacing and fertiliser trial was conducted by Pillai and Khan (1983) in the black and red soils of 'maidan' tract of Arsikere in Karnataka, under the All India Coordinated Coconut and Arecanut Improvement Project. They reported that planting coconut at 7.3m x 7.3m spacing and fertiliser dose of 660:454:906gm N,P and K per palm per year gave maximum nut yield. Planting of coconut with a spacing of 6.1m x 6.1m with the same level of fertiliser dose gave highest gross and net income of Rs. 17,126 and Rs. 12,454 per hectare respectively.

Das (1984) reported that the cost of production of coconuts in Kerala had been estimated at Rs.1.10 per nut under 1982-83 factor costs, without taking the value of land into consideration. In view of the fact that the rate of appreciation of land was significently higher than that of bank interest rates and the land market was out of normal economic ambit, there was no justification to include land value in the investment in present Kerala situation. When a moderate price of Rs. 50,000 per hectare of land was added to the investment on coconuts, the production cost came to Rs. 1.94 per nut. Considering the average production cost and farm gate price of coconut as Rs. 1.10 and Rs. 1.50 per nut respectively, the net returns worked out to be Rs.4,200 per hectare. The cost of bringing one hectare of coconut garden to bearing or the total establishment cost per hectare came to Rs.35,300. The annual maintenance cost came to Rs. 5,500. Since coconut was a small holder plantation crop, atleast 75% of labour required for various operations, excluding harvesting could be expected from the farmer's family itself. Therefore, the returns to family labour and investment per hectare of coconut garden worked out to be Rs.5,760 per annum. The study thus revealed that coconut

cultivation under good management was a profitable proposition in Kerala.

The average annual cost of maintaining a coconut garden in Kerala was estimated by George and Rajasekharan (1985). Using the budgeting technique, it worked out to Rs. 3,888 per hectare. On adding the interest on capital investment for the value of land at the rate of 15% to the annual maintenance cost, the total annual cost worked out to Rs. 18,888. On the basis of an average yield of 9000 nuts per hectare the average cost per 100 nuts worked out to Rs. 210, excluding the cost of management and own labour. Internal rate of returns in coconut cultivation was calculated to be 15% at the price of Rs. 226 per 100 nuts.

MATERIALS AND METHODS

The present study on Economics of coconut cultivation is based on data collected from a sample of cultivators in Calicut district. The procedure adopted in sampling as well as the method of analysis are explained in this chapter.

SAMPLING PROCEDURE

The entire district of Calicut was divided into two zones, sandy zone (Zone I) and laterite zone (Zone II) based on the predominant soil type. Three-stage random sampling design was used for selection of sample farmers for collection of data from the zones with Panchayat as first stage unit, Panchayat ward as second stage unit and coconut growers as third stage unit. From each zone, a sample of 3 Panchayats was selected with probability proportional to area under coconut. The Panchayats thus selected were Quilandy, Chengottukavu and Feroke from zoneI and Balussery, Unnikulam and Omassery from zone II. From each selected Panchayat, two wards were selected at random. A list of coconut growers in the selected Panchayat ward was prepared and their holdings were stratified into the age groups of 0-7 (Planting to flowering stage), 8-15 (Flowering to steady bearing stage) and 16-50 (Steady bearing stage). 3 cultivators each were selected from

first and second groups and 4 cultivators from the third group at random. Thus in total, a sample of 120 cultivators were selected. The selected cultivators were personally interviewed and data recorded on a well structured interview schedule. A specimen of the schedule is given in Appendix-I.

COLLECTION OF DATA

The coverage of this study was limited to west cost tall variety of coconut and hence, the full economic potential of this crop with hybrids as well as under inter/mixed cropping have not been analysed. Further, the crop dealt with here is grown under rainfed condition and subject to two to three life-saving summer irrigation.

The information collected included the area under coconut, item wise and yearwise costs and returns, problems faced by the cultivators and the resource use efficiency. From the holdings of 0-7 age group, data on labour hours spent, labour charges incurred, cost of various inputs utilised and other details for operations such as clearing, leveling and bunding, fencing, digging pits, purchase of seedlings, planting, gap-filling, shading, farm-yard manure and fertiliser application, mulching, inter-cultivation operations and plant protection were collected. From the eighth year onwards, details of harvesting operation were also collected, in addition to

the other details, and included labour hours spent and expenses incurred for harvesting of nuts, heaping and transportation, the number of nuts and dry leaves harvested and the total income obtained from the holding. The survey was conducted during September-November, 1985 and the reference period taken into consideration was 1985-86.

METHOD OF ANALYSIS

The percentage analysis, capital productivity analysis and functional analysis were used for analysing and interpreting the data.

CONCEPTS USED IN THE STUDY

HUMAN LABOUR

(a) Family labour - The actual work done by the member of the family on crop production was taken as family labour.

(b) Hired labour - The actual paid wage labour engaged in crop production was considered as hired labour.

Both family and hired labour were treated alike, considering 8 hours work as one man-day and evaluated on the basis of actual wages paid by the farmer.

LAND TAX

It was taken at the actual rate paid to the revenue

department, which was Rs.10 per hectare during the year 1985 - 86.

COST OF CULTIVATION

Cost of cultivation refers to the total expenses incurred in cultivating one hectare of coconut. The life-span of a coconut palm isexpected to be 60-80 years or even more (Thampan, 1981). The palms start yielding from the eighth year and yield gets stabilised by the sixteenth year of planting. From seventeenth year onwards items of cost remain the same as that of the sixteenth year, while steady yield would continue up to 50 years. From fifty first to fifty fifth year, yield of nuts decline in the reverse order of its increase from eighth to the sixteenth year. Beyond 55 years, the returns over cost would be small and the present worth of this income would be negligibleat the current interest rate. For these reasons analysis was limited to 55 years. Data were collected for a period of 16 years and costs and returns were projected to 55 years. Total cost of cultivation year-wise and item-wise for 16 years was calculated and the percentages of individual items to total costs were worked out for zone I, zone II and for the district.

Being a perennial crop, practical difficulties were experienced in obtaining correct information on income

and expenditure relating to periods much earlier to the period of data collection. Moreover, it was also observed that the costs of inputs had increased considerably over the years. Hence an attempt was made here to present the cost of cultivation as it would have been incurred at 1985-86 prices. For this, information was gathered on the quantities of inputs applied by the sample cultivators during different years from planting till data, that is, for 16 years and evaluated at the rates that existed in the concerned zone during 1985-86.

The cost items included were cost of human labour (both hired and family labour), cost of inputs like seedlings, farm yard manure, fertilisers, plant protection chemicals and materials for fencing, shading and mulching, harvesting charges, cost of tools and implements, land tax and other miscellaneous expenditures. Land value has not been taken into consideration in the present study.

COST OF PRODUCTION

The cost of production of coconuts was worked out in terms of the cost involved in producing one nut. In the computation, the actual expenditure incurred by the sample cultivators was considered.

Cost of production is made up of two major components establishment costs and maintenance costs. For estimating

the cost of production per nut, the following considerations have been taken into account - investment on a coconut plantation as in the case of other investments is an asset that cannot be recycled. The return from the plantation during its yielding period should cover the entire investment plus a fair rate of interest (in this case 11%, the rate at which long-term loan is available), in addition to the annual maintenance cost in the bearing stage(Das,1984.) The total investment, namely costs from the first to the end of seventh year and compound interest thereon were reduced to a capital recovery factor, bearing 11% interest. The capital recovery factor was based on the following formula * :

$$C = \frac{P}{\sum_{t=1}^{n} \frac{1}{(1+i)^t}}$$

Where C = Capital recovery factor

P = Total investment

i = Rate of interest

n = Economic life of the plantation.

The capital recovery factor was added to the annual maintenance charges to arrive at the total annual cost per hectare. From this amount, the income from dry leaves and

* Gittinger, J.P. Compounding and discounting tables for project evaluation. Industrial development bank of India PP.144.

petioles was deducted and the net cost was then divided by the average annual production of nuts during the stabilised period to arrive at the cost of production per nut. Estimation was done separately for zone I, zone II and for the district.

FARMGATE PRICE

For estimating the returns from coconut cultivation, the average farmgate price for nuts was taken into consideration. Due to the fact that the farmgate price of nuts for the year 1985-86 and 1984-85 were highly unusual, the farmgate price for the year 1983-84 was considered which came to be Rs.2.36/nut in both the zones and the district.

CAPITAL PRODUCTIVITY ANALYSIS

Capital productivity analysis brings out the efficiency of capital use in production. There are various methods to measure the capital productivity(Gittinger,1976). The 4 measures used in this study are (1) Pay-back period (2) Benefit-cost ratio (3) Net present worth and (4) Internal rate of return. The estimated annual cost of cultivation and returns obtained over the economic life of the palm were used for these computations. The costs and returns were discounted at 11% rate of interest, being the rate which long-term credit could be obtained.

PAYBACK PERIOD

The payback period is the length of time from the beginning of the project till the net benefit pay up fully the cost of the capital investment (Gittinger, 1976). It is an undiscounted measure of the worth of an endeavour, which measures the efficiency of cultivation by indicating the period within which the returns offset the investment.

The other 3 measures are discounted measures of investment worth.

BENEFIT - COST RATIO

The benefit-cost ratio indicates the return on a rupee of investment. It is defined as the ratio between the present worth of benefits and that of costs. (Gittinger,1976). A project with benefit-cost ratio greater than unity is considered viable.

$$\text{Benefit -cost ratio} = \frac{\text{Present worth of benefits}}{\text{Present worth of costs}}$$

Symbolically,

$$\text{B - C ratio} = \frac{\sum_{t=1}^{n} \frac{Bt}{(1+i)t}}{\sum_{t=1}^{n} \frac{Ct}{(1+i)t}}$$

Where Bt = Benefits in t^{th} year.

Ct = Costs in t^{th} year.

n = Total number of years of the project

i = Rate of interest

NET PRESENT WORTH

The most straightforward discounted cash flow measure of project worth is the net present worth. This is simply the present worth of the net cash flow stream. (Gittinger,1976). It tries to project the feasibility of cultivation and is the difference between the present worth of benefits and present worth of costs. The formal selection criterion for the net present worth measure of project worth is to accept all projects with a positive net present worth when discounted at the opportunity cost of capital.

Symbolically, Net present worth (NPW)

$$= \sum_{t=1}^{n} \frac{Bt - Ct}{(1 + i)^t}$$

The symbols are the same as mentioned earlier.

INTERNAL RATE OF RETURN

Another way of using discounted cash flow for measuring the worth of a project is to find that discount rate which just makes the net present worth of the cash flow equal zero. This discount rate is termed the internal rate of return and, in sense, represents the average earning power

of the money used in the project over the project life (Gittinger, 1976). The formal selection criterion for the internal rate of return measure of project worth is to accept all projects having an internal rate of return above the opportunity cost of capital.

Symbolically, internal rate of return (IRR) is that discount rate 'i' such that

$$\sum_{t=1}^{n} \frac{Bt - Ct}{(1 + i)^t} = 0$$

The symbols are the same as mentioned earlier. The value of 'i' was determined by trial and error method.

Sensitivity analysis was done to see how sensitive the returns from coconut cultivation is to a fall in prices. With a 20 percent fall in prices, the average farmgate price came to Rs.1.89/nut. Internal rate of return was recomputed under this changed price situation.

RESOURCE USE EFFICIENCY

The best method of measuring the nature of resource use efficiency is by fitting a production function (Heady, 1946). A production function is an algebraic equation expressing the relationship between the out put factor and each of the input factors. A production function can be used asa guide to farmers in decision making.

A multiple linear production function which was found to give a better fit was worked out to evalute the influence of the following factors on production. The factors considered were age of the plantation, labour days, quantity of fertiliser, cost of plant protection, holding size and irrigation.

The influence of these factors on gross income per hectare per year in rupees was evaluated.

The function can be represented as

$y = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + b_6 x_6$

Where

y = Cross income per hectare per year in rupees

x_1 = Age of the trees in years.

x_2 = Labour per hectare per year in mandays (Excluding that for irrigation)

x_3 = Quantity of fertiliser per hectare per year in Kilograms.

x_4 = Cost of plant protection per hectare per year in rupees.

x_5 = Land area in hectares.

x_6 = Labour hours for irrigation per hectare per year.

b_1, b_2, b_3, b_4, b_5 and b_6 are regression coefficients.

Resource use efficiency evaluation was done separately for zone I, zone II and for the sample as a whole.

RESULTS AND DISCUSSION

This chapter deals with the results of the study and the discussions thereon. As already mentioned in chapter IV this study is based mainly on data generated through a sample survey of coconut farmers in selected panchayats of Calicut district. The panchayats selected were Quilandy, Chengottukavu, Feroke, Balussery, Unnikulam and Omassery. This chapter is divided into 7 sections. In the first place, an account of certain general socio-economic features of the sample farmer households is attempted. Cost of cultivation of coconut is dealt with in section 2 and cost of production in section 3. Section 4 deals with capital productivity while section 5 deals with resource use efficiency. The general problems faced by the sample farmers are dealt with in section 6 and section 7 deals with the impact of incentives given by different agencies for coconut cultivation.

GENERAL SOCIO-ECONOMIC FEATURES OF THE SAMPLE FARMER HOUSEHOLDS

To obtain a background information about the general socio-economic features of the sample farmer households, their family details regarding education, occupation, holding size, cropping pattern, family income etc were studied.

FAMILY SIZE

The distribution ofrespondent families on the basis of size is given in table 5.1. It can be seen that 14.78 percent of the total families in Zone I and 13.91 percent in Zone II had only 2 to 4 members, while 62.30 percent in Zone I and 60.20 percent in Zone II had 5 to 7 members. The families having 8 to 10 members were 16.67 percent in Zone I and 18.04 percent in Zone II. 6.25 percent in Zone I and 7.85 percent in Zone II had more than 10 members in the family. The average size of family was 6.21 in Zone I and 6.98 in Zone II.

AGE

In table 5.2 the respondents have been classified on the basis of age. It revealed that 32.41 percent of the respondents in Zone I and 30.10 percent in Zone II belonged to the age group of 31 to 40 years. The percentage of respondents in the age group of 41 to 50 years was 32.99 in

Table 5.1 : Distribution of respondent families on the basis of size.

Family Size (Number of members)	Zone I		Zone II		Total	
	No	Percent	No	Percent	No	Percent
2-4	9	14.78	8	13.91	17	14.17
5-7	37	62.30	36	60.20	73	60.83
8-10	10	16.67	11	18.04	21	17.50
Above 10	4	6.25	5	7.85	9	7.50
Total	60	100.00	60	100.00	120	100.00
Average family size	6.21		6.98		6.60	

Zone I and 32.10 in Zone II. 27.10 percent of the respondents in Zone I and 28.51 percent in Zone II were in the age group of 51 to 60 years and those above 60 years were 7.50 percent in Zone I and 9.29 percent in Zone II. The average age for the sample was 47.12 years in Zone I and 49.02 years in Zone II.

EDUCATION

Literacy, and more particularly education plays an important role in the developments of the rural people. An examination of the levels of literacy and education of the sample farmer households showed high levels of literacy. only 0.27 percent of the total in Zone I and 0.72 percent in Zone II were illiterate. 7.24 percent in Zone I and 8.11 percent in Zone II were below five years of age. Those educated up to primary school were 26.27 percent in Zone I and 27.68 percent in Zone II. 32.53 percent in Zone I and 27.91 percent in Zone II were educated upto middle school and those educated upto high school were 24.66 percent in Zone I and 23.39 percent in Zone II. 19.04 percent in Zone I and 17.19 percent in Zone II were found to have been in college. The educational level among the two zones was found to be similar. The distribution of respondent families on the basis of education is given in table 5.3.

Table 5.2. : Age-group classification of respondents

Age (in years)	Zone I		Zone II		Total	
	No	Percent	No	Percent	No	Percent
31 - 40	19	32.41	18	30.10	37	30.83
41 - 50	20	32.99	19	32.10	39	32.50
51 - 60	16	27.10	17	28.51	33	27.50
Above 60	5	7.50	6	9.29	11	9.17
Total	60	100.00	60	100.00	120	100.00
Average age		47.12		49.02		48.07

Zone I and 32.10 in Zone II. 27.10 percent of the respondents in Zone I and 28.51 percent in Zone II were in the age group of 51 to 60 years and those above 60 years were 7.50 percent in Zone I and 9.29 percent in Zone II. The average age for the sample was 47.12 years in Zone I and 49.02 years in Zone II.

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Table 5.3 : Distribution of family members of respondents on the basis of education

Level of Education	Zone I No	Zone I Percent	Zone II No	Zone II Percent	Total No	Total Percent
0 - 5 (Age group)	27	7.24	34	8.11	61	7.70
Illiterate	1	0.27	3	0.72	4	0.51
Primary School	98	26.27	116	27.68	214	27.02
Middle School	84	22.52	96	22.91	180	22.73
High School	92	24.66	98	23.39	190	23.99
Under- graduate	38	10.19	42	10.02	80	10.10
Graduate	33	8.85	30	7.17	63	7.95
Total	373	100.00	419	100.00	792	100.00

Occupation

It was observed that most of the families in the sample had more than one occupation. Of the total number of individuals in the working age group of 14 - 60 years, only 23.92 percent were engaged in agriculture alone in Zone I. In Zone II it was 26.10 percent. The rest had other occupations in addition to agriculture 38.78 percent in Zone I and 33.62 percent in Zone II had government or private jobs or other similar services, along with agriculture. Those engaged in business were 29.18 percent in Zone I and 32.47 percent in Zone II. 8.12 percent in ZoneI and 7.81 percent in Zone II were engaged in all the three occupations. The occupation wise distribution of the families of respondents is given in table 5.4.

Size of Holding

Table 5.5 shows the size distribution of land holdings of the respondents. It was observed that most of them were small holdings of less than 0.50 hectare in area. 48.33 percent of the holdings in Zone I and 36.67 percent in ZoneII were less than 0.50 hectare in area. 25.00 percent in ZoneI and 20.00 percent in Zone II had an area between 0.50 and 1 hectare and 11.67 percent in Zone I and 18.33 percent in Zone II were between 1 and 1.50 hectares. Holdings of area between 1.5 and 2 hectares were 10.00 percent in Zone I and 15.00 percent in Zone II and those between 2 and 2.50 hectares

Table 5.4 : Occupation - wise distribution of the families of respondents.

Occupation	Zone I		Zone II		Total	
	No	Percent	No	Percent	No	Percent
Agriculture alone	66	23.92	81	26.10	147	25.13
Agriculture + Service	107	38.78	104	33.62	211	36.07
Agriculture + Business	80	29.18	101	32.47	181	30.94
Agriculture + Service + Business	22	8.12	24	7.81	46	7.86
Total	275	100.00	310	100.00	585	100.00

Table 5.5 : Distribution of respondents on the basis of holding size.

Holding size (in hectares)	Zone I		Zone II		Total	
	No	Percent	No	Percent	No	Percent
Below 0.5	29	48.33	22	36.67	51	42.50
0.5 - 1	15	25.00	12	20.00	27	22.50
1 - 1.5	7	11.67	11	18.33	18	15.00
1.5 - 2	6	10.00	9	15.00	15	12.50
2 - 2.5	2	3.33	3	5.00	5	4.17
2.5 - 3	1	1.67	2	3.33	3	2.50
Above 3	-	-	1	1.67	1	0.83
Total	60	100.00	60	100.00	120	100.00
Average holding size	0.35		0.39		0.37	

were 3.33 percent in Zone I and 5.00 percent in Zone II. 1.67 percent in Zone I and 3.33 percent in Zone II were between 2.50 and 3 hectares. None of holdings in Zone I were above 3 hectares while it was 1.67 percent in Zone II. The average size of holding was found to be higher in ZoneII than in Zone I. It was estimated as 0.35 hecatre in Zone I and 0.39 hectare in Zone II.

Area under coconut

Analysis of the area under coconut cultivation showed that coconut was being cultivated mostly in small holdings, in both the zones. 50.00 percent of the respondents in Zone I and 53.33 percent in Zone II had only below 0.50 hectare of area under coconut. 25.00 percent in Zone I and 28.33 percent in Zone II had an area between 0.50 and 1 hectare. 10.00 percent in Zone I and 11.67 percent in Zone II had an area between 1 and 1.5 hectares. Those having area between 1.5 and 2 hectares were 10.00 percent in Zone I and 3.33 percent in Zone II and those between 2 and 2.50 hectares were 3.33 percent in Zone I and 1.67 percent in Zone II. Respondents with coconut area above 2.50 hectares were only 1.67 percent in both the zones. The average area under coconut was found to be higher in Zone I than in Zone II. It was estimated as 0.26 hectare in Zone I and 0.22 hectare in Zone II. The distribution of respondents on the basis of area under coconut is given in table 5.6.

Table 5.6 : Distribution of respondents on the basis ofarea under coconut

Area (in hectares)	Zone I		Zone II		Total	
	No	Percent	No	Percent	No	Percent
Below 0.5	30	50.00	32	53.33	62	51.66
0.5 - 1	15	25.00	17	28.33	32	26.67
1 - 1.5	6	10.00	7	11.67	13	10.83
1.5 - 2	6	10.00	2	3.33	8	6.67
2 - 2.5	2	3.33	1	1.67	3	2.50
Above 2.5	1	1.67	1	1.67	2	1.67
Total	60	100.00	60	100.00	120	100.00
Average area	0.26		0.22		0.24	

Family income

For the estimation of family income, income from all sources per annum was considered. The total family income per annum of most of the respondents came in the range of Rs. 5000 to Rs. 15000. 51.67 percent of the respondents in Zone I and 55.00 percent in Zone II had an income within this range. 3.33 percent in Zone II and 5.00 percent in Zone II had an income below Rs. 5000. 38.33 percent in Zone I and 35.00 percent in Zone II had an income within the range of Rs. 15000 to Rs. 25000. Those having income above Rs. 25000 were only 6.67 percent in Zone I and 5.00 percent in Zone II. The distribution of respondents on the basis offamily income is given table 5.7.

Cropping pattern

An analysis of the cropping pattern of the sample holdings showed that in both the zones, a major percentage of the gross cropped area was devoted to the cultivation of coconuts. While 65.90 percent of the gross cropped area in Zone II was under coconut cultivation, in Zone I it was 80.37 percent which was 14.47 percent higher. It could be seen that coconut was the only crop of major importance in Zone I. Rice which isthe staple food was cultivated in 10.82 percent of area in Zone I and 23.81 percent in Zone II. It was second in terms of importance.

Table 5.7 : Distribution of respondents on the basis of family income

Family income (in rupees)	Zone I		Zone II		Total	
	No	Percent	No	Percent	No	Percent
Up to 5000	2	3.33	3	5.00	5	4.17
5000 - 15000	31	51.67	33	55.00	64	53.33
15000 - 25000	23	38.33	21	35.00	44	36.67
Above - 25000	4	6.67	3	5.00	7	5.83
Total	60	100.00	60	100.00	120	100.00

Arecanut was in 8.04 percent of the area in Zone I and 7.49 percent in Zone II. 0.62 percent of the area in Zone I and 2.40 percent in Zone II was devoted to the cultivation of banana. The area under cocoa cultivation was only 0.05 percent in Zone I and 0.20 percent in Zone II. The cropping pattern revealed the highly commercial nature of agriculture pursued by the respondents. The cropping pattern of the sample holdings is shown in table 5.8.

Irrigation

It was seen that most of the coconut holdings were rainfed and subject to two to three life-saving summer irrigations. Irrigation facilities were inadequate in most of the holdings. Water scarcity was a serious problem in some of the holdings. The costs to be incurred in the installation and maintenance of pumsets was said to be high. Farmers who owned pumpsets were only 16.67 percent of the total sample. The coconut area under irrigation in zone I in the sample was 1.05 hectares which was only 6.73 percent of the grossarea under this crop. In Zone II it was 0.99 hectare which was only 7.50 percent of the gross area under this crop. The rest 14.55 hectare of coconut area in Zone I and 12.21 hectares in Zone II was unirrigated. Thus with the bulk of the area being rainfed, unfavourable rainfall patterns posed a serious problem in coconut cultivation. Irrigated and

Table 5.8 : Cropping pattern of the sample holdings.

Crop	Gross cropped area (in hectares)			Percentage to the gross cropped area			Average per farm holding		
	Zone I	Zone II	Total	Zone I	Zone II	Total	Zone I	Zone II	Total
Coconut	15.60	13.20	28.80	80.37	65.90	73.02	0.2600	0.2200	0.2400
Cocoa	0.01	0.04	0.05	0.05	0.20	0.13	0.0002	0.0007	0.0004
Banana	0.12	0.48	0.60	0.62	2.40	1.52	0.0020	0.0080	0.0050
Arecanut	1.56	1.50	3.06	8.04	7.49	7.76	0.0260	0.0250	0.0255
Paddy	2.10	4.77	6.87	10.82	23.81	17.42	0.0350	0.0795	0.0573
Others	0.02	0.04	0.06	0.10	0.20	0.15	0.0003	0.0007	0.0005
Total	19.41	20.03	39.44	100.00	100.00	100.00	0.3235	0.3339	0.3287

unirrigated area under coconut in the sample holdings is shown in table 5.9.

From this study on the general socio-economic features of the sample farmer households, it may be concluded that the level of education of the respondents was fairly adequate to understand written down information relevant to crop cultivation at the farmer level. The exclusive dependence on agriculture, with respect to the sample farmers was less. Pure agriculturists were only a small percentage of the total, with most of them having other occupations such as government or private jobs, business or other similar services, in addition to agriculture. Most of the land holdings in the sample were small holdings with an average size of 0.37 hectare. The fact that a major percentage of the gross cropped area was devoted to the cultivation of coconuts, emphasised the importance of coconuts in the agricultural economy of the area. It could be seen that the facilities for irrigation which was vital in crop cultivation, were inadequate in the study area.

Table 5.9 : Irrigated and unirrigated area under coconut in the sample holdings.

	Area (in hectares)			Percentage to the area under the crop		
	Zone I	Zone II	Total	Zone I	Zone II	Total
Irrigated	1.05	0.99	2.04	6.73	7.50	7.08
Unirrigated	14.55	12.21	26.76	93.27	92.50	92.92
Total	15.60	13.20	28.80	100.00	100.00	100.00

COST OF CULTIVATION

Cost of cultivation refers to the total expenses incurred in cultivating one hectare of coconut. Coconut, being a perennial crop, the costs for its cultivation are incurred over a period of time. Practical difficulties were experienced in obtaining correct information on income and expenditure relating to periods much earlier to the period of data collection for this study. Moreover, it was also observed that the costs of inputs had increased considerably over the years. Often the increase in costs was more than the normal discount rate. Hence, an attempt was made to present the cost of cultivation as it would have been incurred at 1985-86 prices. For this, information was gathered on the quantities of various inputs applied by the sample cultivators during different years from planting till date, that is for 16 years. The inputs used were tabulated and the per hectare requirement of the different inputs for the various years of cultivation have been worked out. The inputs were valued at the rates that existed in the concerned zone during 1985-86. Interest on working capital has not been included in these calculations. This exercise, would present an idea of the cost for undertaking cultivation of one hectare of coconut and the cost that a farmer would incur at the present prices of inputs for 16 years. The cost figures for the district

have been arrived at, after allowing weightage for the area. Total cost for cultivating one hectare of coconut for 16 years ispresented in table 5.10.

Expenditure was the highest during the first year of planting being 12.99, 13.10 and 13.08 percentages respectively for Zone I, Zone II and the district. The high cost during the first year of cultivation was because of preparatory cultivation, cost of seedlings and planting. Total expenditure for Zone I was estimated to be Rs.90167, for Zone II it was Rs.91667 and for the district it was Rs. 91311. The total expenditure for Zone II was 1.66 percent higher than that for Zone I.

Item wise break up of the total cost of cultivation till the period of yield stabilisation i.e. 16 years is shown in Table 5.11. It may be seen from the table that the largest share ofthe total cost for 16 years in all the cases was human labour accounting for about 50 percent. Expenditure on fertiliser accounted for about 24 percent while harvesting charges were around 10 percent. For all the other items the expenditure was found to be below 5 percent.

A comparison of the expenditure for different items reveal that the major item of expenditure was labour cost with 48.38, 50.83 and 50.49 percentages of total cost for

Table 5.10 : Estimated cost of cultivation of coconut per hectare(in Rupees at 1985 - 86 prices).

Year	Zone I		Zone II		District	
1	11712	(12.99)	12010	(13.10)	11940	(13.08)
2	3285	(3.64)	3390	(3.70)	3365	(3.69)
3	3447	(3.82)	3540	(3.86)	3518	(3.85)
4	4548	(5.04)	4607	(5.05)	4608	(5.05)
5	5103	(5.66)	5118	(5.58)	5114	(5.60)
6	5103	(5.66)	5118	(5.58)	5114	(5.60)
7	5103	(5.66)	5118	(5.58)	5114	(5.60)
8	5628	(6.24)	5762	(6.29)	5730	(6.28)
9	5713	(6.34)	5800	(6.33)	5779	(6.33)
10	5732	(6.36)	5839	(6.37)	5814	(6.37)
11	5746	(6.37)	5847	(6.38)	5823	(6.38)
12	5791	(6.42)	5886	(6.42)	5864	(6.42)
13	5814	(6.45)	5903	(6.44)	5882	(6.44)
14	5814	(6.45)	5903	(6.44)	5882	(6.44)
15	5814	(6.45)	5903	(6.44)	5882	(6.44)
16	5814	(6.45)	5903	(6.44)	5882	(6.44)
Total	90167	(100)	91667	(100)	91311	(100)

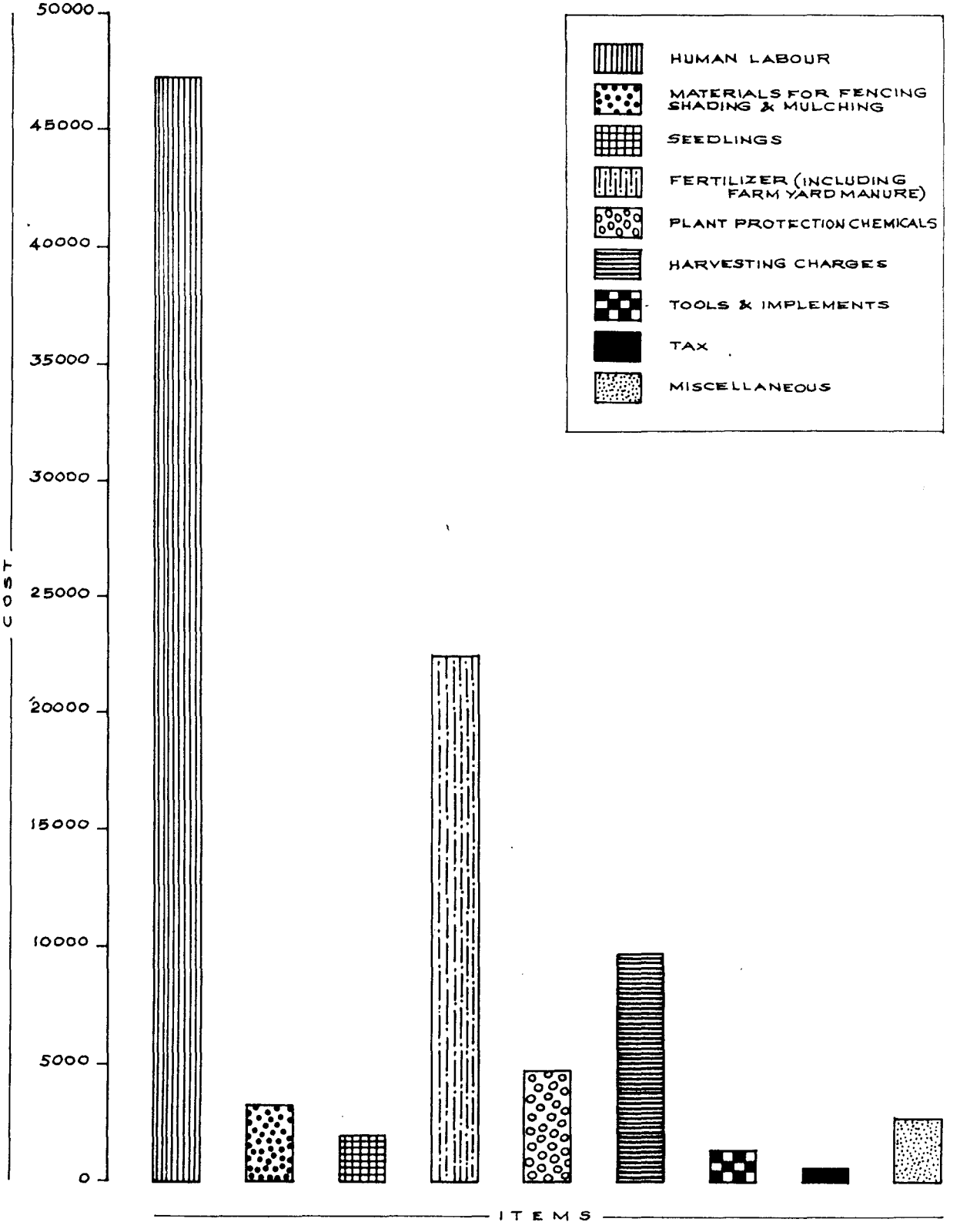
(Figures in parenthesis represent percentages of the total)

Table 5.11: Itemwise break up of the total cost of cultivation for 16 years (in Rupees)

Item	Zone I		Zone II		District	
Human labour	43624	(48.38)	46594	(50.83)	46100	(50.49)
Materials for fencing, shading and mulching	4508	(5.00)	3538	(3.86)	3767	(4.13)
Seedlings	1894	(2.10)	1925	(2.09)	1918	(2.10)
Fertiliser (including farm yard manure)	22542	(25.00)	22183	(24.20)	22058	(24.16)
Plant protection chemicals	4507	(5.00)	4675	(5.11)	4636	(5.08)
Harvesting charges	9224	(10.23)	8983	(9.80)	9040	(9.90)
Tools and implements	650	(0.72)	650	(0.71)	650	(0.71)
Land Tax	160	(0.18)	160	(0.17)	160	(0.18)
Miscellaneous	3058	(3.39)	2959	(3.23)	2902	(3.27)
Total	90167	(100)	91667	(100)	91322	(100)

(Figures in parenthesis represent percentages of the total)

FIG. 3. ITEMWISE TOTAL COST OF CULTIVATION PER HECTARE OF COCONUT FOR 16 YEARS FOR THE DISTRICT (IN Rs.).



Zone I, Zone II and for the district respectively. Estimated labour requirements in coconut cultivation in different years for the two zones as well as for the district is given in Table 5.12. The operations included fencing, land clearing and peg marking, digging pits, planting and gap filling, shading and mulching, manuring, weeding, watering and spraying plant protection chemicals. Hired and family labour were treated alike, considering eight hours work as one man-day. The labour input for the first three years of cultivation for one hectare of coconut garden came to 250, 112 and 128 mandays for the first, second and third year respectively in Zone I. In Zone II, these were 266, 125 and 139 mandays respectively. The corresponding values for the district came to 263, 123 and 137 mandays respectively. For the subsequent four years, the labour requirement remained at 84 mandays per year in Zone I, 91 mandays per year in Zone II and 90 mandays per year in the district. From the eighth year to the sixteenth year of planting, labour requirements remained almost the same. It was around 102 mandays per year in Zone I, 108 mandays per year in Zone II and 107 mandays per year in the district. Labour requirement was highest during the first year of the crop, which was due to the high use of labour for clearing the field, fencing, digging pits and planting. Since harvesting of coconut

Table 5.12a. Estimated labour requirements in coconut cultivation in different years

(Mandays/hectare)

ZONE-I

Operation	Age of the plantation in years															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Fencing with local materials and repairs	70	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Land clearing and peg marking	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Digging pits	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Planting and subsequent gap filling	8	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Shading and mulching	15	10	7	2	2	2	2	-	-	-	-	-	-	-	-	-
Manuring including basin opening and closing	16	17	20	21	21	21	21	22	22	22	22	22	23	23	23	23
Weeding/Forking	10	19	25	27	27	27	27	35	35	35	36	36	36	36	36	36
Irrigation (life-saving irrigations in summer)	39	52	60	20	20	20	20	24	24	24	24	24	24	24	24	24
Spraying and other plant protection	3	4	6	6	6	6	6	12	12	12	12	12	12	12	12	12
Total	250	112	128	84	84	84	84	101	101	101	102	102	103	103	103	103

Table 5.12b. Estimated labour requirements in coconut cultivation in different years

(Mandays/hectare)

ZONE-II

Operation	Age of the plantation in years															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Fencing with local materials and repairs	70	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Land clearing and peg marking	57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diggings pits	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Planting and subsequent gap filling	9	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Shading mulching	15	11	8	2	2	2	2	-	-	-	-	-	-	-	-	-
Manuring including basin opening and closing	20	22	25	26	26	26	26	26	26	26	27	27	28	28	28	28
Weeding/forking	12	23	28	29	29	29	29	36	36	36	37	37	37	37	37	37
Irrigation (life saving irrigations in summer)	39	53	60	20	20	20	20	24	24	24	24	24	24	24	24	24
Spraying and other plant protection	3	4	6	6	6	6	6	12	12	12	12	12	12	12	12	12
Total	266	125	139	91	91	91	91	106	106	106	108	108	109	109	109	109

Table 5.12c. Estimated labour requirements in coconut cultivation in different years

(Mandays/hectare)

DISTRICT

Operation	Age of the plantation in years															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Fencing with local materials and repairs	70	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Land clearing and peg making	56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Digging pits	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Planting and subsequent gap filling	9	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Shading and mulching	15	11	8	2	2	2	2	-	-	-	-	-	-	-	-	-
Manuring including basin opening and closing	19	21	24	25	25	25	25	25	25	25	26	26	27	27	27	27
Weding/Forking	12	22	27	29	29	29	29	36	36	36	37	37	37	37	37	37
Irrigation (life-saving irrigation in summer)	39	53	60	20	20	20	20	24	24	24	24	24	24	24	24	24
Spraying and other	3	4	6	6	6	6	6	12	12	12	12	12	12	12	12	12
Tptal	263	123	137	90	90	90	90	105	105	105	107	107	108	108	108	108

is done by the specially skilled climbers, and the wages paid to them are charged differently from that of general labour, the harvesting time is not shown in Table 5.12, but the cost of this operation has been taken into account at the relevant place.

Total expenditure on labour for Zone II was 6.81 percent higher than that for Zone I. This is because of the higher labour requirement in laterite soil with a hard pan for such operations as land cleaning, digging pits, basin opening and weeding/forking as compared to sandy soil. The total labour requirement for 16 years was 1745 mandays per hectare in Zone I, 1864 mandays per hectare in Zone II and 1844 mandays per hectare in the district.

The break up of the labour utilisation into hired and family labour in mandays along with their percentages to total is given in Table 5.13. During the steady bearing stage, labour contributed by family members came to about 40.95 percent, 42.34 percent and 41.82 percent of the total labour requirement in ZoneI, Zone II and the district respectively.

Purchase of seedlings was during the first year. The cost per hectare was Rs. 1894, Rs. 1925 and Rs. 1918 respectively for Zone I, Zone II and the district as shown in Table 5.11. This included the expenditure on transporting the seedlings also. Cost of seedlings for gap filling

Table 5.13a : Hired and family labour utilisation for coconut per hectare (in mandays)

ZONE I

Year	Hired		Family		Total	
1	138	(55.20)	112	(44.80)	250	(100.00)
2	62	(55.35)	50	(44.64)	112	(100.00)
3	70	(54.69)	58	(45.31)	128	(100.00)
4	47	(55.95)	37	(44.05)	84	(100.00)
5	47	(55.95)	37	(44.05)	84	(100.00)
6	47	(55.95)	37	(44.05)	84	(100.00)
7	47	(55.95)	37	(44.05)	84	(100.00)
8	59	(58.25)	42	(41.75)	101	(100.00)
9	59	(58.25)	42	(41.75)	101	(100.00)
10	59	(58.25)	42	(41.75)	101	(100.00)
11	59	(57.69)	43	(42.31)	102	(100.00)
12	59	(57.69)	43	(42.31)	102	(100.00)
13	60	(58.09)	43	(41.91)	103	(100.00)
14	61	(59.05)	42	(40.95)	103	(100.00)
15	61	(59.05)	42	(40.95)	103	(100.00)
16	61	(59.05)	42	(40.95)	103	(100.00)
Total	996		749		1745	

(Figures in parenthesis represent percentages of the total)

Table 5.13b : Hired and family labour utilisation for coconut per hectare (in mandays)

ZONE II

Year	Hired		Family		Total	
1	141	(53.00)	125	(46.99)	266	(100.00)
2	66	(52.80)	59	(47.20)	125	(100.00)
3	74	(53.24)	65	(46.76)	139	(100.00)
4	50	(54.95)	41	(45.05)	91	(100.00)
5	50	(54.95)	41	(45.05)	91	(100.00)
6	50	(54.95)	41	(45.05)	91	(100.00)
7	50	(54.95)	41	(45.05)	91	(100.00)
8	61	(57.41)	45	(42.59)	106	(100.00)
9	61	(57.41)	45	(42.59)	106	(100.00)
10	61	(57.41)	45	(42.59)	106	(100.00)
11	62	(57.27)	46	(42.73)	108	(100.00)
12	62	(57.27)	46	(42.73)	108	(100.00)
13	62	(56.76)	47	(43.24)	109	(100.00)
14	63	(57.66)	46	(42.34)	109	(100.00)
15	63	(57.66)	46	(42.34)	109	(100.00)
16	63	(57.66)	46	(42.34)	109	(100.00)
Total	1039		825		1864	

(Figures in parenthesis represent percentages of the total)

Table 5.13c : Hired and family labour utilisation for coconut per hectare (in mandays)

DISTRICT

Year	Hired		Family		Total	
1	140	(53.23)	123	(46.77)	263	(100.00)
2	65	(52.85)	58	(47.15)	123	(100.00)
3	73	(53.28)	64	(46.72)	137	(100.00)
4	49	(54.44)	41	(45.56)	90	(100.00)
5	49	(54.44)	41	(45.56)	90	(100.00)
6	49	(54.44)	41	(45.56)	90	(100.00)
7	49	(54.44)	41	(45.56)	90	(100.00)
8	61	(57.94)	44	(42.06)	105	(100.00)
9	61	(57.94)	44	(42.06)	105	(100.00)
10	61	(57.94)	44	(42.06)	105	(100.00)
11	62	(57.94)	45	(42.06)	107	(100.00)
12	62	(57.94)	45	(42.06)	107	(100.00)
13	62	(57.27)	46	(42.73)	108	(100.00)
14	63	(58.18)	45	(41.82)	108	(100.00)
15	63	(58.18)	45	(41.82)	108	(100.00)
16	63	(58.18)	45	(41.82)	108	(100.00)
Total	1032		812		1844	

(Figures in parentheais represent percentages of the total)

has also been included under this. The average number of trees per hectare was 213 in Zone I, 210 in Zone II and 212 in the district.

The expenditure on materials for fencing, shading and mulching came to around 5.00, 3.86 and 4.13 percentage of the total cost of cultivation in Zone I, Zone II and the district respectively. The expenditures were Rs. 4508, Rs. 3538 and Rs.3767 for Zone I, Zone II and for the district respectively, as isevident from Table 5.11.

Total expenditure on fertilizer including farm yard manure was Rs. 22542, Rs. 22183 and Rs. 22058 for Zone I, Zone II and the district respectively. This worked out to 25.00, 24.20 and 24.16 percentages of the total cost of cultivation for sixteen years in Zone I, Zone II and the district respectively.

Expenditure on plant protection included the cost of chemicals, application and hire charges of equipment. The total expenditure was found to be Rs. 4507, Rs. 4675 and Rs. 4636 for Zone I, Zone II and the district respectively. This was 5.00, 5.11 and 5.08 percentages of the total cost of cultivation for 16 years in Zone I, Zone II and the district respectively.

Expenditure on harvesting was incurred only from the eighth year onwards and it was estimated as Rs. 9224, Rs. 8983 and Rs. 9040 in Zone I, Zone II and the district respectively. This came to about 10.23, 9.80 and 9.90 percentages ofthe total cost of cultivation for 16 years in Zone I, Zone II and the district.

The cost for tools and implements for land preparation occur in the first year. Expenditure on this item also included the replacement and maintenancecharges from the second year onwards. The total expenditure was found to be Rs. 650 in both the zones and the district.

Land tax was taken at the actual rate paid to the revenue department, which was Rs. 10 per hectare during the year 1985-86. The expenditure for this item for 16 years came to Rs. 160 in both the zones and the district.

All other expenditures were taken as miscellaneous expenditure. It came to Rs. 3058, Rs. 2959 and Rs. 2982 for Zone I, Zone II and the district respectively which was 3.39, 3.23 and 3.27 percentage respectively of the total cost of cultivation.

Coconut starts yielding from the eighth year and the yield gets established by the sixteenth year of planting. The cost of bringing the plantation upto bearing stage or the initial 7 years' expenditure is the total investment cost. The expenditure for the eighth year and onwards

becomes the maintenance cost for the garden. The costs of investment and maintenance in coconut cultivation are given in Table 5.14. According to this study, the cost of bringing one hectare of coconut garden to bearing or the total investment cost per hectare came to Rs. 38301, Rs.38921 and Rs. 38773 for Zone I, Zone II and the district respectively. It is evident from the table that the largest share of the investment cost in all the cases was human labour accounting for about 51.97, 55.46 and 54.98 percentages of the total investment cost in Zone I, Zone II and the district. Expenditure on fertiliser accounted for about 23.58, 22.31 and 22.53 percentage of the total investment cost in Zone I, Zone II and the district. Materials for fencing, shading and mulching claimed 11.77, 9.09 and 9.46 percentages of the total investment cost in Zone I, Zone II and the district respectively and seedlings accounted for 4.95 percent of the total investment cost in both the zones and the district. For all the other items, expenditure was found to be below 4 percent, in both the zones and the district.

As per this study, the annual maintenance cost per hectare of coconut garden was Rs. 5781, Rs. 5876 and Rs.5853 for Zone I, Zone II and the district respectively. The largest claiment of the maintenance cost, as shown in

Table 5.14a : Costs of investment and maintenance in coconut cultivation (Rupees/hectare)

Zone I

Item	Investment cost (initial 7 years' expenditure)		Maintenance cost (Annual expenditure)	
Human labour	19905	(51.97)	2652	(45.87)
Materials for fencing, shading and mulching.	4508	(11.77)	-	-
Seedlings	1894	(4.95)	-	-
Fertiliser (including farm yard manure)	9030	(23.58)	1503	(25.99)
Plant protection chemicals	1222	(3.19)	365	(6.31)
Harvesting charges	-	-	1025	(17.73)
Tools and implements	335	(0.87)	35	(0.61)
Land tax	70	(0.18)	10	(0.17)
Miscellaneous	1337	(3.49)	191	(3.30)
Total	38301	(100)	5781	(100)

(Figures in parenthesis represent percentages of the total)

Table 5.14b : Costs of investment and maintenance in coconut cultivation (Rupees/hectare

ZONE II

Items	Investment cost (Initial 7 years' expenditure)		Maintenance cost (Annual expenditure)	
Human labour	21586	(55.46)	2807	(47.77)
Materials for fencing, shading and mulching	3533	(9.09)	-	-
Seedlings	1925	(4.95)	-	-
Fertiliser (including farm yard manure)	8683	(22.31)	1474	(25.09)
Plant protection chemicals	1489	(3.83)	365	(6.21)
Harvesting charges	-	-	1000	(17.02)
Tools and implements	335	(0.86)	35	(0.60)
Land tax	70	(0.18)	10	(0.17)
Miscellaneous	1295	(3.33)	185	(3.15)
Total	38921	(100)	5876	(100)

(Figures in parenthesis represent percentages of the total)

Table 5.14c : Costs of investment and maintenance in coconut cultivation (Rupees/hectare)

DISTRICT

Items	Investment cost (initial 7 years' expenditure)		Maintenance cost (Annual expenditure)	
Human labour	21316	(54.98)	2772	(47.36)
Materials for fencing, shading and mulching	3667	(9.46)	-	-
Seedlings	1918	(4.95)	-	-
Fertiliser (including farm yard manure)	8736	(22.53)	1479	(25.27)
Plant protection chemicals	1426	(3.68)	365	(6.24)
Harvesting charges	-	-	1006	(17.19)
Tools and implements	335	(0.86)	35	(0.60)
Land tax	70	(0.18)	10	(0.17)
Miscellaneous	1305	(3.37)	186	(3.18)
Total	38773	(100)	5853	(100)

Table 5.18, was human labour in all the cases accounting for 45.87, 47.77 and 47.36 percentage of the annual maintenance cost in Zone I, Zone II and the district respectively. During the maintenance period, expenditure incurred on seedlings and materialsfor fencing, shading and mulching was nil. Fertiliser accounted for 25.99, 25.09 and 25.27 percentage of the annual maintenance cost in Zone I, Zone II and the district respectively. Harvesting charge were incurred from the eighth year onwards and this claimed 17.73, 17.02 and 17.19 percentage of the annual maintenance cost in Zone I, Zone II and the district respectively. Plant protection chemicals accounted for 6.31, 6.21 and 6.24 percentage of the annual maintenance cost in Zone I, Zone II and the district respectively. For all the other items, expenditure incurred was below 4 percent in both the zones and the district.

It isto be noted that management practices such as shading of seedlings, mulching, chemical fertiliser and farmyard manure application incurred a higher percentage of expenditure in Zone I, as compared to Zone II. Chemical fertiliser and farmyard manure application in Zone I claimed a higher expenditure of 4 percent as compared to Zone II, during the investment period and a higher expenditure of 2 percent during the maintenance

period. This may be due to the fact that in Zone I, coconut was the only source of income for most of the cultivators and hence all the material and non-material inputs were concentrated solely on coconut. Management practices in this zone were much improved as compared to zone II, where most of the cultivators had other income earning crops under cultivation, in addition to coconut.

Considering the crop cycle of coconut as 55 years, the costs and returns per hectare for the zones and the district for the entire period has been worked out and presented in Table 5.15. It has been assumed that the costs from the sixteenth year to the fifty fifth year remain the same. The yield of nuts would decline from the fifty first year to the fifty fifth year in the reverse order of its improvement from eighth to the sixteenth year.

Table 5.15 : Costs and returns per hectare for a crop cycle of coconut (in rupees)

Year	Cost			Returns		
	Zone I	Zone II	District	Zone I	Zone II	District
1	11712	12010	11940	-	-	-
2	3285	3390	3365	-	-	-
3	3447	3540	3518	-	-	-
4	4548	4627	4608	-	-	-
5	5103	5118	5114	-	-	-
6	5103	5118	5114	-	-	-
7	5103	5118	5114	-	-	-
8	5628	5762	5730	4052	3549	3668
9	5713	5800	5779	7387	6381	6618
10	5732	5839	5814	10616	9108	9464
11	5746	5847	5823	13632	12124	12480
12	5791	5886	5864	18659	17151	17507
13	5814	5903	5882	21782	20274	20630
14	5814	5903	5882	25909	23899	24373
15	5814	5903	5882	27022	24508	25101
16-50	5814	5903	5882	27022	24508	25101
51	5814	5903	5882	25962	23952	24426
52	5814	5903	5882	24295	22285	22759
53	5814	5903	5882	22285	20274	20749
54	5814	5903	5882	20670	18659	19134
55	5814	5903	5882	18156	16145	16620
				42600(*)	42600(*)	42600(*)

(*) - Salvage value

COST OF PRODUCTION

Cost of production of coconut is the cost incurred in producing one nut. The actual expenditure incurred by the sample cultivators in each zone was taken for the computation of costs. The economic life of a coconut palm was considered as 55 years, with yield obtained from eighth year onwards.

The cost of bringing one hectare of coconut garden upto bearing stage and the annual cost of maintenance per hectare have already been indicated. The costs were Rs. 38301 and Rs. 5781 respectively for Zone I, and Rs.38921 and Rs. 5876 respectively for Zone II. For the district, these values were Rs. 38773 and Rs. 5853 respectively. The total investment, namely initial 7 years expenditure and the compound interest thereon were reduced to an annuity bearing 11 percent interest. The annuity value in this study came to Rs. 6699 for Zone I, Rs. 6823 for Zone II and Rs. 6793 for the district. It was added to the annual maintenance charges to arrive at the total annual cost per hectare. Here, the total annual cost came to Rs. 12,480 per hectare for Zone I, Rs. 12,699 per hectare for Zone II and Rs. 12,646 per hectare for the district. From this amount, the annual income from dry leaves and

petioles was deducted and the net cost was then divided by the average annual production of nuts during the stabilised period (in this case 10863 nuts for Zone I, 9798 nuts for Zone II and 10049 nuts for the district) to arrive at the cost of production per nut. Accordingly, the cost of production came to Rs. 1.02 per nut for Zone I, Rs. 1.15 per nut for Zone II and Rs. 1.12 per nut for the district. Zone I with a lesser cost of production was found to be economically more efficient than Zone II, with regard to coconut cultivation. The computation of cost of production per nut for Zone I, ZoneII and for the district is shown in Table 5.16.

Table 5.16 : Estimated cost of production of coconut (Rupees/hectare)

Sl No.	Particulars	Zone I	Zone II	District
1	Investment during establishment of plantation upto bearing	38301	38921	38773
2	Compound interest on investment at 11% (1-7 years)	23803	24003	24199
3	Total investment	62104	63245	62972
4	Annuity value (Share of total investment to be adjusted over a period of 48 years)	6699	6823	6793
5	Annual maintenance cost	5781	5876	5853
6	Total cost per hectare per year	12480	12699	12646
7	Income from dry leaves and petioles per year	1385	1370	1374
8	Net cost of production of nuts per hectare per year	11095	11329	11272
9	Average production of nuts per hectare per year	10863	9790	10049
10	Cost of production per nut	1.02	1.15	1.12

ESTIMATING RETURNS

For estimating the returns from coconut cultivation, the average farm-gate price for nuts was taken into consideration. Due to the fact that the farm-gate price of nuts for the years 1985-86 and 1984-85 were highly unusual, the farm-gate price for the year 1983-84 was considered which came to be Rs. 2.36/nut in both the zones and the district. The cost of production per nut was estimated as Rs. 1.02, Rs. 1.15 and Rs. 1.12 per nut in ZoneI, Zone II and the district respectively, as shown in Table 5.16. Considering the farm-gate price and the cost of production, the net return per nut came to Rs. 1.34, Rs.1.21 and Rs. 1.24 in Zone I, Zone II and the district respectively. With an average production of 10863, 9798 and 10049 nuts per hectare per year, the net return from nuts came to Rs. 14556, Rs. 11856 and Rs. 12461 in Zone I, ZoneII and the district respectively. On considering an annual of Rs. 1385, Rs. 1370 and Rs. 1374, from dry leaves and petioles in Zone I, Zone II and the district, the net return per hectare came to Rs. 15941, Rs. 13226 and Rs. 13835 in Zone I, Zone II and the district respectively. Estimated returns from coconut cultivation in rupees per hectare per year is presented in Table 5.17.

Table 5.17 : Estimated returns from coconut cultivation
(in rupees/hectare/year)

Sl No.	Particulars	Zone I	Zone II	District
1	Farm gate price of coconut per nut	2.36	2.36	2.36
2	Cost of production per nut	1.02	1.15	1.12
3	Net return per nut	1.34	1.21	1.24
4	Average production of nuts	10863	9798	10049
5	Net return from nuts	14556	11856	12461
6	Income from dry leaves and petioles	1385	1370	1374
7	Net return on investment per hectare	15941	13226	13835

CAPITAL PRODUCTIVITY ANALYSIS

Coconut has a long gestation period and considerable investments are made over several years before the crop starts to yield. The returns are spread over a long period. The economics of investments on such a crop has to be evaluated taking into consideration the total period the crop is the field.

Capital productivity analysis brings out the efficiency of capital use in production. An attempt is made here to measure the productivity of capital taking into consideration (1) Pay back period (2) Benefit-cost ratio (3) Net present worth and (4) Internal rate of return. The estimated cost of cultivation and returns obtained were used for these computations.

Pay back period

The pay back period is the length of time from the beginning of the project before the net benefits return the cost of the capital investment (Gittinger,1976). It is an undiscounted measure of worthiness of an endeavour, which measures the efficiency of cultivation by indicating the period within which the returns offset the investment.

The pay-back period for the two zones and the district were estimated to be as follows:

ZONE I

Net returns on progressive total for 12th year = Rs.-12,565

Net returns on progressive total for 13th year = Rs. +3403

$$\text{Pay back period} = 12 + 1 \left| \frac{-12565}{-12565 - 3403} \right|$$

$$= 12.79 \text{ years.}$$

ZONE II

Net returns on progressive total for 13th year =Rs.-5371

Net returns on progressive total for 14th year =Rs.12625

$$\text{Pay back period} = 13 + 1 \left| \frac{-5371}{-5371 - 12625} \right|$$

$$= 13.29 \text{ years.}$$

DISTRICT

Net returns on progressive total for 13th year = Rs.-3298

Net returns on progressive total for 14th year = Rs.15193

$$\text{Pay back period} = 13 + 1 \left| \frac{-3298}{-3298 \quad -15193} \right|$$

$$= 13.18 \text{ years}$$

The above results indicate that zone I has a shorter payback period than zone II. The computation of payback period is given in Appendix - II.

Pay back period has two major drawbacks as a measure of investment worth: (1) The payback period fails to consider earnings after the payback period, and (2) it fails to

take into consideration differences in the timing of earnings during the payback period.

The other three measures are discounted measures of investment worth. The costs and returns were discounted at 11% rate of interest, being the rate at which long-term credit could be obtained.

BENEFIT - COST RATIO

The benefit-cost ratio indicates the return on a rupee of investment. It is defined as the ratio between the present worth of benefits and that of costs.(Gittinger,1976). A project with benefit-cost ratio greater than unity is considered viable. All costs and all benefits were discounted for the first year and for each year thereafter. The present worth of benefits and that of costs were then compared. The benefit-cost ratios for the two zones and the district were estimated as follows -

ZONE I

Present worth of benefits = Rs. 85916

Present worth of costs = Rs. 54507

$$\text{Benefit - cost ratio} = \frac{85916}{54507} = 1.58$$

ZONE II

Present worth of benefits = Rs. 77789

Present worth of costs = Rs. 55486

$$\text{Benefit-cost ratio} = \frac{77789}{55486} = 1.40$$

DISTRICT

Present worth of benefits = Rs. 79707

Present worth of costs = Rs. 55253

Benefit-cost ratio = $\frac{79707}{55253} = 1.44$

Since these ratios are greater than unity, the investments are economically justified. The benefit-cost ratio in zone I is 12.86 percent higher than that of zone II. This can be attributed both to the lower cost of cultivation as well as the higher yield in this zone. The computation of benefit-cost ratio isgiven in Appendix III.

NET PRESENT WORTH

The most straight forward discounted cash flow measure of project worth is the net present worth. This is simply the present worth of the cash flow stream. (Gittinger, 1976). It tries to project the feasibility of cultivation and is the difference between the present worth of benefits and present worth of costs. The formal selection criterion for the net present worth measure of project worth is to accept all projects with a positive net present worth when discounted at the opportunity cost of capital. The advantage of net present worth measure as compared to benefit-cost ratio is that, computation process for netting out the amount can ne started at any point of time.

The net present worth of a hectare of coconut cultivation for the two zones and the district were estimated to be as follows:

ZONE I

Present worth of benefits = Rs. 85916

Present worth of costs = Rs. 54507

Net present worth = 85916 - 54507

= Rs. 31409

ZONE II

Present worth of benefits = Rs. 77789

Present worth of costs = Rs. 55486

Net present worth = 77789 - 55486

= Rs. 22303

DISTRICT

Present worth of benefits = Rs. 79707

Present worth of costs = Rs. 55253

Net present worth = 79707 - 55253

= Rs. 24454

The net present worth is positive for the two zones as well as the district. Zone I has a higher net present worth than zone II indicating that coconut cultivation in

this zone gives more favourable returns than in the other zone. The computation of net present worth is given in Appendix III.

INTERNAL RATE OF RETURN

Internal rate of return is that discount rate which just makes the net present worth of the cash flow equal zero (Gittinger,1976). It represents the average earning power of the money used in the project over the project life. The formal selection criterion for the internal rate of return measure of project worth is to accept all projects having an internal rate of return above the opportunity cost of capital. Internal rate of return calculations can be done from any point in time and all points will give the same return. It has an advantage over the other measures in that the returns on investments are expressed as a percentage.

The internal rate of return for the two zones and the district were estimated as follows:-

ZONE I

Present worth of incremental benefit at 11% = Rs.31408

Present worth of incremental benefit at 18% = Rs.-4854

$$\text{Internal rate of return} = 11 + 7 \left\{ \frac{31408}{31408 - (-4854)} \right\}$$

$$= 17.06\%$$

ZONE II

Present worth of incremental benefit at 11% = Rs.22307

Present worth of incremental benefit at 18% = Rs.-8097

$$\text{Internal rate of return} = 11 + 7 \left\{ \frac{22307}{22307 - (-8097)} \right\}$$

$$= 16.14\%$$

DISTRICT

Present worth of incremental benefit at 11% = Rs.24456

Present worth of incremental benefit at 18% = Rs.-7330

$$\text{Internal rate of return} = 11 + 7 \left\{ \frac{24456}{24456 - (-7330)} \right\}$$

$$= 16.39\%$$

Since the internal rate of return in all cases are above 11 percent, which isthe opportunity cost of capital, the investments are worthwhile. Zone I has a higher internal rate of return than zone II indicating that coconut cultivation in this zone ismore profitable than in the other zone. The computation of internal rate of return is given in Appendix IV.

SENSITIVITY ANALYSIS

Sensitivity analysis was done to see how sensitive the returns from coconut cultivation is to a fall in prices. The average farm-gate price taken into

Consideration for estimating the returns was Rs.2.36 per nut. With a 20 percent fall in prices, it came to Rs.1.89 per nut. Internal rate of return was recomputed under this changed price situation. The values were estimated as follows :-

ZONE I

Present worth of incremental benefit at 11% = Rs.15333

Present worth of incremental benefit at 18% = Rs.-9906

$$\text{Internal rate of return} = 11 + 7 \left\{ \frac{15333}{15333 - (-9906)} \right\}$$

$$= 15.25\%$$

ZONE II

Present worth of incremental benefit at 11% = Rs.7849

Present worth of incremental benefit at 18% = Rs.-12625

$$\text{Internal rate of return} = 11 + 7 \left\{ \frac{7849}{7849 - (-12625)} \right\}$$

$$= 13.69\%$$

DISTRICT

Present worth of incremental benefit at 11% = Rs.9616

Present worth of incremental benefit at 18% = Rs.-11984

$$\text{Internal rate of return} = 11 + 7 \left\{ \frac{9616}{9616 - (-11984)} \right\}$$

$$= 14.12\%$$

The above results indicate that coconut cultivation is profitable even under the changed situation of a 20 percent fall in prices. Since the internal rate of return in all the cases are above 11 percent which is the opportunity cost of capital, the investments are worthwhile.

A comparison can be made between the two zones, Zone I which is the Sandy Zone and Zone II, the laterite zone. All the four measures of capital productivity discussed above indicated that the sandy zone (Zone I) was economically more efficient than the laterite zone (Zone II) with regard to coconut cultivation. This can be attributed both to the low cost of cultivation as well as the higher yield in this zone. The total cost of cultivation per hectare for 16 years in laterite zone was 1.66 percent higher than that in sandy zone. This was due to a higher expenditure of 6.81 percent on labour in this zone as compared to the other. Labour requirements in laterite soil with a hard pan for such operations as land clearing, digging pits, basin opening and weeding/forking was higher as compared to sandy soil.

The yield per hectare per year in sandy zone has been recorded to be 10.86 percent higher than that of laterite zone. Coconut being the only source of income

for most of the cultivators in the coastal area (sandy zone), management practices in this zone are much improved as compared to the laterite zone where the cultivators usually have other income earning crops under cultivation, in addition to coconut. The climatic conditions of coastal area also may be favourable for coconut growth and nut production as compared to the laterite zone. Coconut is said to yield poorly in laterite soil with a hard pan, since the fibrous roots of the tree cannot easily penetrate into the soil, especially if rocky and absorption of nutrients is rendered difficult. (Joseph,1980).
A higher percentage of nut production in the sandy zone as compared to the laterite zone can be attributed to all the above factors.

RESOURCE USE EFFICIENCY

A multiple linear production function, which was found to give a better fit was worked out to evaluate the influence of input factors on production. The factors considered were age of the palms, labour days, fertiliser, plant protection, holding size and irrigation.

The influence of these factors on gross income per hectare per year in rupees was evaluated.

The function can be represented as

$y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6$

where y = Gross income per hectare per year in rupees

x_1 = Age of the palms in completed years.

x_2 = Labour per hectare per year in mandays (Excluding that for irrigation).

x_3 = Quantity of fertiliser per hectare per year in Kilograms.

x_4 = Cost of plant protection per hectare per year in rupees.

x_5 = Land area in hectares.

x_6 = Labour hours for irrigation per hectare per year.

b_1, b_2, b_3, b_4, b_5 and b_6 are regression coefficients.

Resource use efficiency evaluation was done separately for zone I, zone II and for the sample as a whole.

(a) Zone I

The regression coefficients, standard errors and t values are given in table 5.18a.

Table 5.15a Regression Coefficients, Standard Errors, and t values

Variables	Regression coefficient	Standard error	t value
Age	655.35**	110.77	5.91
Labour	16.14	9.17	1.75
Fertiliser	2.34	4.67	0.51
Plant protection	23.29	15.62	1.49
Area	1075.81	1710.86	0.63
Irrigation	14.47	10.24	1.41

F = 9.28**

** Significant at 1% level.

R^2 = 0.61

The F ratio was found to be significant at 1% level. The coefficient of multiple determination R^2 was 0.61, implying that 61% of the variation in the dependent variable was explained by the independent variables considered.

The regression coefficient for only the variable age was found to be significent (t value = 5.91) implying that as age increased, gross income also increased.

(b) ZONE II

The regression coefficients, standard erros and t values are given in table 5.17b.

Table 5.17b Regression Coefficients, Standard errors and t values

Variables	Regression Coefficient	Standard error	't' Value
Age	520.68**	96.26	5.41
Labour	18.12*	8.01	2.26
Fertiliser	12.82**	3.71	3.45
Plant protection	23.16	12.27	1.88
Area	885.97	2015.16	0.44
Irrigation	8.22	7.58	1.08

F = 21.35**

** Significient at 1% level

* Significent at 5% level

R^2= 0.78

The F ratio was found to be significent at 1% level. The coefficient of multiple determination R^2 was 0.78, implying that 78% of the variation in the dependent variable was explained by the independent variables considered.

The regression coefficients for the variables age

(t value = 5.41), labour (t value = 2.26) and fertiliser (t value = 3.45) were found to be significant, implying that gross income increased with increase in each of these factors.

(c) Sample as a whole.(Zone I + Zone II).

The regression coefficients, standard errors and t values are given in Table 5.18c.

Table 5.18c Regression Coefficients, Standard Errors, and t values

Variables	Regression Coefficient	Standard error	't' Value
Age	602.74**	66.75	9.03
Labour	19.09**	5.88	3.24
Fertiliser	7.61**	2.82	2.70
Plant Protection	19.76*	9.15	2.15
Area	882.10	1228.60	0.71
Irrigation	11.54	5.97	1.93

F = 28.20**

** Significant at 1% level

* Significant at 5% level

R^2 = 0.68

The F ratio was found to be significant at 1% level. The coefficient of multiple determination R^2 was 0.68%

implying that 68% of the variation in the dependent variable was explained by the independent variables considered.

The regression coefficientsfor the variables age (t value = 9.03), labour (t value = 3.24), fertiliser (t value = 2.70) and plant protection (t value = 2.15). were found to be significant, implying that gross income increased with increase in each of these factors.

Marginal value productivity of these input factors was estimated by taking the partial derivatives of productivity with respect to the inputs concerned, calculated at the geometric mean levelsof the inputs.

$$MVP = \frac{\Delta Y}{\Delta x_i} = \frac{b_i Y}{x_i}$$

Variables	Geometric mean	Regression Coefficient	Marginal value product
Y	15408.94	-	-
Labour	359.37	19.09	818.53
Fertiliser	293.88	7.61	399.01
Plant protection	140.25	19.76	2170.99

The marginal value productivity indicates the returns which on the average can be expected by adding one more unit of the input factor to the present average level of

use, the other factors remaining at their geometric mean levels. The marginal value productivity of the input labour was estimated as 818.53, indicating that with an increase of labour by one manday per hectare per year, gross income increased by Rs. 818.53. The marginal value productivity of the input fertiliser was 399.01, implying that if the quantity of fertiliser was increased by one kilogram per hectare per year, gross income increased by Rs. 399.01. The marginal value productivity of the input plant protection was calculated to be 2170.99, indicating that an increase of rupee one on the expenses on plant protection per hectare per year, resulted in an increase of gross income by Rs. 2170.99. The optimum levels of input use could not be estimated since the fitted production function was linear.

This study on resource use efficiency shows that the age of the trees, labour mandays, fertiliser application and plant protection measures are all factors which have significant influence on the gross income obtained from a coconut garden. Studies conducted by Marar (1963) at the Central Coconut Research Station, Kasaragod, Alikhan (1972) in Tumkur district of Mysore, Margate et al (1978) in Davao, Philippines, Pillai et at (1981), at the Central plantation Crops Research Institute, Regional Station, Kayamgulam and Mandal and Metha (1982) in Goa, have all proved the profitable nature of improved practices in coconut cultivation such as regular manuring and inter cultural operations.

GENERAL PROBLEMS FACED BY THE SAMPLE CULTIVATORS

The study was also aimed at understanding the problems of the sample farmers engaged in the cultivation of coconut.

Management of the crop in almost all the holdings, majority of which were small holdings of less than 0.50 hectare in area, was affected by several socio-economic constraints.

There was a general antipathy among the farmers to chemical fertiliser application. The high cost of fertilizers was one of the factors behind it. Moreover, most of the farmers were not in favour of it, believing that it was detrimental to the health, vigour and long range yielding capacity of palms. Irrigation facilities were quite inadequate in most of the holdings. Water scarcity was a serious problem in some of the holdings, especially in the laterite zone. Also the costs to be incurred in the installation and maintenance of pumpsets was said to be high. Thus, with majority of the holdings being rainfed, unfavourable rainfall patterns posed a serious problem in coconut cultivation.

Use of poor quality planting material resulting in lesser productivity of palms and non adoption of proper spacing was another problem noticed in the holdings.

This was mainly due to lack of scientific knowledge in these aspects. The wage rate prevalent in the area was also said to be high.

Occurence of pests and diseases such as bud rot and stem bleeding was another productivity hindering factor. The high cost of plant protection chemicals together with ignorance of control measures aggravated the problem.

Marketing of produce was found to be another problem faced by the cultivators. Poor transport facilities and high transportation costs rendered marketing difficult. The role of cooperatives in marketing of nuts was not adequate. Price fluctuations were very high and unremunerative prices of nuts led to scanty surpluses with the farmers. Most of them confronted the problem of capital shortage for various cultivation operations. The interest rates charged by the credit institutions were said to be high and the incentives and subsidies given by different agencies meagre.

Moreover there was no strong organisation among the cultivators. Informal co-operative activities in production and marketing would help a lot in the solution of their general problems leading to higher income generation from the holdings.

IMPACT OF INCENTIVES GIVEN BY DIFFERENT AGENCIES FOR COCONUT CULTIVATION

Coconut development in India began to receive the due recognition it deserved only after it was brought within the purview of the National plan in 1955-56. Since then, many major programmes aimed at expansion of area under the crop and productivity improvement were implemented with tangible results.

With a view to protecting the interests of small and marginal coconut cultivators, the Government of India have constituted (by an act of the Parliament in 1979) the coconut Development Board for the integrated development of coconut industry in the country. The development schemes being implemented by the coconut board in different states include

(1) Project for expansion of area under coconut.

This project aims at giving direct financial support to small and marginal farmers undertaking new planting of coconut. A subsidy of Rs.3,000/- hectare is provided by the board under this scheme.

(2) Project for production of quality seedlings.

(3) Project for providing fipancial assistance to coconut growers for the removal of root wilt affected palms in Kerala.

(4) Project for increasing irrigation facilities in coconut gardens. A financial assistance of Rs.1,000/- is provided to farmers for the installation of pumsets, under this scheme.

(5) Project for the establishment of coconut growers' Cooperative Organisations for promoting primary processing and marketing activities.

(6) Project for the setting up of Coconut Technology Development Centre.

Financial aid is provided to industries based on by-products of coconut, award for technological accomplishments and aid to technical research including pilot testing of new processing technology is provided under this scheme.

In Kerala, the Department of Agriculture, the Special Agricultural Development Unit (SADU) and various financial institutions also provide incentives for coconut cultivation.

A special scheme implemented by the Department of Agriculture in Kerala, comprises the free distribution of coconut seedlings to small and marginal farmers. (mini kit distribution). Under another scheme implemented by the department in the southern districts of the state, financial help is provided for spraying against leaf disease

of coconut. Another scheme implemented by the department in cooperation with the FACT in certain panchayats of the state is the intensive fertiliser usage scheme for coconut under which fertiliser packets and technical help are provided at the cultivators' fields.

The Special Agriculture Development Unit (SADU) constituted by the Government of Kerala in 1977, and now under the process of winding up, had as its main objective the improvement in productivity of coconut and pepper with emphasis on the economic uplift of small holders. The project comprised the following programmes.

(1) Newplanting of coconut in Cannanore and Malappuram district. Under this programme, loans were distributed to cultivators for undertaking newplanting of coconut.

(2) Rehabilitation of coconut, including replanting of senile and unproductive palms, in the districts of Cannanore, Koshikode, Malappuram and Trivandrum.

Loans were distributed to cultivators for rehabilitation work, under this programme.

(3) Provision of minor irrigation facilities in newly planted and rehabilitated areas of coconut.

Distribution of loans for the implementation of the various SADU schemes was done by the Kerala State

Cooperative Agricultural Development Bank and selected 10 commercial banks. Refinance from the National Bank for Agriculture and Rural Development (NABARD) was available to all these banks.

The Kerala State Coconut Development Corporation Ltd a public sector enterprise established in 1975 with the aim of protecting the interests of large multitude of coconut growers throughout the state of Kerala has the following major objectives in view:

(1) Development of the coconut industry.
(2) Provision of facilities and conditions conducive to development.
(3) Modernization of coconut based industry in the state.

Towards fulfilling these objectives, the corporation set up two large integrated coconut processing complexes, one each in the southern and northern region of the state.

A study of the incentives and subsidies availed by the selected sample farmers showed that only a small percentage could obtain incentives of any sort. Majority of the farmers were unaware of the development schemes implemented by the coconut Board. A small percentage were found to be beneficiaries of the incentives and subsidies provided by the Department of Agriculture and the Special Agriculture Development Unit. About 20.00 percent of them obtained

coconut seedlings from the department under the minikit distribution scheme and at subsidised prices. 7.50 percent of the sample farmers had availed of loans from the Special Agriculture Development Unit (SADU) for the purchase of pumpsets. Long term loans of Rs.6,000/- to Rs.10,000/- had been availed of by them at an interest rate of 10.50 percent. Around 9.17 percent of the farmers had availed of loans for rehabilitation work in their coconut holdings. An amount of up to Rs.3,300/- per hectare could be availed of for this purpose of which Rs.1,500/- was distributed in first year and the balance amount in the subsequent two years. The interest rate for this long term loan was 10.50 percent.

Most of the sample farmers were of the opinion that incentives and subsidies in respect of coconut cultivation were not much attractive. If at all any beneficial schemes were implemented by the government, these catered to the needs of only a few percentage. The loan amounts distributed were said to be meagre. The amount received by a farmer in relation to the total cost of cultivation was low. Procedural complications and high interest rate also discourage someof them from availing of loans.

The study showed that in general, incentives and subsidies given by different agencies have had very little impact on coconut cultivation in the study area.

S U M M A R Y

The present study on the economics of coconut cultivation in Calicut district, was undertaken with the following objectives in view - (1) To estimate the costs and returns in coconut cultivation. (2) To evaluate the resource use efficiency of yielding coconut plantation. (3) To identify the problemsof coconut cultivators and (4) To examine the impact of incentives given by different agencies for coconut cultivation.

Based on the predominant soil type, the entire district of Calicut was divided into two zones, Sandy zone (Zone I) and Laterite zone (Zone II). The data for the study were collected by personal interview method based on a well structured interview schedule from a sample of 120 coconut cultivators. The sample was selcted by three-stage random sampling with panchayat as first stage unit, panchayat ward as second stage unit and coconut cultivators as third stage unit. The study was undertaken during the year 1985-86. Percentage analysis, capital productivity analysis and functional analysis were used for analysing and interpreting the data.

A study of the general socio-economic features of the sample farmer households showed that the average size of family was 6.6 and 60.83 percent of the sample farmers had 5 to 7 members in their family. The average age for the

Sample was 48.07 years. Almost all the sample farmers were literate. Most of the families in the sample had more than one occupation. Only 25.13 percent of the total respondents were pure agriculturists. Most of the holdings were less than 0.50 hectare in area and the average size of holding was 0.37 hectare. Thus coconut was being cultivated mostly in small holdings and the average area under coconuts was 0.24 hectare. The total family income per annum of most of the respondents came in the range of Rs.5,000/- to Rs.15,000/-. Analysis of the cropping pattern revealed that a major percentage of the gross cropped area was devoted to the cultivation of coconuts. The other crops of importance were paddy, arecanut and bahana. Most of the coconut holdings were rainfed and only 7.08 percent of the gross area under this crop was irrigated.

Data on costs and returns on coconut were collected for a period of 16 years from the year of planting as sixteenth year was regarded as the period of yield stabilisation. Cost of cultivation per hectare was calculated based on 1985-86 prices.

Total cost of cultivation for 16 years was estimated to be Rs. 90,167/- and Rs.91,667 for zone I and Zone II respectively and the average for the district was Rs.91,311/-. Expenditure was the highest during the first year of planting because of preparatory cultivation, cost of seedlings and planting.

The major item of expenditure was human labour constituting about 48.38 percent (Rs.43,624) 50.83 percent(Rs.46,594) and 50.49 percent (Rs.46,100) of the total cost for 16 years in Zone I, Zone II and the district respectively. Labour requirement was the highest during the first year of the crop, which was due to the high use of labour for clearing the field, fencing, digging pits and planting. The total labour requirement for 16 years was 1745 mandays per hectare in Zone I and the corresponding values in Zone II and the district were 1864 and 1844. During the steady bearing stage, labour contributed by family members came to about 40.95 percent, 42.34 percent and 41.82 percent of the total labour requirements in Zone I, Zone II and the district.

The expenditure on seedlings was Rs.1,894, Rs.1,925 and Rs.1,918 respectively for Zone I and II and the district. Materials for fencing, shading and mulching accounted for 5.00 percent (Rs.4,508),3.86 percent (Rs.3,538) and 4.13 percent (Rs.3,767) of the total cost of cultivation in Zone I, Zone II and the district. Expenditure on fertiliser including farm yard manure accounted for 25.00 percent (Rs.22,543),24.20 percent (Rs.22,183) and 24.16 percent (Rs.22,058) in Zones I and II and the district. Plant protection accounted for 5.00 percent (Rs.4,507), 5.11 percent (Rs.4,675) and 5.08 percent (Rs.4,636) of the total cost in ZoneI, Zone II and the district.

Harvesting charges were incurred from the eighth year onwards and these were 10.23 percent (Rs.9,224),9.80 percent (Rs.8,983) and 9.90 percent (Rs.9,040) in Zones I and II and the district. The cost for various tools and implements including the replacement and maintenance charges accounted for 0.72,0.71 and 0.71 percentages of the total cost in Zone I, Zone II and the district. Land tax accounted for 0.18, 0.17 and 0.18 percentages of the total cost in Zones I and II and the district. All other expenditures were taken as miscellaneous expenditure which was 3.39 percent (Rs.3,058), 3.23 percent (Rs.2,959) and 3.27 percent (Rs.2,982) respectively in ZoneI, Zone II and the district.

The cost of bringing the plantation up to bearing stage or the total investment cost come to Rs.38,301, Rs.38,921 and Rs.38,773 per hectare in Zone I, Zone II and the district. The expenditure from the eighth year onwards or the maintenance cost come to Rs.5,781, Rs.5,876 and Rs.5,853 per hectare per year in Zones I and II and the district.

Coconut starts yielding from the eighth year and the yield gets stabilised by the sixteenth year of planting. Steady yield would continue up to 50 years and thereafter nut yield declines from the fifty first year. The average annual production of nuts per hectare during the stabilised period was estimated as 10,863, 9798 and 10,049 nuts in Zone I, Zone II and the district.

Cost of production per nut was estimated as Rs.1.02, Rs.1.15 and Rs.1.12 in Zone I, Zone II and the district respectively.

For estimating the returns from coconut cultivation, the average farmgate price for nuts during the year 1983-84 was considered due to the fact that the farmgate price of nuts for the years 1985-86 and 1984-85 were highly unusual. The estimated net returns on investment per hectare per year came to Rs.15,941, Rs.13,226 and Rs.13,835 in Zones I and II and the district.

Payback period for Zone I, Zone II and the district was found to be 12.79, 13.29, and 13.18 years respectively. Benefit-cost ratios were 1.58, 1.40 and 1.44 for Zones I and II and the district. Net present worth for Zone I, Zone II and the district was estimated as Rs.31,409, Rs.22,303 and Rs.24,454 respectively. Internal rates of return were 17.06 percent, 16.14 percent and 16.39 percent for Zone I and II and the district. Capital productivity analysis showed that the investments were worthwhile in both the Zones and the district. The analysis indicated that Zone I (Sandy Zone) was economically more efficient than Zone II(Laterite Zone) with regard to coconut cultivation.

Resource use efficiency of yielding coconut plantation was studied by fitting a multiple linear production function.

Results showed that the age of the trees, labour mandays, fertiliser, and plant protection were all factors which had significant influence on the gross income obtained from a coconut garden. The marginal value productivity of the factors labour, fertiliser and plant protection were estimated as 818.53, 399.01 and 2170.99 respectively.

The general problems faced by the sample farmers were identified as high labour charges, high cost of inputs, water scarcity, poor irrigation facilities, occurence of pests and diseases, high fluctuations in prices, high transportation costs and other marketing problems, and the absence of a strong organisation among the farmers.

The study showed that in general, incentives and subsidies given by different agencies have had very little impact on coconut cultivation in the study area.

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APPENDIX I

QUESTION FOR DATA COLLECTION

ECONOMIC OF COCONUT CULTIVATION IN CALICUT DISTRICT

1. Name and address of cultivator :

   Village :

   Taluk :

   Block :

2. Distance to the nearest market :

3. Total area owned by the cultivator :

   (a) Leased In (b) Leased out :

4. Total area cultivated :

5. Number of fragments

   Fragment No. Area :

6. Family details

Sl No	Name	Age	Sex	Relation with the Head	Education	Occupation Main	Occupation Subsidiary	Income other than coconut & Intercrops Main	Income other than coconut & Intercrops Subsidiary	Other

7. **CROPPING PATTERN :**

CROP	AREA					
A. SEASONAL CROPS	MUNDAKAN		PUNCHA		VIRIPPU	
	Owned	Leased	Owned	Leased	Owned	Leased
1. Paddy						
2. Pulses						
3. Vegetables						
4. Others						

B. ANNUAL CROPS	NO. OF PLANTS/TREES	AREA	
		Owned	Leased
1. Tapioca			
2. Banana			
3. Others			

C. PERENNIAL TREES	NO. OF PLANTS/TREES	AREA	
		Owned	Leased
1. Coconut			
2. Arecanut			
3. Fruit Trees			
4. Others			

8. **AGRICULTURAL MACHINERY AND IMPLEMENTS**

Item	No./Year of Purchase	Purchase Price	Maintenance Cost (Fuel charge/repairs hire charges)
1. Ploughs			
2. Tractor			
3. Tiller			
4. Sprayer			
5. Duster			
6. Carts			
7. Leveller			
8. Pump set			
9. Mammotties			
10. Others			

9. TAXES

(a) Land Revenue

(b) Water Tax

(c) Panchayat Tax

(d) Income Tax

(e) Others (Specify)

10. LIVESTOCK

	No	Maintenance Cost	Returns
(a) Bullocks			
(b) Cows			
(c) Goat			
(d) Poultry			

11. SOURCE OF IRRIGATION

Source	Area Irrigated	
	Coconut	Others
Canals		
Tanks		
Wells		
Others (Specify)		

Hours required for irrigation of coconut plot :

Frequency of irrigation of Coconuts :

Total number of months during which irrigation was undertaken :

12. PARTICULARS OF COCONUT GARDEN

Sl No	Particulars	Local (Tall)	Hybrid	Total
1.	Total area			
2.	No. of trees in the area			
3.	Age of the garden			
4.	Single row/thope			
5.	Irrigated/rain fed			
6.	Spacing adopted			
7.	No. of bearing trees			
8.	Intercrops followed			
9.	Permanent labour to maintain the coconut garden, if any			
10.	Wage rate :			
	Male :	Female :		

11. COST OF CULTIVATION OF COCONUT GARDEN :

(a) Nature of land :

Plain/undulated :

(b) Soil type :

(c) Age of the plantation :

(d) Sources of planting material (Mother palms or other agencies) :

TABLE - I - Ist yr

AREA | NO. OF TREES | YEAR OF PLANTING

Sl No	Particulars	Labour				Materials		Total Cost
		Men No.	Men No.of hrs	Women No	Women No.of hrs	Quantity	Value	
1	Clearing, levelling & bunding							
2.	Raising the level of the land							
3.	Fencing							
4.	Digging pits							
5.	Curing and filling up pits							
6.	cost of seedlings							
7.	Transport charges							
8.	Salt, BHC application							
9.	planting							
10.	Irrigation*							
11.	Shading							
12.	Others (if any) i) Cleaning of pits ii) Weed removal iii) Digging around plant iv) Gap filling							

* Specify the method of irrigation

Wage rate : Male : Rs. /day

Female Rs. / day

TABLE- II Year of planting : Area

Sl No	Particulars	2nd year						3rd year						4th year					
		No of trees						No. of trees						No. of trees					
		Men		Women		Materials		Men		Women		Materials		Men		Women		Materials	
		No.	No of hrs	No.	No of hrs	Qty	Value	No.	No of hrs	No.	No of hrs	Qty	Value	No	No of hrs	No.	No of hrs	Qty	Value
1.	Cost of i)FYM																		
	ii)Fertilisers																		
	N																		
	P																		
	K																		
	iii)Application charges																		
2.	i)Shading																		
	ii)Mulching																		
	a)Husks																		
	b)leaves																		
	c)Others																		
	iii) Gap filling																		
3.	Inter cultivation operations																		
	i) Ploughing																		
	ii)Weeding																		
	iii)Digging corner																		
4.	Plant protection																		
	i)																		
	ii)																		
	iii)																		
5.	Irrigation cost																		
6.	Others if any																		
	i)																		
	ii)																		
7.	Total																		

Wage rate : Men Women :

TABLE - II

Year of planting

Area

Sl No	Particulars	5th year						6th year						7th year					
		No. of trees						No. of trees						No. of trees					
		Men		Women		Materials		Men		Women		Materials		Men		Women		Materials	
		No	No of hrs	No	No of hrs	Qty	Value	No	No of hrs	No	No of hrs	Qty	Value	No	No of hrs	No	No of hrs	Qty	Value
1	Cost of i)FYM																		
	ii)Fertilisers																		
	N																		
	P																		
	K																		
	iii)Application charges																		
2.	i)Shading																		
	ii)Mulching																		
	a)Husks																		
	b)Leaves																		
	c)Others																		
	iii)Gap filling																		
3.	Inter cultivation operations																		
	i)Ploughing																		
	ii)Weeding																		
	iii)Digging Corner																		
4.	Plant protection																		
	i)																		
	ii)																		
	iii)																		
5.	Irrigation cost																		
6.	Others if any																		
	i)																		
	ii)																		
7.	Total																		

Wage rate : Men : Women :

TABLE - III Year of planting Area

Sl No	Particulars	8th year						9th year						10th year					
		No of trees						No of trees						No of trees					
		Men		Women		Materials		Men		Women		Materials		Men		Women		Materials	
		No	No of hrs	No	No of hrs	Qty	Value	No	No of hrs	No	No of hrs	Qty	Value	No	No of hrs	No	No of hrs	Qty	Value
1.	Cost of i)FYM																		
	ii)Fertilisers																		
	N																		
	P																		
	K																		
	iii)Application charges																		
	iv)Sand																		
2.	Mulching a)Husks																		
	b)Leaves																		
	c)Others																		
3.	Inter cultivation																		
	i)Ploughing																		
	ii)Manually weeding																		
	iii)Earthing up																		
4.	Plant protection																		
	i)																		
	ii)																		
5.	Irrigation*																		
6.	Watch & Ward																		
7.	Harvesting charges																		
	a)Cash																		
	b)Kind																		
8.	Heaping charges																		
9.	Carting to home (Rate/Cart)																		
10.	Total																		

RETURNS		8th year Qty.	8th year Value	9th year Qty.	9th year Value	10th year Qty.	10th year Value
	Nuts						
	Dry leaves						
	Total						

* Specify the method of irrigation. Wage rate : Male : Female:

TABLE - III Year of planting Area

Sl No	Particulars	11th year						12th year						13th year					
		No of trees						No of trees						No of trees					
		Men		Women		Materials		Men		Women		Materials		Men		Women		Materials	
		No	No of hrs	No	No of hrs	Qty	Value	No	No of hrs	No	No of hrs	Qty	Value	No	No of hrs	No	No of hrs	Qty	Value
1.	Cost of i)FYM																		
	ii)Fertilisers																		
	N																		
	P																		
	K																		
	iii)Application charges																		
2.	Mulching a)Husks																		
	b)Leaves																		
	c)Others																		
3.	Inter cultivation																		
	i)Ploughing																		
	ii)Mannually weeding																		
	iii)Earthing up																		
4.	Plant protection																		
	I)																		
	ii)																		
5.	Irrigation *																		
6.	Watch & Ward																		
7.	Harvesting charges																		
	a)Cash																		
	b)Kind																		
8.	Heaping charges																		
9.	Carting to home (Rate/Cart)																		
10.	Total																		

		11th year		12th year		13th year	
		Qty.	Value	Qty.	Value	Qty.	Value
RETURNS	Nuts						
	Dry leaves						
	Total						

* Specify the method of irrigation. Wage rate : Male : Female:

TABLE- III Year of planting: Area

Sl No	Particulars	14th year						15th year					
		No of trees						No of trees					
		Men		Women		Materials		Men		Women		Materials	
		No	No of hrs	No	No of hrs	Qty	Value	No	No of hrs	No	No of hrs	Qty	Value
1.	Cost of i)FYM												
	ii)Fertilisers												
	N												
	P												
	K												
	iii)Application charges												
	iv) Sand												
2.	Mulching a)Husks												
	b)Leaves												
	c)Others												
3.	Inter cultivation												
	i)Ploughing												
	ii)Manually weeding												
	iii)Earthing Up												
4.	Plant protection												
	i)												
	ii)												
5.	Irrigation*												
6.	Watch & Ward												
7.	Harvesting charges												
	a)Cash												
	b)Kind												
8.	Heaping charges												
9.	Carting to home (Rate/Cart)												
10.	Total												

		Qty.	Value	Qty.	Value
RETURNS	Nuts				
	Dry leaves				
	Total				

* Specify the method of irrigation. Wage rate: Male: Female:

TABLE - IV Year of planting: Area No. of trees

Sl No	Particulars	Labour				Materials		Returns	
		Men		Women					
		No.	No of hrs	No	No of hrs	Qty	Value	Qty	Value
1.	Cost of i)FYM								
	ii)Fertilisers								
	N								
	P								
	K								
	iii)Application charges								
	iv)Sand								
2.	Mulching								
	a)Husks								
	b)Leaves								
	c)Others								
3.	Inter cultivation								
	i)Ploughing								
	ii)Manually weeding								
	iii)Earthing up								
4.	Plant protection								
	i)								
	ii)								
5.	Irrigation *								
6.	Watch & Ward								
7.	Harvesting charges								
	a)Cash								
	b)Kind								
8.	Heaping charges								
9.	Carting to home (Rate/Cart)								
10.	Total								

Nuts
Dry leaves
Total

* Specify the method of irrigation

13. Total yield & income from coconut garden

Area :

No. of trees :

Sl No	Particulars	No/Wt	Value per unit	Total Value	Remarks
01	Coconuts				
02	Dry leaves				

i) Total income from coconut crop
ii) Total expenses
iii) Net profit

15. Other sources of income:

1. Dairying/Poultry
2. Govt. & Private jobs
3. Business
4. Total expenditure for the family/year
5. Gross total income of the family
6. Net income
7. Net profit

16. BORROWINGS

a) OUTSTANDING BORROWINGS AT THE BEGINNING OF THE REFERENCE PERIOD

Source	Purpose	Total Amount Borrowed	Amount Outstanding	Amount overdue	Interest	Security

b) BORROWINGS DURING THE REFERENCE PERIOD

Source	Purpose	Amount	Amount to be repaid during the reference period	Amount actually repaid	Reasons for over due, if any	Interest	Security

Incentives & subsidies, if any, obtained from various sources:

Overall opinion about these :

17. PROBLEMS, IF ANY FACED BY THE CULTIVATORS:

Practices	Recommendations	Whether adopted or Not	If not adopted, Reasons

Qualities to be noted:

1. Selection of Seedlings — Early germination, rapid growth, good vigour, having minimum of 4 leaves far 9 month old seedling 10-12 cm. Girth at collar region; early splitting of leaves.

2. Spacing

Planting system.	Spacing
Triangular	7.6M
Square	7.6-9M
* Double hedge	5x5m in rows 9m between pairs of rows.

3. Husk burial — Husk to be buried in linear trenches taken 3M away from the trunk rows of palms or in circular trenches taken around the palm at a distance of 2M. from the trunk. Husksto be placed in layers with concave surface facing upwards and covered with soil.

* Single hedge 5m.in the rows 9m.between rows

Practices	Recommendations	Whether adopted Or Not	If Not adopted Reasons
4. Fertiliser application	$\frac{N}{0.34}$ $\frac{P_2O_5}{0.17}$ $\frac{K_2O}{0.68}$ Kg. per palm per annum in two split doses for rainfed and 3 for irrigated.		
5. Irrigation	Frequency of irrigation Sandy soil - Once in 3-4 days Loam - Once in 7-8 days.		
6. Plant protection			
PESTS			
Rhinoceros beetle	Application of BHC 5%		
RED PALM WEEVIL	Application of Carbaryl 1%		
BLACK HEADED CATERPILLAR	Application of BHC, 0.2%		
DISEASES			
BUD ROT	Spray Bordeaux mixture 1%		
LEAF ROT	Spray Bordeaux mixture 1%		
STEAM BLEEDING	Application of Bordeaux paste		
ROOT WILT			
Management	Proper manuring & mixed farming.		

7. Are there any financial problems :

   i) Lack of credit institutions nearby

   ii) Procedural complications

   iii) Loan amount meagre

   iv) High interest rate

   v) Others

8. Marketing problems, if any (including transportation)

APPENDIX IIa

COMPUTATION OF PAYBACK PERIOD FOR ZONE I

Year	Estimated cost of cultivation (Rs)	Progressive total of cost (Rs)	Returns (Rs)	Progressive total of returns (Rs)	Net returns on progressive total (Rs)
1	11712	11712	-	-	-11712
2	3285	14997	-	-	-14997
3	3447	18444	-	-	-18444
4	4548	22992	-	-	-22992
5	5103	28095	-	-	-28095
6	5103	33198	-	-	-33198
7	5103	38301	-	-	-38301
8	5628	43929	4052	4052	-39877
9	5713	49642	7387	11439	-38203
10	5732	55374	10616	22055	-33319
11	5746	61120	13632	35687	-25433
12	5791	66911	18659	54346	-12565
13	5814	72725	21782	76128	3403
14	5814	78539	25909	102037	23498
15	5814	84353	27022	129059	44706
16to50	5814	90167	27022	156081	65914
51	5814	95981	25962	182043	86062
52	5814	101795	24295	206338	104543
53	5814	107609	22285	228623	121014
54	5814	113423	20670	249293	135870
55	5814	119237	18156	267449	148212

$$\text{Payback period} = 12 + 1 \left(\frac{-12565}{-12565 - 3403} \right)$$

$$= 12.79 \text{ years}$$

APPENDIX IIb

COMPUTATION OF PAYBACK PERIOD FOR ZONE II

Year	Estimated cost of cultivation (Rs)	Progressive total of cost (Rs)	Returns (Rs)	Progressive total of returns (Rs)	Net returns on progressive total (Rs)
1	12010	12010	-	-	-12010
2	3390	15400	-	-	-15400
3	3540	18940	-	-	-18940
4	4627	23567	-	-	-23567
5	5118	28685	-	-	-28685
6	5118	33803	-	-	-33803
7	5118	38921	-	-	-38921
8	5762	44683	3549	3549	-41134
9	5800	50483	6381	9930	-40553
10	5839	56322	9108	19038	-37284
11	5847	62169	12124	31162	-31007
12	5886	68055	17151	48313	-19742
13	5903	73958	20274	68874	-5371
14	5903	79861	23899	92486	12625
15	5903	85764	24508	116994	31230
16-50	5903	91667	24508	141502	49835
51	5903	97570	23952	165454	67884
52	5903	103473	22285	187739	84266
53	5903	109376	20274	208013	98637
54	5903	115279	18659	226672	111393
55	5903	121182	16145	242817	121635

$$\text{Payback period} = 13 + 1\left(\frac{-5371}{-5371 - 12625}\right)$$

$$= 13.29 \text{ years}$$

APPENDIX IIc

COMPUTATION OF PAYBACK PERIOD FOR THE DISTRICT

Year	Estimated cost of cultivation (Rs)	Progressive total of cost (Rs)	Returns (Rs)	Progressive total of returns (Rs)	Net returns on progressive total (Rs)
1	11940	11940	-	-	-11940
2	3365	15305	-	-	-15305
3	3518	18823	-	-	-18823
4	4608	23431	-	-	-23431
5	5114	28545	-	-	-28545
6	5114	33659	-	-	-33659
7	5114	38773	-	-	-38773
8	5730	44503	3668	3668	-40835
9	5779	50282	6618	10286	-39996
10	5814	56096	9464	19750	-36346
11	5823	61919	12480	32230	-29689
12	5864	67783	17507	49737	-18046
13	5882	73665	20630	70367	-3298
14	5882	79547	24373	94740	15193
15	5882	85429	28101	119841	34412
16-50	5882	91311	25101	144942	53631
51	5882	97193	24426	169368	72175
52	5882	103075	22759	192127	89052
53	5882	108957	20749	212876	103919
54	5882	114839	19134	232010	117171
55	5882	120721	16620	248630	127909

$$\text{Payback period} = 13 + 1\left(\frac{-3298}{-3298 - 15193}\right)$$

$$= 13.18 \text{ years}$$

APPENDIX IIIa

COMPUTATION OF BENEFIT-COST RATIO AND NET PRESENT WORTH FOR ZONE I

Year	Estimated cost of cultivation (Rs)	Benefit (Rs)	Discount factor at 11%	Present worth of cost (Rs)	Present worth of benefit (Rs)
1	11712	-	1.1100	13000	-
2	3285	-	0.8116	2666	-
3	3447	-	0.7312	2520	-
4	4548	-	0.6587	2996	-
5	5103	-	0.5930	3026	-
6	5103	-	0.5346	2728	-
7	5103	-	0.4817	2458	-
8	5628	4082	0.4340	2443	1759
9	5713	7387	0.3909	2233	2888
10	5732	10616	0.3522	2019	3739
11	5746	13632	0.3173	1823	4325
12	5791	18659	0.2858	1655	5333
13	5814	21782	0.2575	1497	5609
14	5814	25909	0.2319	1349	6008
15	5814	27022	0.2090	1215	5648
16-50	5814	27022	1.8510	10762	50018
51	5814	25962	0.0049	28	127
52	5814	24295	0.0044	26	107
53	5814	22285	0.0039	23	87
54	5814	20670	0.0036	21	74
55	5814	18156	0.0032	19	58
		42600(a)	0.0032		136
				54507	85916

(a) Salvage value

Benefit-Cost ratio = $\frac{85916}{54507}$ = 1.58

Net present worth = 85916 - 54507 = Rs. 31409

APPENDIX IIIb

COMPUTATION OF BENEFIT-COST RATIO AND NET PRESENT WORTH FOR ZONE II

Year	Estimated cost of cultivation (Rs)	Benefit (Rs)	Discount factor at 11%	Present worth of cost (Rs)	Present worth of benefit (Rs)
1	12010	- -	1.1100	13331	-
2	3390	-	0.8116	2751	-
3	3540	-	0.7312	2588	-
4	4627	-	0.6587	3048	-
5	5118	-	0.5930	3035	-
6.	5118	-	0.5346	2736	-
7	5118	-	0.4817	2465	-
8	5762	3549	0.4340	2501	1540
9	5800	6381	0.3909	2267	2494
10	5839	9108	0.3522	2056	3208
11	5847	12124	0.3173	1855	3847
12	5886	17151	0.2858	1682	4902
13	5903	20274	0.2575	1520	5221
14	5903	23899	0.2319	1369	5542
15	5903	24508	0.2090	1234	5122
16-50	5903	24508	1.8510	10926	45364
51	5903	23952	0.0049	29	117
52	5903	22285	0.0044	26	98
53	5903	20274	0.0039	23	79
54	5903	18659	0.0036	21	67
55	5903	16145	0.0032	19	52
		42600(a)	0.0032		136
				55486	77789

(a) Salvage value

$$\text{Benefit-cost ratio} = \frac{77789}{55486} = 1.40$$

Net present worth = 77789 - 55486 = Rs. 22303

APPENDIX IIIc

COMPUTATION OF BENEFIT-COST RATIO AND NET PRESENT WORTH FOR THE DISTRICT

Year	Estimated cost of cultivation (Rs)	Benefit (Rs)	Discount factor at 11%	Present worth of cost (Rs)	Present worth of benefit (Rs)
1	11940	-	1.1100	13253	-
2	3365	-	0.8116	2731	-
3	3518	-	0.7312	2572	-
4	4608	-	0.6587	3035	-
5	5114	-	0.5930	3033	-
6	5114	-	0.5346	2734	-
7	5114	-	0.4817	2463	-
8	5730	3668	0.4340	2487	1592
9	5779	6618	0.3909	2259	2587
10	5814	9464	0.3522	2048	3333
11	5823	12480	0.3173	1848	3960
12	5864	17507	0.2858	1676	5004
13	5882	20630	0.2575	1515	5312
14	5882	24373	0.2319	1365	5652
15	5882	25101	0.2090	1229	5246
16-50	5882	25101	1.8510	10888	46462
51	5882	24426	0.0049	29	120
52	5882	22759	0.0044	26	100
53	5882	20749	0.0039	23	81
54	5882	19134	0.0036	21	69
55	5882	16620	0.0032	19	53
		42600(a)	0.0032		136
				55253	79707

(a) Salvage value

$$\text{Benefit-cost ratio} = \frac{79707}{55253} = 1.44$$

Net present worth = 79707 - 55253 = Rs.24454

APPENDIX IVa

COMPUTATION OF INTERNAL RATE OF RETURN FOR ZONE I

Year	Estimated cost of cultivation (Rs)	Annual Benefit (Rs)	Incremental Benefit (Rs)	Discount factor at 11% (Rs)	Present worth at 11% (Rs)	Discount factor at 18% (Rs)	Present worth at 18% (Rs)
1	11712	-	-11712	1.1100	-13000	0.8470	-9920
2	3285	-	-3285	0.8116	-2666	0.7180	-2359
3	3447	-	-3447	0.7312	-2520	0.6090	-2099
4	4548	-	-4548	0.6587	-2996	0.5160	-2347
5	5103	-	-5103	0.5930	-3026	0.4370	-2230
6	5103	-	-5103	0.5346	-2728	0.3701	-1888
7	5103	-	-5103	0.4817	-2458	0.8141	-1602
8	5628	4052	-1576	0.4340	-684	0.2662	-420
9	5713	7387	1674	0.3909	654	0.2250	377
10	5732	10616	4884	0.3522	1720	0.1911	933
11	5746	13632	7886	0.3173	2502	0.1622	1279
12	5791	18659	12868	0.2858	3678	0.1370	1763
13	5814	21782	15968	0.2575	4112	0.1161	1854
14	5814	25909	20095	0.2319	4660	0.0990	1989
15	5814	27022	21208	0.2090	4432	0.0835	1771
16-50	5814	27022	21208	1.8510	39256	0.3785	8027
51	5814	25962	20148	0.0049	99	0.00021	4
52	5814	24295	18481	0.0044	81	0.00018	3
53	5814	22285	16471	0.0039	64	0.00016	3
54	5814	20670	14856	0.0036	53	0.00013	2
55	5814	18156	12342	0.0032	39	0.00011	1
		42600(a)	42600(a)	0.0032	136	0.00011	5
					31408		-4854

(a) Salvage value

$$IRR = 11 + 7 \left\{ \frac{31408}{31408 - (-4854)} \right\} = 17.06\%$$

APPENDIX IVb

COMPUTATION OF INTERNAL RATE OF RETURN FOR ZONE I

Year	Estimated cost of cultivation (Rs)	Annual benefit (Rs)	Incremental Benefit (Rs)	Discount factor at 11% (Rs)	Present worth at 11%	Discount factor at 18% (Rs)	Present worth at 18% (Rs)
1	12010	-	-12010	1.1100	-13331	0.8470	-10172
2	3390	-	-3390	0.8116	-2751	0.7180	-2434
3	3540	-	-3540	0.7312	-2588	0.6090	-2156
4	4627	-	-4627	0.6587	-3048	0.5160	-2388
5	5118	-	-5118	0.5930	-3035	0.4370	-2237
6	5118	-	-5118	0.5346	-2736	0.3781	-1894
7	5118	-	-5118	0.4817	-2465	0.3141	-1607
8	5762	3549	-2213	0.4340	-960	0.2662	-589
9	5800	6381	581	0.3909	227	0.2250	131
10	5839	9108	3269	0.3522	1151	0.1911	625
11	5847	12124	6277	0.3173	1992	0.1622	1018
12	5886	17151	11265	0.2858	3220	0.1370	1543
13	5903	20274	14371	0.2575	3701	0.1161	1668
14	5903	23899	17996	0.2319	4173	0.0990	1782
15	5903	24508	18605	0.2090	3888	0.0835	1554
16-50	5903	24508	18605	1.8510	34438	0.3785	7042
51	5903	23952	18049	0.0049	88	0.00021	4
52	5903	22285	16382	0.0044	72	0.00018	3
53	5903	20274	14371	0.0039	56	0.00016	2
54	5903	18659	12756	0.0036	46	0.00013	2
55	5903	16145	10242	0.0032	33	0.00011	1
		42600(a)	42600	(a)0.0032	136	0.00011	5
					22307		-8097

(a) Salvage value

$$IRR = 11 + 7 \left\{ \frac{22307}{22307 - (-8097)} \right\} = 16.14\%$$

APPENDIX IVc

COMPUTATION OF INTERNAL RATE OF RETURN FOR THE DISTRICT

Year	Estimated cost of cultivation (Rs)	Annual Benefit (Rs)	Incremental Benefit (Rs)	Discount factor at 11% (Rs)	Present worth at 11% (Rs)	Discount factor at 16%	Present worth at 16% (Rs)
1	11940	-	-11940	1.1100	-13253	0.8470	-10113
2	3365	-	-3365	0.8116	-2731	0.7180	-2416
3	3518	-	-3518	0.7312	-2572	0.6090	-2142
4	4608	-	-4608	0.6587	-3035	0.5160	-2378
5	5114	-	-5114	0.5930	-3033	0.4370	-2235
6	5114	-	-5114	0.5346	-2734	0.3701	-1892
7	5114	-	-5114	0.4817	-2463	0.3141	-1606
8	5730	3668	-2062	0.4340	-895	0.2662	-549
9	5779	6618	839	0.3909	328	0.2250	189
10	5814	9464	3650	0.3522	1286	0.1911	698
11	5823	12480	6657	0.3173	2112	0.1622	1080
12	5864	17507	11643	0.2858	3328	0.1370	1595
13	5882	20630	14748	0.2575	3798	0.1161	1712
14	5882	24373	18491	0.2319	4288	0.0990	1831
15	5882	25101	19219	0.2090	4017	0.0835	1605
16-50	5882	25101	19219	1.8510	35574	0.3785	7274
51	5882	24426	18544	0.0049	91	0.00021	4
52	5882	22759	16877	0.0044	74	0.00018	3
53	5882	20749	14867	0.0039	58	0.00016	2
54	5882	19134	13252	0.0036	48	0.00013	2
55	5882	16620	10738	0.0032	34	0.00011	1
		42600(a)	42600(a)	0.0032	136	0.00011	5
					24456		-7330

(a) Salvage value

$$IRR = 11 + 7 \left\{ \frac{24456}{24456 - (-7330)} \right\} = 16.39\%$$

APPENDIX Va

SENSITIVITY ANALYSIS - 20% FALL IN PRICE

COMPUTATION OF INTERNAL RATE OF RETURN FOR ZONE I

Year	Estimated cost of cultivation (Rs)	Annual Benefit (Rs)	Incremental Benefit (Rs)	Discount factor at 11%	Present worth at 11% (Rs)	Discount factor at 18%	Present worth at 18% (Rs)
1	11712	-	-11712	1.1100	-13000	0.8470	-9920
2	3285	-	-3285	0.8116	-2666	0.7180	-2359
3	3447	-	-3447	0.7312	-2520	0.6090	-2099
4	4548	-	-4548	0.6587	-2996	0.5160	-2347
5	5103	-	-5103	0.5930	-3026	0.4370	-2230
6	5103	-	-5103	0.5346	-2728	0.3701	-1888
7	5103	-	-5103	0.4817	-2458	0.3141	-1602
8	5628	3351	-2277	0.4340	-988	0.2662	-606
9	5713	6085	372	0.3909	145	0.2250	84
10	5732	8714	2982	0.3522	1050	0.1911	570
11	5746	11129	5383	0.3173	1708	0.1622	873
12	5791	15155	9364	0.2858	2676	0.1370	1283
13	5814	17677	11863	0.2575	3055	0.1161	1377
14	5814	21004	15190	0.2319	3523	0.0990	1504
15	5814	21916	16102	0.2090	3365	0.0835	1345
16-50	5814	21916	16102	1.8510	29805	0.3785	6095
51	5814	21057	15243	0.0049	75	0.00021	3
52	5814	19690	13876	0.0044	61	0.00018	2
53	5814	18080	12266	0.0039	48	0.00016	2
54	5814	16765	10951	0.0036	39	0.00013	1
55	5814	14752	8938	0.0032	29	0.00011	1
		42600(a)	42600(a)	0.0032	136	0.00011	5
					15333		-9906

(a) Salvage value

$$IRR = 11 + 7 \left\{ \frac{15333}{15333 - (-9906)} \right\} = 15.25\%$$

APPENDIX Vb

SENSITIVITY ANALYSIS - 20% FALL IN PRICE

COMPUTATION OF INTERNAL RATE OF RETURN FOR ZONE II

Year	Estimated cost of cultivation (Rs)	Annual Benefit (Rs)	Incremental Benefit (Rs)	Discount factor at 11%	Present worth at 11% (Rs)	Discount factor at 18%	Present worth at 18% (Rs)
1	12010	-	-12010	1.1100	-13331	0.8470	-10172
2	3390	-	-3390	0.8116	-2751	0.7180	-2434
3	3540	-	-3540	0.7312	-2588	0.6090	-2156
4	4627	-	-4627	0.6587	-3048	0.5160	-2388
5	5118	-	-5118	0.5930	-3035	0.4370	-2237
6	5118	-	-5118	0.5346	-2736	0.3701	-1894
7	5118	-	-5118	0.4817	-2465	0.3141	-1607
8	5762	2948	-2814	0.4340	-1221	0.2662	-749
9	5800	5280	-520	0.3909	-203	0.2250	-117
10	5839	7506	1667	0.3522	587	0.1911	319
11	5847	9922	4075	0.3173	1293	0.1622	661
12	5886	13947	8061	0.2858	2304	0.1370	1104
13	5903	16470	10567	0.2575	2721	0.1161	1227
14	5903	19394	13491	0.2319	3129	0.0990	1336
15	5903	19903	14000	0.2090	2926	0.0835	1169
16-50	5903	19903	14000	1.8510	25914	0.3785	5299
51	5903	19447	13544	0.0049	66	0.00021	3
52	5903	18080	12177	0.0044	54	0.00018	2
53	5903	16470	10567	0.0039	41	0.00016	2
54	5903	15155	9252	0.0036	33	0.00013	1
55	5903	13142	7239	0.0032	23	0.00011	1
		42600(a)	42600(a)	0.0032	136	0.00011	5
					7849		-12625

(a) Salvage Value

$$IRR = 11 + 7 \left\{ \frac{7849}{7849 - (-12625)} \right\} = 13.68\%$$

APPENDIX Vc

SENSITIVITY ANALYSIS - 20% FALL IN PRICE

COMPUTATION OF INTERNAL RATE OF RETURN FOR THE DISTRICT

Year	Estimated cost of cultivation (Rs)	Annual Benefit (Rs)	Incremental benefit (Rs)	Discount factor at 11% (Rs)	Present worth at 11% (Rs)	Discount factor at 18%	Present worth at 18% (Rs)
1	11940	-	-11940	1.1100	-13253	0.8470	-10113
2	3365	-	- 3365	0.8116	-2731	0.7180	-2416
3	3518	-	-3518	0.7312	-2572	0.6090	-2142
4	4608	-	-4608	0.6587	-3035	0.5160	-2378
5	5114	-	-5114	0.5930	-3033	0.4370	-2235
6	5114	-	-5114	0.5346	-2734	0.3701	-1892
7	5114	-	-5114	0.4817	-2463	0.3141	-1606
8	5730	3043	-2687	0.4340	-1166	0.2662	-715
9	5779	5470	-309	0.3909	-121	0.2250	-70
10	5814	7791	1977	0.3522	696	0.1911	378
11	5823	10207	4384	0.3173	1391	0.1622	711
12	5864	14232	8368	0.2858	2392	0.1370	1146
13	5882	16755	10873	0.2575	2800	0.1161	1262
14	5882	19774	13892	0.2319	3222	0.0990	1375
15	5882	20378	14496	0.2090	3030	0.0835	1210
16-50	5882	20378	14496	1.8510	26832	0.3785	5487
51	5882	19827	13945	0.0049	68	0.00021	3
52	5882	18460	12578	0.0044	55	0.00018	2
53	5882	16850	10968	0.0039	43	0.00016	2
54	5882	15535	9653	0.0036	35	0.00013	1
55	5882	13522	7640	0.0032	24	0.00011	1
		42600(a)	42600(a)	0.0032	136	0.00011	5
					9616		-11984

(a) Salvage value

$$IRR = 11 + 7 \left\{ \frac{9616}{9616 - (-11984)} \right\} = 14.12\%$$

ECONOMICS OF COCONUT CULTIVATION IN CALICUT DISTRICT

By

PREMAJA, P.

ABSTRACT OF A THESIS

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COLLEGE OF HORTICULTURE

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ABSTRACT

A study on the economics of coconut cultivation in Calicut district was conducted during the period 1985-86, to evaluate the costs and returns, capital productivity, resource use efficiency of yielding plantation, the problems of coconut cultivators and the impact of incentives given by different agencies for coconut cultivation.

Three stage random sampling was adopted for the study and data were collected from a sample of 120 cultivators by personal interview method.

Coconut was cultivated mostly in small holdings and the average area under coconut holding in the sample was 0.24 hectares. Most of the holdings were rainfed.

Total cost ofcultivation for 16 years was estimated to be Rs.91,311 for the district, in terms of 1985-86 prices. The major item of expenditure was human labour constituting about 50.49 percent of the total cost. Fertilisers including farm yard manure accounted for 24.16 percent and harvesting charges for 9.90 percent of the total cost for 16 years. The total cost of bringing one hectare of coconut plantation up to bearing stage (initial 7 years' expenditure) was estimated as Rs.38,773 and the maintenance cost per hectare per year was Rs.5,853.

The average annual production of nuts per hectare during the stabilised period was estimated as 10049 nuts. Cost of production per nut was calculated as Rs.1.12. The estimated net returns on investment per hectare per year come to Rs.13,835, based on 1983-84 prices.

Pay back period was found to be 13.18 years. Benefit-cost ratio was calculated as 1.44. Net present worth was Rs.24,454 and internal rate of return was caculated to be 16.39 percent. The factors age, labour, fertiliser and plant protection were found to have significant influence on the gross income obtained from a coconut garden.

High input costs, poor irrigation facilities and difficulties associated with marketing were some of the general problems faced by the sample farmers. The study showed that in general, incentives and subsidies given by different agencies have had very little impact on coconut cultivation in the study area.