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A STUDY OF THE COCONUT ECONOMY OF KERALA, 1956-1983

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UNDER THE FACULTY OF SOCIAL SCIENCES

By

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D E C L A R A T I O N

This is to certify that the thesis entitled "A study of the Coconut Economy of Kerala, 1956-1983" submitted for the degree of Doctor of Philosophy in the Department of Applied Economics, Cochin University of Science and Technology is a record of bonafide research carried out by me under the guidance of Dr.K.C. Sankaranarayanan, Professor and Head of the Department of Applied Economics, Cochin University of Science and Technology and no part of it has been submitted for any other degree or diploma.

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CERTIFICATE

Certified that the thesis "A Study of Coconut Economy of Kerala, 1956-1983" is the record of bonafide research carried out by Ajoy Mathew, under my guidance. The thesis is worth submitting for the degree of Doctor of Philosophy in Economics.

Cochin,
25 March 1987

(Dr. K.C.Sankaranarayanan)

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CHAPTER I

INTRODUCTION

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In mythology the coconut palm, known as 'Kalpavriksha' (Tree of Heaven), was supposed to have been brought down to Kerala from heaven for the prosperity of the people of the area. The importance of coconut to Kerala can be judged by the fact that the name of the state, Kerala, itself means "land of coconut". Coconut is an important part of the diet of the population. The palm contributes byproducts that are useful in many ways to the households. Coconut cultivation and industry contribute substantially to Kerala's economy, so much so that coconut can be called the backbone of the economy of the state.

Coconut Situation in Kerala

Coconut is mainly a small peasant crop. The average size of a coconut holding in the state is less than 0.5 hectare and about 90 per cent of the holdings come in the size group of one hectare or less. Thus, coconut cultivation is very important for poor and marginal farmers. The estimated number of coconut holdings in the state is more than 30 lakhs.

Kerala's share in the total area under coconut in India in 1983 was 59.15 per cent and its share in all-India production of coconut in the same year was 43.15 per cent. In the same year coconut contributed Rs. 5629.63 million to the state's income. It has the biggest share of 37.39 per cent in the state's agricultural income.

In 1982-83 coconut occupied the second largest share of 30.94 per cent of the state's net area sown and contributed 13.32 per cent to the state's income. About 16 per cent of the workforce depends upon coconut and its allied products.

Nearly three-fourth of the nuts produced in Kerala are disposed off in the form of nuts itself by the cultivators after retaining 15 per cent for household consumption. Only about 50 per cent of the copra produced in Kerala is used for crushing in the local milling sector and the balance is exported mainly to Maharashtra.

According to the Directorate of Coconut Development and Trade, the annual consumption of coconut among the middle and high income groups is 430 nuts per household and among the lower income families it comes to 150 nuts on an average. The consumption study made by the Directorate also concludes that middle and high income groups consume 29 kilograms of coconut oil every year. Lower income groups consume 15 kilograms of coconut oil annually.

About the Crop

The coconut palm (cocos nucifera linn) is a perennial, edible, oil bearing, crop of the tropics. The coconut palm is reported to have existed from pre-historic times. "Adequate evidence is available of its occurance in India some 3000 years ago".[1] Among the various views put forward regarding the origin of coconut, the most convincing one, according to Menon and Pandalini, is that it might have originated "in any one of the places in South East Asia stretching from the Malay peninsula in the West New Guinea and Malanesia in the East".[2] It is found throughout the humid tropical areas such as Malayan Archipelago, South East Asia, India, Sri Lanka, Pacific territories and West Indies.[3] "It is the most widely distributed

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1. P.K.Thampan, Coconut Culture in India, The Green Villa Publishers, 1972, p.5.

2. M.K.Muliyar, "Coconut-Introduction", Summer Institute on Improvement and Management of Plantation Crops, 1974, Central Plantation Crops Research Institute, Kasargod, p.24.

3. P.K.Thampan, op.cit., p.5.

of all palms".[4] Philippines, India, Indonesia, Sri Lanka and Thailand are the major coconut producing countries of the world.

The coconut palm requires the following conditions for its growth :

Latitude: It thrives well within 23° of the equator. However, it is temperature that determines the limit of latitude. It is found to yield economically even in very high latitudes ranging from 26° N (Assam) to 25° S (Madagascar).

Altitude: The coconut palm is found upto an altitude of 600 metres above sea level. However, the limit of the altitude at which it can grow successfully depends upon the latitude. The general opinion is that it may be possible to grow the palm at an elevation upto 900 metres in areas nearest to the equator.

Rainfall: A well distributed rainfall of 200 cm per annum is considered optimum for the palm. The rainfall can range from 100 cm to 300 cm. However, the palm can do well even in high rainfall areas upto 380 cm. The distribution of rainfall, drainage status and moisture

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4. M.K.Muliyar, op. cit., p.24.

holding capacity of the soil are very important. If the rainfall is evenly distributed, even a low rainfall of 100 cm will be adequate for the palm. A higher precipitation can be of advantage if the soil is well drained. Long spells of dry period when the water table drops considerably is always harmful to the crop. Where the soil is well drained and annual rainfall is less than 100 cm, economic production is possible only under irrigation. Coconut cultivation is also possible in dry areas where there is adequate sub-soil moisture.

Temperature: The palm requires an equitable climate, neither very hot nor very cold. The optimal annual temperature for the best growth and maximum yield is 27°C with a variation of 6°C to 7°C. In areas wh the mean temperature falls below 21°C and also where the range of temperature is fairly wide, the palm fails to flourish.

Humidity: Though the palm favours a warm humid condition persistent high humidity through out the year is conduciv to incidence of fungal diseases like budrot and also results in low uptake of nutrients due to slow transpiration.

Sunshine: About 2000 hours of sunshine per year are considered necessary for the successful growth and yield of coconut.

Nearness to sea : The coastal climate is better for the growth of the crop, being less subject to fluctuations in the temperature as compared to the interior and is fairly humid. The palms benefit from better supplies of sub-soil moisture due to the continuous seepage of fresh water to the sea from higher inland areas. Further, the constant movement of sub-soil moisture near the coasts due to the ebb and flow of the tide is also beneficial to the palm. But, nearness to the sea is not a limiting factor for the cultivation of coconut.

Soil: The coconut palm adapts to a range of soils. It is water supply that determines the suitability of soil types. It adapts to soils ranging from littoral sand to heaviest clays. The best soil for coconut is a rich alluvium or loam, having proper soil moisture and drainage, for example, the soil in the backwater areas of Kerala. K.M.Pandalai has stated that with suitable soil and water management practices and adoption of proper amelioratory measures, where necessary, all normal soils could be used for coconut cultivation.[5]

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5. K.M.Pandalai, "Certain Aspects of Soil Suitability to Coconut Cultivation", Indian Coconut Journal, 6, Pp. 89 - 93 .

The major coconut growing soils are laterite, coastal alluvium (sandy), red sandy loam, lowland valley soil, alluvial soil (river) and reclaimed marshy soil.

The crop is perennial in nature with the effective root zone confined to 2 metres radius from the trunk and 120 cm depth. Unlike many other perennial tree crops, in the case of coconut, the growth, leaf production, flowering and fruiting constitute a regular and continuous process. A healthy palm produces 12-14 leaves and a bunch in each leaf axil in a year. For the metabolic functions to proceed at a regular pace, nutrients and water availability also should be regular.

Varieties of the Coconut Palm

Distinct varieties of coconut are only two, namely, tall and dwarf. But as a result of cross polination, especially in talls, wide variations in the types of coconut palms exist. These variations relate to height of the palm, colour, shape and size of coconut etc. Yield of coconut and quality (oil content) of copra also vary.

Tall variety : It has a long and stout trunk growing upto a height of about 15 to 18 metres. The crown has 25-40 fronds and the length of a fully opened frond is about 6 metres. This variety lives upto an age of 80 to 90 years. It tolerates diverse soil and climatic conditions and starts bearing coconut after 7-10 years of planting under rainfed conditions and within 5-7 years under optimum conditions. The byproducts such as copra, oil and fibre are of good quality. The coconut matures within a period of 12 months after pollination.

The various types of the tall variety are the following:

1) West Coast Tall ;
2) Kappadam ;
3) Laccadive ordinary, medium and micro ;
4) Andaman giant ; and
5) Exotic types: Java, New Guinea, Cochin, China and Philippines.

Dwarf variety: This variety is characterised by its short stature and early bearing. The dwarf grows more rapidly than the tall variety and starts flowering in about 3-4 years. This variety yields heavily but has the tendency to be irregular in bearing. Normally, an adult palm attains a height of about 5 metres. The dwarf does not live as long as the tall and its yield starts declining after 25 years of yielding.

The various varieties of the dwarf are as follows:

1) Chowghat dwarf ;
2) Gangabondan ; and
3) Malayan dwarf.

As various good qualities are distributed unevenly among the tall and dwarf, hybrids have been created so that the qualities of both varities are brought together.

Hybrids: The various varieties of hybrids are :

1) Tall x Tall ;
2) Tall x Dwarf; and
3) Dwarf x Tall.

Uses of Coconut Palm

Coconut is one of the most important oil bearing tree crops in the tropics. Almost every part of the tree is used. The raw nut and edible copra are important articles of food and of Hindu religious ceremonies in Kerala. Coconut oil is used in cooking ; and in industry it is used for the manufacture of vegetable ghee, soaps, and toilet articles. The coconut cake which is the by-product of the oil producing industry is used extensively as animal feed and coconut manure. The water of the tender nut is a refreshing drink. The husk gives coir fibre which is used for producing a variety of products such as yarn, mats, brushes etc. The shell is burnt and converted into charcol which is used in the manufacture of gas masks. Spoons and ladles and decorative articles are made out of the shell. The trunk of the palm is useful as timber and the leaf is used for thatching roofs, making baskets, mats, brooms etc. The sweet juice obtained by tapping the unopened enclosing covering the new flowers is an invigorating drink when fresh or may be converted into jaggery. When allowed to ferment, the juice gets converted into an alcoholic drink called toddy which has a wide market in the state.

A study regarding the pattern of utilisation of coconut in Kottayam district gives the following information.[6]

a)	As seed	:	0 . 8 per cent
b)	For culinary needs	:	49 . 56 per cent
c)	Tender nuts for consumption	:	0 . 1 per cent
d)	for copra	:	50 percent
e)	For Pooja, marriage etc.	:	0 . 26 per cent
	Total	:	100 per cent

6. Based on a study by V.A.George, Assistant Director of Agriculture (M), Principal Agricultural Office, Kottayam, "Production and Marketing of Coconut in Kottayam District".

The above information can be taken as a rough approximation of the use of coconut in Kerala.

Coconut husk is used in the following proportions in Kottayam District.

a)	For coir industry	:	15 per cent
b)	For household fuel	:	75 per cent
c)	For mulching, commercial need etc.	:	10 per cent
	Total	:	100 per cent

On the other hand, coconut shell is used in Kottayam district in the following proportions:

a)	For fuel	:	75 per cent
b)	For industrial need (as activated carbon)	:	5 per cent
c)	For household purposes and handicrafts	:	20 per cent
	Total	:	100 per cent

There are innumerable other uses to which the various parts of the coconut are put. No wonder that the coconut palm is called Kalpavriksha (Tree of Heav n).

PLATE 1.1

AN EXCELLENT HARVEST OF COCONUT

India's Position in Coconut Cultivation in the World

India occupies the third position in production of coconut in the world. India's share in world production of this crop was 14.8 per cent on the average in the triennium ending 1976. Philippines is the biggest producer of coconut (33.2 per cent) ; and Indonesia comes second (20.8 per cent). The share of Philippines in the production of copra (conversion of the coconut Kernel into oil bearing copra) is even better, with 48.2 per cent of world output of copra. On the other hand, India's share in the case of copra is only 7.5 per cent, which is not commensurate even with its own share in world coconut production. This means that, unlike Philippines where a substantial portion of coconut is converted into copra, in India the major share of coconut goes for direct consumption purposes. Table 1.1 gives a picture of coconut and copra production in different parts of the world with break-up data for Asia in terms of the major producing countries, namely, Philippines, Indonesia, India and Sri Lanka.

TABLE 1.1

World Production of Coconuts and Copra
(Annual Average for the Triennium Ending 1976)

(Quantity in 1000 million tons)

Country/Region	Coconut		Copra	
World	30234	(100.0)	4348	(100.0)
Africa	1542	(5.1)	164	(3.7)
North Central America	1479	(4.9)	192	(4,4)
South America	523	(1.7)	32	(0.7)
Asia	24532	(81.2)	3688	(84.2)
Philippines	10051	(33.2)	2108	(48.2)
Indonesia	6291	(20.8)	851	(19.4)
India	4475	(14.8)	328	(7.5)
Sri Lanka	1550	(5.1)	154	(3.5)
Others	2165	(7.3)	247	(5.6)
Oceania	2158	(7.1)	308	(7.0)

Source : Jacob Mathew, "Trend and Fluctuations in Prices of Coconuts and Coconut Oil", M.Phil Thesis, Centre for Development Studies, Trivandrum, 1978.

Position of Coconut in the Oilseeds Economy of India

India is the third largest oilseed producing country in the world with an area of 25.3 million hectares and production level of 12.5 million tonnes of all oilseeds. Table 1.2 gives a comparative picture of the oil content of different oil seeds in India.

TABLE 1.2

Oil Content (Percentage) of Different Oilseeds in India

Oilseed	Percentage rate
Groundnut kernel	40 - 44
Rapeseed & Mustard	31 - 33
Sesamum seed	41 - 43
Linseed	31 - 33
Castor seed	40 - 42
Soyabeen	18.7 - 21
Sunflower seed	37 - 40
Nigerseed	35
Safflower	25 - 30
Copra (coconut kernel)	62 - 68

Source: Prafulla K.Das, "The place of Coconut Oil in Indian Vegetable Oils", Agricultural Situation in India, Vol. XXXIX, No.5, August 1984, pp. 317-324.

From table 1.2 we see that coconut is a highly oil potential crop. It gives the highest oil content among competing crops.

It is true that, in terms of area and total production, coconut does not occupy any leading position in the oilseed economy of India as a whole. In 1975-76 the total area under coconut in the country was only 11,14,700 hectares compared to 70,18,800 hectares under groundnut, 22,63,300 hectares under sesamum and 34,92,100 hectares under rapeseed and mustard taken together. However, this all-India comparison is inadequate for an understanding of Kerala's economy because, for Kerala state, coconut oil has a pre-eminent place, though other oils such as palm oil, have recently entered the consumption basket in the state. The data regarding area under oilseed crops in India are presented in table 1.3.

TABLE 1.3
Area Under Oilseed Crops in India

(Area '000 ha.)

Crop	1955-56	1975-76
Groundnut	4973.7	7012.8
Castorseed	588.0	503.6
Sesamum	2496.3	2263.3
Rapeseed & Mustard	2413.0	3492.1
Linseed	1425.7	2075.9
Coconut	650.3	1114.7

Source: Jacob Mathew, op.cit.

It is also important to note that the oil productivity of coconut per hectare is the highest as can be seen from available data.

The average per hectare oil yields of different oil yielding crops in India are as follows:[7]

1.	Coconut oil	:	550 Kg/ha.
2.	Groundnut oil	:	300 Kg/ha.
3.	Rapeseed/mustard oil	:	170 Kg/ha.
4.	Sesamum oil	:	100 Kg/ha.

From the above we see that coconut gives highest per hectare yield of oil.

Coconut Cultivation in India

India accounts for nearly 16 per cent of the world area and around 12 per cent of the world production of coconut.[8] The percentage of area under coconut in net area sown in India increased from 0.53 in 1951-52 to 0.77 in 1976-77.[9]

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7. P.K.Das, "Coconut Situation in India", *Agricultural Situation in India*, Vol. XXXVIII, No.5 August, 1983.

8. P.K.Das, "Coconut Situation in India", *Agricultutal Situation in India*, Vol.XXXVIII, No.5, August, 1983, p. 275.

9. *Ibid*.

According to an estimate, coconut culture and industry provide full or part-time employment to over 10 million people in India.[10] In 1972 the production of coconut which was valued at Rs. 2450 million was about 2 per cent of the national agricultural income. "Coconut contributes about Rs. 6000 million worth of agricultural and industrial goods and Rs. 200 million to the foreign exchange annually".[11] In the areas where it is grown the economic and domestic life of the majority of the population is woven around this multi-purpose palm.

Coconut is essentially a crop of the small landholder. In India the average size of the coconut holding is as small as 0.20 hectares and more than 90 per cent of the holdings have an area less than one hectare. Hardly 2 per cent of the holdings have an area of 2 hectares or above. The distribution of coconut holdings in the major coconut cultivating states is given in table 1.4.

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10. *Ibid.*, P.3.

11. *Kerala Kaumudi*, 23 April 1981.

TABLE 1.4

Size of Coconut Holdings in India

Size of holdings (In hectares)	Percentage of holdings of different sizes			
	Kerala	Tamil Nadu	Karna-taka	Andhra Pradesh
Less than 0.2	37.1	61.5	52.5	61.7
0.2 - 1.0	52.8	33.2	42.9	36.6
1.0 - 2.0	7.9	3.6	3.6	1.7
2.0 and above	2.2	1.7	1.0	-

Source: P.K.Thampan, Coconut Culture in India, The Green villa Publishers, 1972, p.6.

From table 1.4 we see that the distribution of holdings according to size is more egalitarian in Kerala. While in Tamil Nadu, Karnataka and Andra Pradesh the smallest size-group of less than 0.2 hectare commands between 52.5 to 61.7 per cent of the holdings, in Kerala only 37.1 per cent of the holdings come in this size-group. In Kerala more holdings lie in the size-group 0.2 - 1.0 hectare. A similar feature holds true for the other two size-groups.

Place of Kerala in Area and Production of Coconut in India

Kerala State accounts for the largest area under coconut palms as well as production of coconut among the various states in the Indian Union. In terms of area, Kerala had in 1976 a total area under coconut of 6,94,600 hectares out of the all-India total of 10,74,1000 hectares, that is, about 64.6 per cent of the total. In terms of output of coconut, Kerala's contribution was 3443.37 million nuts out of the all India total of 5837.11 million nuts ; the percentage share of the state worked out to 59. Table 1.5 presents information regarding area and production of coconut in different states in India.

TABLE 1.5

State-Wise Area and Production of Coconut in India

(1976)

Area : '000 hectares
Production : million nuts

State	Area		Production	
Andhra Pradesh	39.3	(3.7)	162.54	(2.8)
Assam	4.9	(0.5)	25.07	(0.4)
Karnataka	153.3	(14.3)	777.88	(13.3)
Kerala	694.6	(64.6)	3443.37	(59.0)
Maharashtra	9.3	(0.9)	50.64	(0.9)
Orissa	13.2	(1.2)	53.03	(0.9)
Tamil Nadu	108.9	(10.1)	1094.90	(18.7)
Tripura	0.8	(0.1)	1.13	(negl)
West Bengal	6.7	(0.6)	22.00	(0.4)
Andaman & Nicobar	20.2	(1.9)	64.07	(1.1)
Goa, Daman & Diu	18.7	(1.7)	104.00	(1.8)
Lakshadweep	2.8	(0.3)	21.80	(0.4)
Pondicherry	1.6	(0.1)	16.68	(0.3)
All India	1074.1	(100.0)	5837.11	(100.0)

Source: Jacob Mathew, op.cit.

From table 1.5 it is clear that in India Kerala is the leading state with reference to area and production of coconut. Karnataka comes second as far as area under coconut is concerned and Tamil Nadu comes third; but Tamil Nadu comes second as far as production of coconut is concerned.

The distribution of area and production in the major coconut growing areas of the country is given in table 1.6.

TABLE 1.6

Area and Production of Coconut in Important Coconut Growing Areas in 1982-83

Coconut Growing Areas	Area ('000 hectares)	Production (in million nuts)
Kerala	658.5	2444.3
Tamil Nadu	143.0	1650.0
Karnataka	178.9	930.1
Others	132.9	639.9

Source: N.John Kurian and P.N.Joseph, "Coconut Situation in India", Indian Coconut Journal, Vol.XV, No.3 and 4. July and August 1984.

Table 1.6 gives a comparative picture of the area and production of coconut in the three southern states, Kerala, Tamil Nadu and Karnataka. While Tamil Nadu has an area under coconut which is less than one-fifth of that of Kerala, in terms of production, the former accounts for more than half of Kerala's production of coconut.

Data regarding average production of coconut under different Five Year Plans are presented in table 1.7.

Table 1.7 shows that all-India production of coconut kept increasing till the Fourth Plan, but declined during the Fifth Plan. But states such as Assam, Karnataka, Maharashtra, Orissa and Lakshadweep Union Territory increased their production. Some states could not be compared due to nonavailability of data in the initial period, for example, Tripua, Goa and Pondicherry.

Table 1.8 presents data regarding spatial distribution of average area and production of coconut in each Plan period.

TABLE I.7

Average Production of Coconut Under Different Plans

(million nuts)

State/Union Territory	Average during Plans						
	1950-51	I	II	III	AP	IV	V
Andhra Pradesh	306.0 (100)	296.2 (99)	310.0 (101)	245.8 (81)	196 (64)	172.6 (56)	166.4 (54)
Assam	13.0 (100)	13.0 (100)	12.0 (92)	10.6 (82)	11.0 (85)	11.0 (85)	22.8 (175)
Karnataka	369.0 (100)	353.8 (96)	465.3 (126)	402.4 (109)	460.0 (125)	673.8 (183)	791.2 (214)
Kerala	2026.0 (100)	2779.0 (137)	3242.8 (160)	3277.0 (162)	3620.3 (179)	3923.0 (194)	3359.4 (166)
Maharashtra	30.0 (100)	30.6 (102)	33.8 (133)	32.8 (109)	32.7 (109)	45.0 (150)	49.8 (166)
Orissa	34.0 (100)	33.8 (99)	42.0 (124)	40.8 (120)	28.3 (83)	39.2 (115)	54.4 (160)
Tamil Nadu	436.0 (100)	430.8 (93)	428.8 (92)	732.0 (158)	823.0 (178)	933.4 (202)	1089.4 (235)
Tripura	NA	NA	NA	NA	0.2	0.6	1.2
West Bengal	22.0 (100)	22.0 (100)	22.0 (100)	22.0 (100)	22.0 (100)	22.0 (100)	22.0 (100)
A&N Islands	3.0 (100)	3.0 (100)	25.4 (847)	34.0 (1133)	38.0 (1267)	53.2 (1773)	61.8 (2060)
Goa	NA	NA	NA	NA	70.0	81.0	99.0
Lakshadweep	15.0 (100)	14.0 (93)	10.2 (68)	18.0 (120)	17.3 (115)	20.2 (135)	21 .2 (141)
Pondicherry	NA	NA	9.4	12.3	13.0	15.6	15.0
INDIA	3282.0 (100)	3976.4 (121)	4608.0 (140)	4851.0 (148)	5353.0 (163)	5981.2 (182)	5753.4 (175)

Note: Figures in parentheses denote indices in respect to pre-Plan year of 1950-51 as the base.

Source: Prafulla K.Das, "Coconut Situation in India", Agricultural Situation in India, Vol.XXXVIII, No.5, August 1983.

TABLE I.8

Spatial Distribution of Average Area and Production of Coconut in Each Plan Period

State/Union Territoty	Area (Percentage)				
	I	II	III	IV	V
Andhra Pradesh	5.39	5.05	4.18	3.55	3.72
Assam	0.13	0.19	0.39	0.37	0.45
Karnataka	13.85	13.43	13.16	12.43	14.31
Kerala	68.27	69.61	67.48	67.94	64.59
Maharashtra	1.24	1.06	1.00	0.85	0.84
Orissa	0.71	0.67	0.94	0.99	1.24
Tamil Nadu	8.64	7.70	9.27	9.62	10.17
West Bengal	1.05	0.97	0.85	0.62	0.62
A & N Islands	0.27	0.80	0.99	1.39	1.81
Lakshadweep	0.42	0.33	0.33	0.26	0.26
Others	0.03	0.19	1.41	1.98	1.99
INDIA	100.00	100.00	100.00	100.00	100.00

(Contd.)

TABLE 1.8 (Contd.)

State/Union Territory	Production (Percentage) I	II	III	IV	V
Andhra Pradesh	7.44	6.73	5.07	2.89	2.89
Assam	0.33	0.26	0.23	0.18	0.40
Karnataka	8.90	10.09	8.29	11.27	13.74
Kerala	69.88	70.38	67.55	65.59	58.39
Maharashtra	0.78	0.74	0.68	0.75	0.87
Orissa	0.85	0.91	0.85	0.65	0.94
Tamil Nadu	10.83	9.31	15.09	15.60	18.93
West Bengal	0.55	0.48	0.45	0.37	0.38
A & N Islands	0.08	0.54	0.70	0.89	1.08
Lakshadweep	0.35	0.22	0.37	0.33	0.37
Others	0.01	0.34	0.72	1.48	2.01
INDIA	100.00	100.00	100.00	100.00	100.00

Source: Prafulla K Das, *op.cit.*

Table 1.8 reveals that there was no substantial increase or decrease in the share of the states in total area under coconut in India. The share of some states in all India area decreased over time; such states are Andra Pradesh, Kerala, Maharashtra, West Bengal and also Lakshadweep Union Territory. All other states increased their share in all-India area, including Tamil Nadu which increased its share in total area from 8.64 per cent in the First Plan to 10.17 per cent in the Fifth Plan.

The share of the states in total production in India, as can be seen from the same table, shows that there has been substantial changes in the share of some states. Andra Pradesh had 7.44 per cent share in all India production in the First Plan ; it decreased to 2.89 per cent in the Fifth Plan. Karnataka increased its share from 8.90 to 13.74 per cent in the same period. Kerala's share decreased substantially from 69.88 per cent to 58.39 per cent. On the other hand, Tamil Nadu increased its share substantially from 10.88 to 18.93 per cent.

Table 1.9 gives information regarding average productivity of coconut in different Plan periods.

From table 1.9 we find that in many states average yield declined furing the period covering the First to the Fifth Plan periods. Such states were Andhra Pradesh, Assam, Kerala, Orissa and Tripura. The other states that increased their yield were rnataka, Maharashtra and Tamil Nadu and the Union Te tories of Andaman and Nicobar Islands, Goa, Lakshadweep and Pondicherry.

TABLE 1.9

Average Productivity of Coconut in Different Plan Periods

(nuts/ha.)

State/Union Territory	Average of 1946-47 to 1950-51	Average during Plan periods				
		I	II	III	IV	V
Andhra Pradesh	9,210	8,667	8,935	7,266	4,588	4,164
Assam	11,000	16,250	18,000	3,317	2,784	4,697
Karnataka	3,960	4,010	5,032	3,796	5,045	5,142
Kerala	4,980	6,372	6,783	6,005	5,382	4,837
Maharashtra	4,181	3,872	4,661	4,058	4,965	5,510
Orissa	6,750	7,511	9,040	5,976	3,712	4,045
Tamil Nadu	5,660	7,890	3,109	9,701	9,059	9,964
Tripura	NA	NA	NA	NA	1,429	1,379
West Bengal	3,143	3,265	3,255	3,199	3,284	3,284
A&N Islands	NA	1,820	4,252	4,272	3,748	3,162
Goa	NA	NA	NA	NA	4,218	5,294
Lakshadweep	NA	5,224	4,500	6,767	7,214	7,571
Pondicherry	NA	NA	8,764	10,028	9,875	9,375
INDIA	5,332	6,243	6,708	5,996	5,996	5,353

Source : Prafulla K.Das, op. cit.

Table 1.10 gives the compound rate of growth of area, production and yield of coconut in different states during different Plan periods. From this table we find that in most states there has not been any consistent decline in either area, production or yield . except in Kerala. In Kerala, yield declined continuously from the Second Plan onwards. In Karnataka, during the Third Plan there was a substantial increase in production and yield, but during the First, Fourth and Fifth Plans there was decline in production and yield. In Tamil Nadu on the other hand, there was substantial increase in area and production.

The analysis given above amply proves our contention that coconut cultivation occupies a very important position in the economy of Kerala and an understanding of the trends in growth in area, production, productivity, market structure and so on in the case of this crop has a significant bearing on the general economic situation of Kerala State. Hence the significance of the present study.

OBJECTIVES OF THE STUDY

The objectives of the present study are,

i) to analyse the area, production and productivity of coconut cultivation in Kerala and to

TABLE I.10

Compound Growth Rate of Area, Production and Yield of Coconuts in Different States and Different Plan Periods

(Percent per annum)

State/Union Territory		Five Year Plan periods I	II	III	IV	V
Andhra Pradesh	A	0.89	(-) 1.68	(-) 0.91	1.96	(-) 0.47
	P	(-) 5.76	(-) 0.95	13.75	(-) 3.66	(-) 1.06
	Y	(-) 6.60	0.74	14.79	(-) 5.52	(-) 0.59
Karnataka	A	(-) 1.03	3.13	4.09	2.38	2.85
	P	(-) 0.93	4.88	(-) 2.34	2.57	4.03
	Y	(-) 0.10	1.69	(-) 6.18	0.19	1.16
Kerala	A	2.11	2.36	3.41	1.39	(-) 2.74
	P	9.20	0.75	0.27	(-) 1.46	(-) 3.89
	Y	6.95	(-) 1.58	(-) 3.10	(-) 2.81	(-) 1.19
Maharashtra	A	(-) 0.63	4.79	0.74	(-) 2.97	0.56
	P	6.85	(-) 7.63	3.89	(-) 1.54	(-) 4.10
	Y	7.53	(-)11.84	3.12	1.48	(-) 4.63
Orissa	A	0.00	2.13	9.11	0.76	9.83
	P	(-)0.31	12.89	(-) 8.81	0.51	14.48
	Y	(-)0.31	10.53	(-)16.42	(-)0.26	4.23
Tamil Nadu	A	(-)5.68	1.95	12.03	2.35	0.16
	P	(-)2.92	1.97	12.05	1.45	0.92
	Y	2.93	0.02	0.01	(-)0.88	(-) 0.14
A&N Islands	A	1.21	38.02	4.59	26.67	(-) 0.26
	P	(-)0.00	66.09	2.86	16.19	(-) 0.98
	Y	(-) 1.21	20.34	(-) 1.65	(-)8.28	(-) 0.72
Lakshadweep	A	(-) 4.85	(-) 3.58	5.07	(-)0.00	0.00
	P	(-) 7.79	10.76	4.24	2.52	0.00
	Y	(-) 3.09	14.97	(-) 0.79	2.52	0.00
INDIA	A	0.75	2.41	4.71	1.80	(-) 1.25
	P	5.24	1.26	2.54	(-)0.16	(-) 1.75
	Y	4.46	(-) 1.12	(-) 2.08	(-)1.93	(-) 0.50

TABLE I.10 (Contd.)

State/Union Territory		1951-52 to 1980-81	1966-67 to 1980-81
Andhra Pradesh	A	0.73	1.41
	P	(-) 2.67	(-) 1.17
	Y	(-) 3.38	(-) 2.56
Karnataka	A	2.56	3.36
	P	3.42	4.93
	Y	0.84	1.53
Kerala	A	2.10	0.10
	P	0.73	(-) 1.65
	Y	(-) 1.34	(-) 1.74
Maharashtra	A	0.95	0.43
	P	2.31	3.80
	Y	1.34	3.36
Orissa	A	5.54	6.82
	P	2.19	8.65
	Y	(-) 3.17	1.72
Tamil Nadu	A	3.41	2.25
	P	4.33	2.62
	Y	0.89	0.36
A & N Islands	A	9.83	7.70
	P	11.74	6.07
	Y	1.74	1.52
Lakshadweep	A	0.43	0.14
	P	2.50	1.58
	Y	2.06	1.43
INDIA	A	2.40	0.98
	P	1.56	0.20
	Y	(-) 0.82	(-) 0.77

Source : Prafulla K Das, op.cit.

Note : A = Area
P = Production
Y = Yield

identify the relative importance of area and productivity in production and the factors which influence these parameters ;

(ii) to assess the changes in cost of production and profitability of coconut cultivation ;

(iii) to estimate the marketed surplus of coconut for each category of farmers, namely, large, medium, small and tiny ; and

(iv) to study the economics of coconut prices and marketing.

HYPOTHESIS

The major hypotheses of the study are the following:

(i) The area under coconut cultivation in Kerala has been declining due to a number of causes such as substitution by other crops, replacement of coconut gardens by residential buildings etc ;

(ii) Productivity of coconut has been declining since the 1950s owing to (i) conversion of marginal and unsuistable land into coconut gardens, (ii) unremunerative prices of coconut and (iii) the impact of rootwilt and other diseases ;

(iii) Productivity per acre is higher on the smaller sized farms compared to the larger sized farms ; but productivity per person is higher on the larger sized farms compared to the smaller sized farms ;

(iv) Modern technology and practices have a positive effect on productivity of coconut and are cost-efficient ; and

(v) Coconut farms are adversely affected by the downward trend in the parity index of prices.

METHODOLOGY

Collection of Secondary data

The study is based on both secondary and primary data. Secondary data have been collected from various institutions such as the Kerala State Planning Board ; Directorate of Agriculture ; Directorate of Economics and Statistics ; Directorate of Coconut Development (Coconut Development Board), Government of India, Cochin; Central Plantation Crops Research Institute (CPCRI), Kasaragod ; Kerala Agricultural University, Mannuthi ; Centre for Development Studies, Trivandrum and ; Indian Institute for Regional Development Studies, Kottayam.

Collection of Primary Data

Primary data was generated through field surveys using structured questionnaire schedules. Two districts in Kerala, namely, Kottayam and Alleppey were selected for the field study ; these districts were taken not as samples, but as case studies. Therefore, no generalisations or statistical inferences from the sample to the universe have been attempted. In Kottayam district, two panchayats, namely, Kumarakom and Thiruvarpu were selected and from Alleppey district, Chettikulangara and Thekkekara panchayats were selected.

The two districts were deliberately chosen because these districts have sizeable concentration of coconut gardens. The four villages selected for the study have coconut as the predominant item of cultivation. Kottayam district is the worst affected by root-wilt disease and, therefore, the selection of this district has the added advantage in the study of the impact of root-wilt on coconut production and productivity.

In the four villages, a total number of 200 households were selected. The selection of the households was purposively done so as to provide enough cases in all size groups.

The instrument used for the field survey, that is, the questionnaire schedule covered aspects such as area, production, consumption, marketing, income and its sources, cost of production, prices etc, in addition to certain qualitative questions pertaining to cropping pattern, irrigation, root-wilt disease, hybrids and so on.

The data thus collected, have been analysed with the help of computer.

SCHEME OF THE STUDY

In the introductory chapter of the dissertation the importance of coconut cultivation for the economy of Kerala State has been highlighted. The second and third chapters contain analysis of changes in area, production and productivity of coconut cultivation in the state. The use of modern agricultural practices by coconut farmers is analysed in chapter IV. Cost of production and profitability are dealt with in chapter V, while the issues relating to coconut prices and marketing are presented in chapter VI. Diseases affecting coconut is the theme covered under chapter VII . Summary and conclusions are provided at the end.

C H A P T E R II

CHANGES IN AREA AND PRODUCTIVITY

CHAPTER II

CHANGES IN AREA AND PRODUCTIVITY

Analysis of area under coconut, based on data published by the Directorate of Economics and Statistics, Government of Kerala, clearly shows that the total area under the crop which showed a continuous increase upto 1976 started declining since then. During the period 1958 to 1976 the area under coconut steadly expanded from 4,75,680 hectares to 6,94,990 hectares. But from the peak in 1976, the area witnessed steady fall, reaching a figure of 6,74,380 hectares in 1983.

The time series data given in table 2.1 presents a very disturbing trend. Apparently, despite all the efforts taken by the Government of Kerala, Department of Agriculture and various other agencies concerned with the development of coconut cultivation, the continuous and alarming decline in the total area under coconut has continued unabated.

TABLE 2.1

Area Under Coconut Cultivation in Kerala

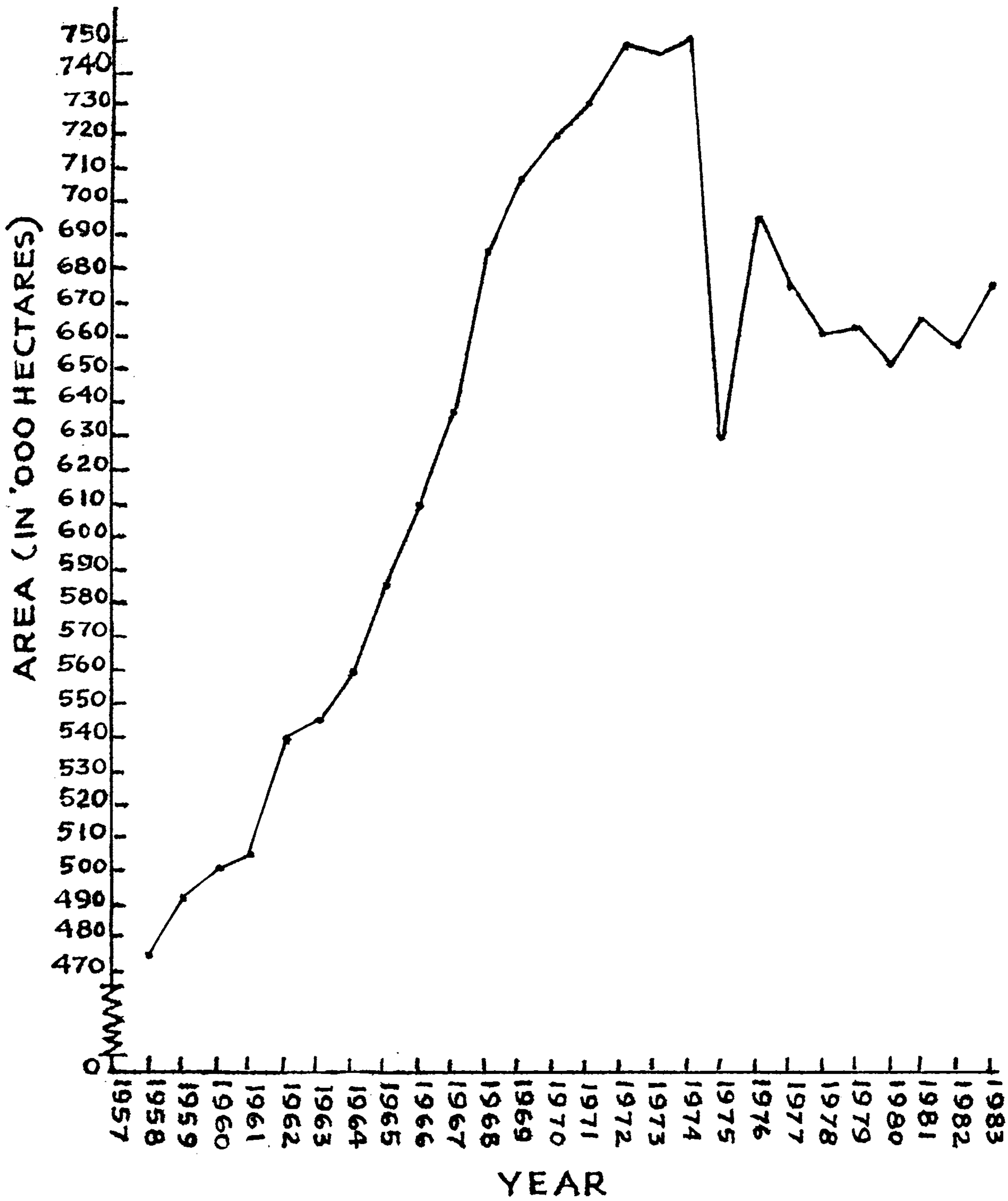
(1957-1983)

Year	Area in '000 hectares
1958	475.68
1959	492.54
1960	500.76
1961	504.82
1962	539.26
1963	544.99
1964	558.99
1965	586.31
1966	609.58
1967	638.72
1968	686.06
1969	707.84
1970	719.14
1971	730.26
1972	745.43
1973	744.83
1974	748.17
1975	629.95
1976	694.99
1977	673.46
1978	660.63
1979	662.62
1980	651.37
1981	666.62
1982	658.84
1983	674.38

Source: Directorate of Economics and Statistics, *Statistics for Planning*, Kerala.

GRAPH 2.1

CHANGES IN AREA
UNDER COCONUT CULTIVATION IN KERALA 1957-1983



The data on area under coconut in the state was analysed by studying its trend in sub-periods. The data was analysed in three separate methods: (i) by finding the average cumulative percentage cariation (average rate of change), (ii) by finding the absolute percentage variation, and (iii) by fitting a linear trend equation of the form y = a+bx and computing the values for a and b. The results are given in table 2.2.

TABLE 2.2

Analysis of Trend of Area in Sub-periods of the Period 1955-56 to 1982-83

Period	Average cumulative percentage variation	Absolute percentage variation	Trend values	
			a values	b values
1955-56 to 1959-60	2.41	9.96	436.35	10.5
1960-61 to 1964-65	2.59	11.63	482.78	15.66
1965-66 to 1969-70	4.84	20.73	549.85	31.95
1970-71 to 1974-75	1.12	4.04	715.79	7.26
1975-76 to 1979-80	-2.32	-4.22	705.01	-9.29
1980-81 to 1982-83	0.55	3.53	641.10	11.51

Note : Computed from figures given in Statistics for Planning, Directorate of Economics and Statistics, Trivandrum.

The area increase under coconut from 1955-56 to 1974-75 was mainly due to the conversion of paddy land into coconut. This is clear from Jeemol Unni's study where she states that "actual (net) area under rice has fallen, particularly in recent years, whereas area under coconut has increased phenomenally. There is suggestive evidence to show that coconut has been substituting rice on wet land"[1]. This substitution has been continuing in Kerala and consequently there should have been increase in area under coconut. But this is not reflected in the data furnished by the Directorate of Economics and Statistics. Data shows a decline in area between 1975-76 and 1979-80. But since then, again, there has been an increase in area which is in conformity with our argument. The decline in area, incidently, took place after the Directorate of Economics and Statistics changed their methodology in calculating area under coconut. Hence, there is strong suspicion that it was the change in methodology which showed area under coconut declining between 1975-76 and 1979-80.

1. Jeemol Unni, "An analysis of Changes in the Cropping Pattern in Kerala with Particular Reference to the Substitution of Coconut for Rice", M.Phil dissertation, Jawaharlal Nehru University, 1981.

This conclusion is substantiated by our study to see if any correlation existed between area under coconut and area under other crops. In table 2.3 we give a distribution of districts in which a significant inverse relation exists between coconut and other crops which could imply substitution. We find that coconut substituted pulses in 7 districts, sweet potato in 5 districts, ragi in 4 districts, plantain and banana in 3 districts and sesamum in 3 districts. Other crops were substituted by coconut only in one or two districts. But pulses, sweet potato and ragi were significantly substituted by coconut, with plantain and banana and sesamum claiming lesser significance. Thus, instead of evidence for decline in area of coconut we find evidence for increase in area due to substitution. We have not considered positive correlation because it could occur only with simultaneous increase or decrease between coconut and other crops.

TABLE 2.3

District-wise Distribution of Inverse Relationship of Coconut with Other Crops

Sl. No.		Triva-andrum	Qui-lon	Alle-ppey	Kott-ayam	Idi-kki	Erna-kulam	Tri-chur	Pal-ghat	Mala-puram	Kozhi-kode	Cann-noor
1.	Rice											
2.	Jowar					X						
3.	Ragi		X			X	X	X				
4.	Other cereals & Millets						X					
5.	Pulses		X	X	X	X	X	X		X		
6.	Sugarcane	X										X
7.	Pepper			X		X						
8.	Chillies											
9.	Ginger	X		X								
10.	Turmeric			X						X		
11.	Cardamom					X				X		
12.	Arecanut											
13.	Mangoes					X						

TABLE 2.3 (Contd.)

Sl. No.		Triva-ndrum	Qui-lon	Alle-ppey	Kott-ayam	Idi-kki	Erna-kulam	Tri-chur	Pal-ghat	Mala-puram	Kozh-ikode	Canna-noore
14.	Citrus fruit											
15.	Plantain & Banana					X				X		X
16.	Cashewnut							X		X		
17.	Tapioca	X				X						
18.	Sweet Potato	X				X	X			X		X
19.	Other vegetables		X									
20.	Other food crops	X										
21.	Groundnut	X										
22.	Castor							X				
23.	Sesamum	X		X		X						
25.	Cotton							X	X			
26.	Tobacco											
27.	Tea								X			X
28.	Coffee					X					X	
29.	Rubber					X						
30.	Other non-food crops	X										

Source: Own Computation from Statistics for Planning, Kerala.

Table 2.4 substantiates our conclusion of expansion of area under coconut through extension to uncultivated land. We see that coconut was inversely related to barren and uncultivable land in 5 districts, with permanent pastures and other grazing land in 5 districts, with fallow land other than current fallow in 6 districts, out of 9 districts where significant inverse relation exists.

Thus, coconut substituted not only other crops, but also, its cultivation was extended to uncultivated land. Details are given in the technical annexure to this chapter.

TABLE 2.4

District-wise Distribution of Inverse Relationship of Coconut with Area Uncultivated

Sl.		Triva-ndrum	Alle-ppey	Kott-ayam	Erna-kulam	Palg-hat	Canna-noore	Tri-chur	Idi-kki	Mala-puram
2.	Forests		X							X
3.	Land put to non-agricultural uses		X							
4.	Barren & Unculti-vable land				X		X	X	X	X
5.	Permanent pastures and other grazing land	X	-		X		X	X	X	
6.	Land under misc. tree crops not included in net area sown	X			X					
7.	Cultivable waste	X	X				X			
8.	Fallow land other than Current fallow	X		X		X	X		X	X
9.	Current Fallow		X		X	X				

Source: Own Computation from Statistics for Planning, Kerala

In order to analyse trends in district-wise area under coconut for the years 1957-58, 1967-68, 1977-78 and 1980-81, a linear equation of the form y = a+bx, (y being district-wise area under coconut and x years) was fitted to the data ; and the values for a and b were obtained. The values, thus obtained, are presented in table 2.4 (a)

TABLE 2.4 (a)

Trend of District-wise Area Under Coconut

District	a Values	b Values
Trivandrum	49.925	6.757
Quilon	54.199	8.647
Alleppey	75.485	-3.364
Kottayam	66.750	-3.726
Idukki	11.576	2.363
Ernakulam	39.892	5.852
Trichur	23.956	8.099
Palghat	6.027	4.811
Malappuram	71.562	-5.941
Kozhikode	114.645	-4.244
Cannanore	47.063	10.057

Source: Own Computation from Statistics for Planing, Kerala.

Keeping in view the limitations of the data base, and comparing the b value, we find that in four districts out of eleven the trend in area has been on the decline. Of the rest, Quilon and Cannanore have registered high b values which indicate that the rate of increase of area in these two districts has been faster. The two districts, Alleppey and Kottayam, which have registered negative b values are districts which have been affected intensely by root-wilt disease.

TABLE 2.4 (b)

District-wise Area Under Coconut in Certain Years
(in hectare)

District	1957-58	1967-68	1977-78	1980-81
Trivandrum	55926	61762	75806	73770
Quilon	56221	77718	87563	81770
Alleppey	68242	77595	59354	63110
Kottayam	57305	70009	51300	51120
Idukki			14257	16620
Ernakulam	40765	59132	57304	60880
Trichur	33092	40958	49641	54030
Palghat	4677	25650	18937	22950
Malappuram			65621	59680
Kozhikode	101531	120698	99440	94470
Cannanore	45522	76061	94246	72980

Source: Directorate of Economics and Statistics, Kerala, Statistics for Planning.

From table 2.4b we find that there has been a decline, as the data shows, during 1967-68 and 1977-78. The districts in which the area declined during 1967-68 were Alleppey, Kottayam, Palghat and Kozhikode. The districts in which the area declined in 1977-78 were Trivandrum, Quilon, Malappuram and Cannanore. There were two districts in which area increased upto 1980-81 ; they are Ernakulam and Trichur,

During the 9 year period between 1955-56 and 1964-65 area kept increasing but at a slow average rate of 2.5 per cent every year. During the 5 year period, 1965-66 to 1969-70, area under coconut increased on an average at a very fast rate of 4.84 per cent. During this period specially and the earlier 9 year period area kept increasing owing to a number of factors. Though there was the depressing effect of the decline in productivity, which was caused mainly by the impact of the worsening root-wilt disease, area under coconut grew, apparently due to the following reasons:

1) Coconut was a crop which provided a greater income compared to most other crops ;

2) Land reforms had increased the number of small farmers and for them coconut was a crop which met their cash needs ;

3) The state government provided certain attractive schemes for the extension of area under coconut.

Productivity of Coconut Farms

A study of the trends in average productivity of coconut farms in Kerala measured in terms of nuts per hectare shows that there has been an alarming decline in productivity. From 6832 nuts per hectare in 1957-58, it reached a very low figure of 3711 nuts per hectare in 1982-83. Table 2.4(c) gives the absolute figures as well as percentage variation in each year showing negative figures for most of the years.

The main cause for the continuous decline in yiėld from 1955-56 to 1979-80 is the root-wilt disease. From table 2.5 which is taken from the CPCRI study we find that average yield of palms declines with advance in root-wilt intensity. As shown in table 2.6 it is clear that in most districts the intensity of disease is high. Thus, it is clear that it is the wide prevelance of root-wilt which has caused a decline in yield. This is also substantiated by an estimate of production loss made by CPCRI (table 2.6).

TABLE 2.4 (c)

Productivity of Coconuts in Kerala
1957-58 to 1982-83

Year	Productivity (nuts/hectare)	Percentage variation
1957 - 58	6832	-
1958 - 59	6832	0.00
1959 - 60	6430	-5.88
1960 - 61	6430	0.00
1961 - 62	6130	-4.67
1962 - 63	5985	-2.37
1963 - 64	5864	-2.02
1964 - 65	5864	0.00
1965 - 66	5616	-4.23
1966 - 67	5618	0.04
1967 - 68	5625	0.13
1968 - 69	5588	-0.66
1969 - 70	5589	0.02
1970 - 71	5536	-0.95
1971 - 72	5539	0.05
1972 - 73	5260	-5.04
1973 - 74	4972	-5.48
1974 - 75	4961	-0.22
1975 - 76	4963	0.04
1976 - 77	4817	-2.94
1977 - 78	4583	-4.86
1978 - 79	4861	6.06
1979 - 80	4576	-5.86
1980 - 81	4618	0.92
1981 - 82	4509	-2.36
1982 - 83	4721	4.70

Source: Government of Kerala, Directorate of Economics and Statistics, Statistics for Planning.

GRAPH 2.2

VARIATION OF PRODUCTIVITY OF COCONUT IN KERALA 1957-58 TO 1982-83 IN PERCENTAGE

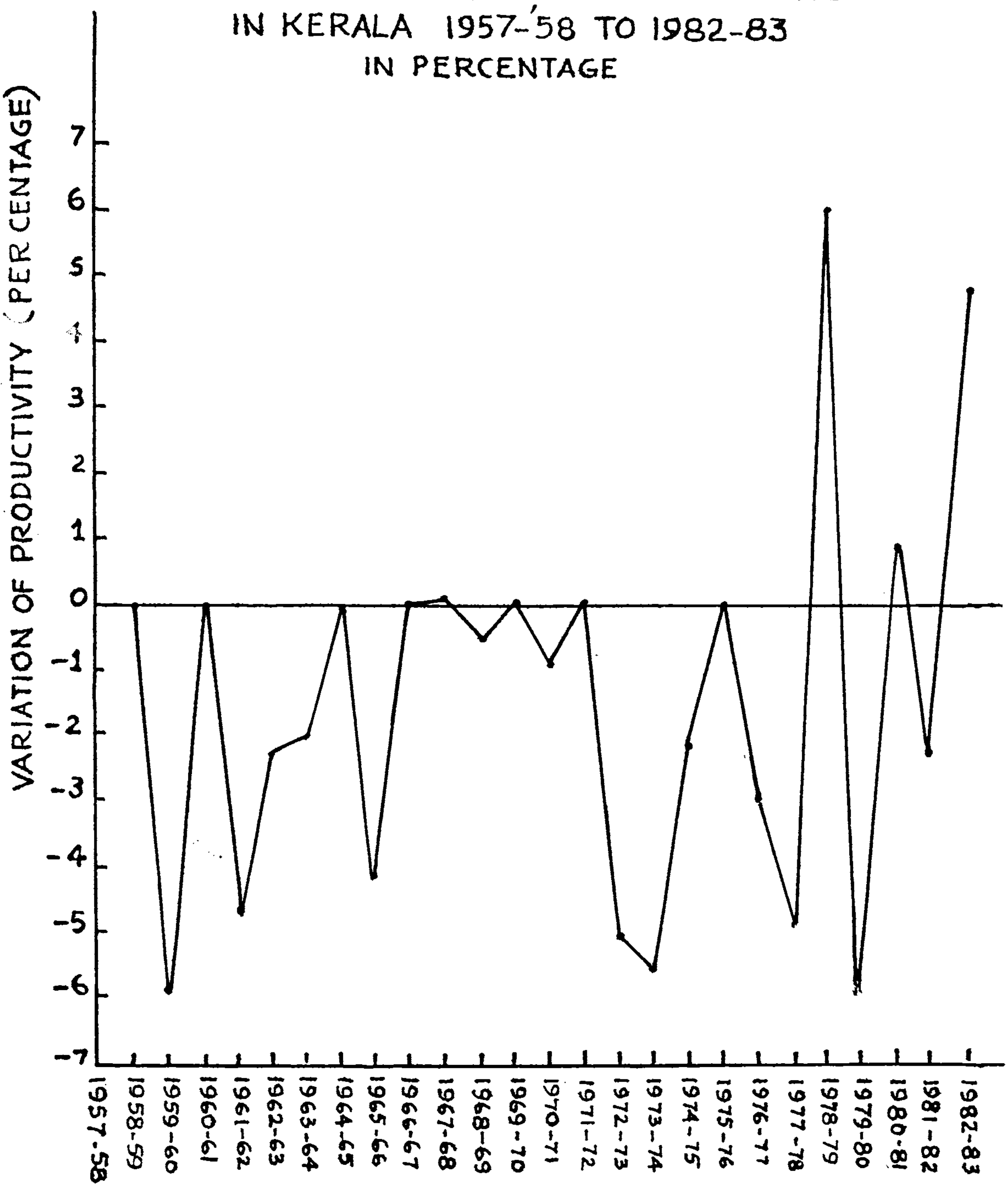


TABLE 2.5

Estimated Average Yield (Nuts) Per Palm

Sl. No.	District	Average Yield per Palm			
		RWF	DE	DA	Overall
1.	Trivandrum	78	34	9	77
2.	Quilon	66	37	22	54
3.	Pathanamthitta	78	52	27	59
4.	Alleppey	86	48	22	49
5.	Kottayam	68	36	13	35
6.	Idukki	67	34	20	49
7.	Ernakulam	80	37	12	59
8.	Trichur	63	50	31	63
	Overall	72	41	19	57

RWF = Root (wilt) Free

D.E = Diseased Early

D.A = Disease advanced

Figures given for the overall means are weighted means.

Source: Ibid.

According to table 2.7 production loss in eight districts due to root-wilt in 1984 amounted to 968.09 million nuts.

TABLE 2.6

Percentages of Non Bearing and Bearing Palms Under Various Categories of Disease

Sl.No.	District	Non-bearing palms				Bearing palms				
		RWF	DE	DA	Total diseased	RWF	DE	DA	Total disea-sed	Overall+ diseased
1.	Trivandrum	99.69	0.22	0.31	0.31	97.54	1.88	0.58	2.46	1.52
2.	Quilon	83.03	13.49	3.48	16.97	68.13	22.68	9.19	31.87	28.55
3.	Pathanamthitta	81.26	12.90	5.84	18.74	44.88	29.53	25.59	55.12	38.22
4.	Alleppey	59.64	29.75	10.61	40.36	19.84	56.77	23.39	80.16	70.69
5.	Kottayam	53.19	37.38	9.43	46.81	14.44	61.56	24.00	85.56	75.63
6.	Idukki	94.90	4.69	0.41	5.10	64.70	27.01	8.29	35.30	34.18
7.	Ernakulam	78.61	19.64	1.75	21.39	51.43	39.91	8.66	48.57	34.52
8.	Trichur	99.42	0.42	0.16	0.58	95.39	3.75	0.86	4.61	2.60
	Overall+	83.24	13.50	3.26	16.76	59.10	29.54	11.36	40.90	32.37

Note: RWF = Root(wilt) Free, D.E. = Diseased Early, DA = Disease Advanced
The figures given for the overall mean are weighted means.

Source: Coconut Root (wilt) Disease Intensity, Production Loss and Future Strategy : A Survey Report, Central Plantation crops research Institute, 1985.

TABLE 2.7

Estimated Loss in Production
(In million nuts)

Sl.No.	District	Loss in production
1.	Trivandrum	11.34
2.	Quilon	110.56
3.	Pathanamthitta	99.89
4.	Alleppey	271.02
5.	Kottayam	254.39
6.	Idukki	31.11
7.	Ernakulam	177.13
8.	Trichur	12.65
	Total	968.09

Source: Ibid.

From a study by M.V.George we find that during the period 1960-61 to 1974-75, while productivity of food crops improved only by 1.4 per cent, that of non-food crops improved by 2 per cent. If we consider that this period coincided with the period of the 'Green Revolution', we realise that the benefits of the improved technology were assimilated by Kerala farmers, especially those farmers cultivating non-food crops. This is because in no other period was there such an improvement in productivity. This means that the package of improved practices and their requirement of higher dosage of inputs were practised by Kerala farmers, especially farmers cultivating non-food crops. This behaviour of Kerala farmers should encompass coconut farmers also. This implies that, despite higher dosage of inputs and improved techniques, the decline in coconut productivity could not be averted. This fact strengthens our argument that the main cause for decline in productivity is the root-wilt disease.

In the present study an effort was made to collect primary data through field survey inorder to quantify the reasons for the decline in yield. Table 2.8 gives the major reasons as obtained through primary data collection.

From table 2.8 we see that more than 88 per cent of the respondents felt there was decline in yield. Moreover, 94 per cent of farmers opined that the root-wilt disease was the main cause for decline in yield. Other important reasons were ageing of palms, curtailment of fertilizers due to rise in fertilizer prices, and declining quality of soil.

TABLE 2.8

Decline in Yield and Reasons

(Figures in Percentages)

Details	Yes	No	Reasons
If Decline	88.5	11.5	
Reasons			
I. Impact of root-wilt			94.35
II. Declining quality of soil			55.37
III. Fertilizers curtailed due to rise in fertilizer prices			30.51
IV. Ageing of palms			23.73
V. Lack of cultural practices			7.35
VI. Lack of Irrigation			3.39

Note: For ascertaining reasons, multiple choice questions were given. Therefore, the figures for reasons do not add up to 100 per cent.

Source: Primary Data collected through field survey.

Our field study also revealed that during the three years prior to the survey there was a definite trend showing a decline in bearing coconut palms and an increase in the number of non-bearing trees (see table 2.9).

From table 2.10 we find that maximum yield of nuts is in the months of March, April, May and June.

TABLE 2.9.

Trend in Bearing and Non-Bearing Palms

Year	Bearing	Non-bearing
1981	100.00	100.00
1982	96.29	105.65
1983	89.85	117.45

Source: Primary Data collected from field survey.

There are variations in the nuts harvested between different months in an year. As seen from table 2.10, the highest average yield is in the month of April (13 per cent of the nuts harvested in an year). This is followed by March (11.1 per cent) and May (10.5 per cent). These variations are determined by a number of factors, particularly climate.

TABLE 2.10

Percentage of Nuts Harvested in the Different Months of the Year

Month	1	2	3	4	Mean
January	6.4	6.4	7.1	9.0	7.2
February	7.7	8.9	9.6	10.2	9.1
March	9.8	10.8	11.5	12.2	11.1
April	14.1	14.1	11.8	12.1	13.[illegible]
May	11.7	11.4	9.3	9.6	10.5
June	9.8	9.7	7.6	9.5	9.1
July	8.2	8.3	8.1	4.7	7.3
August	7.7	7.8	7.7	6.1	7.3
September	6.5	5.9	7.4	6.1	7.3
October	5.6	4.8	6.3	6.2	5.7
November	6.5	6,3	6.2	6.4	6.4
December	6.0	5.6	7.4	7.9	6.7

Source : Jacob Mathew, "Trend and Fluctuations in Prices of Coconuts and Coconut Oil", M.Phil Thesis, Centre for Development Studies, Trivandrum, 1978.

PLATE 2.1

A COCONUT PALM WITH EXCELLENT YIELD

TABLE 2.11

Seasonal Variation in Yield and Quality of Nuts

(per hectare)

Particulars	January	February	March	April	May	June
Yield in 1961	405	594	709	963	771	610
Weight of Husked nut (g)	479	511	518	575	583	555
Copra content per nut (g)	138	138	151	168	162	158
Particulars	**July**	**August**	**September**	**October**	**November**	**December**
Yield in 1961	530	463	383	351	306	346
Weight of husked nut (g)	556	545	535	528	523	504
Copra content per nut (g)	158	129	150	150	146	127

Source: Directorate of Economics and Statistics, Kerala, Statistics for Planning.

From table 2.11, we see that there are fluctuations in yield of coconut within a year. Yield is found to be higher during March to June, and corresponds closely to the monsoon period. The weight of husked nut is uniformaly distributed though copra content is found to vary seasonally.

Analysis of Productivity - Size wise

Recent debates among economists show the importance of the size-productivity debate. Though there is controversy regarding methodology, definition etc, the controversy rests around the reported finding that size and productivity are inversely related. The case of coconut would, thus, be interesting to see if this relation exists in a plantation crop. Data (table 2.12) in their raw form show that holdings between 0-200 cents had the highest range of yield of 34-48 nuts while holdings between 201-500 cents showed the next highest range of 29-31 nuts. Holdings between 501-600, 601-700, 701-800 cents gave 23, 50 and 19 respectively. Holdings between 901-1000 cents and above 1000 cents gave 31 and 19 nuts respectively.

The yield rate for the size group 601-700 cannot be taken as representative as the number of cases in this group was not statistically significant. Thus, if we leave out the size-group 601-700, we see that yield has been coming down as the size of holdings increases.

TABLE 2.12

SIZE-WISE DISTRIBUTION OF PRODUCTIVITY

Size-Holding	Productivity//Palm
0 - 50	36.95
51 - 100	48.04
101 - 200	34.29
201 - 300	29.82
301 - 400	29.92
401 - 500	30.98
501 - 600	22.77
601 - 700	49.98*
701 - 800	18.75
901 - 1000	31.43
Above 1000	18.75

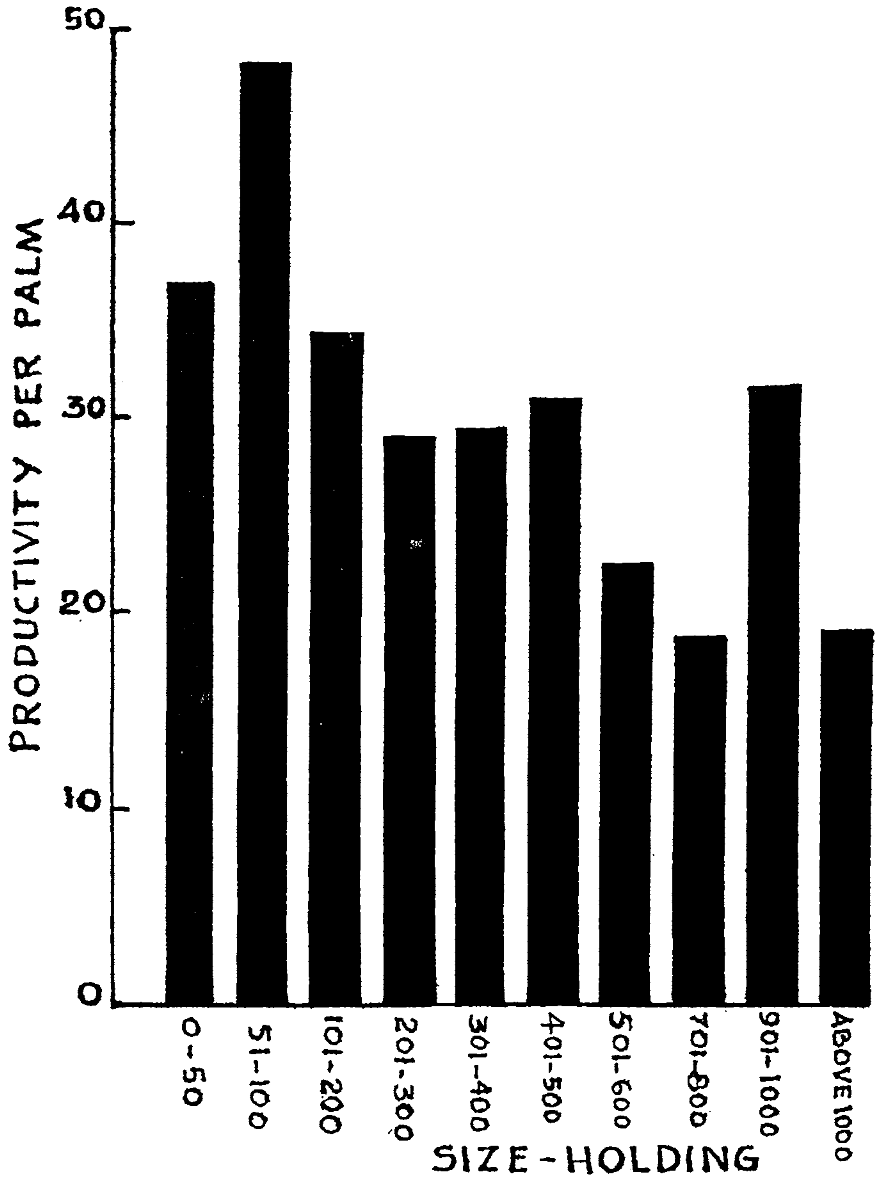
Note : There was no entry in the size group 801-900 cents.

* Not taken for calculation as data biased due to only one entry.

Source : Primary Data Collected through field survey.

GRAPH 2.3

SIZE-WISE DISTRIBUTION OF PRODUCTIVITY
(IN NUMBER OF NUTS)



We see from table 2.12 that yield declines as the size of holdings increases. This observation is confirmed by a correlation exercise. The co-efficient of correlation worked out to -0.496. This value was significant at the 5 per cent level (one-sided test). Thus, it is clear that an inverse relationship exists between size of coconut holdings and productivity.

Size-productivity relation was also studied after eliminating the impact of irrigation (table 2.13) ; for this the data was seperated into those cases which had irrigation and those which had no irrigation. The holdings which were not irrigated were studied using correlation. The resulting co-efficient was -0.234. This was not significant. Thus, when the effect of irrigation was eliminated we see that the inverse relation between size and productivity is not significant.

We tried to see if the inverse relation between size and productivity existed after eliminating the impact of quality differences between coconut holdings (table 2.15). Value of Land was taken to denote differences in quality of land. Accordingly, productivity and value of land were correlated. The result was a co-efficient of -0.264. This value of the co-efficient was not significant even at the 10 per cent level. This means that the inverse size-productivity relation was eliminated when analysis of the same was done after taking into account differences in quality of land.

TABLE 2.13

Productivity in Unirrigated Coconut Holdings

No. of Cases	Size of Holdings	Productivity (No. of nuts)
15	26 - 50	29.08
53	51 - 100	33.89
65	101 - 200	32.86
27	201 - 300	29.21
12	301 - 400	31.06
3	401 - 500	30.84
3	501 - 600	18.67
1	601 - 700	35.09
1	901 - 1000	31.43
1	Above 1000	18.75

Note: Nil entries ignored.

Source: Primary Data Collected from Field Survey.

TABLE 2.14

Productivity in Irrigattd Holdings

No. of Cases	Size of Holdings	Productivity (No. of nuts)
3	25 - 50	29.33
5	51 - 100	45.09
5	101 - 200	38.38
1	201 - 300	36.00
1	301 - 400	16.22
2	401 - 500	31.18
2	701 - 800	38.12

Source: Data Collected from field survey.

Table 2.14 shows no significant variation in productivity between various size holdings. Thus the effect of size on productivity is insignificant in farms which are homogenous as far as availability of irrigation is concerned.

TABLE 2.15

Productivity According to Quality of Land

No. of cases	Value of one cent of land (in Rs.)	Productivity (Number of nuts)
1	150	26.67
1	200	52.17
1	438	49.98
2	500	28.67
1	600	40.83
2	833	37.50
30	1000	32.07
1	1200	40.00
1	1250	28.00
29	1500	31.42
1	1851	40.00
41	2000	41.84
1	2368	33.85
14	2500	26.10
1	2800	32.00
35	3000	30.76
4	3500	24.23
1	3750	16.67
13	4000	37.70
14	5000	37.70
3	6000	60.83
1	7000	26.80
1	7875	16.00
1	8000	38.00
2	10,000	23.04

Source: Primary Data Collected through Field Survey.

We also tried to study productivity in terms of productivity per labourer. For this, data was arranged according to output per labour used. The resulting table (2.16) was then analysed using correlation. Consequently we got a correlation co-efficient of 0.586 which was significant at the 1 per cent level (two sided test). This means that productivity per labour was positively associated with increase in size of holdings.

TABLE 2.16

Output Per Labour Input

Size-Group	Output/Labour
0 - 25	96.00
26 - 50	38.83
51 - 100	66.65
101 - 150	67.33
151 - 200	76.15
201 - 250	76.36
251 - 300	67.35
301 - 400	95.52
401 - 500	90.40
501 - 600	47.74
601 - 700	109.89
701 - 800	174.17
901 - 1000	39.71
Above 1000	326.09

Source: Primary Data Collected through Field Survey.

Impact of Rainfall and Summer Irrigation on Yield

Available data shows that there is no clear-cut relationship between the quantum of rainfall and yield of coconut. Tables 2.17 and 2.18 give a picture of yield alternating between increase and decrease as rainfall increases. This means that yield does not give a perfect fit to a rising trend of quantity of rainfall.

Table 2.17 has been prepared by using information available from "A Note on the Relationship between Yield of Coconut and Rainfall Pattern in the Backwater Region of Kerala", by G.Mathai and K.S.Panicker, which appeared in the Agricultural Research Journal of Kerala, (1978, 1612) P. 254. The yield has been rearranged according to rainfall received. The rearrangement is

TABLE 2.17

Effect of Quantity of Rainfall on Yield of Coconut

Year	Rainfall (mm)	Mean yield (Number of nuts/ha.)	Sign of change
1968	1766.5	953.3	
1974	2317.5	719.0	-
1967	2424.5	921.3	+
1975	2500.6	755.8	-
1970	2669.4	865.3	+
1972	2818.0	982.8	+
1973	2848.8	906.7	-
1971	2966.7	929.0	+
1969	3233.8	872.4	-
1976	3505.9	924.8	+

done in ascending order according to quantity of rainfall. The result has been additionally clarified with a column of direction or sign of change of mean yield.

TABLE 2.18

Effect of Number of Days of Rainfall on Yield of Coconut

Year	Number of rainy days	Mean yield (Number of nuts/ha.)	Sign of change
1975	143	755.8	
1972	143	982.8	+
1968	145	953.3	-
1974	147	719.0	-
1970	152	865.3	+
1971	157	929.0	+
1967	158	921.3	-
1973	164	906.7	-
1976	166	924.8	+
1969	166	872.4	-

Source: E.V.Nelliat, R.V.Nair and P.Thomas Varghese, "Response of High Yielding Coconut Genolypes to Fertilizer levels under Rainfed Conditions", Placrosym - I 1978.

In table 2.18 the average number of days of rainfall received in different years between 1967 and 1976 have been arranged in an ascending order and the corresponding mean yield has been given. This has been done to see if increase in number of days of rainfall has a corresponding effect on yield. The result, however, does not show a rising trend. On the other hand, it is alternating between increase and decrease.

On recapitulating tables 2.17 and 2.18 one can understand that variation in quantity of rainfall above a certain level need not produce significant changes in yield, but on the other hand distribution of rainfall has a positive association with yield.

In a study[3] on yield differences between best managed gardens and the national average in plantation crops it was found that the difference was quite substantial for coconut. It was 340 per cent, only next to pepper with 372 per cent while differences for tea, coffee and rubber were lower with 77.9. 110,

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3. K.M.Muliyar and Prafulla K.Das, "R&D Systems and their constraints; Transfer of Technology in Small-holder Plantation Agricultures", Background Papers : Workshop on Changing Perspectives in Extension (March 12-15, 1984), National Institute of Rural Development, Hyderabad.

153.2 per cent respectively. The high difference for coconut indicates that the performance of most of the coconut gardens is far below the level attainable.

On going through the productivity of some important plantation crops in India it became clear that coconut has not been as dynamic as tea, coffee and rubber whose productivity more than doubled between 1950-51 and 1980-81. While cashewnut declined in productivity that of cardamom and pepper remained constant. Productivity of coconut increased after 1950-51, but since 1960-61 it has been declining.

TECHNICAL ANNEXURE

SUBSTITUTION OF AREA UNDER COCONUT

To study whether substitution has been taking place we have done correlation between coconut area and area under other crops and other uses. Since the phenominon of substitution is complex, a number of factors impinching upon it, much more detailed studies are required. However, despite limitations of a single correlation study, we have ventured to present the data and the results. It is hoped that, despite limitations, the data will give some insights into the phenomenon of substitution between coconut and other crops.

As substitution of cropped area is measured, in correlation, through an inverse relationship; we study those crops which have a significant inverse relation with coconut. We find that in Trivandrum district, the crops which have a significant inverse relation (at 5 per cent, 1 per cent and 0.1 per cent levels) are Sugar-cane, Ginger, Tapioca, Sweet potatoe, Other Food Crops, Groundnut, Sesamum and other Non-Food crops (Table A 1.1) The crops listed above are such that they are substitutable by coconut. Thus, we may infer that the increase in coconut area in Trivandrum district was due to substitution of crops listed above.

TABLE A 1.1

Correlation of Area Under Coconut with Area of Other Crops in Trivandrum District for the Period 1957-58 to 1981-82

	Correlated items	Coconut correlated to (Correlation co-efficient)
1	Rice	- 0.05
3	Ragi	- 0.37
4	Other cereals and millets	- 0.27
5	Pulses	0.46[a]
6	Sugarcane	- 0.70[c]
7	Pepper	-0. 09
9	Ginger	- 0.50[b]
10	Turmeric	0.41[a]
11	Cardamom	0.29
12	Arecanut	0.75[c]
13	Mangoes	0.77[c]
15	Plantain & Banana	0.24
16	Cashewnut	0.64[c]
17	Tapioca	- 0.75[c]
18	Sweet Potato	- 0.86[c]
19	Other Vegetables	0.29
20	Other food crops	- 0.79[c]
21	Groundnut	- 0.47[a]
22	Castor	- 0.33
23	Sesamum	- 0.48[a]
27	Tea	- 0.14
28	Coffee	0.52[b]
29	Rubber	0.91[c]
30	Other non-food crops	- 0.51[b]

Note: a = Significance at 5 percent level
b = significance at 1 percent level
c = significance at 0.1 percent level.

Source: Own computation based on figures from <u>Statistics for Planning</u>, Kerala.

From table A 1.2 we see that in Quilon district Ragi, Pulses and other Vegetables are inversely related. These crops, therefore, may have been substituted by Coconut.

From table A 1.3 we see that in Alleppey district the crops which have a significant inverse relationship are Pulses, Pepper, Ginger, Turmeric and Sesamum. Therefore, we may infer that these crops have been substituted by coconut.

From table A 1.4 we see that only pulses has a significant inverse relationship with coconut in Kottayam district. Thus we can only say that pulses was substituted by coconut in Kottayam.

From table A 1.5 we see that in Idikki district Jowar, Ragi, Pulses, Pepper, Cardamom, Mangoes, Plantain and Banana, Tapioca, Sweet Potato, Sesamum, Coffee and Rubber had significant inverse relationship with coconut. We can therefore say that these crops may have been substituted by coconut.

TABLE A 1.2

Correlation of Area Under Coconut with Area of Other Crops in Quilon District for the period 1957-58 to 1981-82

No.	Correlated items	Coconut correlated to (correlation co-efficient)
1	Rice	- 0.06
3	Ragi	- 0.43[a]
5	Pulses	- 0.44[a]
6	Sugarcane	0.02
7	Pepper	0.12
9	Ginger	0.27
10	Turmeric	0.20
11	Cardamom	0.34
12	Arecanut	- 0.30
13	Mangoes	- 0.12
15	Plantain & Banana	- 0.03
16	Cashewnut	0.09
17	Tapioca	- 0.19
18	Sweet Potato	0.19
19	Other Vegetables	-0.58[b]
20	Other food crops	- 0.23
22	Castor	0.28
23	Sesamum	0.93[c]
27	Tea	- 0.10
28	Coffee	- 0.16
29	Rubber	- 0.13
30	Other non-food crops	- 0.36

Note: a = Significance at 5 per cent level
b = Significance at 1 per cent level
c = Significance at 0.1 per cent level.

Source: Own Computation of correlation based on figures from Statistics for Planning, Kerala.

TABLE A 1.3

Correlation of Area Under Coconut with the Area of other Crops in Alleppey District for the period 1957-58 to 1981-82

No.	Correlated items	Coconut correlated to (correlation coefficient)
1	Rice	0.28
3	Ragi	- 0.28
5	Pulses	- 0.52[b]
6	Sugarcane	0.45[a]
7	Pepper	- 0.58[b]
9	Ginger	- 0.73[c]
10	Turmeric	- 0.45[b]
12	Arecanut	0.69[c]
13	Mangoes	0.23
15	Plantain & Banana	- 0.34
16	Cashewnut	- 0.04
17	Tapioca	- 0.18
18	Sweet Potato	0.32
19	Other Vegetables	0.60[c]
20	Other food crops	0.70[c]
22	Castor	0.63[c]
23	Sesamom	- 0.43[a]
29	Rubber	- 0.12
30	Other non-food crops	0.46[a]

Note: a = Significance at 5 percent level.
b = Significance at 1 percent level
c = Significnace at 0.1 percent level.

Source: Own computation based on data from *Statistics for Planning*, Kerala .

TABLE A. 1.4

Correlation of Area Under Coconut with Area of other Crops in Kottayam District for the Period 1957-58 to 1981-82

No.	Correlated items	Coconut Correlated to (correlation co-efficient)
1	Rice	0.53[b]
3	Ragi	0.30
4	Other cereals and millets	0.73[c]
5	Pulses	- 0.77[c]
6	Sugarcane	0.52[b]
7	Pepper	0.71[c]
9	Ginger	0.36
10	Turmeric	0.33
11	Cardamom	0.71[c]
12	Arecanut	0.91[c]
13	Mangoes	0.37
15	Plantain & Banana	0.28
16	Cashewnut	0.08
17	Tapioca	0.55[b]
18	Sweet Potato	0.77[c]
19	Other Vegetables	0.83[c]
20	Other food crops	0.74[c]
22	Castor	0.61[c]
23	Sesamum	- 0.31
27	Tea	0.56[b]
28	Coffee	0.64[c]
29	Rubber	- 0.37
30	Other non-food crops	0.73[c]

Note: a = Significance at 5 per cent level
b = Significance at 1 per cent level
c = Significance at 0.1 per cent level.

Source : Own computation of correlation based on figures from Statistics for Planning, Kerala.

TABLE A 1.5

Correlation of Area Under Coconut with Area of Other Crops in Idikki District for the Period 1957-58 to 1981-82

No.	Correlated items	Coconut correlated to (Correlation co-efficient)
1	Rice	0.03
2	Jowar	- 0.54[b]
3	Ragi	- 0.66[c]
4	Other cereals and millets	- 0.30
5	Pulses	- 0.88[c]
6	Sugarcane	- 0.09
7	Pepper	- 0.76[c]
9	Ginger	- 0.29
10	Turmeric	- 0.12
11	Cardamom	- 0.70[c]
12	Arecanut	0.15
13	Mangoes	- 0.70[c]
15	Plantain and Banana	- 0.67[c]
16	Cashewnut	0.94[c]
17	Tapioca	- 0.91[c]
18	Sweet Potato	- 0.62[c]
19	Other Vegetables	0.38
20	Other food crops	0.72[c]
22	Castor	0.95[c]
23	Sesamum	- 0.88[c]
27	Tea	0.95[c]
28	Coffee	- 0.83[c]
29	Rubber	- 0.53[b]
30	Other non-food crops	0.71[c]

Note: a = Significant at 5 per cent level
b = Significant at 1 per cent level
c = Significant at 0.1 per cent level.

Source: Own computation based on figures from <u>Statistics for Planning</u>, Kerala.

From table A 1.6 we see that in Ernakulam district Ragi, other cereals and millets, Pulses, and Sweet Potato had a significant inverse relation with coconut. Therefore we may say that coconut substituted the cultivation of the above crops.

From table A 1.7 we see that in Trichur district Ragi, Pulses, Cashewnut, Castor and cotton were inversely related to coconut. Thus we may say that the cultivation of these crops was substituted by coconut.

From table A 1.8 we see that in Palghat district only Cotton and Tea were significantly inversely related to coconut. Thus we can only say that these two crops may have been substituted by coconut.

From table A 1.9 we find that in Malappuram district Pulses, Turmeric, Cardamom, Plantain and Banana, Cashewnut, and Sweet Potatoe were inversely related to coconut. Thus we may say that the cultivation of these crops was substitution by coconut cultivation.

TABLE A 1.6

Correlation of Area Under Coconut with Area of Other Crops in Ernakulam District for the Period 1957-58 to 1981-82

No.	Correlation item	Coconut correlated to (correlation coefficient)
1	Rice	0.70[c]
2	Jowar	0.25
3	Ragi	- 0.40[a]
4	Other cereals and mittelts	- 0.39[a]
5	Pulses	- 0.40[a]
6	Sugarcane	- 0.23
7	Pepper	0.23
9	Ginger	0.21
10	Trumeric	0.20
11	Cardamom	- 0.23
12	Arecanut	0.85[c]
13	Mangoes	- 0.30
15	Plantain & Banana	0.62[c]
16	Cashewnut	- 0.10
17	Tapioca	0.01
18	Sweet Potato	- 0.64[c]
19	Other vegetables	- 0.08
20	Other food crops	- 0.19
22	Castor	0.55[b]
23	Sesamum	0.21
27	Tea	- 0.28
28	Coffee	0.06
29	Rubber	0.89[c]
30	Other non-food crops	0.05

Note: a = Significant at 5 percent level
b = Significant at 1 percent level
c = Significant at 0.1 percent level

Source: Own computation of Correlation based on data from *Statistics for Planning*, Kerala

TABLE A 1.7

Correlation of Area Under Coconut with Area of Other Crops in Trichur District for the Period 1957-58 to 1981-82

No.	Correlated items	Coconut correlated to (correlation coefficeint)
1	Rice	0.59[b]
3	Ragi	- 0.38[a]
4	Other Cereals and millets	0.05
5	Pulses	- 0.49[b]
6	Sugarcane	0.22
7	Pepper	0.61[c]
9	Ginger	0.29
10	Turmeric	0.09
12	Arecanut	0.74[c]
13	Mangoes	- 0.07
15	Plantain & Banana	0.81[c]
16	Cashewnut	- 0.71[c]
17	Tapioca	0.51[b]
18	Sweet Potato	- 0.26
19	Other Vegetables	- 0.32
20	Other food crops	-0.12
22	Castor	- 0.50[b]
23	Sesamum	0.35
25	Cotton	- 0.59[b]
27	Tea	0.09
28	Coffee	0.36
29	Rubber	0.86[c]
30	Other onon-food crops	- 0.20

Note: a = Significant at 5 percent level
b = Significant at 1 percent level
c = Significant at 0.1 percent level.

Source: Own computation of correlation based on data from *Statistics for Planning*, Directorate of Economics and Statistics, Kerala.

TABLE A 1.8

Correlation of Area Under Coconut with Area of Other Crops in Palghat District for the Period 1957-58 to 1981-82

No.	Correlated items	Coconut correlated to (correlation coefficient)
1	Rice	0.54[b]
2	Jowar	- 0.34
3	Ragi	- 0.26
4	Other cereals and millets	0.19
5	Pulses	0.15
6	Sugarcane	0.11
7	Pepper	0.09
8	Chillies	0.14
9	Ginger	0.12
10	Turmeric	0.12
11	Cardamom	0.02
12	Arecanut	0.13
13	Mangoes	0.42[a]
15	Plantain & Banana	0.02
16	Cashewnut	0.36
17	Tapioca	0.68[c]
18	Sweet Potato	0.74[c]
19	Other Vegetables	- 0.07
20	Other food crops	0.26
21	Groundnut	- 0.22
22	Castor	0.00
23	Sesamum	0.13
25	Cotton	- 0.45[a]
27	Tea	- 0.45[a]
28	Coffee	0.50[b]
29	Rubber	0.08
30	Other non-food crops	0.39

Note: a = Significant at 5 percent level
b = Significant at 1 percent level
c = Significant at 0.1 percent level

Source: Own computation of correlation based on data from <u>Statistics for Planning</u>, Kerala

TABLE A 1.9

Correlation of Area Under Coconut with Area of Other Crops in Malappuram District for the Period 1987-58 to 1981-82

No.	Correlated item	Coconut correlated to (correlation co-efficient)
1	Rice	0.86[c]
3	Ragi	- 0.12
4	Other Cereals & Millets	0.00
5	Pulses	- 0.64[c]
6	Sugarcane	- 0.32
7	Pepper	0.52[b]
8	Chillies	0.89[c]
9	Ginger	0.69[c]
10	Turmeric	- 0.78[c]
11	Cardamom	- 0.54[b]
12	Arecanut	0.77[c]
13	Mangoes	- 0.36
15	Plantain & Banana	- 0.46[a]
16	Cashewnut	- 0.50[b]
17	Tapioca	0.64[c]
18	Sweet Potatoe	- 0.77[c]
19	Other Vegetables	0.53[b]
20	Other food crops	0.48[a]
23	Sesamum	- 0.71[c]
27	Tea	0.35
28	Coffee	0.20
29	Rubber	- 0.16
30	Other non food crops	- 0.18

Note: a = Significant at 5 per cent level
b = Significant at 1 per cent level
c = Significant at 0.1 per cent level.

Source: Own computation of correlation based on data from <u>Statistics for Planning</u>, Directorate of Economics and Statistics, Kerala.

As seen in Table A 1.10 we find that in Kozhikode district only coffee crop had a significant inverse relation with coconut. Thus only coffee seems to have been substituted by coconut in Kozhikode district.

From table A 1.11 we see that in Cannanore district Sugarcane, Plantain and Banana, Sweet - Potato and Tea had a significant inverse relationship with coconut, Therefore we may say that these crops were substituted by coconut.

From table A 1.12 we find that in Trivandrum district permanent pastures and other Grazing land, Land under Miscellaneous tree crops not included in Net Area Sown, Cultivable Waste, Fallow Land other than Current Fallow and Current Fallow, were in inverse relation to area under coconut. We may therefore say that area under such uses as listed above was substituted by coconut. That is, coconut cultivation was extended to such areas as listed above.

From table A 1.13 on Quilon district, no meaningfull relation can be discerned.

TABLE A 1.10

Correlation of Area Under Coconut with Area of Other Crops in Kozhikode District for the Period 1957-58 to 1981-82

No.	Correlated items	Coconut correlated to (correlation coefficient)
1	Rice	0.75[c]
3	Ragi	0.41[a]
4	Other Cereals & Millets	0.72[c]
5	Pulses	0.66[c]
6	Sugarcane	- 0.15
7	Pepper	- 0.30
8	Chillies	0.62[c]
9	Ginger	0.55[b]
10	Turmeric	0.35
11	Cardamom	- 0.30
12	Arecanut	0.68[c]
13	Mangoes	0.45[a]
14	Citrus fruit	0.10
15	Plantain & Banana	0.44[a]
16	Cashewnut	0.88[c]
17	Tapioca	0.65[c]
18	Sweet Potato	0.35
19	Other vegetables	0.45[a]
20	Other food crops	0.67[c]
22	Castor	0.49[b]
23	Sesamum	0.36
25	Cotton	0.34
27	Tea	- 0.06
28	Coffee	-0. 39[a]
29	Rubber	0.77[c]
30	Other non-food crops	0.79[c]

Note: a = Significant at 5 per cent level
b = Significant at 1 per cent level
c = Significant at 0.1 per cent level.

Source: Own computation of correlation based on data from Statistics for Planning, Kerala.

TABLE A 1.11

Correlation of Area Under Coconut with Area of Other Crops in Cannanore District for the Period 1957-58 to 1981-82

No.	Correlated items	Coconut correlated to (correlation coefficient)
1	Rice	- 0.08
3	Ragi	- 0.30
4	Other cereals and millets	- 0.05
5	Pulses	0.06
6	Sugarcane	- 0.44[a]
7	Pepper	- 0.14
8	Chillies	- 0.22
9	Ginger	0.33
10	Turmeric	0.21
11	Cardamom	- 0.00
12	Arecanut	0.23
13	Mangoes	0.13
14	Citrus fruit	- 0.09
15	Plantain & banana	- 0.67[c]
16	Cashewnut	0.68[c]
17	Tapioca	0.36
18	Sweet Potato	- 0.77[c]
19	Other vegetables	- 0.18
20	Other food crops	- 0.12
22	Castor	- 0.26
23	Sesamum	- 0.32
26	Tobacco	- 0.06
27	Tea	- 0.46[a]
28	Coffee	0.36
29	Rubber	0.66[c]
30	Other non-food crops	- 0.26

Note: a = Significant at 5 per cent level
b = Significant at 1 per cent level
c = Significant at 0.1 per cent level

Source: Own computation of correlation based on figures from Statistics for Planning, Kerala.

TABLE A 1.12

Correlation results of Coconut Area with Items Under Classification of Area of Trivandrum District from 1957-58 to 1981-82

No.	Correlation with Items	Coconut correlation to
1	Nil	
2	Forests	0.366
3	Land put to non-agricultural uses	0.901[c]
4	Barren and Uncultivable Land	- 0.185
5	Permanent pastures and other grazing land	- 0.454[a]
6	Land under misc tree crops not included in net Area sown	- 0.553[b]
7	Cultivable waste	- 0.386[a]
8	Fallow land other than current fallow	- 0.764[c]
9	Current fallow	- 0.622[c]
10	Net Area Sown	- 0.091
11	Total Cropped Area	- 0.091
12	Area Sown More than once	0.753[c]

Note: a = Significant at 5 per cent level
b = Significant at 1 per cent level
c = Significant at 0.1 per cent level.

Source: Own computation based on figure from *Statistics for Planning*, Kerala.

TABLE A 1.13

Correlation results of Coconut Area with Items Under Classification of Area of Quilon District from 1957-58 to 1981-82

No.	Correlation with Items	Coconut correlation to
1	Nil	
2	Forests	0.419[a]
3	Land put to non-agricultural uses	0.367
4	Barren and unclutivable land	0.150
5	Permanent pastures and other grazing land	0.355
6	Land under misc tree crops not included in net area sown	0.088
7	Cultivable waste	- 0.092
8	Fallow Land other than current fallow	0.113
9	Current fallow	0.299
10	Net area sown	- 0.508[b]
11	Total cropped area	- 0.424[a]
12	Area sown more than once	0.231

Note: a = Significant at 5 percent level
b = Significant at 1 percent level
c = Significant at 0.1 percent level

Source: Own computation based on figures from *Statistics for Planning*, Kerala.

From table A 1.14 we see that in Alleppey district area under Forests, Land put to non-agricultural uses, cultivable waste and current fallow had a significant inverse relation with area under coconut. Among these we cannot say that coconut substituted Land put to non-agricultural uses. All other areas listed above may have been used for coconut cultivation.

From table A 1.15 we see that in Kottayam district only Fallow land other than current fallow had a significant inverse relation with coconut. Thus, coconut cultivation may have been extented into Fallow Lands.

From table A 1.16 we see that in Ernakulam district Barren and Uncultivable Land, Permanent Pastures and other Grazing Land, Land under Miscellaneous Tree Crops and Current Fallow had a significant inverse relation with coconut. Therefore, it is possible that coconut cultivation was extended to such lands also.

TABLE A 1.14

Correlation results of Coconut Area with Items under Classification of Area of Alleppey District from 1957-58 to 1981-82

No.	Correlation with Items	Coconut correlated to
2	Forests	- 0.769[c]
3	Land put to non-agricultural uses	- 0.740[c]
4	Barren and uncultivable Land	- 0.117
5	Permanent pastures and other grazing land	0.342
6	Land under misc tree crops not included in Net Area Sown	0.563[b]
7	Cultivable waste	- 0.676[c]
8	Fallow Land other than current fallow	0.177
9	Current Fallow	- 0.523[b]
10	Net Area Sown	0.900[c]
11	Total Cropped area	- 0.121
12	Area sown more than once	- 0.455[a]

Note: a = Significant at 5 percent level
b = Significant at 1 percent level
c = Significant at 0.1 percent level

Source: Own computation based on figures from *Statistics for Planning*, Kerala

TABLE A 1.15

Correlation Results of Coconut Area with Items under Classification of Area of Kottayam district from 1957-58 to 1981-82

No.	Correlation with Items	Coconut correlated to
2	Forests	0.582^{b}
3	Land put to non-agricultural uses	- 0.132
4	Barren and uncultivable land	0.197
5	Permanent pastures and other grazing land	0.538^{b}
6	Land under misc tree crops not included in Net Area Sown	0.065^{c}
7	Cultivable waste	0.305
8	Fallow land other than current Fallow	-0.791^{c}
9	Current Fallow	- 0.332
10	Net Area Sown	0.704^{c}
11	Total Cropped area	0.603^{c}
12	Area Sown more than once	- 0.320

Note: a = Significant at 5 percent level
b = Significant at 1 percent level
c = Significant at 0.1 percent level.

Source: Own computation based on figures from Statistics for Planning, Kerala

TABLE A 1.16

Correlation Results of Coconut Area with Items Under Classification of Area of Ernakulam District From 1957-58 to 1981-82

No.	Correlation with Items	Coconut correlated to
2	Forests	- 0.205
3	Land put to non-agricultural uses	0.675[c]
4	Barren and uncultivable land	- 0.649[c]
5	Permanent pastures and other grazing land	- 0.643[c]
6	Land under misc tree crops not included in Net Area Sown	- 0.816[c]
7	Cultivable waste	0.591[b]
8	Fallow Land other than current Fallow	0.441[a]
9	Current Fallow	- 0.518[b]
10	Net Area Sown	0.219
11	Total cropped area	0.072
12	Area sown more than once	0.287

Note: a = Significant at 5 per cent level
b = Significant at 1 per cent level
c = Significant at 0.1 percent level

Source: Own computation based on figures from Statistics for Planning, Kerala

From table A 1.17 we find that in Palghat district Fallow Land other than current fallow and current fallow had a significant inverse relation with coconut. Thus, coconut cultivation may have been extended to areas under such uses as shown above.

From table A 1.18 we see that in Kozhikode district there is no significant and meaningful inverse relation of coconut with lands under various uses. Thus we can only say that no significant substitution took place.

In table A 1.19 we see that in Cannanore district Barren and Uncultivable Land, Permanent pastures and other Grazing Land, Cultivable waste and Fallow Land other than Current Fallow had significant inverse relation with coconut. We may therefore say that coconut cultivation was extended to Land under other uses as given above.

TABLE A 1.17

Correlation Results of Coconut Area with items Under Classification of Area of Palghat District from 1957-58 to 1981-82

No	Correlation with Items	Coconut correlated to
2	Forests	- 0.262
3	Land put to non-agricultural uses	0.276
4	Barren and uncultivable land	- 0.297
5	Permanent postures and other grazing land	- 0.027
6	Land under misc tree crops not included in net Area Sown	- 0.300
7	Cultivable waste	- 0.288
8	Fallow land other than current fallow	- 0.713[c]
9	Current Fallow	- 0.480[a]
10	Net area sown	0.578[b]
11	Total cropped area	0.260
12	Area sown more than once	- 0.078

Note: a = Significant at 5 percent level
b = Significant at 1 percent level
c = Significant at 0.1 percent level

Source: Own computation based on figures from *Statistics for Planning*, Kerala

TABLE A 1.18

Correlation Results of Coconut Area with Items under Classification of Area of Kozhikode District from 1957-58 to 1981-82

No	Correlation with Items	Coconut correlated to
2	Forests	0.666
3	Land put to non-agricultural uses	- 0.119
4	Barren and uncultivable land	0.128
5	Permanent pastures and other grazing land	0.307
6	Land under misc free crops not included in net area sown	0.396
7	Cultivable waste	0.426
8	Fallow land other than current fallow	0.174
9	Current Fallow	0.158
10	Net area sown	0.826
11	Total cropped area	0.663
12	Area Sown more than once	- 0.507

Source: Own computation based on figures from *Statistics for Planning*, Kerala

TABLE A 1.19

Correlation of Coconut Area with Items Under Classification of Area of Cannanore District from 1957-58 to 1981-82

No.	Correlation with Items	Coconut correlation to
2	Forests	0.123
3	Land put to non-agricultural uses	0.231
4	Barren and uncultivable land	- 0.545[b]
5	Permanent pastures and other grazing land	- 0.661[c]
6	Land under misc tree crops not included in net area sown	- 0.325
7	Cultivable waste	- 0.928[c]
8	Fallow Land other than current fallow	- 0.882[c]
9	Current Fallow	0.390
10	Net area sown	0.696
11	Total cropped area	- 0.167
12	Area sown more than once	0.464

Note: a = Significant at 5 per cent level
b = Significant at 1 per cent level
c = Significant at 0.1 percent level.

Source: Own computation of correlation based on data from Statistics for Planning, Kerala

From table A 1.20 we see that in Trichur district, Barren and uncultivable Land and permanent pastures and other Grazing Land had a significant inverse relation with coconut. Thus, coconut cultivation may have been extended to Land under such uses as given above.

From table A 1.21 we see that in Idikki district Barren and Uncultivable Land, Permanent pastures and other grazing Land, Land under Fallow Land other than current Fallow have a significant inverse relation with coconut. Thus, land under such uses may have been used for Coconut cultivation. Items 10, 11 and 12 are not mentioned here because they are not significant for pruposes of analysis.

From table A 1.22 we see that in Malappuram district Forests, Barren and uncultivable Land, Fallow Land other than current fallow and current fallow land had a significant inverse relation with coconut. Thus, coconut cultivation may have been extended to such lands as given above.

TABLE A 1.20

Correlation of coconut Area with Items Under Classification of Trichur District from 1957-58 to 1981-82

No.	Correlation with Items	Coconut correlated to
2	Forests	- 0.389
3	Land put to non-agricultural uses	0.771[c]
4	Barren and unclutivable land	- 0.645[c]
5	Permanent pastures and other grazing land	- 0.534[b]
6	Land under misc tree crops not included in net area sown	0.596[b]
7	Cultivable waste	- 0.377
8	Fallow land other than current fallow	0.155
9	Current fallow	0.055
10	Net area sown	0.528
11	Total cropped area	- 0.354
12	Area sown more than once	0.710

Note: b = Significant at 1 percent level
c = Significant at 0.1 percent level

Source: Own computation based on figures from Statistics for Planning, Kerala.

TABLE A 1.21

Correlation of Coconut Area with Items Under Classification of Area of Idikki District from 1957-58 to 1981-82

No	Correlation with Items	Coconut correlated to
2	Forests	0.950[c]
3	Land put to non-agricultural uses	0.130
4	Barren and uncultivable land	- 0.940[c]
5	Permanent pastures and other grazing land	- 0.756[c]
6	Land under misc tree crops not included in net area sown	- 0.970[c]
7	Cultivable waste	- 0.895[c]
8	Fallow land other than current fallow	- 0.921[c]
9	Current Fallow	0.894[c]
10	Net area sown	0.958
11	Total cropped area	0.462
12	Area Sown more than once	- 0.428

Note: c = Significant at 0.1 per cent level

Source: Own computation based on figures from Statistics for Planning, Kerala

TABLE A 1.22

Correlation of Coconut Area with Items Under Classification of Area of Malappuram District from 1957-58 to 1981-82

No	Correlation with items	Coconut correlated to
2	Forests	- 0.546[b]
3	Land put to non-agricultural uses	- 0.741[c]
4	Barren and uncultivable land	- 0.773[c]
5	Permanent pastures and other grazing land	0.692[c]
6	Land under misc tree crops not included in net area sown	0.408[a]
7	Cultivable waste	0.216
8	Fallow Land other than current fallow	- 0.717[c]
9	Current fallow	- 0.825[c]
10	Net area sown	0.841[c]
11	Total cropped area	0.276
12	Area sown more than once	- 0.166

Note: a = Significant at 5 percent level
b = Significant at 1 percent level
c = Significant at 0.1 percent level

Source: Own computation based on figures from *Statistics for Planning*, Kerala.

CHAPTER III

ANALYSIS OF PRODUCTION

CHAPTER III

ANALYSIS OF PRODUCTION

In this chapter it is proposed to analyse the changes in production over the years in the various districts of Kerala State. The trends in production will be analysed and the data will be decomposed into area and yield effect so as to study the cause for changes in production. The relation between size of holding and production, relative position of South Indian states in coconut cultivation, the existence of unproductive palms and the role of incentives given by government in influencing production are also studied. A technical Annexure on fertilizer application is given at the end.

Table 3.1 gives district-wise data on production of coconut in Kerala.

TABLE 3.1

District-wise Production of Coconut in Certain Areas of Kerala (Million nuts)

District	1957-58	1967-68	1977-78	1980-81
Trivandrum	370	483	320	354
Quilon	424	451	375	344
Alleppey	503	532	283	294
Kottayam	339	342	192	188
Idikki			40	43
Ernakulam	294	348	276	327
Trichur	220	260	311	347
Palghat	32	108	62	80
Malappuram			266	264
Kozhikode	702	818	524	456
Cannanore	315	301	422	311

Source: (i) Agricultural Statistics in Kerala, 1975, Bureau of Economics and Statistics ;

(ii) Statistics for Planning, Directorate of Economics and Statistics, Kerala, 1977, 1980, 1983.

To find out the trend of production in the various districts of the State for the years 1957-58, 1967-68, 1977-78 and 1980-81, a linear equation of the form y = a+bx was fitted to the data between 1957-58 and 1980-81: y being production in various districts and x being years. By fitting the equation a and b values were obtained which were taken as approximations of the trend. These figures are given in table 3.2.

TABLE 3.2

Trend of District-wise Production of Coconut

District	a Value	b Value
Trivandrum	434.5	-21.1
Quilon	477.5	-33.4
Alleppey	1154.0	+300.4
Kottayam	416.0	-60.3
Idikki	37.0	3.0
Ernakulam	4.5	122.7
Trichur	176.5	43.2
Palghat	46.0	9.8
Malappuram	262.0	-2.0
Kozhikode	883.0	-103.2
Cannanore	310.0	10.9

Source: Own Computation based on official figures.

From table 3.2 we see that, out of the eleven districts, six were having negative b values indicating that the production of coconut in these districts was declining. Of these Alleppey had the biggest negative value for b which means that production in Alleppey had declined quite sharply. Of the remaining five districts which showed an increasing trend, Ernakulam showed the biggest increase.

Table 3.3 presents data regarding total production and yield per hectare of coconut in Kerala for the period 1952-53 to 1981-82.

From table 3.3 on production and yield of coconut in Kerala we find that production increased till 1971-72, but since then there was a decline. Yield, on the other hand, kept declining from 1952-53 itself.

The production of coconut in the period 1955-56 to 1982-83 was broken into sub-periods to analyse the trends of production in the sub-periods. For analysing the trend, three measures were used, namely, (i) average cumulative percentage variation, (ii) absolute percentage variation and (iii) the values obtained by fitting a linear trend equation of the from $y = a+bx$. The values obtained thus, are given in table 3.4.

TABLE 3.3

Production and Yield of Coconut in Kerala

	Production (Million nuts)	Yield (Nuts per hectare)
1952 - 53	2978	6919
1953 - 54	3042	6919
1954 - 55	3076	6919
1955 - 56	3039	6919
1956 - 57	3182	6919
1957 - 58	3199	6832
1958 - 59	3248	6832
1959 - 60	3365	6430
1960 - 61	3220	6430
1961 - 62	3247	6130
1962 - 63	3305	5985
1963 - 64	3262	5864
1964 - 65	3273	5864
1965 - 66	3293	5616
1966 - 67	3425	5618
1967 - 68	3593	5625
1968 - 69	3834	5588
1969 - 70	3956	5589
1970 - 71	3981	5536
1971 - 72	4054	5539
1972 - 73	3921	5260
1973 - 74	3793	4972
1974 - 75	3712	4961
1975 - 76	3439	4963
1976 - 77	3348	4817
1977 - 78	3053	4583
1978 - 79	3211	4861
1979 - 80	3032	4576
1980 - 81	3038	4618
1981 - 82	3006	4509

Source: Compiled from Statistics for Planning, Directorate of Economics and Statistics, Government of Kerala.

GRAPH 3.1

PRODUCTION OF COCONUT IN KERALA

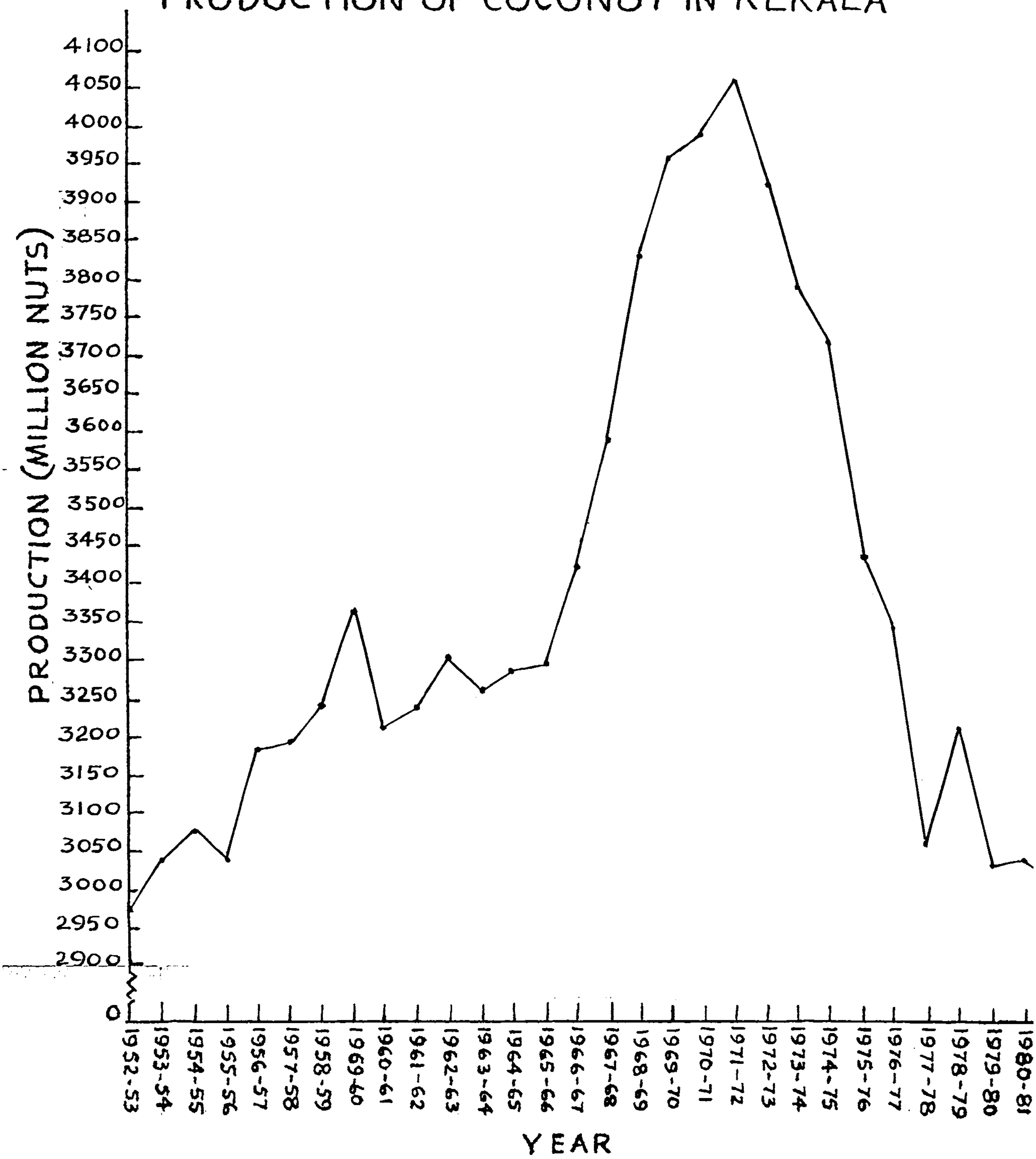

TABLE 3.4

Analysis of Trend of Coconut Production During Sub-periods of the Period 1955-56 to 1982-83

Period	Average cumulative percentage variation	Absolute percentage variation	Trend Values: a Values	Trend Values: b Values
1955-56 to 1959-60	2.08	8.58	3039.2	59.8
1960-61 to 1964-65	-0.53	1.65	3171.1	12.1
1965-66 to 1969-70	3.88	20.13	3099.7	173.5
1970-71 to 1974-75	-1.23	-6.76	4140.9	-88.9
1975-76 to 1979-80	-2.89	-7.41	3441.1	-64.7
1980-81 to 1982-83	0.11	5.85	2890.0	88.0

Source: Own figures based on official data

The average cumulative percentage variation is the same as average rate of change. Thus, we see that the rate of increase of production has been positive only in 1955-56 to 1959-60, 1965-66 to 1969-70 and the last period, 1980-81 to 1982-83. As the rate of decrease of production was quite weak in 1960-61 to 1964-65 its impact on overall production change in production was minimal. This is also shown by the b value of the trend equation for this period.

Till 1969-70 the rate of increase of production was faster than that of the subsequent periods. Since 1970-71 the rate of change of production was negative with an improvement only after 1980-81.

The absolute percentage variation shows a picutre of increase till 1969-70 with a substantial increase in the period 1965-66 to 1969-70. Thus, production has been increasing till this period. In the period after 1969-70, absolute production declined with an increase only after 1980-81.

The trend values indicate that production showed a positive trend till 1969-70 and after 1980-81.

If we decompose the changes in production, it will be possible to analyse the causes for the changes in production. The decomposition of the changes in production into yield effect, area effect and interaction effect for the sub-periods analysed above is given below. The decomposition has been done using the following formula

$P = A_1 \times y + Y_1 \times A + y \times A$

P = Chnage in production (between t_1 and t_n)

A_1 = Initial area (In t_1)

A = Change in area (Between t_1 and t_n)

Y_1 = Initial yield (In t_1)

y = Change in yield (Between t_1 and t_n)

The first term on the right hand side of the formula is the yield effect, the second term the area effect and the third term the interaction effect.

TABLE 3.5

Yield and Area Effect in Production Change

Period	Yield effect	Area effect	Interaction effect
1955-56 to 1959-60	-14.65	116.01	-1.46
1960-61 to 1964-65	-543.28	706.45	-63.17
1965-66 to 1969-70	-2.39	102.94	-0.49
1970-71 to 1974-75	-151.05	59.74	-6.10
1975-76 to 1979-80	-45.03	-56.87	+1.90
1980-81 to 1982-83	38.18	60.47	+1.35

Source: Own computation based on figures for area, production and yield from Statistics for Planning, Directorate of Economics and Statistics.

From table 3.5 we see that the yield effect has been negative through out the period from 1955-56 to 1979-80. But, till 1969-70 area effect was positive and at the same time significant enough to compensate for the negative yield effect. This significant area effect, thus, made production increase possible. But, after 1970-71 and till 1979-80 we find that the area effect does not compensate the negative yield effect. Thus, during 1970-71 to 1974-75 production declined mainly due the negative growth of yield. On the other hand, during 1975-76 to 1979-80 production declined due to the combined negative trend in yield and area.

On the basis of primary data collected through field survey, we have analysed the distribution of production of coconuts per acre as between different size-holdings. From table 3.6 it would appear that the maximum per acre productivity is in the size-holding, 401-500 cents. However, the data presented in the table show a general trend of declining productivity as the size of holding increases.

The data was subjected to a correlation exercise. The co-efficient of correlation turned out to be -0.764. This was significant at the 1 per cent level. Thus, we can state that production per acre is inversely related to size of coconut holding.

TABLE 3.6

Size-Wise Distribution of Production

Size-holding	Production per acre
0 - 50	1790.34
51 - 100	1900.01
101 - 200	1543.47
201 - 300	1415.53
301 - 400	1357.13
401 - 500	1870.68
501 - 600	979.64
701 - 800	1312.50
901 - 1000	1100.00
Above 1000	1000.00

Note : There was no entry in the size-group 801-900 cents.

Source : Primary data collected through field survey.

Relative Position of Kerala, Tamil Nadu and Karnataka in Coconut Production

Coconut production in Kerala has come down to 1,905 million nuts in 1983-84 from 2,444 million nuts in 1982-83. It was 3,008 million nuts in 1980-81 and 3,006 million nuts in 1981-82.

At the same time, the neighbouring States, Tamil Nadu and Karnataka, have marched ahead. Tamil Nadu recorded an increase in area under crop and also production between 1955-56 and 1982-83, from 0.51 lakh hectares and 417 million nuts to 1.43 lakh hectares and 1,650 million nuts, respectively. The latest figures available for Karnataka show that the Coconut Development Board has distributed subsidy for raising new plantations for about 1,100 hectares in 1984-85. (Subsidy is fixed at Rs. 3,000 per hectare payable in five annual instalments).

The all-India estimates of area under cultivation and production of coconuts for 1982-83 were 11.13 lakh hectares and 566.4 crores of nuts respectively. It was higher than the 1981-82 figures: 10.91 lakh hectares and 557.3 crores nuts. The increase was mainly due to the contribution of Tamil Nadu ; but it was neutralised by drop in production in Kerala, due to the drought in 1983, according to a report of the Coconut Board.

The area under coconut in Karnataka has also risen to 1.78 lakh hectares from 1.76 Lakh hectares in 1981-82. The increase is also evident in production figures.

While some parts of Kerala have been seriously affected by the root-wilt disease, in the neighbouring states such as Karnataka and Tamil Nadu the incidence of this disease has not been found and the plants have remained healthy.

Existence of Uproductive Palms

Among the reasons given for fall in production it is said that cultivation habit of coconut farmers is unscientific. It is said that palms which have low yield are not cut. We tried to study this aspect in our field survey. From the following table (3.7) on Percentage of Farmers who cut Unproductive Palms we see that coconut farmers in most size-holdings have cut unproductive palms. In one size-holding all the farmers concerned cut unproductive palms. In some size-holdings a majority have cut unproductive palms.

TABLE 3.7.

Percentage of Farmers Who Cut Unproductive Palms

Sl.No.	Size Class of Farm Households	Farmers who cut (Percentage)
1	0 - 50	68
2	51 - 100	38
3	101 - 200	40
4	201 - 300	45
5	301 - 400	31
6	401 - 500	67
7	501 - 600	80
8	601 - 700	0
9	701 - 800	100
11	901 - 1000	0
12	Above 1000	0

Note : There was no entry in the size-group 801-900 cents.

Source : Data collected through field survey.

It is evident that in many size-holdings, as can be seen from table 3.7, some farmers have not cut unproductive palms. But, in most cases such unproductive palms are mainly root-wilt affected palms and are otherwise in age-groups where they can yield. About 79 per cent of coconut farmers who were interviewed opinioned that they have not cut such palms because they think that the root-wilt intensity will come down and the palms will begin normal yielding again (see table 3.8). Some farmers opined that there was uncertainity about yields from newly planted palms because they may not continue to grow and may die off. Some respondents opined that newly planted seedlings do not establish themselves well.

TABLE 3.8

Reasons for Not Cutting Unproductive Palms

Reasons	Percentage
Don't want to take special effort/cost	11.90
Uncertainty about yield of newly planted palms	9.50
Difficulty in establishing new seedlings	2.38
Hope that unproductive palms would yeild in future	78.57

Note : Due to multiple choices given, the percentages do not add to 100.

Source : Primary data collected from field survey.

Incentives Received by Coconut Farmers

The purpose of various incentives given by the government is to elicit positive responses from farmers for increasing production. Various subsidies are given for improving cultivation practices. Table 3.9 gives size-wise share of incentives received by coconut farmers.

TABLE 3.9

Size-wise Share of Incentives for Coconut Cultivation (In Percentage)

Size-class of holdings	Seedling	Subsidy of fertilizer	Loan	Cutting root-wilt affected palms
0 - 50	2.79	0.00	0.00	97.21
51 - 100	4.16	26.26	0.00	69.58
101 - 200	1.41	3.19	42.54	52.86
201 - 300	2.17	30.63	5.17	62.03
301 - 400	23.79	0.00	0.00	76.21
401 - 500	0.00	0.00	0.00	100.00
501 - 600	20.51	0.00	0.00	79.49
601 - 700	0.00	0.00	0.00	100.00
701 - 800	6.25	0.00	0.00	93.75
901 - 1000	0.00	0.00	0.00	100.00
Above 1000				

Source : Primary Data collected through field survey.

From the above table we find that for all size-groups of holdings the major incentive given was for cutting root-wilt affected coconut palms. Loan given was practically nil in most size-holdings except in size-holding 101-200 cents. Subsidy given on fertiliser was also low. Only respondents in three size-holdings received this subsidy and its proportion to total subsidy was also low. Most of the respondents received subsidy on seedlings, but except for two size-groups, farmers in most size-groups received amounts which were too little compared to the total quantum of all subsidies.

TABLE 3.10

Proportion of Various Agricultural Incentives in Total Value of Incentives

Incentive	Percentage of total
Seedling	3.69
Subsidy on fertilizers	10.12
Loan	24.00
Cutting of root-wilt affected palms	62.19

Source: Primary Data collected through field survey.

From table 3.10 we see that subsidy given for cutting root-wilt affected palms took 62 per cent of total value of incentives given by the government. Loans constituted a poor second with 24 per cent. Subsidies on fertilizers and seedlings were very low, they being 10 and 4 per cent respectively.

From tables 3.9 and 3.10 we find that subsidies and loans given for purchase of seedlings and fertilizers have a low priority among our respondents. As subsidy on purchase of seedling is low (4 per cent of total), it does not significantly induce the farmers to resort to replanting and start new cultivation. Subsidy on fertilizer is also low and it may not induce the respondents to go in for more manuring. Loans given by the government form only one-fourth of total incentives given; and such loans have gone mainly to a particular size-group and most of the respondents did not receive subsidy or loans. In other words, those subsidies which would have made significant impact on improving cultivation was not prominent in the total subsidy given. The only prominent subsidy given was for cutting root-wilt affected coconut palms. Thus, while existing palms would be cut, no significant incentives are given for purposes which would help in rejuvenating the farms. By cutting away root-wilt affected palms the farmer becomes a loser. It is important to note that this step was initiated by the government along with the propogation of cocoa and oil palms.

Table 3.11 shows that from 1977-81 to 1983 sizeable portion of government incentives were given to farmers between size-groups 51-300 cents.

TABLE 3.11

Share of Incentives Received by Coconut Farmers According to Size-grpups

Size-class of households	1960-76	Percentage of total amount 1977-81	1982	1983	Total
0 - 50	0	1.85	4.34	0.89	1.70
51 - 100	0	17.59	26.51	10.72	14.72
101 - 200	0	30.81	38.43	66.52	56.67
201 - 300	0	32.78	19.36	12.10	15.99
301 - 400	0	0.00	5.70	5.11	4.63
401 - 500	0	9.23	0.00	0.00	1.08
501 - 600	0	0.00	2.99	3.70	3.12
601 - 700	0	7.38	0.00	0.00	0.86
701 - 800	0	0.37	0.00	0.95	0.69
801 - 900	0	0.00	0.00	0.00	0.00
901 - 1000	0	0.00	1.07	0.00	0.22
1000 & Above	0	0.00	1.60	0.00	0.32
Total		100 .00	100.00	100.00	100.00
Total amount (in Rupees)		81300.00	14042.00	47304.00	69476.00

Note : Figures may not add up due to rounding.

Source : Primary Data collected through field survey.

T E C H N I C A L A N N E X U R E

RECOMMENDED PRODUCTION FUNCTIONS

FOR TWO-FACTOR (N, K)

INTERACTIONS FOR COCONUT

TECHNICAL ANNEXURE

RECOMMENDED PRODUCTION FUNCTIONS FOR TWO-FACTOR (N.K.) INTERACTIONS FOR COCONUT[1]

Some mathematical models recommended for two-factor interactions such as observed in this experiment for coconut are as follows:-

1) Quadratic Model

$$Y = a \pm b_1 N \pm b_2 N^2 \pm b_3 k \pm b_4 k^2 \pm b_5 NK.$$

2) Square root Model

$$Y = a \pm b_1 N^{1/2} \pm b_3 K \pm b_4 K^{1/2} \pm b\, N^{1/2} K^{1/2}$$

3) Mixed Models

$$Y = a \pm b_1 N \pm b_2 N^{1/2} \pm b_3 K + b_4 K^{1/2} \pm b_5 NK$$

OR

$$Y = a \pm b_1 N \pm b_2 N^2 + b_3 K \pm b_4 K^2 \pm b_5 NK$$

4) Logarithmic Model

$$Y = \beta \, N^{x1} \, K^{x2}$$

The above equations are to be based on tables of yield at different levels of combination of N & K. For example, an equation of the response surface was obtained as follows:

$$Y = 1377.9300 + 0.0655N - 0.0067\, N^2 + 10.3182\, K - 0.0618\, K^2 + 0.0210\, NK$$

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1. V. Abeywardena, Economics of Fertiliser Use, Working Paper No. XV, Coconut Research Institute, Ceylon.

where Y is the expected yield of copra (Lb/acre) when sulphate of Ammonia (20.6 percent) is applied at the rate of N Lb/acre and Muriate of Potash (50 percent K_2o) at the rate of K lb/acre (an acre reckoned to contain 66 palms.)

The above question was obtained by imputing corresponding values of N, K and Y from the following table and then solving as simultaneous equations.

TABLE A.3.1

Yield of Copra (lb/acre) at Different levels of N & K

	K_o	K_1	K_2
N_o	1390	1734	1785
N_1	1277	1868	1900
N_2	1268	1660	1996

N_o = 0 K_o = 0 K_1 = 0.375 lb K_2o/palm/tree

N_1 = 0.25 lb N/palm/year

N_2 = 0.50 lb N/palm/year

K_2 = 0.75 lb K_2o/palm/year

Optimum Fertilizer Dosage

"the optimum fertilizer dosage is commonly understood to be that combination of nutrient levels that give the maximum absolute net profit per unit area. Alternatively (taking N and K to be the nutrients involved) the optimum fertilizer dosage could be defined as that level of applied N and K at which the income obtained from the additional yield (Y) due to small increment of each nutrient (N and K) will be just sufficient to meet the cost of the latter. Any application beyond this level decreases profit and application below this level foregoes some profit.[2]

These optimum values could be determined mathematically by equating the first partial derivatives of the production function (w.r. to N and K) to their corresponding nutrient to crop price ratios. For instance if the production function is given by,

$$Y = a + b_1 N^2 + b_3 K - b_4 K^2 + b_5 NK$$

The optimum dosage for N and K will be given by a solution of the following two equations:

$$b_1 - 2b_2N + b_5N = \frac{Cn}{C_p} \quad \text{.........} \quad (1)$$

$$b_3 - 2b_4 K + b_5K = \frac{C_K}{C_p} \quad \text{.........} \quad (2)$$

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2. Ibid.

Economic Dosages for Fixed Targets of Production

"The concept of an optimum fertilizer dosage dealt with above pre-supposes that there are no restrictions either on resources (ie. capital and fertilizer) or on production. The aim is to derive the maximum absolute net profit per unit area of land. However, under certain market conditions or depending on the availability of processing machinery etc it may be necessary to set a target on production. This is especially so with seasonal crops. In certain cases either to avoid a glut in the market or possibly due to the fact that the available processing machinery is limited, one may have to fix the level of production and by rigorously restricting production to the optimum, the deficit may have to be met through imports; or it may be that unless the production is in excess of the optimum, losses may have to be incurred by having to allow processing machinery and permanent labour to idle. Such situations, where one is restricted to a certain target of production call for a precise determination of the least cost combination of nutrients that will just secure the given target of production."[3]

Suppose Yt is the target of production and C_n and C_k the costs per unit of N and K respectively and C_F the total cost of fertilizer.

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3. Ibid.

Then we get:-

$$Y_t = a + b_1N - b_2N^2 + b_3K - b_4K^2 + b_5 NK \ldots\ldots(3)$$

and $$C_F = C_n N + C_k K \ldots\ldots\ldots\ldots\ldots(4)$$

The economic nutrient combination (N and K) to achieve the given target of production (Y_t) will be such as to minimise C_F subject to equation (3) above.

The points of the minimum cost combination of N and K for a given price ratio of nutrients is obtained mathematically by equating the ratio of the partial derivatives of the production function to the price ratio of nutrient, ie.

$$\frac{\frac{dy}{dN}}{\frac{dy}{dK}} = \frac{C_n}{C_K} \ldots\ldots\ldots\ldots(5)$$

$$= \frac{b_1 - 2b_2 + b_5K}{b_3 - 2b_4K - b_5N} = \frac{Cn}{CK}$$

The minimum cost nutrient combination corresponding to the given target of production is given by solving the equation resulting from equating equation (3) and (5)

Economic Dosage When Capital is Limited

"While normally the cost of manuring per acre of coconut based on the optimum dosage is (say) Rs. 37.42, the situation may be that one cannot afford more than (say) Rs. 20 per acre in manuring. Under such circumstances, planters adopt the practice of manuring the whole estate at a lower rate of fertilizer based on the ratio of money available to money required. For example, if the money available is Rs.20 per acre, deducting Rs.9.90 being the cost of application, a balance of Rs.10.10 is left for purchase of fertilizer; whereas if money is available _ad lib_, an amount of Rs. 37.42 minus Rs. 9.90 (ie. Rs. 27.52) is left for the purchase of fertilizer. The rate of fertilizer applied is then $\frac{10.10}{27.52}$th of the usual optimum dosage. An important point to remember in this procedure is that the ratio of nutrients does not change, but the quantity of the mixture is reduced proportionately. When capital is limited, landowners, it appears, adopt another procedure. If they have (say) only Rs. 20.00 against the required Rs. 37.42, they manure a proportionate part of the estate at the usual optimum dosage - ie., $\frac{20.00}{37.42}$ or 53 per cent of the estate is manured at the normal dosage and the remaining portion of the estate is left unmanured."[4]

Suppose N and K be the required economic dosage and C_M be the amount of cash available per acre. Then we get

$$C_M = CnN + C_k K \quad \dots\dots\dots\dots \quad (6)$$

The minimum cost line is given by -

$$\frac{b_1 - 2b_2N + b_5K}{b_3 - 2b_4K + b_5N} = \frac{C_n}{C_K} \quad \dots\dots\dots \quad (7)$$

The economic nutrient combination for the given outlay, CM, and the given price ratio C_n/C_K is obtained by solving equations (6) and (7) for N and K.

When the level of manuring is lowered the N:K ratio changes. When capital was easily available it was 15:10; when it falls to Rs.20/- per acre it changes to 10:42.

A minimum Recommended Dosage

Economic nutrient dosages applicable to the whole state under conditions of limited capital are subject to a certain lower limit. This is called the "minimum recommended rate".

"Suppose the income function for yield in excess of what is obtainable without the addition of fertilizers is given by,

$$Y_1 = b_1N - b_2N^2 + b_3K - b_4K^2 - b_5NK$$

and the cost function for fertilizers is given by

$$Y_2 = a^1 + b_1^1 N + b^1{}_3K$$

Then the "minimum recommended rate" is given by the values of N and K when the criterion

$$Y = \frac{Y_1 - Y_2}{Y_2}$$

(giving the average return per unit investment on fertilizer) is a maximum, ie., when

$$\frac{dy}{DN} = 0 \quad \ldots\ldots\ldots\ldots \quad (8)$$

and $$\frac{dy}{dk} = 0 \quad \ldots\ldots\ldots\ldots \quad (9)$$

When capital available is insufficient to apply at least the minimum recommended rate over the whole it will be more economic to apply the minimum recommended rate over a limited average depending on the capital available.[5]

TABLE A 3.2

Economics of Manuring Coconut at 50 Per cent Subsidy - (Small Holdings)

(Based on an economic analysis of the data of the N P K Experiment at Bandirippuwa)

(1) Market Price of Copra Rs. per Candy		(2) Optimum Dosage/Acre (66 Palms) Sulphate of Ammon. 20.6% N	Saphos Phospha: 27.5% P_2O_5	Muriate of Potash 50% K_2O	(3) Cost of fertilisation per acre (Rs)	(4) Yield of Copra at optimum dosage Ib/acre
LOW	(1)	0.424	0.501	0.775		
Rs.100	(2)	2.06	1.82	1.55		
per	(3)	135.80	120.12	102.60	35.40	1963.95
Candy	(4)	7.8%	9.2%	14.3%		
MEDIUM	(1)	0.492	0.501	0.820		
Rs.180	(2)	2.39	1.82	1.64		
Per	(3)	157.60	120.12	108.00	37.42	1972.81
Candy	(4)	8.4%	8.6%	14.0%		
HIGH	(1)	0.517	0.501	0.835		
Rs.260	(2)	2.51	1.82	1.67	38.30	1974 .86
per	(3)	165.90	120.12	110.10		
Candy	(4)	8.6%	8.5%	13.9%		

Note: (1) Ib. of element per palm

(2) Ib. fertilizer per palm

(3) lb. fertilizer per acre

(4) Proportion of nutrient element in mixture

Source: *Ibid*.

TABLE A 3.2 (Contd.)

(5) Net Income at optimum dosage (ie. minus cost of ferti. Rs./Acre	(6) Income at maximum response Rs./Acre	(7) Income without fertilization Rs./Acre	(8) Profit from ferlizer alone Rs./Acre	(9) Profit from investment on fertilisation percentage
315.31	313.04	246.06	69.25	196
596.70	595.44	442.91	153.79	411
878.70	877.84	639.76	238.94	625

Source: Ibid

TABLE A 3.3

Economics of Manuring Coconut at 50 Per cent Subsidy when Capital is Limited

(Market Price of Copra at Rs.180/Candy)

(based on an economic analysis of the data of the N P K Experiment at Bandirippuwa)

Capital available per acre	Quantity of Fertilizer applied on ratio basis: Ib/acre N	P	K	Yield of Copra Ib/ acre	Profit from fertilizer alone
Ad Lib (Rs.37.42 per acre	257.60	120.12	108.00	1972.8	153.75
Rs. 20 per acre	57.84	44.08	39.67	1719.5	89.79
Rs. 25 per acre	86.48	65.91	59.31	1835.6	122.11
Rs. 30 per acre	115.11	87.74	78.96	1916.7	143.17
Rs. 35 per acre	143.75	109.56	98.60	1962.7	152.[illegible]6

Source: Ibid.

TABLE A 3.3 (Contd.)

Capital available per acre	Fraction of Estate Manured on ratio basis				
	Rate/Acre			Yield of Copra lb/ acre	Profit from fertilizer alone
	N	P	K		
Ad lib (Rs.37.42 per acre	157.60	120.12	108.00	1972.8	153.79
Rs. 20 per acre	157.60	120.12	108.00	1683.4	81.40
Rs. 25 per acre	157.60	120.12	108.00	1774.5	102.46
Rs. 30 per acre	157.60	120.12	108.00	1855.6	123.54
Rs. 35 per acre	157.60	120.12	108.00	1936.7	144.60

Source: Ibid.

TABLE A 3.3 (Contd.)

Capital available per acre	Manured at the Economic Dosage Level				
	Ib/acre			Yield of Copra Ib/ acre	Profit from fe-rtilizer alone
	N	P	K		
Ad Lib (Rs.37.42 per acre	157.60	120.12	108.00	1972.8	153.79
Rs. 20 per acre	17.39	44.08	73.27	1827.8	124.60
Rs. 25 per acre	57.60	65.91	87.74	1890.5	139.75
Rs. 30 per acre	97.92	57.74	93.24	1936.2	149.44
Rs. 35 per acre	138.14	109.56	103.20	1964.7	153.60

Source: Ibid.

TABLE A.3.4

Response in Yield to the Different Levels of Application of N, P and K Based on Combined 10 years Data[6]

Levels of nutrient	N	P	K
0	47.8	50.9	50.0
1	55.9	53.5	54.0
2	54.7	53.9	54.4
Mean	52.8	52.8	52.8
L.S.D. (5%)	2.3	2.3	2.2
Conclusion	$N_2N_1N_o$	$P_2P_1P_o$	$K_2K_1K_o$

Phosphorus failed to show any significant effect for the first nine years (1959 was an exception) but then for the next three years significant effects were seen. The combined analysis also revealed significant main effects for P, probably reflecting the trend observed in the later years.

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6. Mohammed Kunhi Muliyar and E.V.Nelliat, "Response coconut Palms to NP and K Fertilizer Application on the West Coast of India", Oleagineux,

TABLE A 3.5

Main Effects of N, P and K on Nut Characters

Mean value and Percentage Increase or Decrease over no Nutrient for Different Characters (10 year Average)

	Weight of unhusked nuts (gm)	Volume of un-husked	Weight of husked nuts (gms)	Volume of husked nut (cc)	Copra Weight per nut (gm)
N_0	987.1	2619	535.3	583.1	179.2
N_1	928.6++ (-5.9)	2502 (-4.4)	482.1++ (-9.9)	530.9++ (-9.0)	164.8++ (-8.0)
N_2	890.6++ (-9.8)	2404 ++ (-8.2)	467.0++ (-12.8)	516.6 ++ (-11.4)	162.1++ (-9.5)
P_0	934.4	2517	489.8	537.5	168.9
P_1	932.2 (-0.2)	2513 (-0.1)	499.1 (1.9)	550.9 (2.5)	168.5 (0.4)
P_2	939.7 (0.6)	2496 (-0.8)	495.5 (1.2)	542.2 (0.9)	167.7 (-0.7)
K_0	895.0	2331	476.9	530.4	163.3
K_1	953.6++ (6.6)	2562++ (9.9)	503.3+ (5.5)	550.2 (3.7)	171.0+ (4 .7)
K_2	957.7++ (7.0)	2632++ (12.9)	504.1++ (5.7)	550.1 (3 .7)	178.8+ (5.2)

Note: + Significant at 5% level
++ Significant at 1% level
() Figures in the bracket denote percentage increase or decrease over no nutrient.

Source: Ibid.

Potash showed significant impact on yield for the first time in the fifth year (1957) and had been showing similar results for the subsequent years. Both the lower and higher doses of potash gave signigicantly higher yields than (no potash) treatment. Higher level of potash gave higher yield than lower level, though the difference was not significant.

Among the two factor interactions, only PK showed consistent effect. It truned out to be significant in eight out of eleven years and also for the combined 10 years data.

TECHNICAL ANNEXURE

MANURING AND FERTILIZER USE

TECHNICAL ANNEXURE

MANURING AND FERTILIZER USE

Studies in India have shown that an adult bearing palm removes from the soil every year about 5556.56 gm N, 275 gm. P_2O_5, 833.53 gm. K_2O, 501.56 gm. C_aO and 209.86 gm. MgO. Though nitrogen, phosphoric acid and potash are considered the main nutrients for coconut it also exhausts appreciable quantities of lime and magnesia which emphasises the need for their replacement. Of the different elements required, potash appears to be the most important followed by nitrogen. "... the optimum doses of different nutrients were found to be about 0.5 Kg. N, 0.32 Kg P_2O_5 and 1.2 Kg. K_2O per palm per year".[1]

In the coarse-textured soils, fertilisers cannot be expected to give any appreciable results until physical proportion of such soils are improved by the application of organic manures or silt. In the case of

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1. P.K.Thampan, Coconut Culture in India, The Green Villa Publishers, 1972.

the fine textured soils, the soil condition should be improved by application of river sand or gravel. In the case of laterite soil which is deficient in major nutrients, organic manures supplemented with NPK should be applied.

Under conditions of optinum manuring and irrigation the West Coast Tall palms come to flowering in the fourth or fifth year.

Based on the conditions of growth the manurial schedule given in the following table is recommended for the young palms.

TABLE A 3.6

Manurial Schedule for Young Palms

Age of Palm	Dosage to be applied	
	Irrigated	Rainfed
1st year (after 3 months)	1/4 adult dosage	1/4 adult dosage
2nd year	1/2 adult dosage	3/8 adult dosage
3rd year	Full dose	1/2 adult dosage
4th year	Full dose	3/4 adult dosage
5th year	Full dose	Full dose

Source: Ibid.

For maximum efficiency, fertilisers should be applied round the palm in the entire area upto a distance of about two metre from the bole and forked in.

There is a particular dose of chemical fertilizers which optmises crop production. This is evident from a NPK fertilizer trial conducted on coconut palms.[2]

In this case the three elements were given to coconut separately. It was found that in the case of N and K the dose of 750 g/palm optmised yield. Either decrease or increase in levels of application of these two elements decreased nut yield. But it was seen that in the case of P, increase in dosage increased yields, but the rate of increase of yield declined.

The application of fertilizers is influenced by the soil moisture condition. The best time for the purpose is when the soil is neither too dry nor too wet. Under west-coast conditions the best time for fertiliser

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2. P.Gopalasundaram, E.V.Nelliat, P T Varghese, K.Sivaraman and MGK Nair, "N P K Fertiliser Experiment on Young Palms in Sandy Loam Soil ; Agronomy I (231), Nutritional Requirement of Coconut Under Different Soil Types," Annual Report, 1982, CPCRI, Kasargod.

application is August-September. In the case of organic manures like compost, farmyard manure, green leaves etc. the best time for their application is June-July. If green manure crops are raised, the proper time for their incorporation is August-September.

For an adult bearing palm the following manurial combinations (table A 3.7) exclusively made-up of organic manures are recommended for coarse-textured soils which are deficient in organic matter.

TABLE A 3.7

Manurial Combinations of Organic Manures

Mixture	Manure	Quantity (Kg.)
1	Farmyard manure or compost	50 to 100
2	Fish Guano	7.5 to 10
	Wood ash	30
	or	
	Coconut husk ash	4
3	Prawn dust	7.5 to 10
	Wood ash or	30
	Coconut husk ash	4
4	Groundnut oil cake	7.5 to 10
	Wood ash or	30
	Coconut husk ash	4
	Bonemeal	1 to 2

Source: Ibid.

CHAPTER IV

COCONUT FARMERS AND THE USE OF MODERN PRACTICES

CHAPTER IV

COCONUT FARMERS AND THE USE OF MODERN PRACTICES

One normally expects that, if modern farming practices are adopted, the total returns of coconut gardens in general, and those of small farmers in particular, would increase. But modern farming practices include use of hybrid seedlings, fertilizers and adequate provision for irrigation. But this calls for additional cost which the farmers owning only small plots of land would find beyond their means. As Krishnaji has correctly pointed out,

> In any case a mere demonstration of the technical possibility of raising the income from small farms is not enough ..... It would depend to a great extent on the availability of credit to small farmers"[1]

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1. M.Krishnaji,"Economics of Inter and Mixed Cropping in the Coconut Gardens of Kerala : Some Preliminary Findings", working Paper No.14, Centre for Development Studies, Trivandrum.

Use of Variety of Seedlings

Tables 4.1 and 4.2 presents the preference of the respondents regarding vatiety of coconut seedlings used as planting material and the main reasons for this preference. Data shows that a majority of respondents use the local variety as planting materials. The main reason given for this preference is that the hybrids have lesser tolerance to root-wilt disease. The hybrids, once affected by the disease, deteriorate faster than the local variety. Also, root-wilt affected palms are poor in their capacity to survive till bearing and their mortality rate is very high.

Opinion collected from the respondents also shows that hybrids are erratic bearers and tend to perform badly under lesser care. The hybrids are also more prone to failure in establishing into grown-up palms than the local variety. Moreover, many farmers opined that the short life-span of hybrids was a major disincentive. The farmers also complained that there was massive adulteration in the supply of hybrids seedlings.

The local varieties, on the other hand, have a better record in establishing and growing into bearing palms and are more resistant to root-wilt.

TABLE 4.1

Use of Variety of Palm for Replanting

Variety	Percentage
Local	86.00
Hybrids	46.00

Note: Percentages are independently worked out from total ; since some farmers use both varities, the percentage totals do not add upto 100.

Source: Primary Data Collected through field survey.

Table 4.1 shows that an overwhelming number of farmers use the local variety for replanting. The percentage of farmers who use the local variety and hybrids, overlap because some farmers who use local varieties for replanting, also use hybrids.

Table 4.2 presents opinions about hybrids which are also synonymous with high yielding varities (H.Y.V's) in some cases. There are H.Y.V's which are not hybrids, but we have not taken them for the present analysis. We find that only 43 per cent of the farmers consider that the hybrids are more productive than local varities.

Regarding resistance to root-wilt, a sizeable majority in the opinion that hybrids are less resistant to root-wilt than local varieties.

TABLE 4.2

Opinion About Hybrids and H.Y.V

Details	Percentage
More productive than local variety	42.86
Less productive than local variety	57.14
More resistant to root-wilt than local variety	18.18
Resistance to root-wilt same as local variety	14.55
Less resistant to root-wilt than local variety	67.27

Source: Primary Data collected through field survey.

Opinions were sought regarding advantages of hybrids with reference to root-wilt and yield. According, to an overwhelming percentage of respondents, practical experience during cultivation showed that the hybrids did not have any advantage over the local variety in preventing the adverse affect on yield due to root-wilt. But, as regards its yielding capacity, about half of the respondents felt that hybrids increased average yield.

TABLE 4.3

Opinion About Advantages of Hybrids

Details	Yes(%)	No(%)
It stops decrease in yield due to root-wilt	9.94	90.06
It increases average yield	49.61	50.39

Source: Primary data collected through field survey

Density of Palm Population

In Kerala, Tamil Nadu and Karnataka the average density of palms per hectare is 229, 325 and 125 respectively. The productivity per hectare, on the one hand, is 4558, 9762 and 5176 nuts per hectare respectively. The productivity per palm is 32, 46 and 54 nuts respectively. Thus, though Tamil Nadu has productivity per palm lower than Karnataka, the per hectare productivity is higher in Tamil Nadu which means that higher density increases productivity per hectare. In Kerala, whereas per palm productivity is very low, due to higher density per hectare, productivity per hectare is only slightly below that of Karnataka. The same situation prevails in Pondicherry and Lakshadweep. In the Lakshadweep Islands the average density is 251 palms per hectare; the per palm productivity is only 7709 nuts, whereas the per palm productivity is only 38 nuts. P.K.Thampan is of the opinion that it is desirable to adopt a palm density 10 per cent higher than the present average of 229 palms per hectare in Kerala.

From table 4.4, which gives two experiments on the density of cultivation which maximises yield, we find that it is 141 palms per acre which maximises yield in both the experiments. This is significant as the optimum density prescribed in Kerala is 70 palms per acre. The prescribed distance in Kerala is 25 feet. On the other hand, in the experiment referred to, the spacing prescribed is 17.6 feet.

TABLE 4.4

Density of Cultivation and Yield Characteristics

Average Spacing(ft)	Number of palms/acre	Number of nuts/palm	Number of nuts/acre
Experiment I			
15.6	178	58.0	10,329
17.6	141	85.0	12,008
19.6	114	86.2	9,800
21.7	93	73.2	6,776
23.9	76	84.7	6,447
Experiment II			
15.6	178	32.5	5,788
17.6	141	43.2	6,110
19.6	114	53.0	6,022
21.7	93	59.2	5,481
23.9	76	77.5	5,895

Note: Malayan Dwarf and Malayan Dwarf x Jamaican Tall hybrid has been used in this experiement. The varieties have not been used separately.

Source: Compiled from Table "S/4 Pera Experiment", in C.I.Barrant, "Agronomy/Crop Physiology", 18th Report of the Research Department, The Coconut Industry Board, 1978, Jamaica, West Indies, p.22.

In a study on the effect of palm density and levels of NPK fertilizers on yield (table 4.5) and quality of coconut, conducted by K.J.Abraham, it has been shown that yield of coconut palms can be raised to the maximum level with high doses of fertilizer input, and with high palm density.

TABLE 4.5

Effect of Palm Density and Levels of NPK Fertilizers on Yield and Quality of Coconut

SPACING*

	Spacing	Plant density (No.of palms/ha.)
S0	5.0 M x 5.0 M	400
S1	7.5 M x 7.5 M	178
S2	10.0 M x10.0 M	100

FERTILIZER LEVELS*

Symbols	g/ tree/ year N	P	K
M0	0	0	0
M1	340	225	450
M2	680	450	900

Source: K J Abraham, "Effect of Palm density and levels of NPK fertilizers on yield and quality of coconut", Thesis for Master of Science in Agriculture, Department of Agronomy, College of Agriculture, Trivandrum.

* Result of experiment given below.

TABLE 4.6

Yield of Nuts per ha for the Years 1972 to 1976 and the Mean for Five Years

Treatment		1972	1973	1974	1975	1976	Mean
So	Mo	0	220	67	0	259	109
So	M1	1506	3231	2401	5121	3902	3232
So	M2	4270	5937	4486	7667	7453	5963
S1	Mo	0	7	303	362	110	156
S1	M2	5738	6937	5218	7931	5821	6329
S2	Mo	0	444	0	0	8	90
S2	M1	3817	4758	4242	5200	2917	4187
S2	M2	5600	6575	4758	7200	6075	6042
So		1929	3129	2318	4263	3871	3101
S1		3927	5227	4257	6688	4729	4965
S2		3139	3926	3000	4133	3000	3440
Mo		0	224	123	121	126	118
M1		3687	4975	3954	6084	4213	4583
M2		5304	7093	5498	8879	7261	6805

Source: K J Abraham, "Effect of Palm Density and Levels of NPK Fertilizers on Yield and Quality of Coconut", Thesis for Master of Science in Agriculture, Department of Agronomy, College of Agriculture, Trivandrum.

From table 4.6 we see that the highest yield was when maximum fertilizer application was done, that is, M2 level, without any strict spacing. Under conditions such as the latter we see that the spacing was the normal spacing which is less than 7.5 metres.

Further, the rationale for certain cultivation practices such as overcrowding of palms in small plots of land have their own rationale so far as small cultivators are concerned, for example, "it appears that the gross income ... per hectare from overcrowded plantations implies a larger net income from that corresponding to good farming conditions".[2]

Mixed Cropping with Cocoa

The advantages of mixed cropping with cocoa was being propogated by certain quarters. We have tried to study this using both secondary and primary data.

The opinion of the sample respondents in our study regarding the effect of mixed cropping of cocoa on the productivity of coconut was sought. This is given in table 4.7 . Out of those who responded about the impact of cocoa on productivity of coconut, only

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2. N.Krishnaji, op.cit.

7.69 per cent claimed that cocoa cultivation benefited coconut productivity, albeit indirectly, that is through the benefit of manure given to cocoa which was also utilized by coconut. Over 67 per cent opinioned that cocoa cultivation reduced coconut productivity and about 24 per cent could not discern much changes. This finding is quite important because many concerned scientists assume nutrient contribution by certain intercrops. Mainly giving the example of cocoa, it is being propagated that such intercrops should be prefered for intensive cultivation of coconut gardens through intercrops because of their 'natural' nutrient contribution capacities. Thus, certain crop mixes are being canvassed for adoption by displacing other intercrops. The fact remains that many such crops recommended, especially cocoa, draw enormous amounts of nutrients in times of nutrient deficiency and compete with the main crop, namely, coconut, thus bringing down coconut yield.

TABLE 4.7

Effect of Mixed Cropping of Cocoa on Productivity of Coconut palms and Reasons for Increase in Productivity

Details	Percentage
Increased Productivity	7.69
Decreased Productivity	67.69
No change	24.62

Source: Primary Data collected through field survey

The above aspect is made clear in the study by P.Thomas Varghese et al, and they point out that "if while cultivating intercrops the management practices were inadequate and if incompatible intercrops were grown it can lead to reduction in productivity of main crop and that of the intercrop. Competition among crops can arise if soil is inadequate in fertilisers (nutrients) or during the dry months if the soil does not contain adequate moisture".[3]

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3. P.Thomas Varghese, P K R Nair, E.V.Nelliat, Rama Verma, and P Gopalasundaram, "Intercropping with Tuber Crops in Coconut Garden", Placroosym -1, Agronomy, Soil Physiology and Economics of Plantations Crops, E.V.Nelliat,(ed) Proceedings of the first annual symposium on Plantation Crops.

The above conclusion on the detrimental impact of cocoa is also brought out in the following study. In a mixed-cropping trail with cocoa (table 4.8) it was found that in the pre-experimental period yield of coconut in control was better than coconut with single and double hedge cocoa. Even during the experimental period, between June 1972 and July 1974 yield of coconut without intercrop of cocoa was better than yield of coconut with single hedge cocoa. Yield of coconut with double hedge cocoa was lower than yield of coconut with single hedge cocoa. In the period July 1974 to June 1975 yeild of coconut with single hedge cocoa was higher than yield of coconut without cocoa and with double hedge cocoa. But, yield of coconut without cocoa was higher than yield of coconut with single hedge cocoa. Thus, the argument that intercropping with cocoa increases yield is not justified in this experiment.[4] In fact, in the first experimental period coconut without cocoa yields more. Further it is argued that double hedge cocoa benefitted coconut more than single hedge cocoa or pure coconut stand. But this is not evident from the CPCRI experiment. In fact, during the entire experimental period yield of coconut with double hedge cocoa was lower than yield of the pure coconut stand and yield of coconut with single hedge cocoa.

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4. P K R Nair, et-al "Inter and Mixed Cropping Trials", Annual Report, CPCRI, 1975.

TABLE 4.8

Yield of Coconut Palms Under Mixed Cropping with Cocoa

Treatment	Average annual yield of nuts/palm			
	Pre-experimental period January 1969 to December 1970	Experimental period		
		June 72-June 74	July 74-June 75	July 72-June 75
Control(no cocoa)	73	120	149	130
Single hedge cocoa	67	112	164	129
Double hedge cocoa	51	109	142	120

Source: V P Bhaskaran and K Leela, "Response of coconut to irrigation in relation to production status of palms and soil types", Placrosym-1, Agronomy soils physiology and economics of Plantation crops, E.V.Nelliat (ed.).

In our field survey, out of those who gave reasons for increase or decrease of coconut yield due to impact of cocoa (table 4.9) only about 7 per cent informed that cocoa increased coconut yield, but this was not a direct impact but that manure artificially applied to cocoa was also utilised by coconut. More than 93 per cent replied that cocoa adversely affected coconut due to its competition with coconut for nutrients. None opined that cocoa contributed any nutrients as such.

At the same time mixed cropping notably did not have appreciable attention among respondents in its impact on coconut productivity. Only 4 out of 200 (2 per cent) of the respondents claimed increased productivity and seven out of 200 (3.5 per cent) stated that it decreased productivity, about 27 respondents (13.5 per cent) could not discern much impact. This suggests that mixed crops did not have significant relevance in terms of their impact on coconut. But this is because crops which figure in mixed cropping occupy a miniscule of the total crop population. Crops such as jackfruit, nutmeg, mangoe, pepper etc are not cultivated widely among coconut palms. But even among the few who replied about the impact of mixed cropping, the majority felt that it affects coconut adversely due to nutrient competition.

TABLE 4.9

Reasons for Increase and Decrease of Yield Due to Cocoa Intercropping

Details	Percentage
	Reasons for increase
Manure given to cocoa also helps coconut	6.82
	Reasons for decrease
Takes manure meant for coconut palm	93.18

Source: Primary Data collected from Field Survey

Intercropping Impact on Yield of Coconut

Our study indicates that intercropping of tapioca in coconut gardens have little effect on the productivity of coconut. Out of the total respondents in the sample households where interviews were held, 28.72 per cent recroded "no change" in coconut productivity. While 4.26 per cent of the respondents stated that, from their experience, intercropping of tapioca increased the productivity of coconut, 7.45 per cent gave the contrary opinion that such intercropping actually decreased productivity. In the case of 59.57 per cent of the respondents tapioca was not part of their cropping pattern and, therefore, the question was not applicable in their case.

TABLE 4.10

Effect of Intercropping of Tapioca on Productivity of Coconut and Reasons

Details	Percentage
Increased productivity	4.26
Decreased productivity	7.45
No change	28.72
Not applicable	59.57
Total	100.00

Source: Primary Data collected from Field Survey.

Reasons listed for decrease in productivity was again ascribed to the intercrop of tapioca taking away fettility meant to be used only by coconut palms.

Summer Irrigation

From table 4.11 we see that the biggest response to summer irrigation was among poor yielders which may show the lack of proper irrigation among them. The effect of irrigation declined with higher yields.

In an experiment[6] at the Central Plantation Crops Research Institute (CPCRI) it was found that increased quantum of water alone does not increase yield of nuts. On the other hand, higher IW/CPE (Irrigation water per cumulative pan evaporation) ratios and higher doses of NPK lead to higher yield. It was also found that the highest IW/CPE ratio was marginally better than the second highest level of NPK application in terms of yield.

In an experiment[6] on the impact of summer irrigation on coconut palms of varying yeild performance

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5. "Irrigation-cum-Fertilizer Experiment from Early Stage of Growth", E.V.Nelliat, P.Gopala-Sundaram and K.Siveraman (eds.), Annual Report 1981, CPCRI, Kasargod.

6. V.P.Bhaskaran and K.Leela, "Response of Coconut to Irrigation in relation to Production Status of Palms and Soil Types", in "Agronomy, Soils Physiology and Economics of Plantation Crops, Placrosym-1, 1978.

TABLE 4.11

Response of Different Yield Groups in Coconut to Summer Irrigation

Particulars	Yield of nuts/palm/year: Poor (below 20 nuts)	Low (20-40) nuts)	Medium (40-60 nuts)	High (61-80 nuts	Mean
1. Pre-irrigation	13.4	30.2	54.3	70.9	42.2
2. Transit period	33.6	56.1	77.7	82.9	62.6
Increase	20.1	25.9	23.4	12.0	20.4
Over 1	(150.4)	(85 .7)	(43.4)	(16.9)	(48.3)
3. Post irrigation					
Yield	42.2	69.5	85.2	94.8	73.5
Increase over(2)	8.6	13.4	7.6	11.9	10.9
Increase over(1)	28.8	39.3	31.0	23.4	31.3
4. Cost benefit ratio	1:2.9	1:3.5	1:3.1	1:2.4	1:3.1
3 over 1 (%)	210.4	130.01	50.7	30.3	

Source: E.V.Nelliat et al, "Irrigation requirement of coconut and response to levels of fertiliser under irrigated conditions during the early bearing stage", in E.V.Nelliat (ed), Agronomy, soils physiology and Economics of plantation crops, Placrosym-1, 1978.

PLATE 4.2

WATERING IN A COCONUT GARDEN

it was found that poor yielders responded most. It was found that poor yielders (below 20 nuts per year) increased their post-irrigation yield by 210.4 per cent due to summer irrigation. Coconut palms which were low yielders (20-40 nuts per year) increased their post irrigation yield by 130.01 per cent. Medium yielders (40-60 nuts per year) increased their post-irrigation yield by 50.7 per cent. High yielders (60-80 nuts per year) increased their post irrigation yield only by 30.3 per cent. Thus, it is clear that summer irrigation has considerable impact on poor and low yielders. Considering the fact that average yield in Kerala is low, summer irrigation would benefit production of coconut in Kerala considerably.

It has been found that in areas where the rainfall ranges below 1270 mm (50 inches) and between 2540 mm (100 inches) the coconut palm is known to be very sensitive to moisture stress. Studies relating to yearly fluctuations in these areas reveal that crops in a given locality can fluctuate within a range as much as 40 per cent of the mean yield due to fluctuations in rainfall and "... even in healthy palms ... nearly two-thirds of the potential crop is lost due to poor setting of nuts and/or immature nutfall and this can be largely attributed to moisture stress arising from inadequate rainfall".[7]

In an experiment[8] to study effect of watering on copra content it was found that under favourable conditions watering improved copra out-turn significantly by 12.8 per cent for single dose weekly, 12.3 per cent for double dose fortnightly and 7.6 per cent for single dose fortnightly. Under drier conditions the improvement in copra out-turn was higher with 19.2 per cent for double dose fortnightly.

In the same study an experiment on influence of watering on total copra yield revealed that in unfavourable conditions total copra yield increased by

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7. V.Abeywardena, "Influence of Watering on the Yield of Coconut", Sri Lanka, Ceylon Coconut Quarterly (1979), Coconut Research Institute, Unuwila, Pp. 30, 91-100.

8. V.Abeywardena, "Influence of Watering on the Yield of Coconut", Ceylon Coconut Quarterly, 1979, Pages 30, 91-100.

54.2 per cent when the coconut palm was watered by single dose weekly. Total copra yield increased lesser when watering was done double dose fortnightly (46.1 per cent) and even lesser (25.3 per cent) for single dose fortnightly.

In an experiment on influence of watering on the number of female flowers it was found that watering increased female flowers but the result is peculiar, for, the response was better while watering single dose fortnightly than double dose fortnightly or single dose weekly. The peculiarity is more evident since the percentage of immature nutfall is least in single dose weekly.

In the same series of experiments,[10] one on influence of watering on production of mature nuts, it was found that under unfavourable comditions the biggest increase came in the case of single dose weekly

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9. V. Abeywardena, "Influence of Watering on the Yield of Coconut". Ceylon Coconut Quarterly (1979) Coconut Research Institute, Unuwila, Srilanka, pages 30, 91-100.

10. Ibid.

(30.8 per cent), the second best response (19.3 per cent) was from double dose fortnightly and the lowest increase (17 per cent) was from single dose fortnightly. In this experiment it was also found that absolute levels of nut yield were higher under favourable conditions. This showed that even in favourable conditions a certain amount of moisture stress does exist.

In the field survey conducted for the present study the respondents were asked about their opinion as to whether, in terms of their experience or assessment, modern practices (compared to traditional methods) had a positive impact or no impact on profitability of coconut cultivation. As can be seen from table 4.12, except in the case of size-class 601-700 cents (where all respondents recorded a positive impact), most or all the cultivator-respondents indicated that modern practices have no impact.

TABLE 4.12

Impact of Modern Practices on Profit Compared to Traditional Methods

Sl.No.	Size-class of farm households	Impact of Modern Practices (Percentage)	
		Positive	No impact
1.	0 - 50	15.79	84.21
2.	51 - 100	28.30	71.70
3.	101 - 200	18.57	81.43
4.	201 - 300	24.14	75.86
5.	301 - 400	15.38	84.62
6.	401 - 500	16.67	83.33
7.	501 - 600	40.60	60.00
8.	601 - 700	100.00	0.00
9.	701 - 800	0.00	100.00
10.	901 - 1000	0.00	100.00
11.	Above 1000	0.00	100.00

Note: Size-class 801-900 cents is not included since there are no entries for this class in the sample studied.

Source: Primary Data collected from Field Survey.

T E C H N I C A L   A N N E X U R E

SCIENTIFIC OPINION ON VARIETY OF PALMS

TECHNICAL ANNEXURE

SCIENTIFIC OPINION ON VARIETY OF PALMS

Tall x Dwarf Hybrids

For the T x D hybrid, the ordinary tall is the female parent and the dwarf the male parent. In India the different forms of dwarf variety used as male parent are dwarf orange, dwarf green, gangabondam and Malayan dwarf yellow.

TABLE A 4.1

Comparison of the Performance of Various Hybrid Palms and the West Coast Tall

Variety of palm	Age at first flowering		Mean yield of nuts	Copra content per nut (in g.)	Mean annual out-turn (in. Kg)
	Year	Month			
Tall x Dwarf (28 years old)	3	6	119.5	195.9	23.5
Tall x Gangabondan (12 years old)	4	5	102.3	195.4	19.9
Dwarf x Tall (28 years old)	5	-	133.0	206.9	27.5
Tall Under best conditions	8	4	94.0	187.2	17.6

Source: Compiled from P.K.Thampan, "Coconut Hybrids" Fourth Session of the FAO Technical Working Party on Coconut Production, Protection and Processing, Kingston, Jamaica, 14-25 September 1975.

Various nut and copra characters of Tall x Dwarf Green, Tall x Dwarf Orange and Tall x Gangabondam such as weight of unhusked nut, husked nut, components of husked nut (nut water, kernel and shell content and copra per nut) were studied. The results showed that all the hybrids showed heterosis in the weight of the husked nut water and kernel content. Among the various male parents involved, Dwarf Orange and Gangabondam proved to be the best for the production of economic hybrids with the West Coast Tall. In another study, the Tall x Dwarf Orange hybrids were found to be significantly superior to the Tall x Dwarf Green hybrids. In the seedling stage the hybrids with Dwarf Orange as the pollen parent was more vigorous in growth and showed superiority in all the growth characters compared to hybrids with Dwarf Green as pollen parent.

Thus, various scientific studies try to prove the advantage of hybrids compared to West Coast Tall. But as our field study shows, the farmers from their practical knowledge recall the short comings of hybrids and prefer the West Coast Tall as planting material.

TABLE A 4.2.

Seedling Characters of Coconut Hybrids

Particulars	Tall X Dwarf Green	Tall X Dwarf Orange	Differences whether significant (P = 0.05)
Mean number of days taken for germination	95.9	75.0	Yes
Girth at collar (cm) Height (cm.)	10.96	12.12	Yes
Number of leaves produced in a year	6.70	7.60	Yes

Source: P.K.Thampan, "Coconut Hybrids", Fourth Session of the FAO Technical Working Party on Coconut Production, Protection and Processing, Kingston, Jamaica, 14-25 September 1975.

The superiority or otherwise of a particular dwarf type over the others has not been conclusively proved yet. Though dwarf green was found to be inferior to other types it was found to be superior to Malayan Dwarf (yellow) in all the crosses with the local tall types.

Even in Sri Lanka the performance of T x D hybrids proved superior to the ordinary T x T progenies. The results obtained there on the performance of T x D hybrids involving three different dwarf forms and the T x T progenies for the period 1963-70 are presented in the following table (table A 4.3).

TABLE A 4.3.

Performance of the Three Hybrid Types Compared with Tall

Progeny type	Time taken for flowering (months)	Nuts produced	Mean yield (1969-70) weight of husked nuts (kg)	Weight per nut (g)
Tall x Dwarf Pumila	34.8	64	35.84	562.45
Tall x Dwarf eb urnea	37.1	67	36.29	539.77
Tall x Dwarf regia	38.9	55	29.94	544.30
Tall x Tall	52.9	39	23.59	607.87

Source: P.K.Thampan, op.cit.

From the above table we see that the Tall x Dwarf hybrids are superior to the tall in all qualities except the wieght per nut. A comparison of yield and weight of nuts between T x D and T x T in Sri Lanka is given below (table A 4.4.).

TABLE A 4.4

Mean Yield Per Progeny of Experimental Material

Year after planting	Tall x Dwarf Punila		Tall x Tall	
	Number of nuts	Weight of husked nuts (kg)	Number of nuts	Weight of husked nuts (kg)
5th	23	16.4	-	-
6th	68	48.2	22	16.3
7th	86	55.9	52	31.8
8th	65	50.2	65	46.5
9th	103	66.8	84	57.6
10th	108	85.4	88	-
11th	129	102.5	121	96.5
12th	146	129.1	126	130.4

Source: P.K. Thampan, op.cit.

Tall x Dwarf also exhibit certain undesirable traits. "In India it has been observed in a few cases that the hybrid planting material supplied to the growers showed predominantly dwarfish traits with manifestations of alternate bearing tendency, bunch buckling and less tolerance to drought under field conditions. In certain instances, the hybrids after having given initial good yields failed to maintain consistency in yield subsequently. Similarly, unlike the tall variety, the hybrid palms are easily susceptible to soil moisture fluctuations, resulting in shedding of buttons and drooping of leaves during summer".[1]

Dwarf x Tall

The Dwarf x Tall hybrid is more vigorous than either of the parents and is a prolific yeilder. It bears in four to five years after planting and outyields the ordinary tall. The nut and copra characters are better than the dwarfs and more or less similar to the talls.

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1. P.K.Thampan, op.cit.

CHAPTER V

COST OF PRODUCTION AND PROFITABILITY

CHAPTER V

COST OF PRODUCTION AND PROFITABILITY

An experiment to determine production costs and return over the years was made by P.K. Das.[1]

Considering 8 hour work as 1 manday the labour input for the three years for preparing 1 ha of coconut garden comes to 257, 115 and 126 mandays for the first, second and third year, respectively. For the subsequent four years, the labour requirement remains at 87 mandays/year and from the eighth year onwards it remains at 104 mandays/year (see table 5.1).

A total of 200 seedlings were considered adequate for establishing 175 palms over a period of three years. The quantity of organic manures in the form of compost was limited to 25 kg/palm or 4.4 tonnes/ha/year. The quantum of fertilizers was fixed as per the CPCRI's recommendation of 500 g N+320g P_2O_5+1200g K_2O/palm/

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1. P.K.Das, "Estimating Production Costs and Returns for Coconut in Kerala", Journal of Plantation Crops 12(2), December 1984, Pp. 152-159.

TABLE 5.1

Estimated Labour Requirements in Coconut Cultivation in Different Years (mandays/ha)

Sl. No.	Operation	Age of plantation in year 1	2	3	4-7 (per year)	8-60 (per year)
1.	Fencing with local material and repairs	70	8	8	8	8
2.	Land clearing and peg making	55	-	-	-	-
3.	Digging pits	35	-	-	-	-
4.	Planting and subsequent gap filling	8	2	1	-	-
5.	Shading and mulching	15	11	6	-	-
6.	Manuring including basin opening and closing	16	18	20	22	24
7.	Weeding/forking	10	20	25	30	36
8.	Irrigation (pot irrigation in summer months)	42	52	60	20	24
9.	Spraying and other plant protection	3	4	6	7	12
	Total	254	115	126	87	104

annum from the third year onwards, limiting one-third and two-thirds of it for the first and second year, respectively.

In this study, the plant protection expenditure was limited to prophylactic measures like application of BHC 5 per cent for the control of rhinoceros beetle and spraying of bordeaux mixture twice a year. The requirement of these chemicals gradually increases from small quantity as the canopy size of the palms develops and from the eighth year onwards the estimated quantity of BHC 5 per cent comes to 44 Kg/ha while copper sulphate and lime requirements come to 17.5 Kg each/ha. A contingency of Rs. 200/year for the non-bearing period and Rs.300/year for bearing period has been considered in order to meet any sort of emergency or unforeseen expenditure, besides depreciation and upkeep of deadstocks (see table 5.2).

According to this study, the cost of bringing one hectare of coconut garden to bearing or the total establishment cost per hectare comes to Rs. 35,300 (See table 5.3)

The expenditures for the eighth year and onwards becomes the annual maintenance cost for the garden and

TABLE 5.2

Material Input Requirements in Coconut Cultivation in Different Years per Hectare

Description	Units	Age of plantation in year					
		1	2	3	4-5 (per year)	6-7 (per year)	8-60 (per year)
Seedlings	Numbers	175	18	7	-	-	-
Farm Yeard manure	Tonnes	4.4	4.4	4.4	4.4	4.4	
Fertilizers							
Urea	Kg	63.5	127	190	190	190	190
Superphosphate	Kg	117	234	350	350	350	350
Muriate of potash	Kg	117	234	350	350	350	350
Plant protection Chemicals							
B H C 5 per cent	Kg	3.5	7	14	21	28	44
Copper sulphate	Kg	3.5	7	9	10.5	14	17
Lime	Kg	3.5	7	9	10.5	14	17

as per this estimate, it comes to Rs. 5,500. The harvesting cost at the rate of Rs.1/palm/harvest for six harvests in a year has been charged to the annual maintenance cost beginning from eighth year and this comes to Rs. 1050/ha/year.

Though the yield per palm varies from year to year, the expected productivity pattern, as per the experimental evidence, indicates that from the fifteenth year of planting it stabilizes at an average of 60 nuts/palm throughout its economic life under good management. With this assumption the yeild level of 10,500 nuts/ha for an adult garden has been worked out.

This yield level appears to be little more than double the present average yield of coconut in Kerala as per the official statistics and, therefore, the validity of this study may be seriously questioned. Here, one has to bear in mind that the average productivity of coconut/ha for the state is estimated by dividing the total production of nuts in a given year with the total area under this crop in that year without taking into consideration the distribution of pre-bearing, early bearing and senile palms in the population at that stage. Under that score, the official estimate is

TABLE 5.3

Costs of Investment and Maintenance in Coconut Cultivation (Rupees/hectare)

Item	Rate/unit		Investment cost Initial 7 years Expenditure	Investment cost Initial 7 years Percentage		Maintenance cost Annual Expenditure	Maintenance cost Annual Percentage
Labour	20.00 man-days		16,860	47.8		2,080	37.8
Materials for fencing shading and mulching	-		3,800	10.8		-	
Seedling	6.00/seedlings		1,200	3.4		-	
Farm yard manure	100.00/Tonne		3,080	8.6		440	8.0
Fertilizers:							
Urea	2.20/Kg	2509			418		
Superphosphate	1.10/Kg	2311			385		
Muriate of potash	1.30/Kg	2730			455		
			7,650	21.4		1,258	22.9
Total fertilizer cost							
BHC 5 per cent	1.10Kg	134.75			48.40		
Copper sulphate	17.00/Kg	1164.50			297.50		
Lime	1.50/Kg	102.75	1,402	4.0	26.25	372	6.8
Total plant protection chemicals							
Harvesting charges	1.00/palm/harvest		-			1,050	19.1
Contingencies	200.00/yr		1,400	4.0		300	5.4
Total			35,292	100.0			
	Say		35,300			5,500	100.0

Source: Ibid.

certainly an under estimate.[2] Besides this, as stated earlier, a vast majority of the coconut gardens in Kerala are now left under gross neglect and quite a sizeable proportion of these are also in the grip of root (wilt) disease. As a result of these facts, the growth rates in productivity of coconuts in most of the districts of Kerala are now found to be negative.[3] This study however, examines the economic viability of coconut cultivation in Kerala under a given package which calls for greater resource mobilisation and thereby ensures higher level of productivity. The on-farm experiments and out-reach programmes of CPCRI in the root (wilt) tracts have also revealed that the productivity of root (wilt) palms could be raised by 26 to 30 per cent with proper management.[4]

Costs of producing coconuts are made up of two major components, commonly designated as (1) establishment or overhead costs and (2) maintenance costs.

The return from the plantation during its yielding period should cover the entire investment plus

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2. Ibid.

3. P.K.Das, etal, 1982.

4. Bavappa, 1973, Jayshankar and Radha, 1982.

a fair rate of interest (in this case 10 per cent) in addition to the annual maintenance cost in the bearing stage. The total investment, namely, initial seven years expenditure and the compound interest thereon have been reduced to an annuity bearing 10 per cent interest.

The annuity value in this study comes to Rs. 6603/ha and it has been added to the annual maintenance charges to arrive at the total annual cost per hectare. Here, the total annual cost comes to Rs. 12,103/ha. From this amount, the income from dry leaves and petioles have been deducted and the net cost is then divided by the average annual production of nuts during stabilized period (in this case 10,500 nuts) to arrive at the cost of production per nut. Accordingly, the cost of production comes to Rs.1.10/nut under the given situation (see table 5.4).

TABLE 5.4

Estimated Cost of Production of Coconut in Kerala

(Rupees/hectare)

Sl. No.	Particulars	Without land value	With land value at the rate of Rs.50,000/ha
1.	Investment during establishment of plantation upto bearing	35,300	85,300
2.	Compound interest on investment at 10% (1-7 yrs.)	20,512	67,948
3.	Total investment (Sl.No. 1+2)	55,812	1,53,248
4.	Annuity value (share of total investment to be adjusted over a period of 60 years)	6,603	15,393
5.	Annual maintenance cost	5,500	5,500
6.	total cost/ha/yr.(Sl.No. 4+5)	12,103	20,893
7.	Income from dry leaves and petiolese/year	525	525
8.	Net cost of production of nuts/ha/year(Sl.no.6-7)	11,578	20,368
9.	Average production of nuts/ha/year	10,500 nuts	
10.	Cost of production per nut (Sl.No.8divided by 9)	1.10	1.94

Source: Ibid.

It may be appropriate to note at this stage that the value of land was not taken into consideration as an item of the investment, since land is not a wasting asset, when proper nutrition is provided to land for its exploitation. Logistically, even if land is kept fallow, the return to investment on land will more than compensate its cost by the present rate of appreciation. Moreover, coconut in Kerala, is by and large, a backyard crop of the small-holders where the main share of the investment on land goes to house of the owners (as the land value is decided by the locational factors) even though the house occupies a small portion of the compound where coconut palms find place not only as a source of food and cash, but also for aesthetic value.

For estimating the returns, the farm-gate price is more relevant than other prices. In the year 1982-83, the average farm-gate price for coconuts in Kerala was Rs. 1.50/nut. Considering this price and the production cost of Rs.1.10, the net return from one hectare of coconut garden comes to Rs. 4200/year. However, since coconut is a small holder crop, at least 75 per cent of labour required for various operations is expected from the farmer's family source itself. The imputed value of family labour in that case comes to Rs. 1560 from the contribution of 78 mandays/year. In view of this, the estimated returns to investment and family labour in coconut gardens come to Rs. 5760/ha/year (see table 5.5). Further, when we consider inter/mixed croppings in coconut gardens the returns become higher than that observed in the case of monoculture of coconut.

TABLE 5.5

Estimated Returns from Coconut Cultivation

(per ha/year)

Sl.No.	Particulars	Rs. Ps.
1.	Farm-gate price of coconut/nut	1.50
2.	Cost of production/nut	1.10
3.	Net return/nut (Sl.No. 1-2)	0.40
4.	Net return on ivestment/ha (Sl.No. 3 x 10,500)	4,200 .00
5.	Family labour income from coconut holding (for 78 mandays at the rate of Rs. 20/day)	1,560.00
6.	Return to investment and family labour (Sl.No. 4+5)	5,760.00

Source : Ibid.

This study clearly brings out the fact that coconut cultivation under good management is a profitable proposition in Kerala. Since the scope of the above study was limited to monoculture of WCT variety of coconut, the full economic potential of this crop with hybrids as well as under inter/mixed cropping has not been expressed here. Hence, the cost of production of nuts is found to be lower and the returns from the coconut-based farming systems are higher than what has been observed in the field study conducted for the purpose of the present dissertation.

C.A. Kunhiraman and P.Thomas Varghese have estimated the cost of production of coconuts for the years 1976-77 and 1979. The results of their study is reported in table 5.6.

TABLE 5.6

Cost of Production of Coconut
(In Rupees)

	1976-77	1979
Cultivation expense/palm	13.60	13.34
Yield/bearing palm	62.70	86.00
Value of nuts per palm	51.41	91.16
Net profit/palm	37.81	77.82
Cost of production of 1000 nuts	216.91	161.21

Source: (1) C A Kunhiraman and P Thomas Varghese, Annual Report, CPCRI 1977.

(2) CPCRI, Annual Report, 1979

Note : (1) at the rate of Rs. 820 per 1000 nuts
(2) at the rate of Rs. 1060 per 1000 nuts

Table 5.6 shows that, while cultivation costs have not changed much between 1976-77 and 1979, the yield and price of nuts have gone up resulting in better returns.

From a study[5] conducted by the Indian Institute for Regional Development Studies we get detailed costs incurred for coconut cultivation from the first year of its planting till its expiry. In the first nine years the costs are capital costs. In the first year the major cost is incurred on buying seedlings. Other costs are for digging pits, filling them and for irrigation. In the second year the major cost is on application of farm yard manure. Other costs are for widening pits and irrigation. The third year shows a similar cost structure. In the fourth year the main cost is on application of farm yard manure. The other cost is on widening and clearing the pits. In the fifth, sixth seventh and eight years the costs are similar to that of the fourth year. In the ninth year the main cost is on application of farm yard manure and fertilizer. The other cost is on digging. In the tenth year, in addition to the costs of the ninth year, harvesting costs enter as part of maintenance costs. From the eleventh year onwards, till the fourteenth year, application of manure and harvesting costs are the main costs. The same pattern is repeated in subsequent years till the palm reaches senility.(see table 5.7).

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5. Indian Institute for Regional Development Studies, Maximization of Income and Output in Kerala, Research Report submitted to the Indian Council of Agricultural Research, New Delhi.

TABLE 5.7

Economics of Coconut Cultivation - 1983-84

Average farm price = Rs. 1350/ per 1000 nuts

Average stand per hectare = 200

Year		Activity	Labour days M	Labour days W	Material Cost (Rs.)	Total cost (Rs.)
1.	(a)	Cost of 200 seedlings at Rs. 5/-	-	-	1000	1000
	(b)	Taking 200 pits	25	-	-	450
	(c)	Filling the Pits with sand and wood ash and planting the seedlings.	15	-	300	570
	(d)	Irrigation for 5 months	-	60	-	540
		Sub Total	40	60	1300	2560
2.	(a)	Widening and clearing the pits and digging	10	-	-	180
	(b)	Farm yard manure/compost (one tonne) and its application.	2	5	150	771
	(c)	Irrigation	-	40	-	360
		Sub Total	12	45	150	771

TABLE 5.7 (Contd.)

Year		Activity	Labour days M	Labour days W	Material cost (Rs)	Total cost (Rs)
3.	(a)	Widening and clearing the pits and digging	12	-	-	216
	(b)	FYM (2 tonnes) and its application	3	5	300	399
	(c)	Irrigation	-	20	-	180
		Sub Total	15	25	300	795
4.	(a)	Widening and clearing the pits and digging around the palms	12	-	-	216
	(b)	Application of Farm Yard manure (2 tonnes) and 200 Kg of fertiliser mixture	5	5	600	735
		Sub Total	17	5	600	951
		5,6,7 & 8 - Same as for 4th Year.				
9.	(a)	Digging	15	-	-	270
	(b)	Application of F Y M (2 tonnes) and 300 Kg. of fertiliser	5	6	750	894
		Sub Total	20	6	750	1164

TABLE 5-7 (Contd.)

Year		Activity	Labour days M	Labour days W	Material Cost (Rs)	Total Cost (Rs)
10.		Same as for 9th Year + harvesting charges	40*	6	750	1668
		Sub Total	40	6	750	1668
11.	(a)	Digging	15	-	-	240
	(b)	Application of FYM (2 tonnes) and 400 Kgs of fertilizers	5	8	900	1062
	(c)	Plant protection - Spraying	8*	-	200	392
	(d)	Other miscellaneous expenses	-	-	60	60
	(e)	Harvesting	20*	-	-	504
		Sub Total	48	8	1160	2258
		12, 13, & 14 - Same as for 11th Year.				

* For harvesting operation and spraying the climber has to be paid wages at the rate of Rs. 30/- per day.

TABLE 5.7 (Contd.)

Year		Activity	Labour days M	Labour days W	Material Cost (Rs)	Total Cost (Rs)
15 to 40	(a)	Digging	15	-	-	270
	(b)	Application of FY manure (3 tonnes) and 400 Kgs. of fertilizers	5	8	1050	1212
	(c)	Spraying	8	-	200	392
	(d)	Miscellaneous expenses	-	-	60	60
	(e)	Harvesting	24	-		624
		Sub Total	52	8	1310	2558

Receipts

Year	Output (Quantity)	Value (Rs)
1 to 9 years	-	NIL
10th Year	1000 nuts & Cadjans	1600
11th Year	2500 nuts & Cadjans	3625
12th Year	4000 nuts & Cadjans	5650
13th Year	5000 nuts & Cadjans	7000
14th Year	7000 nuts & Cadjans	9700
15th Year to 40th Year	9000 nuts & Cadjans	12400

One limitation of the above cost calculation is that the costs which are spread over 40 years are calculated on the basis of the current year prices, in this case, 1983-84. However, we may take this as an approximation to the actual time-series data, especially in the light of the non-availability of actual time-series data.

The output in the various years are also presented. This data is based on norms and, therefore, have to be taken with caution. Similarly, the value of the output over the forty years is calculated on the basis of 1983-84 data. But it shows that receipts which are nil till the ninth year, being its gestation period, begin increasing progressively from Rs. 1600 in the tenth year to Rs. 12400 in the fortieth year.

Table 5.8 gives costs, revenue (gross returns) and margin (net returns). It shows that capital costs are highest in the first year and continues till the ninth year, when again the amount is high. From the tenth year, current (maintenance) costs are more or less constant at Rs. 2258. The farm begins yielding revenue since the tenth year. The margin is negative till the tenth year and positive and increasing from the eleventh year onwards.

Table 5.9 gives net present value from one hectare of coconut monocrop. We get a value of Rs. 11959 at 11 per cent discount rate and a loss of Rs. 110 at 20 per cent discount rate. We take the value of Rs. 11959 as realistic and subsequently we get an internal rate of return of 20 per cent.

TABLE 5.8

Coconut (1983-84)

Estimated Annual Cost, Revenue and Margin (in Rupees per hectare)

Year	Cost (Capital & Current)	Yield (Nuts)	Revenue*	Margin (+) & (-)
1.	2560	-	-	- 2560
2.	771	-	-	- 771
3.	795	-	-	- 795
4.	951	-	-	- 951
5.	951	-	-	- 951
6.	951	-	-	- 951
7.	951	-	-	- 951
8.	951	-	-	- 951
9.	1164			- 1164
10.	1668	1000	1600	- 68
11.	2258	2500	3625	+1367
12.	2258	4000	5650	+ 3392
13.	2258	5000	7000	+ 4742
14.	2258	7000	9700	+ 7442
15 to 25	2558	9000	12400	+ 9842
			=	+ 15562

* Includes value of cadjans (Rs.250) ; price of nuts is calculated at Rs. 1350/1000.

TABLE 5.9

Coconut (1983-84)

Net Present Worth and Internal Rate of Return

Year	Net Cash flow	D.F. (11%)	Present worth at 11%	D.F. (20%)	Present worth
1.	(-) 2560	0.09009	(-) 2306	0.8333	(-) 2133
2.	(-) 771	0.8116	(-) 626	0.6944	(-) 540
3.	(-) 795	0.7312	(-) 581	0.5787	(-) 460
4.	(-) 951	0.6587	(-) 626	0.4823	(-) 458
5.	(-) 951	0.5935	(-) 564	0.4019	(-) 382
6.	(-) 951	0.5346	(-) 508	0.3349	(-) 319
7.	(-) 951	0.4817	(-) 458	0.2791	(-) 265
8.	(-) 951	0.4339	(-) 413	0.2326	(-) 221
9.	(-) 1164	0.3910	(-) 455	0.1938	(-) 226
10.	(-) 68	0.3522	(-) 24	0.1615	(-) 11
11.	(+) 1367	0.3173	(+) 434	0.1346	+ 184
12.	(+) 3392	0.2858	(+) 969	0.1122	+ 381
13.	(+) 4742	0.2575	(+) 1221	0.0935	+ 443
14.	(+) 7442	0.2320	(+) 1726	0.0779	+ 580
15. to 25	(+) 9842	1.4398	(+) 14170	0.3370	+ 3317
			(-) 6561 (+) 18520		- 5015 + 4905
			11959		- 110

NPV = 11959

$$IRR = 11 + 9 \times \frac{11959}{12069} = 11 + 8.9$$

$= 19.9$ rounded to 20 per cent.

RESULTS OF FIELD SURVEY

Components of Paid Maintenance Cost

From the table 5.10 which presents data collected through field survey, we see that tilling, application of fertilizer and harvesting (plucking) charges form the major components of costs in coconut cultivation. We further see that holdings above size of 600 cents have a lower proportion of their total paid maintenance costs spent on soil improvement such as application of manure and tilling of soil. It is mainly the holdings in size-group 51-600 cents that do substantial expenditure on tilling and application of manures. Households having below size 50 cents are not predominently cultivators, and as such, do not have such costs as mentioned above. But for all size holdings, cost on harvesting is quite substantial ranging from 21 to 56.6 per cent of the total cost. This is because harvesting is a semi-skilled job and requires hiring in of climbers. In size-group 701-800 cents, harvesting charges took

TABLE 5.10

Share of Various Paid Maintenance Costs in Total Maintenance Costs

(In Percentages)

Size-wise holding	Tilling	Chemical fertilizer/ soil conditioner	Purchases farm yard manure	Taking pits	Weeding	Pesticides and plant protection	Plucking	Gathering	Labour for manuring	Irrigation	Total
0.50	18.88	1.23	22.84	3.72	0	4.49	40.42	2.79	5.63	0	100
51.100	24.94	15.79	9.55	2.20	0	2.57	29.89	7.06	5.98	2.03	100
101.200	30.87	9.75	20.96	2.60	0	2.21	36.54	9.95	5.65	0.34	100
201-300	22.36	17.52	20.89	0.58	0	1.37	24.14	6.08	5.68	1.00	100
301-400	17.55	18.41	13.06	1.40	0.63	2.05	24.51	9.17	7.85	0.63	100
401-500	20.25	17.26	23.18	2.24	0	1.56	21.04	9.88	4.60	0	100
501-600	32.01	11.01	13.01	0	0	0	29.47	7.78	6.24	0	100
601-700	0	8.43	0	34.88	0	4.07	49.83	0	2.79	0	100
701-800	14.44	0	0	0	0	0	56.55	16.42	0	12.59	100
901-1000	24.55	0	16.86	19.64	0	0	24.96	11.78	2.21	0	100
1000	0	0	0	0	0	0	100	0	0	0	100

Source: Primary data collected through field survey.

upto 56.6 per cent of total paid maintenance costs while expenditure on fertilizers was nil. Such instances are not rare and are commonly called 'growth under neglect'. This is because even without fertilizer application and other plant protection measures coconut continues to yield. We find, similarly, that tilling charges are nil in some size-groups. Such behaviour is prompted by rising prices of inputs. It is also clear that lower size-holdings do not spend much on chemical fertilizers. Expenditure on irrigation is also low except in the size-holding of 701-800 cents.

Cost-Return Ratios

In table 5.11 we have worked out the cost-return ratios for different size-groups. In order to see if there was any relation between cost-return ratio and its distribution size-wise, we used the correlation technique. The correlation co-efficient turned out to be 0.704. This value is significant at the 1 per cent level. Thus, we see that returns are greater compared to costs on bigger farms.

TABLE 5.11

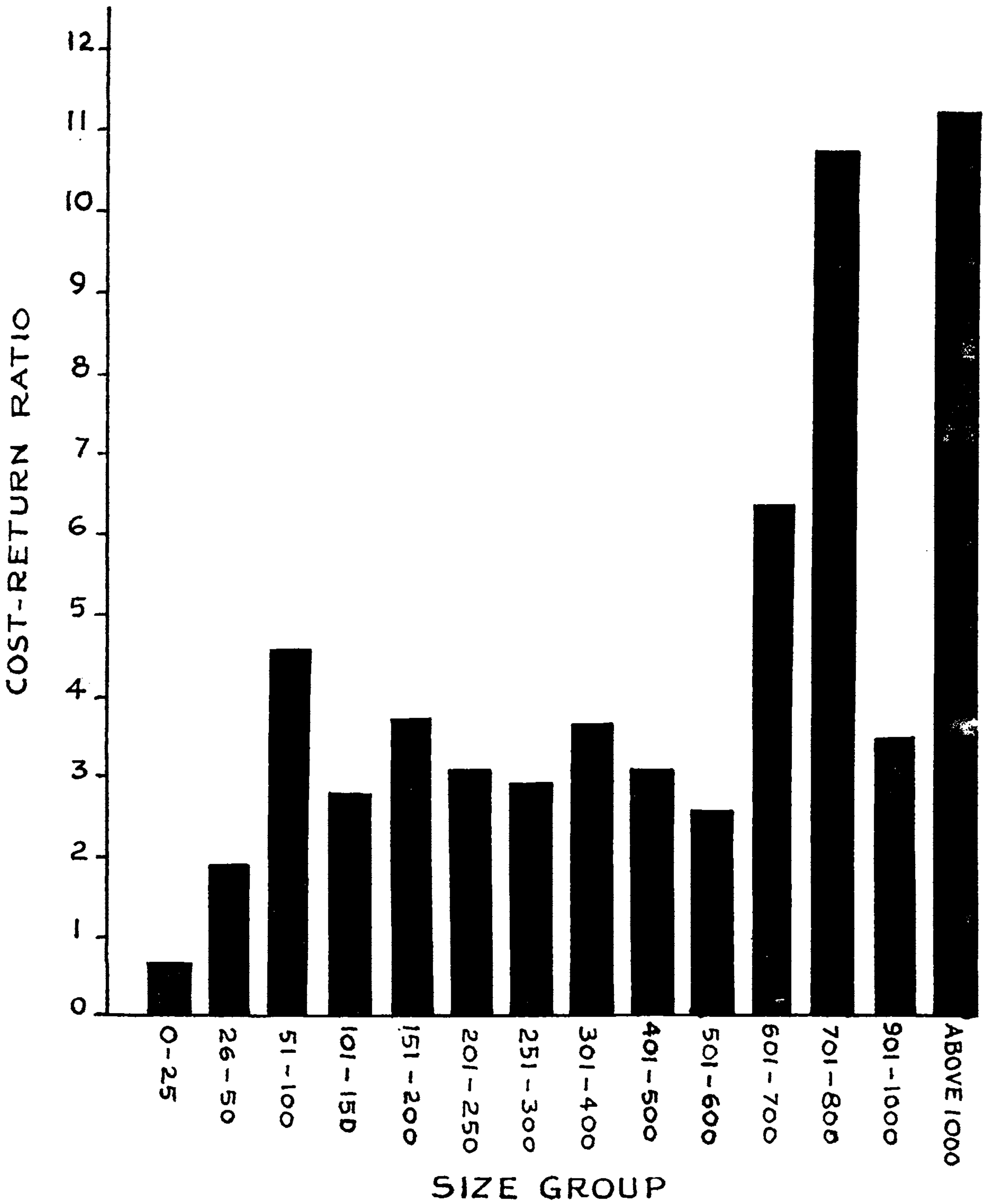
Cost-Returns Ratio for Coconut

Size-groups	Cost-return Ratio
0 - 25	0.70
26 - 50	1.86
51 - 100	4.61
101 - 150	2.80
151 - 200	3.70
201 - 250	3.08
251 - 300	2.91
301 - 400	3.68
401 - 500	3.09
501 - 600	2.54
601 - 700	6.34
701 - 800	10.74
901 - 1000	3.44
Above 1000	11 .22

Source: Primary Data collected through field survey.

GRAPH 5.1

COST-RETURN RATIO FOR COCONUT



Aspects of Profitability of Coconut

Another criterion for efficiency evaluation is the profitability of farms. Of course, there are limitations in this analysis as profitability is a biased concept which portrays the farming operation in the same way as a capitalist farm which produces with the aim of selling and for a profit. This may not be true of a coconut grower in Kerala. This is because, for most of the coconut growers, income from coconut cultivation and sales account for only a part, in some cases a small part, of the grower's net income. Most of the growers use a substantial portion of their produce for domestic consumption. In fact, for some, cultivation is mainly for domestic consumption, though they would sell the surplus. But, for many, cultivation is certainly not guided by such considerations as profit maximisation and input efficiency. Many coconut plots are, therefore, operated in conditions of low input use. We deliberately avoid usage of terms such as 'grown under conditions of neglect', as the rationale behind such terms need not apply in full to local conditions.

Despite the above limitations, average profits from coconut cultivation of the sample households have

TABLE 5.12

Average Profit of Farmers from Coconut

Size-Holding	Average proft per Acre
0 - 50	969.02
51 - 100	1525.11
101 - 200	1355.31
201 - 300	1479.69
301 - 400	1456.79
401 - 500	1771.24
501 - 600	1197.19
701 - 800	1681.88
901 - 1000	1313.90
Above 1000	1220.20

Note: There is no entry in the size-group 801-900 cents.

Source: Primary Data collected through field survey.

been compared size-wise using correlation.

In table 5.12 data on average profit from coconut cultivation is presented. This is arranged according to size of holdings. In order to study the relationship between average profit and size-wise distribution of holdings, we used correlation. The co-efficient of correlation worked out to 0.054. This value of the correlation co-efficient was not significant even at the 5 per cent level. Therefore, we cannot argue in favour of any significant relationship between size of holding and average profit per acre. As neither any significantly positive or negative relationship exists we can only say from the data that average profit does not change significantly with differences in size of holding.

Table 5.13 gives the distribution of the number of households of various sizes which have profits ranging from less than Rs.250 per acre to Rs. 5000 per acre and above. The distribution is quite interesting, for, we see that in size holdings below 200 cents profit per acre lies below the range of Rs. 2001-2500 and there is a concentration below the range Rs. 501-750. All size-groups above

TABLE 5.13

Profitability from Coconut

Profit per acre	Size-class of farming households										
	0-50	51-100	101-200	201-300	301-400	401-500	501-600	601-700	701-800	901 1000	Above 1000
Below 250	11	10	8	0	1	0	0	0	0	0	0
251-500	3	9	12	1	0	0	0	0	0	0	0
501-750	1	8	5	1	0	0	0	0	0	0	0
751-1000	2	1	6	1	0	0	0	0	0	0	0
1001-1500	1	13	11	3	1	0	0	0	0	0	0
1501-2000	0	5	5	3	2	0	0	0	0	0	0
2001-2500	1	4	3	2	1	0	0	0	0	0	0
2501-3000	0	1	5	5	0	0	0	0	0	0	0
3001-3500	0	0	3	1	2	0	0	0	0	0	0
3501-4000	0	0	3	3	1	0	1	0	0	0	0
4001-4500	0	1	0	1	0	0	1	0	0	0	0
4501-5000	0	0	1	1	0	1	0	0	0	0	0
above 5000	0	2	11	6	5	4	2	1	1	1	1

Source: Primary Data collected from field survey.

600 cents have profitability above Rs. 5000 per acre. These findings are not unexpected as it is mainly large-sized holdings which can have high profits per acre as the size of their marketed surplus is larger.

On asking the respondents about profitability of coconut vis-a-vis other crops, most of the respondents in all size-groups opined that coconut was more profitable. However, as can be seen from table 5.14 in the smaller size holdings some respondents felt that other crops were more protitable. Among such respondents some had also shifted from coconut cultivation to other crops.

Components of Total Income

From table 5.15 we see that in the lowest size-holding 0-50 cents there is no income from agricultural activity other than coconut (which is only 2.95 per cent of total income). The main source for this size-holding is remittances. This lopsidedness gets reduced as the size-holdings increases, with higher and higher incomes from paddy cultivation. In the size-holding 101-200 cents the share coconut in total income is 12 per cent and income from salary is important with a 49 per cent share. In the next size-holdings the shares of paddy

TABLE 5.14

Opinion About Profitability of Coconut and Change in Coconut Cultivation

Size-holding of farm Households	Coconut more profitable	Others more profit-able	Percentage of farmers who changed coconut cultivation
0 - 50	88.89	11.11	22.22
51 - 100	90.91	9.09	4.35
101 - 200	97.87	2.13	8.16
201 - 300	85.37	14.63	2.38
301 - 400	91.30	8.70	8.70
401 - 500	87.50	12.50	25.00
501 - 600	84.62	15.38	14.29
601 - 700	100.00	0.00	0.00
701 - 800	100.00	0.00	25.00
901 - 1000	100.00	0.00	20.00
Above 1000	90.00	10.00	20.00

Source: Primary Data collected through field survey.

TABLE 5.15

Size-wise Share of Total Income from Each Acticity*

Size-Class of Holdings	Paddy	Coconut	Salary	Remit-tance	Others
0 - 50	0.00	2.95	8.83	56.92	31.30
51 - 100	0.28	7.22	16.74	24.75	51.00
101 - 200	0.81	12.26	49.05	19.99	17.89
201 - 300	5.20	13.10	24.99	10.58	46.13
301 - 400	2.82	22.74	24.97	20.60	28.87
401 - 500	3.24	5.43	67.85[1]	11.79	11.69
501 - 600	11.45	19.73	40.74[1]	11.16	16.9
601 - 700	13.75	43.96	0.00	18.42	23.8[illegible]
701 - 800	53.78	22.96	0.00	7.32	15.94
801 - 900	30.34	31.28	0.00	0.00	38.39
901 - 1000	41.16	21.15	0.00	8.82	28.39
1101 - 1200	65.44	5.64	0.00	0.00	28.92
1201 - 1300	42.65	37.76	5.08	0.00	11.51
1701 - 1800	42.23	44.20	0.00	0.00	13.57
1801 - 1900	18.96	50.72	0.00	11.00	10.71
Above 2000	83.31	13.11	0.00	0.00	3.58

1 this data need not be representative as the sample is low.

* In this table size of holding is total holding, including other crops such as paddy. In some of the earlier tables only coconut holding sizes were shown.

Source: Primary Data collected through field survey.

as well as that of coconut go up. This tendancy continue and we find that as the size-holding increases the share of coconut and paddy taken together in total income increases upto 96.42 per cent in the highest size-group.

As can be seen from table 5.16 paddy and coconut are not predominant in total income of the hamlets interviewed. Instead, salary incomes accounts for about 30 per cent in total and other sources 26 per cent. Paddy and coconut which are the main source of agricultural income come to only 30 per cent of the total income.

TABLE 5.16

Share of Each Source of Income in Total

Source of Income	Percentage
Paddy	13.45
Coconut	16.83
Salary	29.55
Remittance	14.35
Others	25.81

Source: Primary data collected through field survey.

Comparative Profitability of Crops

Table 5.17 depicts the opinion of farmers regarding profitability of coconut vis-a-vis other crops. We find that an overwhelming percentage of farmers were of the opinion that coconut was the most protifable crop.

TABLE 5.17

Opinion of Farmers About Profitability of Crops

Details	Percentage
Coconut most profitable cultivable crop	92
Other cultivable crops more profitable than coconut	8

Source: Primary data collected through field survey.

Profitability of Cultivating Hybrids

About 50 per cent of farmers felt that cultivating hybrids was more profitable (see table 5.18).

TABLE 5.18

Profitability of Cultivating Hybrid Palms Compared to Local Palms

Details	Percentage
More profitable	50.39
Less profitable	49.61

Source: Primary data collected through field survey.

Root-wilt Impact on Profitability

From table 5.19 we see that an overwhelming proportion of respondents opined that cultivation of coconut had become less remunerative due to impact of root-wilt disease.

TABLE 5.19

Impact of Root-wilt Disease on Profitability of Coconut Palms

Details	Percentage
Farm become less remunerative	94.5
Farm not become less remunerative	5.5

Source: Primary data collected through field survey.

Debt among Coconut Households

TABLE 5.20
Debt Position of Farming Households

Size-Class of Households	Debt	No debt
0 - 50	33.33	66.67
51 - 100	35.19	64.81
101 - 150	28.26	71.74
151 - 200	37.50	62.5
201 - 250	23.53	76.47
251 - 300	25.00	75.00
301 - 350	50.00	50.00[1]
351 - 400	9.09	90.91
401 - 450	0.00	100.00
451 - 500	0.00	100.00
501 - 600	20.00	80.00
601 - 700	0.00	100.00
701 - 800	0.00	100.00
901 - 1000	0.00	100.00
Above 1000	0.00	100.00

1. This figure must be taken with caution as the number of respondents is low.

Source: Primary data collected through field survey.

From table 5.20 we see that, debt is prevelant mainly in smaller size-groups. Debt is prevelant upto 37 per cent in size-groups upto 200 cents. As expected bigger size-groups do not have debt.

C H A P T E R VI

COCONUT PRICES AND MARKETING

CHAPTER VI

COCONUT PRICES AND MARKETING

Coconut, being the most important primary agricultural produce of Kerala State, contributing about one-third of the agricultural income of the state,[1] it is highly important to examine the price situation of the crop and its marketing structure.

A study of yearly changes in farm prices shows that farm prices of coconut have been widely fluctuating. Though unstable the price changes have been progressive and therefore must have acted as an incentive for many farmers to adopt coconut cultivation.

An analysis of yearly trends in coconut farm prices over the 22 year period starting 1955-56 and ending 1977-78 shows that there has been an average increase of

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1. "Agroprocessing for development in Kerala", paper by Regional Research Laboratory, Trivandrum, presented at the Seminar on "Research Potential of Kerala", organised by the State Committee on Science,and Technology, Kerala and CWRDM, Kozhikode.

28.11 per cent, while the average increase for all major crops was 25.33 per cent. Thus,the farm price increase of coconut in these 22 years was only slightly higher than normal. In this period coconut farm prices registered the second highest increase among farm prices of other important crops. Coconut farm prices increased by 591 per cent compared to 901 per cent increase in cashewnut farm prices and fared much better than arecanut whose farm price increased only by 113 per cent.

From the data given in table 6.1 it is clear that, though there were wide fluctuations in the prices of coconut from time to time, in general, there was a substantial increase in the farm price, witnessing an increase from Rs.137.40 per 1000 nuts in 1955-56 to Rs.1266.40 per 1000 nuts in 1982-83.

Wholesale Price of Coconut

Wholesale prices have also kept fluctuating over the period under study. As can be seen from table 6.2, the absolute prices also witnessed a very fast rate, the price level increasing from Rs.131 per 1000 nuts to Rs. 1410.28 in 1981-82.

TABLE 6.1

Coconut Farm Prices (1955-56 to 1982-83)

Year	Farm Price in Rupees/'000 nuts	Percentage variation
1955 - 56	137.40	
1956 - 57	153.61	11.80
1957 - 58	178.49	16.20
1958 - 59	193.67	8.50
1959 - 60	192.74	- .48
1960 - 61	214.65	11.37
1961 - 62	213.55	- .51
1962 - 63	247.84	16.06
1963 - 64	240.24	-3.07
1964 - 65	267.68	11.42
1965 - 66	391.25	46.16
1966 - 67	368.74	-5.75
1967 - 68	453.70	23.04
1968 - 69	392.84	-13.41
1969 - 70	498.74	26.96
1970 - 71	575.20	15.33
1971 - 72	420.70	-26.86
1972 - 73	527.90	25.48
1973 - 74	890.10	68.61
1974 - 75	851.30	-4.36
1975 - 76	668.60	-21.46
1976 - 77	913.00	36.55
1977 - 78	987.17	8.12
1978 - 79	1020.95	3.42
1979 - 80	1142.77	11.93
1980 - 81	1330.30	-14.09
1981 - 82	1257.50	-5.47
1982 - 83	1266.40	-0.70

Source: Government of Kerala, Directorate of Economics and Statistics, Statistics for Planning.

TABLE 6.2

Wholesale Prices of Coconut

Year	Wholesale prices	Percentage vatiations
1955-56	131.00	
1956-57	168.00	28.24
1957-58	202.70	20.65
1958-59	201.20	- .74
1959-60	224.10	11.38
1960-61	223.10	- .45
1961-62	245.50	10.04
1962-63	256.30	4.40
1963-64	248.70	-2.97
1964-65	369.60	48.61
1965-66	400.50	8.36
1966-67	441.60	10.26
1967-68	420.00	-4.89
1968-69	428.70	2.07
1969-70	599.80	39.91
1970-71	489.50	-19.89
1971-72	463.50	-3.54
1972-73	746.90	61.14
1973-74	980.70	31.30
1974-75	677.60	-30.91
1975-76	828.40	22.26
1976-77	963.60	16.32
1977-78	1072.90	11.34
1978-79	1177.80	9.77
1979-80	1155.42	1.93
1980-81	1458.46	26.22
1981-82	1410.28	3.30.

Source: Government of Kerala, Directorate of Economics and Statistics, Statistics for Planning.

In order to better analyse the changes in farm prices of coconut between 1955-56 and 1982-83 we broke down the period into three year sub-periods. The result is given in table 6.3. We see that farm price of coconut increased most rapidly between 1964-65 and 1966-67. The second highest increase was between 1955-56 to 1957-58. Price decreased in two sub-periods. Between 1973-74 and 1975-76 it was highest with a decline of 24.88 per cent. Price declined again between 1970-71 and 1972-73. There was an increase in price in other sub-periods ranging from 9.93 per cent and 12.50 per cent except in 1979-80 to 1981-82 when it increased only by 0.96 per cent.

TABLE 6.3

Farm Price of Coconut in Kerala during three-Year Periods between 1955-56 and 1987-83

Period	Percentage Change
1955-56 to 1957-58	29.91
1958-59 to 1960-61	10.83
1961-62 to 1963-64	12.50
1964-65 to 1966-67	37.75
1967-68 to 1969-70	9.93
1970-71 to 1972-73	-6.86
1973-74 to 1975-76	-24.88
1976-77 to 1978-79	11.82
1979-80 to 1981-82	0.96

Source: Own computation based on figures from Directorate of Economics and Statistcs, Statistics for Planning.

An increase in price, other things being equal, should result in an increase in production. But this takes place with a time lag. In the case of coconut, which is a perennial crop, there are two kinds of time lags in the changes in production. These two time lags are short-term and long-term. The short-term time lag in changes in production takes place as a result of changes in cultural practices such as irrigation, manuring, spading, plant protection measures etc. This time lag takes place normally within a year. The other time lag in changes in production takes place through an increase in area under coconut cultivation and the gestation period till the newly planted palms begin to yield.

We measure here the changes in production taking place in the short-term. In order to study the impact of changes in prices on changes in production we have used correlation method. We have tried to measure the impact of farm price of coconut and wholesale price of coconut oil on production. On correlating farm price and production of coconut between 1955-56 to 1981-82 we got a co-efficient of 0.035. This was not significant statistically. So a definite answer cannot be given regarding the relationship between the two. But, it must be noted that the relationship is positive. A positive co-efficient would signify that a change in price is followed by a change in production in the same direction.

To see if changes in wholesale price of coconut oil had any impact on production of coconut we used correlation analysis. The resultant co-efficient was -0.187, This was not statistically significant.

Normally it is expected that a higher price for a product would induce the farmers to expand the area under the concerned crop. In a field study conducted by the Indian Institute for Regional Development Studies, Kottayam it was revealed that coconut had the unique distinction of achieving the highest increase of 2.19 lakh hectares in the cropped area during 1957-83. But when compared to the exhorbitant annual average increase of 40 per cent in the farm prices of coconut, area increase (annual average) was too small with 1.8 per cent. Also, annual average change in production and productivity were found to be negative with -0.7 per cent and -1.6 per cent respectively. This was mainly due to acute root (wilt) and leaf diseases prevalent in the six southern districts of Quilon, Alleppey, Kottayam, Idukki, Ernakulam and Trichur. For the steep fall in the yield rate (44 percent), change in the structure of existing coconut plantations in favour of younger ones was also responsible.

Table 6.4 gives data regarding annual rate of change in price and area between 1957-58, and 1983-84 for coconut along with six other crops.

There was a significant increase of 1059 per cent in the price of coconut in 1983-84 compared to 1957-58, as can be seen from table 6.5 . Whenever coconut, copra and coconut oil were in short supply the prices used to shoot up. To overcome the gap between supply and demand, copra was imported at prices much below the internal rate. This step usually brought down the prices of coconut and coconut products.

To measure the relationship between changes in price and area under coconut in comparison to other crops the concept of arc elasticity was used in the study referred to above. The formula for arc or average elasticity is:

$$\frac{(A2 - A1)/(A2 + A1)}{(P2 - P1)/(P2 + P1)} \quad \text{or} \quad \frac{(A2 - A1)}{(A2 + A1)}\frac{(P2 + P1)}{(P2 - P1)}$$

Applying the formula for the time period 1957-83 arc elasticity has been computed. The results are given in table 6.6 .

TABLE 6.4

Annual Rate of Change in Prices and Area Between 1957 - 58 and 1983 - 84

Sl.	Commodity	Percentage Annual Change			
		Price	Area	Production	Productivity
1.	Paddy/Rice	24.0	-0.13	(+) 1.1	(+) 1.3
2.	Tapioca	47.6	+0.34	(+) 5.9	(+) 5.1
3.	Coconut	40.7	+1.82	(-) 0.7	(-) 1.6
4.	Arecanut	12.0	+0.77	(+) 1.0	(+) 0.1
5.	Pepper	32.7	+0.64	(-) 0.3	(-) 0.8
6.	Cashew	45.5	+8.58	(+) 0.4	(-) 2.4
7.	Rubber	16.6	+6.60	(+)23.9	(+) 6.4

TABLE 6.5

Farm Prices of Important Commodities

Sl.No.	Commodity	Unit	1957-58 (Rs)	1983-84 (Rs)	Percentage chanage over 1957-58
1	Paddy	Quintal	34.45	249.75	625
2	Coconut	1000 Nos.	178.49	2075.11	1059
3	Arecanut	1000 Nos.	22.80	95.01	313
4	Cashewnut	Quintal	45.80	591 .11	1184
5	Tapioca	Quintal	8.11	106.95	1238
6	Plantain	100 Nos.	1.50	12.00	700
7	Pepper	Quintal	155.96	1485.00	852
8	Rubber	Quintal	323.0	1715.0	431

Source: Government of Kerala, State Planning Board, Statistics for Planning, Sl.No.5 and Economic Review 1984.

TABLE 6.6

Long Run Arc Elasticity of Crops Between 1957 and 1983

Sl.No.	Crop	Area Change (%)	Price Change (%)	Arc Elasticity
1.	Paddy	-3.5	625	-0.02
2.	Tapioca	8.9	1238	+0.05
3.	Coconut	47.3	1059	+0.28
4.	Arecanut	19.9	313	+0.15
5.	Pepper	16.7	852	+0.10
6.	Cashew	223.2	1184	+0.62
7.	Rubber	171.6	431	+0.68

Source: Study by IIRDS, Kottayam.

Except for paddy arc elasticity is found to be positive for all major crops of Kerala with the highest value of 0.68 for rubber.

Farm Prices of Coconut Compared to Farm Prices of other Important Crops

The farm prices of coconut cannot be considered in isolation. Hence, we have compared the farm prices of coconut with prices of other important crops, Paddy, Tapioca, Banana and Pepper. Comparative data are given in table 6.7.

TABLE 6.7

Fram Prices of Important Crops

(in Rupees)

Year	Coconut (100 Nos)	Paddy (Qtl)	Tapioca (Qtl)	Banana (100 Nos)	Pepper (Qtl)
1955 - 56	137.40	16.40	5.10	5.51	266.53
1956 - 57	153.61	20.64	9.35	5.77	189.68
1957 - 58	178.49	20.00	8.11	6.21	155.96
1958 - 59	193.67	22.56	6.27	6.39	268.45
1959 - 60	192.74	23.84	8.59	6.64	399.18
1960-61	214.65	23.92	7.85	6.83	403.32
1961 - 62	213.55	25.44	10.11	8.25	313.75
1962 - 63	247.84	24.00	9.59	9.04	251.21
1963 - 64	240.24	25.94	8.85	8.79	270.80
1964 - 65	267.68	39.52	17.55	10.63	339.94
1965 - 66	391.25	50.48	17.42	11 .15	358.12
1966 - 67	368.74	59.48	17.95	13.20	365.15
1967 - 68	453.70	79.28	23.02	16.02	320.17
1968 - 69	392.84	63.04	20.55	16.99	329.92
1969 - 70	498.74	59.12	18.48	17.18	559.54
1970 - 71	575.20	54.32	20.84	16.86	611.61
1971 - 72	420.70	99.62	20.82	17.14	540.97
1972 - 73	527.90	119.19	25.43	19.65	524.85
1973- 74	890.10	187.53	34.83	23.29	794.94
1974 - 75	851.30	246.23	37.45	26.94	1012.38
1975 - 76	668.60	182.98	40.22	31.39	1168.78
1976 - 77	913.00	142.74	35.57	32.46	1567.60
1977 - 78	987.17	130.69	28.89	33.09	1606.39
1978 - 79	1020.95	125.76	34.45	32.86	1508.10
1979 - 80	1142.77	133.24	41.22	38.08	1358.57
1980 - 81	1395.40	156.84	40.06	37.94	1191.54
1981 - 82	1153.70	182.85	49.86	42.78	1172.98

Source: Directorate of Economics and Statistics, <u>Stastistics for Planning</u>, Kerala.

In table 6.8 the index numbers of farm prices of some important crops in Kerala are given. We find that in the year, 1981-82, the index number of farm price of Paddy was the highest. The figure for coconut was only second next to paddy. But if we take the previous year into consideration we find that the index number of coconut farm price was greater than that of Paddy. The increase in price of pepper was the lowest as shown by the index numbers ; it was only 440 in 1981-82. The farm price of Banana fared better than Pepper but was worse than others. The farm price of Tapioca increased faster than that of coconut till 1976-77. In the case of paddy the increase in farm price as shown by index numbers was fastest. It was even faster than coconut farm price. The fastest increase in the case of Paddy farm price was till 1974-75 when the index number of farm price of paddy was 1501, while that of coconut was only 620. That is, the increase in farm price of Paddy was more than double the increase of coconut till 1974-75. But after 1974-75 there was a fall in Paddy price. Though the increase in farm price of Tapioca was faster than coconut, it was not as remarkable as that of Paddy. Coconut farm price also fluctuated widely between 1965-66 to 1976-77, the fluctuation reaching nearly 50 per cent as shown by index numbers, as between 1968-69 and 1970-71, that is within two years.

TABLE 6.8

Index Numbers of Farm Price of Important Crops in Kerala Between 1955-56 and 1981-82

(1955-56 = 100)

Year	Coconut (100 nos)	Paddy (Qtl)	Tapioca (Qtl)	Banana (100 nuts)	Pepper (Qtl)
1955-56	100	100	100	100	100
1956-57	112	126	183	105	71
1957-58	130	122	159	113	59
1958-59	141	138	123	116	101
1959-60	140	145	168	121	150
1960-61	156	146	154	124	151
1961-62	155	155	198	150	118
1962-63	180	146	188	164	94
1963-64	175	158	174	160	102
1964-65	195	241	344	193	128
1965-66	285	308	342	202	135
1966-67	268	363	352	240	137
1967-68	330	483	451	291	120
1968-69	286	384	403	308	124
1969-70	363	360	362	312	210
1970-71	419	331	409	306	229
1971-72	306	607	408	311	203
1972-73	384	727	499	357	197
1973-74	648	1143	683	423	289
1974-75	620	1501	734	489	380
1975-76	487	1116	789	570	439
1976-77	664	870	697	589	588
1977-78	718	797	566	601	603
1978-79	743	767	675	596	566
1979-80	832	812	808	691	510
1980-81	1016	956	785	689	447
1981-82	840	1115	978	776	440

Source: Own Computation based on Statistics for Planning, Kerala.

According to a study by Jacob Mathew, changes in per capita production of coconuts in Kerala and per capita real income in the state together could explain nearly 90 per cent of the variations in prices of coconut oil. The above study also shows that fluctuations in prices of coconut oil within a year have also increased.

It is also clear from the above study that imports into India of copra, coconut oil and coconuts have turned out to be the most important factor influencing the price behaviour of coconut oil.

> "Imports of copra and coconut oil (in grams per capita of copra equivalent) steadily increased from 107.2 in 1950 to 366.5 in 1957. bringing a steady decline in the prices during this period; they have declined thereafter to 101.4 in 1965 and reduced practically to a trickle in recent times (1973-1976); the moderate increase in price during 1957 to 1965 and the very sharp increase thereafter can thus be attributed to the decline in imports".[2]

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2. Jacob Mathew , "Trend and fluctuations in prices of coconuts and Coconut Oil", M.Phil dissertation, Jawaharlal Nehru University (Centre for Development Studies, Trivandrum).

The study by the same author shows that prices of coconut and coconut oil are to be a large extent determined by excess demand as reflected in the quantum of imports. Production of the major oil seeds also had no influence on coconut oil prices. This may be due to limited substitutability of coconut oil by other oils, due to entrenched food habits and tastes,.Moreover, production of other oils may not have a strong influence as it may be excess demand which influences price.[3]

Prices of other edible oils was also seen to move closely with prices of coconut oil. Thus, shortages in the oilseed and oil markets will produce its impact on coconut oil.[4] Per capita production and per capita real income were found to have significant influence on the price behaviour of coconut oil (as shown in Jacob Mathew's study). The above study shows that output variations explain price trends in Kerala to a large extent.[5]

From table 6.9 we see that the index numbers of farm price of coconut moved fastest. There was comparable increase in coconut oil prices too. On the other hand, index numbers of groundnut oil and sesamum oil showed slower increase over the same period.

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3 Ibid., P. 28

4 Ibid., P. 29

5 Ibid., P.38.

TABLE 6.9

Relative Prices of Coconut, Coconut Oil, Groundnut Oil and Sesamum Oil in India

(Base : 1960 = 100)

Year	Farm prices of coconut in Kerala		Wholesale prices of					
			Coconut oil		Groundnut oil		Sesamum Oil	
	Rs./1000 nuts	Index No.	Rs/ Qtl.	Index Number	Rs/ Qtl.	Index Number	Rs/ Qtl.	Index Number
1960	207	100	240	100	208	100	254	100
1965	351	170	438	183	271	130	292	115
1970	587	284	702	292	483	232	487	192
1975	722	349	841	350	699	336	746	294
1976	813	392	954	397	542	260	695	274
1977	948	458	1095	456	829	398	836	329
1978	1066	515	1207	503	704	338	727	286
1979	1053	509	1163	485	866	416	838	330
1980	1334	644	1526	636	1006	484	1139	448

Source: P.K.Das, "The Place of Coconut Oil in Indian Vegetable Oils," Agricultural Situation in India, August 1984, Vol.XXXIX, No.5, p 324.

Parity Index

The parity index calculation presented in table 6.10 shows that coconut farmers were in a favourable position. This is because except for three years between 1955-57 and in 1975-76 price received by coconut farmers was greater than prices paid by them.

Parity index, however, is not adequate to explain the problem faced by coconut farmers, or the absence of it. This is particularly true of the large proportion of small coconut cultivators. Only a detailed class-wise size-group-wise analysis will give us adequate clue about the implications of the apparently favourable parity index. It is, ofcourse, true that coconut farmers are better of than farmers of many other crops in this respect.

Marketed Surplus

On analysing marketed surplus per acre for various size-classes of holdings it was seen that it gave a very weak though positive correlation. The value of the correlation co-efficient was 0.003, which is almost insignificant. But on analysing table 6.11 it was seen that till the size-group 401-500 cents marketed surplus per acre kept increasing. It was lowest for size-group 0-50 cents with 471 nuts per acre. From the size-group 501-600 cents onwards there was no regular trend in marketed surplus. The figure of 3466 for size-group 601-700 is not taken into consideration as it is exceptional.

TABLE 6.10

Parity Index of Prices : Prices Paid and Prices Received by Coconut Farmers

(Index Base: 1952-53 = 100)

Year	Index of prices paid	Index of coconuts prices received	Parity
1953-54	99		
1954-55	89	90	101
1955-56	90	88	98
1956-57	99	97	98
1957-58	101	110	109
1958-59	106	120	113
1959-60	112	119	106
1960-61	118	133	113
1961-62	126	132	105
1962-63	133	153	115
1963-64	139	149	107
1964-65	156	166	106
1965-66	172	242	141
1966-67	193	228	118
1967-68	214	281	131
1968-69	227	243	107
1969-70	238	309	130
1970-71	243	356	147
1971-72	254	260	102
1972-73	277	327	118
1973-74	348	551	158
1974-75	421	527	125
1975-76	415	414	99
1976-77	410	565	138
1977-78	414	611	148
1978-79	435	632	145
1979-80	451	707[a]	157
1980-81	518	863[a]	167
1981-82	594	714	120
1982-83	639+		
1983-84			

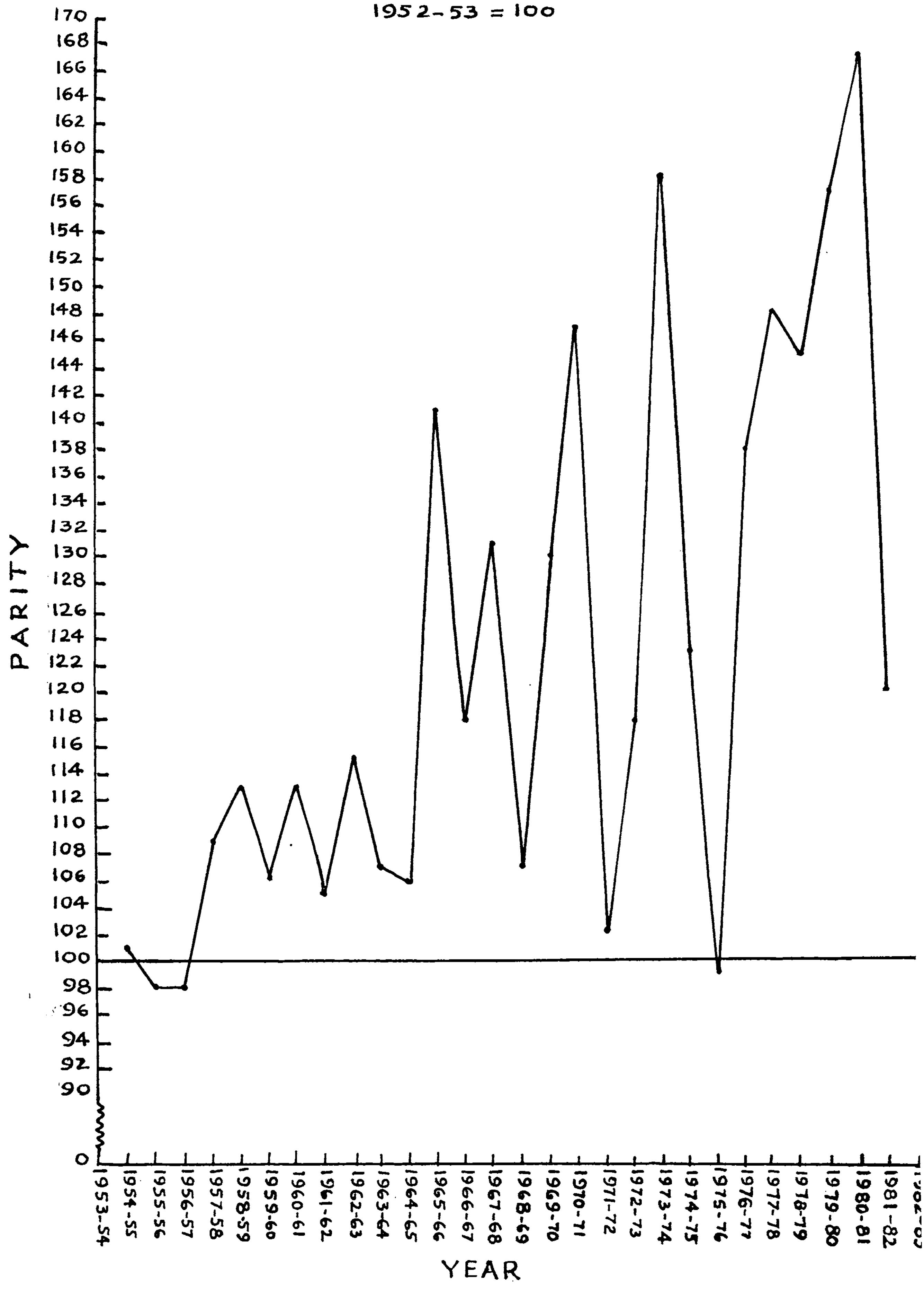
1952-53 Coconut price 3 161.66/1000 nuts

a. simple averages

\+ Provisional

Source: Onn calculation.

GRAPH 6.1
PARITY INDEX FOR COCONUT FARMERS
1952-53 = 100



Since the correlation of table 6.11 gives an insignificant coefficient, it implies that marketed surplus is uniformly distributed among size-groups.

TABLE 6.11

Size-wise Distribution of Marketed Surplus

Size-Holding	Marketed Surplus per acre
0 - 50	471.30
51 - 100	997.51
101 - 200	1060.54
201 - 300	1199.78
301 - 400	1112.76
401 - 500	1585.84
501 - 600	821.59
601 - 700	3485.71
701 - 800	1058.25
901 - 1000	1017.40
Above 1000	730.00

Source: Primary Data collected through field survey.

From table 6.12 we see that the share of marketed nuts in total production declined from 81 per cent in 1981 to 78.24 per cent in 1983.

TABLE 6.12

Share of Marketed Nuts in Total Production

Year	Marketed nuts in total (%)
1981	81.00
1982	79.02
1983	78.24

Source: Primary Data collected through field survey

We also see that marketed surplus declined to 81.79 per cent in 1983 (with 1981 as 100).

TABLE 6.13

Percentage Changes in Marketed Surplus

Year	Trend (%)
1981	100
1982	92.13
1983	81.79

Source: Primary Data collected through field survey.

Market Structure

The cultivators sell their produce to the village merchants or to the agents of the wholesale traders. Though the cultivators sell the bulk of their crop as unhusked nuts, a good part of it reaches the consumers in the form of husked nuts. Copra makers generally purchase coconuts at the garden and if it is to be stored they are not husked. Copra makers often give advances to cultivators and village merchants which is later adjusted against the price of the nuts bought.

The agencies who distribute coconut oil are oil mills, wholesale merchants, commission agents and brokers. Oil mills market their oil by selling direct through their own sales organisations, or through brokers to wholesale merchants.

Trade in coconut is oligopolistic in nature, with a large number of cultivators to sell their produce and only a few village merchants and wholesale merchants acting as agents of the millers. The complex and interlocking arrangement by private millers, traders, wholesalers and large industrial houses has remained intact for such a long time that it is surprising that no serious efforts have been made for the creation of a rational marketing arrangement by which the genuine interests of the cultivators are protected. The efforts taken by official agencies have not been successful so far.

The trade in coconut oil is also controlled by a handful of traders, most of whom are the millers themselves, whereas the retail market for coconut oil is spread all over the country. Due to the lack of good number of wholesale traders, competition is weak and prices are not always determind by supply and demand. The markets for coconuts and coconut products are well integrated and the prices of coconuts and copra are determined by the coconut oil prices.

Only about 50 per cent of the 2.95 lakh tonnes of copra produced in Kerala is used for crushing in the local milling sector and the balance is marketed mainly to Maharashtra. The copra crushed annually in Kerala yield 96000 tonnes of coconut oil.

About 3/4 of the nuts produced in Kerala are disposed off in the form of nut itself by the cultivators after retaining 15 per cent for their own consumption. Out of this, 950 million nuts are used up in raw form in Kerala annually.

The consumption study made by the coconut directorate concluded that middle and high income groups consumed 29 kilogrammes of coconut oil every year. In 1976 such households numbered 7.5 lakhs, lower income groups consumed 15 kilogrammes of coconut oil annually. This group numbered about 27.5 lakhs in 1976. Thus, we get the total consumption of the households in 1976 as 63000 tonnes. The industrial consumption in the state is 2000 tonnes. Hotels consume another 1000 tonnes per annum.

About 30,000 tonnes of coconut oil move out of Kerala to other states annually and about 150 million nuts have been moving out of Kerala every year.

According to the Directorate of Coconut Development and Trade, the annual consumption of coconuts among the middle and high income groups was 430 nuts per household and among the lower income groups it was 150 nuts per household per year on an average. Assuming that in 1976 roughly 7.5 lakh households belonged to the second category, the annual household consumption would work out to 735 million nuts in 1976. Coconut is also, used for religious purposes and some are plucked as tender nuts. For these one may account about 60 million nuts. Accounting the above two purposes for which coconut is used and the 5 million nuts used as seeds, total consumption of coconut would be 800 million nuts in the state.

According to a study by Kirloskar Consultants, on an average about 1.4 lakh tonnes of copra move out of Kerala every year, out of which a good part goes to Maharashtra.

Seasonal indices for coconut prices were found to be influenced by the demand for coconuts from copra makers and oil mills. The influence of the supply factor on the prices of coconuts is of a limited nature.[6]

> It was also seen that while the farm prices of coconut during the last two decades or so have been rising faster than the wholesale prices and consumer prices there has been a declining trend visible since the beginning of 1975. Since the beginning of 1975 the wholesale and consumer prices have been overtaking the farm prices, thus, affecting the economy of the coconut farmers.[7]

Wholesale prices of coconut oil increased faster than that of other vegetable oils such as groundnut oil and sesamum oil, as can be seen from table 6.11.

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6 Jacob Mathew, Trend and Fluctuations in Prices of Coconut and Coconut Oil, M.Phil dissertation, Centre for Development Studies, Trivandrum.

7 State Planning Board, Kerala, Economic Review, 1975.

Soon after coconut prices began nosediving a proposal was mooted by the state government that floor price be declared by the central government. But this scheme got scuttled. After this the state government began stocking copra and coconut oil, mainly through the Warehousing Corporation. But these measures came late and they did not seriously help the crop in the market. Soon they sold large quantities to the soap manufacturers and other industrialists at a lower price.

The price of 1000 coconuts increased in December 1983 from Rs.1600 to Rs.2400 in the Calicut market and by July 1984 it rallied around Rs.3000.

> During this period, the coconut farmers could realise a good profit in spite of low production due to drought. They showed considerable interest in the rejuvenation programme like applying the fertilizers to old coconut palms, and following other cultural practices. Some of the growers also started irrigating the palms wherever possible by digging wells, energising pumpsets etc for obtaining higher and higher returns.[8]

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8 "Crash in Prices of Coconut: A Major Problem", <u>Materials for Journalists</u>, Central Plantation Crops Research Institute, Kasargod, March 1985.

Magnitude of loss to Coconut Growers

Because of import of coconut oil, Kerala's coconut cultivators have lost Rs.175 crores according to State Agriculturist's Association convenor E.Gopalakrishna Menon.[9] "The large-scale import of coconut oil has further affected the farmer".[10]

In India, particularly Kerala, coconut farmers are realing under the grip of middleman who completely control and monopolise the market scene with the result that a reasonable price is denied to the farmers for their produce.[11]

Also, unsteady markets because of the interference of multinationals and monopoly procurers are playing havoc with the livelihood of the average farmer here. Moreover, years of extensive research conducted in the country has failed to find a remedy for killer diseases and such as root-wilt affecting coconut plantations here.[12]

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9 "Velichenna Irakkumathi Moolam Karshakarkku 175 Kodikal Nashtam", Mathrubhoomi, 15 November 1981.

10 "A Grevious Blow to Coconut Growers", Indian Express, Cochin, 28 November 1981.

11 "An Overseas Lesson for Coconut Farmers in Kerala", Indian Express, 24 July, 1983, p.5.

12 Ibid.

District-wise Variations

From table 6.14 we see that in the case of coconut (with husk) the mean wholesale price during 1954-64 was highest in Ernakulam and lowest in Malappuram. During the period 1970-75 the highest price was registered in Trichur. Ernakulam came only second; the lowest wholesale price was in Cannanore district. In the period 1976-79 the mean wholesale price was again highest in Trichur ; increase in mean wholesale price in period 2 over period 1 was highest in Trichur district followed by Ernakulam district. The lowest increase in mean wholesale price in the same period was in Cannanore district. The increase in mean wholesale price in period 3 over period 1 was in highest again in Trichur district and lowest in Cannanore district.

In the case of mean wholesale price of copra during the period 1954-64 the highest price was registered in Alleppey district. During the second period (1970-75) the highest mean wholesale price of copra was again in Alleppey district. The highest increase in mean wholesale price of copra in period 2 over period 1 was in Cannanore district.

TABLE 6.14

Inter-district variations in the Mean Wholesale Prices of Coconuts (with husk), Copra and Coconut Oil During Different Periods

District	Mean wholesale price during Period 1 (1954-64)	Period 2 (1970-75)	Period 3 (1976-79)	Percentage increase over period 1: Period 2	Period 3
(i) Coconuts (with husk) (Rs./100 nuts)					
Trivandrum	226.22	624.33	930.21	186.0	311.2
Quilon	236.38	670.72	1002.96	183.7	324.3
Alleppey	239.53	679.35	986.21	183.6	311.7
Ernakulam	245.38	728.06	1055.39	196.7	330.1
Trichur	241.07	758.29	1092.12	214.6	353.0
Malappuram	214.18	613.65	928.26	185.6	332.1
Calicut	221.18	601.76	903.74	172.1	308.6
Cannanore	223.98	585.34	824.34	161.3	268.0
Mean	231.07	657.69	965.41	184.6	317.8
(ii) Copra (Rs./Qtl.)					
Quilon	167.91	507.16	709.12	202.0	322.3
Alleppey	169.68	521.47	726.96	207.3	328.4
Kottayam	168.48	520.52	730.08	209.0	333.3
Ernakulam	163.04	502.99	711.37	208.5	336.3
Trichur	166.42	504.93	724.90	203.4	329.6
Calicut	167.66	506.84	727.77	202.3	334.1
Cannanore	162.69	500.39	710.56	207.6	336.8
Mean	166.55	509.19	718.68	205.7	331.5
(iii) Coconut Oil (Rs./Qtl.)					
Quilon	249.18	762.02	1072.49	205.8	330.4
Alleppey	249.90	777.58	1097.39	211.2	339.1
Kottayam	249.77	777.60	1090.87	211.3	336.7
Ernakulam	248.92	780.63	1101.21	213.6	324.4
Trichur	249.75	777.27	1079.40	211.2	332.2
Calicut	253.51	780.73	1081.60	208.0	326.6
Cannanore	247.72	792.57	1094.10	219.9	341.7
Mean	249.82	778.34	1088.15	211.6	335.6

Source: Jacob Mathew, 'Inter District Variations in the prices of Coconuts, Copra and Coconut Oil in India,' Contribution No.192, CPCRI, Kasargod, 1980.

As regards the mean wholesale price of coconut oil, the highest during period 1 was in Calicut district during period 2 was in Cannanore district, during period 3 was in Ernakulam district. The increase of mean wholesale price of coconut oil in period 2 over period 1 was in Cannanore district, and in period 3 over period 1 was also in Cannanore district.

From table 6.15 we see that the net availability of coconut oil has been decreasing since 1960-61 to 1978-79. This is partly because production has come down and import has been reduced. Imports were eleminated between 1973-74 and 1975-76 and during 1973-74 production also touched a low, which resulted in lowest ever supply of coconut oil during the above period (1960-61 to 1978-79).

From table 6.16 we see that coconut oil production in 1978-79 was lower than that in 1960-61, Production of other oils except linseed oil, increased.

TABLE 6.15

Net Availability of Coconut Oil in India
Between 1960-61 and 1979-80

(Base 1960 = 100)

Year	Production '000 Tonnes	Production Index Number	Net Import '000 Tonnes	Net Import Index Number	Total Supply '000 Tonnes	Total Supply Index Number
1960-61	197	100	63	100	260	100
1961-62	187	94	56	89	243	93
1962-63	295	98	64	102	259	100
1963-64	195	98	57	90	252	97
1964-65	184	93	40	63	224	86
1965-66	180	91	33	52	213	82
1966-67	171	86	18	29	189	73
1967-68	173	87	16	25	189	73
1968-69	170	86	9	14	179	76
1969-70	186	94	11	17	197	76
1970-71	190	96	12	19	202	78
1971-72	187	94	7	11	194	75
1972-73	181	92	4	6	185	71
1973-74	173	87	Ve	Ve	173	67
1974-75	178	90	0	0	178	68
1975-76	181	92	0	0	181	70
1976-77	170	86	4	6	174	67
1977-78	180	91	17	27	197	76
1978-79	180	91	30	48	210	81

Source: Prafulla K Das, "The Place of Coconut Oil in Indian Vegetable Oils," Agricultural Situation in India, August 1984, Vol. XXXIX, No.5, p. 324.

TABLE 6.16

Trend in Production of Major Vegetable Oils in India

('000 tonnes)

Year	Coconut oil	Ground-nut oil	Rapeseed and mustard oil	Sesamum oil	Linseed oil	Castor oil
1960-61	197	1062	417	151	149	38
1964-65	184	1363	460	151	147	37
1965-66	180	969	403	132	96	28
1966-67	171	1006	379	129	73	38
1967-68	173	1324	491	139	130	42
1968-69	170	1044	418	131	95	40
1969-70	186	1171	489	139	140	43
1970-71	190	1413	633	175	141	47
1971-72	187	1429	456	140	259	54
1972-73	181	918	590	120	127	50
1973-74	173	1354	545	150	151	80
1974-75	178	1157	715	119	170	73
1975-76	181	1516	616	136	180	50
1976-77	170	1192	472	161	124	62
1977-78	180	1400	500	160	150	80
1978-79	180	1470	570	170	148	84

Source: Ibid.

From table 6.17 we see that as in 1979 the biggest import of vegetable oil was that of soyabeen oil. Next came Palm Oil. We also see that during the period 1975-79 the fastest increase in imports was that of Soyabeen Oil. Sunflower Oil, Groundnut Oil and Coconut oil import was low, with that of Groundnut Oil completely eliminated in 1979.

The prices of coconut are largely determined by merchants. Following the import of coconut oil, the demand for coconut oil from Kerala has declined. This has had a dampening and often disturbing effect on the production of coconut.

Decline in coconut prices, even for brief periods, has undoubtedly serious implications to the survival of Kerala's economy in general and the state's agrarian economy in particular. If unchecked, the price situation can take the economy to a point where it may "destroy Kerala's agriculture".[13]

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13 Translated from <u>Kerala Kaumudi</u> (Trivandrum) November 17, 1981.

TABLE 6.17

Import of Vegetable Oils into India During 1975-79

(Thousand tonnes)

Oils	1975	1976	1977	1978	1979	1975-79	Average of percentage
Soyabeen	4	151	441	513	555	333	42.8
Palm	62	26	320	486	396	258	33.1
Rapeseed	16	37	298	273	138	152	19.6
Sunflower	-	-	17	28	17	12	1.5
Groundnut	1	16	38	4	-	12	1.5
Coconut	-	2	19	23	16	12	1.5
	83	232	1133	1327	1122	779	100.0

Source: P.K.Das, "The Place of Coconut Oil in Indian Vegetable Oils", Agricultural Situation in India, August 1984, Vol. XXXIX, No.5, p 324.

C H A P T E R VII

DISEASES AFFECTING COCONUT

CHAPTER VII

DISEASES AFFECTING COCONUT PALMS

ROOT-WILT DISEASE

This disease was first noticed in three isolated pockets, one at Erattupettah in Kottayam district and two at Kathipara and Kayankulam in Alleppey district within 50 Kilometre of each other, following the floods of 1882. Since then it has been slowly spreading to North and South Kerala and even to Tamil Nadu.

The disease has been noticed in all types of soils under varying ecological conditions from foot hills to coastal sands. Although the disease occurs in palms of all ages, young palms in pre and early bearing stages are more susceptible.

The disease is debilitating in nature but not leathel. Loss in terms of nut-yield is proportional to the intensity of the disease and varies from 10 to 80 per cent.

Symptoms of Root-wilt Disease

The characteristic symptoms of the disease are general wilting of the leaves and yellowing of leaflets.

The abnormal bending or ribbing of leaflets termed as flacidity is a typical feature of the disease. There is abnormal shedding of female flowers and buttons. As the disease advances, the whole crown gets smaller in size due to reduction in size and number of leaves. There is also a reduction in the number of roots produced and a high percentage of roots is seen to rot.

<u>Impact of Root-wilt Disease</u>

According to a study by the CPCRI[1] the disease which was first reported in 1882 in the erstwhile state of Travancore has now spread to eight districts of Kerala, namely, Trivandrum, Quilon, Pathanamthitta, Alleppey, Kottayam, Idukki, Ernakulam and Trichur. Isolated incidence has been reported from other districts.

The effects of the disease on nut quality characteristics, oil content and free fatty acid content have been scientifically studied. Table 7.1 provides data on this aspect.

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1. <u>Coconut Root (wilt) Disease - Intensity, Production Loss and Future Strategy: A Survey Report</u>, Central Plantation Crops Research Institute, Kasaragod, 1985.

TABLE 7.2

Root (wilt) Disease Incidence in WCT and D x T Hybrid Palms at CPCRI Regional Station, Kayamkulam

WC Tall Planted in 1970		D x T Hybrid planted in 1972	
Year from planting	Disease incidence (per cent)	Year from planting	Disease incidence (Per cent)
1	-	1	-
2	-	2	-
3	-	3	-
4	-	4	-
5	2.2	5	1.5
6	4.3	6	3.6
7	8.8	7	5.0
8	22.5	8	6.5
9	29.3	9	19.6
10	35.5	10	20.2

Source: P.K. Das, Possibilities of Increasing Producticity of Coconuts from Non-monetary Inputs, CPCRI Contribution No. 399.

Thirty per cent of the area under crop in Kerala comprising 15 million palms has been affected by root-wilt.[2] The annual loss in production is significant, as given earlier, according to the CPCRI study.[3] It is estimated that the loss which Kerala economy incurs every year due to the disease is about Rs. 300 crores.[4]

Kerala State which has so far been the first in India in the matter of coconut production is likely to be relegated to the second position as Tamil Nadu is constantly increasing area and output of coconut. This possibility is not likely to be avoided unless urgent steps are taken to solve the root-wilt and other diseases affecting coconut in Kerala. The area under coconut in Tamil Nadu is only about 20 per cent of the total area of coconut in Kerala. But during the last decade coconut production in Tamil Nadu increased by 77 per cent, while that of Kerala decreased by 40 per cent.[5]

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2. Coconut Root (wilt) Disease-Intensity, Production Loss and Future strategy : A survey Report, Central Plantation Crops Research Institute, Kasaragod, 1985.

3. Ibid.

4. Malayala Manorama, Editorial, 31 January 1985.

5. Kerala Kaumudi, 18 June 1984.

Research into Root-wilt

The Director of the Central Plantation Crops Research Institute (CPCRI), Kasargod, Dr. K.V.A.Bavappa told pressmen at New Delhi, 7 April 1985 that the Coconut Research Centre at Kayamkulam was very close to success in preventing the root-wilt disease affecting coconut.[6] He attributed the reason for root-wilt to a particular type of pest; however, the experimental work in this regard has only reached an advance stage and a final verdict will have to wait.

"The cause of the malady reported nearly a century ago has now been elucidated to be Mycoplasma like organism (MLO), through its consistent presence in different tissues of the root (wilt) affected palms seen under the electron microscope and its conspicous absence in the disease free palms."[7]

The Programme for Rehabilitation of Root-wilt Affected Palms

The programme for rehabilitation and rejuvenation of the disease affected coconut plantations satrted in 1977-78 is an ill-concieved plan. The programme which

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6. Malayala Manorama, April 8, 1985.

7. Ibid.

plans to contain the disease between two belts, one in the north (Trichur district) and the other in the south (Trivandrum district) would not serve its purpose. The scheme plans to replant disease affected palms, but those palms which are replanted would also suffer from the disease. Moreover, those palms which are having the disease would also be yielding. Thus, by cutting-off all disease-affected palms, the farms concerned would be suffering losses. Apart from the fact that newly replanted palms would take a gestation period to start yielding, there is no guarantee that the newly yeilding palms would yield more than the palms which are cut. This is because newly planted palms are also likely to contract the disease and their yielding may be uneconomic. Further, there is no evidence that, by removing all palms affected by root-wilt, the disease in that area would come to an end.

Available data show that improving the soil physical condition and nutrient status, primarly through organic sources, can substantially help to increase the yield of root (wilt) affected palms. "When animal waste was recycled there was an overall increase in yield of diseased palms by 26.1 per cent (plot average). This also resulted in increased soil organic carbon content and microbial activity".[8]

"No positive result has so far been obtained with the use of fungicides and bactericides in the control of the root-wilt disease. All attempts to isolate resistant varieties by progeny testing of healthy palms from diseased areas, and also using pollen from these for making crosses, have not so far yielded positive results".[9]

Despite various measures taken by government authorities, including those by agricultural extension officers, it is surprising that the coconut farmers generally are not aware of such measures. The data collected through our field survey are given in table 7.3.

As can be seen from the table, most of the respondents (61.48 per cent) do not know of any existing measures against root (wilt) disease. Further, a significant portion (37.7 per cent) of the respondents

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8. K.V.A.Bavappa, "Root (Wilt) disease of Coconut - Where and Whither," Indian Coconut Journal, Vol.8 No.9, January 1983.

9. Coconut Diseases of Uncertain Etiology, Central Plantation Crops Research Institute, Kasargod, 1983.

TABLE 7.3

Awareness of Farmers About Existing Anti-root (wilt) Measures

Details	Response (Percentage)
Nothing	37.70
Don't know	61.48
No response	0.82

Source: Primary data collected through field surveys.

opined that there are no anti-root (wilt) measures at all. This is a sad commentary on whatever measures the government have been implementing so far, successful or not, in eradicating the disease or otherwise.

PESTS AND DISEASES

There are a number of pests and diseases affecting coconut palms. Their nature, the type of damage caused and remedial measures are described in the following paragraphs.

1) Rhinocerous Beetle

This is the most serious pest of the coconut palm and is found in all the coconut growing countries. The coconut palm has been found to be the most favoured of all the palms by this beetle. The damage is caused by the adult beetle which is active in the night.[11]

Nature of damage: The adult beetle bores into the soft tissue of the bud by cutting and chewing the tender unopened leaves and inflorescences. Though the adult palms do not die from this beetle's attack, it may cause the death of young palms by boring into the growing point and destroying it. In India, on an average, the beetle destroys one inflorescence per palm, thus reducing the yield by ten per cent every year.[12]

Control measures

As the breeding takes place in manure pits and other decaying organic refuses, the beetle can be effectively controlled by destroying it at the earlier stages of development such as eggs, grubs and pupae.

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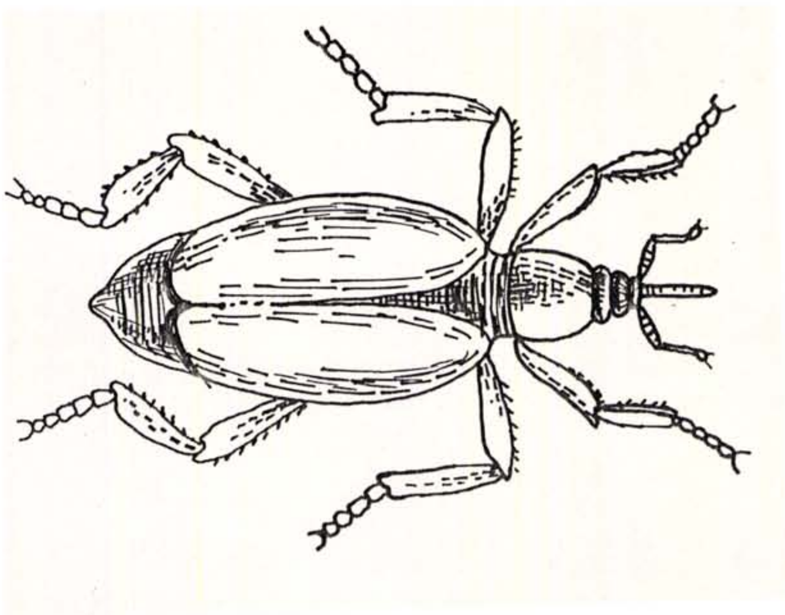
11. P.K.Thampan, Coconut Culture in India, The Green Villa Publishers, 1972

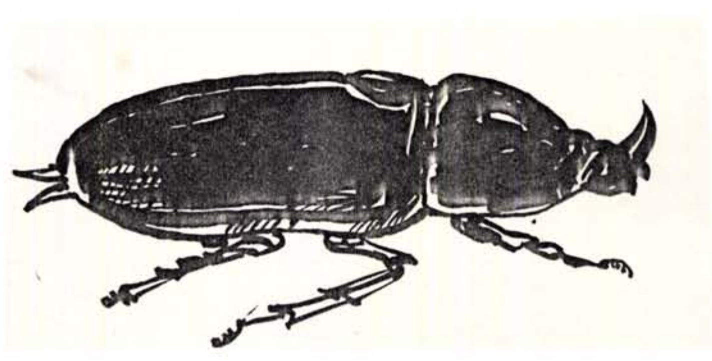
12. Ibid.

PESTS AFFECTING COCONUT PALM

1. RED PALM WEEVIL



2. RHINOCEROUS BEETLE



This can be done by spraying the manure pits every alternate month with a 0.1 per cent solution of BHC. Equally, important is the maintenance of the garden in a clean condition. The organic refuses and coconut logs and stumps should be properly disposed off. Mechanical extraction of the beetle from the crown of the palms with a beetle hook is also effective.

2) <u>Red Palm Weevil</u>

The Red Palm Weevil is a dangerous pest of the coconut palm. The damage is done by the grubs which spend all their time inside the palm, feeding on the soft tissue. For laying of eggs the female beetle is attracted to those palms which are injured either by the Rhinocerous beetle or by other means. The beetle scoops out small cavities on the injured protions and lays its eggs. The grubs, on hatching bore into the soft tissue of the stem or crown for feeding and ultimately cause the death of the affected palm.

The first indication of the presence of the past is holes on the stem with chewed fiborous material sometimes protruding out. Usually a reddish brown liquid is found oozing out of these holes. At this stage, if the grubs are promptly destroyed, the affected palm can be saved.

Control measures

As the female weevil lays eggs in the wounds caused by the Rhinocerous beetle, control measures against the Rhinocerous beetle may help to minimise the attack of the Red Palm Weevil.

Secondly, injection of the chemical, Pyrocone E 2/20, at one per cent concentration into the infected trees at the rate of 1000-1500 C.C. per tree has been found to be effective.[13]

3) Coreid Bug

As a result of the attack by this pest, the attacked buttons do not develop and tender nuts become barren.[14]

Control measures: The control measure for this pest is to apply BHC/Sevin 0.2 per cent or Endosulfan (Thiodan) 0.05 per cent on the newly opened inflorescence after the receptive phase of female flowers.[15]

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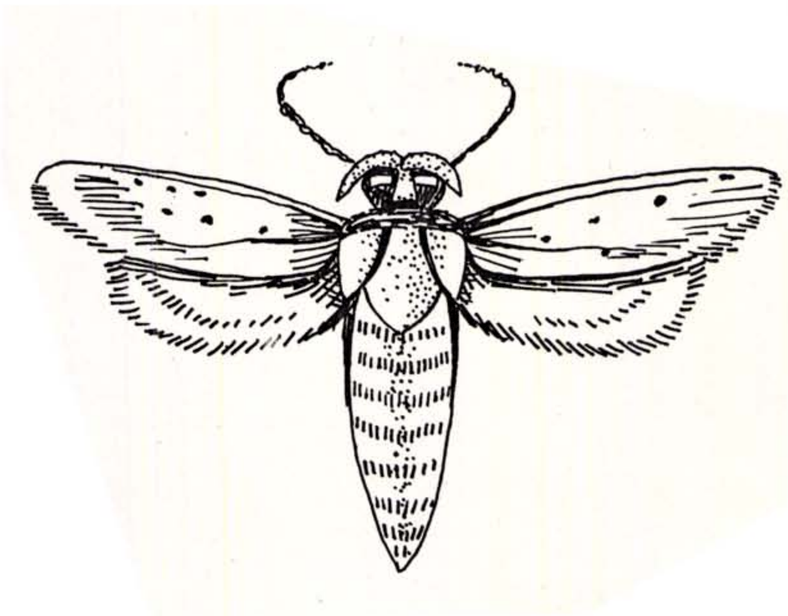
13. Farm Guide 1983, Farm Information Bureau, Government of Kerala,

14. Ibid.

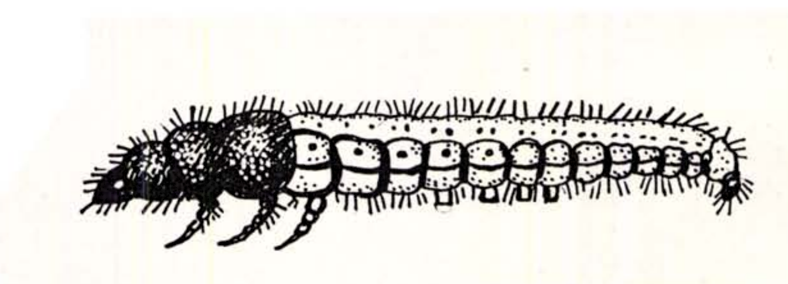
15. Ibid.

3. BLACK HEADED CATERPILLAR

a) MOTH OF THE CATERPILLAR



b) CATTERPILLAR



4) Black Headed Caterpillar

The Black Headed Caterpillar or the leaf eating caterpillar is the larva of a medium sized moth which is common in the coastal and backwater areas of the country. The larvae live on the green matter of the leaves and cause a reduction in the functional leaf surface, leading to reduced yield.[16]

Control measures: The suggested control measure is spraying of the affected palms once in two months with a 0.2 per cent DDT solution.[17] Biological control has also been found to be effective.[18]

5) Cockchafer

The larvae of the cockchafer beetle, popularly known as 'white grubs', cause damage to the coconut palms by feeding on the roots. It lives inside the soil and are usually found in sandy or sandy loam soils of certain localities of Kerala.

Control measures: Firstly, tillage in the months of May and September when the larvae emerge in large numbers from the sub-soil to the surface will expose

16. P.K.Thampan, op cit.

17. Ibid.

18. Ibid.

the pest to the attack of natural predators like birds, cats, dogs etc. Secondly, application of about 63 kilograms of 5 per cent BHC or 30 kilograms of 5 per cent chlordane per hectare at the time of tillage will effectively control the pest.[19]

Rats

The rat is a serious pest of the coconut palm in certain localities. The extent of damage caused by rats is estimated to be 5 to 10 per cent of the total production every year.[20] The rats enter palms and dig into the immature nuts to eat the meat. The attacked nuts are damaged and eventually they fall down. The damage is severe in coconut gardens where the palms are closely planted where the rats can jump from one palm to another and remain on the crown of the palm for many days.

Control measures: Use of traditional traps is the most popular measure against rats. A variety of traps are used for the purpose in different parts of the country. Most of the control measures, however, are not effective because the rats are intelligent enough to avoid the traps

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19. Ibid.

20. Ibid.

and baits. Recently the use of warfarin block has been recommended to control the rats. The advantage of warfarin blocks over other chemicals is that it affects the rat a few days after its consumption and the death will be suspected to be natural. Warfarin block is also not affected by rain and does not need replacement until completely eaten away.

DISEASES

Apart from pests, the coconut palms are badly affected by a number of diseases.

1) Stem Bleeding

Stem bleeding was first reported in India in 1922. It occurs in coconut palms in all types of soils. The extent of damage varies from reduction in yield to complete death of the palms.[21] Palms affected with stem bleeding are found exuding a reddish brown liquid through cracks on the lower part of the husk.[22] The disease is believed to be caused by infection by ceratostomella paradox through the growth cracks on the stem.[23]

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21. Coconut disease of uncertain Etiology, Central Plantation Crops Research Institute, Kasargod.

22. Ibid.

23. Ibid.

Control measures : A number of control measures have been suggested, the most important of which are the following:

i) Organic manuring: In experiments in certain gardens it was found that by stopping NPK fertilisers and applying organic or fish manure, stem bleeding could be stopped.[24]

ii) Coal tar treatment: The blooding area is covered with molten coal tar or Bordeaux paste.

iii) Improving drainage in lowlying waterlogged areas, and soil moisture conservation measures in drought areas has proved beneficial.[25]

2) Bud Rot

The symptom of this disease is that the central leaves wither with yellowish discolouration and get easily detached. The rotting spreads to the soft tissue of the bud and it gets destroyed.[26]

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24. Ibid.

25. Ibid.

26. Farm Guide 1983, Farm Information Bureau, Government of Kerala.

PLATE 7.4

PUMPING MEDICINE IN COCONUT GARDEN
WITH SIMPLE HAND PUMP

Control measures: "In the early stages of the disease remove affected tissues and treat the crown with Bordeaux paste. A protective covering should be given till normal shoots emerge. Burn all disease affected tissues removed from the palm. Spray 1 per cent Bordeaux mixture on treated and neighbouring plants as a preventive measure".[27]

3) Mahali and Grey Blight

Shedding of female flowers and immature nuts are the symptoms of the disease. Lesion appears on the young fruits or buttons near the stalk which later develop to decay of the underlying tissues.

Control measures: The suggested control measure is to spray 1 per cent Bordeaux mixture on the crown before monsoon and once or twice at intervals of 40 days or spray copper fungicides.[28]

4) Grey Blight

It appears in the mature leaves of the outer whorl as yellow specks encircled by a greyish band which

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27. Ibid.

28. Ibid,

later becomes white. The spots later coalese into irregular necrotic patches.[29]

Defects of Measures for Controlling Pests and Diseases

A review of available literature shows that considerable work has been done by scientists in the field of not only analysis of the causes of diseases and pests affecting coconut, but also remedial measures. Unfortunately, most of the findings still remain within the four walls of research institutions and experimental stations and adequate efforts have not been made so far to disseminate such scientific knowledge to the large population of coconut farmers in Kerala ; particularly small and medium farmers. Extension work undertaken by agricultural scientists remain ornamental and cannot, by any means, be considered adequate enough even to cope with the fringe of the problem.

Coconut, being the most important crop having a significant weight in the economy of Kerala in general, and the agrarian sector in particular, it is high time that policy makers, planners, agricultural scientists and administrators give a fresh look at the policies

29. Ibid.

and strategies of developments pursued so far. Even with the existing scientific and technological knowledge about various aspects of coconut cultivation, substantial progress can be made, provided effective delivery mechanisms are evolved for the dissemination of knowldege and the transfer of appropriate technology supported by supply of adequate inputs, infrastructural arrangements and follow-up action to support the coconut cultivators on a continuous and sustained basis.

TECHNICAL ANNEXURE

NUTRITIONAL STATUS OF ROOT-WILT AFFECTED PALMS AND SOILS

T E C H N I C A L   A N N E X U R E

NUTRIENT STATUS STUDIES OF ROOT-WILT AFFECTED PALMS AND SOILS

Major nutrients (N, P and K)

It is seen that total nitrogen content of healthy soils is lower than that of disease affected area with the exception of coastal sand and sandy loam. Available P did not differ while exchangeable K was lower in diseased trait in sandy loam and reclaimed soil but only in the former there was a statistical significance.

In the case of leaf levels of these nutrients healthy palms had lower levels compared to unhealthy palms and in most cases the differences were statistically significant. The tendency of these nutrients is to accumulate in diseased palms.

Secondary elements (Ca, Mg and S)

There was no difference in exchangeable Ca and Mg of soil between healthy and diseased zones. On the contrary, sulphur status was generally lower in diseased trait and significantly so in alluvial and sandy loam. Leaf levels of these elements more or less followed the same pattern.

Trace elements (Fe, Mn, ZA, Cu, B, Mo and AL)

Fe was significantly higher in laterite and coastal sandy soils. In healthy lateriate, coastal sandy and sandy loam soils easily reducible and active Mn trends were significantly higher, while exchangeable Mn was higher in sandy loam. Zinc was found in significantly higher concentrations in healthy zone in alluvial, reclaimed and coastal sandy soils. The trend, though similar in other soils also, was not significant. Molybdenum status of alluvial soil in healthy zone was significantly low as compared to the diseased zone.

Foliar analysis of levels of micronutrients showed that zinc was invariably lower in diseased palms, Manganese was significantly higher in healthy palms growing on coastal sand and sandy loam. Though a similar trend was observed in other soils also, the difference between healthy and diseased palms was not significant. Iron content of healthy palms on alluvial and laterite was significantly higher than that of diseased palms on the same soils. In healthy palms on coastal sand the molybdenum content was significantly higher than that in the diseased palms. Baron content of healthy palms was higher in alluvial soil.

In case of AL the healthy palms were found to contain significantly higher amounts in all soils as compared to diseased palms.

Observations rule out the possibility of the association of major nutrient deficiencies with the disease.

As regards Ca and Mg no regular pattern is apparent. The results do not agree with observations that low levels of Ca and Mg in palm may be the major factor responsible for the disease incidence. However, imbalances in the cationic ratios in diseased palms are evident. The ratios K/Na, K/Mg, K/Ca+Mg and K/(Na+Ca+Mg) are considerably lower in healthy palms, indicating the predominance of K in diseased palms. When the total content of monovalents (K+Na) and that of divalents (Ca+Mg) were compared the values showed a steady increase in the total monovalents with increasing disease intensity and divalents just the reverse trend.

Among secondary nutrients S seems to be of importance. Though the available S content in healthy palms is significantly higher only in alluvial soil, in other soils a similar trend is evident. Sulphur contents of leaf also follow the same pattern with very few exceptions. As sulphur is a constituent of certain amino acids which go into the creation of protein, the protein metabolism may be adversely affected. S deficiency is also shown by N/S and P/S ratios. Both these ratios are higher in diseased palms showing the inadequacy of S.

Among the micronutrients, Cu and B do not seem to have a role in the incidence of disease. Main emphasis may be placed on Zn, Mn, Fe and Mo in this group of nutrients. Differences in Zn content of both leaf and soil between healthy and diseased trait is the most contrasting of all. The diseased palm, in general, showed a very low concentration of less than 10 ppm while healthy palms showed a mean value well above 15 ppm. Zn/P ratio is also more than double as compared to that of diseased palms. Leaf values of Mn were considerably lower in the diseased palms and in coastal sand the diseased palm gave extremely lower values (less than 10 ppm) as against a mean value of 83.6 ppm in healthy palms. Mn/P ratio is also considerably higher in healthy palms.

Molybdenum and Fe content of soils did not show much relation to the disease though the latter is higher in healthy zone than in laterite soil. Leaf content of these two nutrients, however, were lower in diseased palms. A higher ratio of P/Fe in diseased palms was also observed.

It is also interesting to observe that except Cu and B, the content of all other trace elements including AL in the diseased palms are lower than in healthy palms.

Source of information: N.G.Pillai, et.al, Minieral Nutrition of Root (wilt) Affected Coconut Palm, Fourth session of the FAO Technical Working Party on Coconut Production , Protection and Processing, Kingston, Jamaica, 14-25 September 1975.

C H A P T E R VIII

SUMMARY AND CONCLUSIONS

CHAPTER VIII

SUMMARY AND CONCLUSIONS

Coconut cultivation and industry contribute substantially to the economy of Kerala so much so that coconut may be characterised as the backbone of the State's economy. Kerala's share in the total area under coconut in India in 1983 was 59.15 per cent and its share in all-India production of coconut in the same year was 43.15 per cent.

India's Position in Coconut Cultivation in the World

India occupies the third position in production of coconut in the world. India's share in world production of this crop was 14.8 per cent on the average in the triennium ending 1976. Philippines is the biggest producer of coconut (33.2 per cent) ; and Indonesia comes second (20.8 per cent). The share of Philippines in the production of copra (conversion of the coconut Kernel into oil bearing copra) is even better, with 48.2 per cent of world output of copra. On the other hand, India's share in the case of copra is only 7.5 per cent, which is not commensurate even with its own share in world coconut production This means that, unlike Philippines where a substantial portion of coconut is converted into copra, in India the major share of coconut goes for direct consumption purposes.

India is the third largest oilseed producing country in the world with an area of 25.3 million hectares and production level of 12.5 million tonnes of all oilseeds. It is true that, in terms of area and total production, coconut does not occupy any leading position in the oilseed economy of India as a whole. In 1975-76 the total area under coconut in the country was only 11,14,700 hectares compared to 70,18,800 hectares under groundnut, 22,63,300 hectares under sesamum and 34,92,100 hectares under rapeseed and mustard taken together, However, this all-India comparison is inadequate for an understanding of Kerala's economy because, for Kerala State, coconut oil has a pre-eminent place, though other oils such as palm oil, have recently entered the consumption basket in the state.

Changes in Area under Coconut

Data given by the Directorate of Economics and Statistics, Government of Kerala, show that area under coconut was increasing till 1975-76. But, between 1975-76 and 1979-80 the official figures show decline in area. Our suspicion, strengthened by analysis, is that this is due to changes in the methodology of data collection adopted by the Directorate. In fact, official data show increases in area since 1979-80. The increases in area under coconut over the years was due to substitution of other crops by coconut and by extension of coconut cultivation to uncultivated lands. The most substantial increase took place in the period 1965-66 to 1969-70 when the area under coconut increased by 20.73.

Coconut had a clear price advantage during the 1960s. But, during the 1970s this price advantage was lost to other crops such as cashewnut and rubber. However, substantial areas under different annual crops were converted into coconut gardens.

Analysis of trends in district-wise area under coconut, according to the Directorate of Economics and Statistics, shows that there was decline in area in four out of the eleven districts. Quilon and Cannanore witnessed faster growth rates compared to other districts. On the other hand, Alleppey and Kottayam districts registered negative growth rate in area ; these are incidentally the districts which are intensely affected by root-wilt disease.

During the 9 year period between 1955-56 and 1964-65 area kept increasing but at a slow average rate of 2.5 per cent every year. During the 5 year period, 1965-66 to 1969-70, area under coconut increased on an average at a very fast rate of 4.84 per cent. During this period specially and the earlier 9 year period area kept increasing owing to a number of factors. Though there was the depressing affect of the decline in productivity, which was caused mainly by the impact of the worsening root-wilt disease, area under coconut grew, apparently due to the following reasons :

1) Coconut was a crop which provided a greater income compared to most other crops ;

2) Land reforms had increased the number of small farmers and for them coconut was a crop which met their cash needs ;

3) The state government provided certain attractive schemes for the extension of area under coconut.

Productivity of Coconut Farms

A study of the trends in average productivity of coconut farms in Kerala measured in terms of nuts per hectare shows that there has been an alarming decline in productivity. From 6832 nuts per hectare in 1957-58, it reached a very low figure of 4712 nuts per hectare in 1982-83.

Recent debates among economists show the importance of the size-productivity debate. Though there is controversy regarding methodology, definition etc, the controversy rests around the reported finding that size and productivity are inversely related. The case of coconut would, thus, be interesting to see if this relation exists in a plantation crop. Data in their raw form show that holdings between 0-200 cents had the highest range of yield of 34-48 nuts while holdings between 201-500 cents showed the next highest range of 29-31 nuts. Holdings between 501-600, 601-700, 701-800 cents gave 23,50 and 19 respectively. Holdings between 901-1000 cents and above 1000 cents gave 31 and 19 nuts respectively.

The yield rate for the size group 601-700 cannot be taken as representative as the number of cases in this group was not statistically significant. Thus, if we leave out the size-group 601-700, we see that yield has been coming down as the size of holdings increases.

Based on data generated by the field study we worked out the co-efficient of correlation between yield and size of coconut holdings.

The co-efficient of correlation worked out to -0.496. This value was significant at the 5 per cent level (one-sided test). Thus, it is clear that an inverse relationship exists between size of coconut holdings and productivity.

Size-productivity relation was also studied after elimination and impact of irrigation ; for this the data was seperated into those cases which had irrigation and those which had no irrigation. The holdings which were not irrigated were studied using correlation. The resulting co-efficient was -0.234. This was not significant. Thus, when the effect of irrigation was eliminated we see that the inverse relation between size and productivity is not significant.

We tried to see if the inverse relation between size and productivity existed after eliminating the impact of quality differences between coconut holdings. Value of land was taken to denote differences in quality of land. Accordingly, productivity and value of land were correlated. The result was a co-efficient of -0.264. This value of the co-efficient was not significant even at the 0.1 per cent level. This means that the inverse size-productivity relation was eliminated when analysis of the same was done after taking into account differences in quality of land.

Some researchers have opined that analysis of only productivity per unit of land is inadequate. They argue that, instead, output per unit of labour should also be analysed in relation to size of holdings. We adopted this method and got a correlation co-efficient of 0.586. Thus, it is clear that productivity of labour is higher in bigger farms.

Kerala is slowly, but steadily, losing the prime position it enjoyed as the leading coconut producing state in the country. The monopoly it has in coconut is being challenged by states such as Tamil Nadu and Karnataka which are contributing their might in terms of increasing area and production.

There have been occassions when coconut trees were cut under the pretext of an "unremunerative" crop to give way to more "profitable" crops such as rubber and cocoa. This was a feature in the southern pockets of the state. The farmers did this in the background of low prices during 1982 when other edible oils like groundnut were recording higher levels of prices.

Coconut farmers are realing under the grip of middlemen who control and monopolise the market scene with the result that a reasonable price is denied to the farmers for their produce. Uneconomic prices and unsteady market, beeause of multinationals and monopoly producers, are playing havoc with the livelihood of the average coconut farmer. The conditions of coconut farmers have been aggrevated by the inability of our science and technology institutions to find a remedy for a killer disease such as root-wilt despite years of extensive research.

An analysis of the trends in production in various districts of Kerala shows that, out of the eleven districts, six have witnessed decline in coconut production. The decline in production was quite sharp in Alleppey district. Of the remaining five districts, which showed an increasing trend, Ernakulam had the biggest increase. For analysing the trend three measures were used: average cumulative percentage variation, absolute percentage variation and the values obtained by fitting a linear trend equation of the form $y = a + bx$. Till 1969-70 the rate of increase in production was faster than that in the subsequent periods. Since 1970-71 the rate of change in production has been negative, with an improvement only after 1980-81.

Data relating to changes in production were decomposed into yield effect, area effect and interaction effect for the period 1955-56 through 1982-83 using the following formula.

$$P = A_1 \times y + y_1 \times A + y \times A$$

where P is change in production (between t_1 and t_n), A_1 is initial area (in t_1), A is change in area (between t_1 and t_n) y_1 is initial yield (in t_1) and y is change in yield (between t_1 and t_n). Our analysis shows that the yield effect or contribution of yield to change in production has been negative throughout the period except in the last period 1980-81 to 1982-83. It was mainly the increase in the area which contributed to increase in production till 1969-70 and which continued to have a positive contribution even during the period 1970-71 to 1974-75.

With better farming practices, which require ploughing, digging basins and applying adequate quantities of fertilizers, the total returns of coconut gardens in general, and those of small farmers in particular, can be increased. But, the additional cost involved is often beyond the capacity of small farmers. Further, the existence of certain cultivation practices such as overcrowding of palms in small plots of land have their own rationale so far as small cultivators are concerned. It appears that plots with density of cultivation above that prescribed by scientists as optimum, give larger net income.

Primary data collected through field survey shows, that, according to the farmers who were given multiple choices, the main reasons for decline in yield of coconut were : (i) disease (94.35 per cent) (ii) declining quality of soil (55.37 per cent) ; (iii) rise in input prices (23.73 per cent) ; and (iv) ageing of palms (23.73 per cent).

Use of Modern Practices

Data shows that a majority of respondents use the local variety as planting materials. The main reason given for this preference is that the hybrids have lesser tolerance to root-wilt disease. The hybrids, once affected by the disease, deteriorate faster than the local variety. Also, root-wilt affected palms are poor in their capacity to survive till bearing and their mortality rate is very high.

Opinion collected from the respondents also shows that hybrids are erratic bearers and tend to perform badly under lesser care. The hybrids are also more prone to failure in establishing into grown-up palms than the local variety. Moreover, many farmers opined that the short life-span of hybrids was a major disincentive. The farmers also complained that there was massive adulteration in the supply of hybrids seedlings.

The local varieties, on the other hand, have a better record in establishing and growing into bearing palms and are more resistant to root-wilt.

Most of the coconut farmers who were interviewed in the present study opined that modern practices have no advantage over traditional methods as far as their impact on profits was concerned.

The opinion of the sample respondents regarding the effect of mixed cropping of cocoa on the productivity of coconut was examined. Out of those who responded about the impact of cocoa on the productivity of coconut, only 7.69 per cent claimed that cocoa cultivation benefited coconut productivity, albeit indirectly, that is, through the benefit of manure given to cocoa which was also utilised by coconut. Over 67 per cent of those for whom the question mattered opined that cocoa cultivation reduced coconut productivity and 24 per cent could not discern much change. This finding is quite important because certain scientists have been promoting the theory of nutrient contribution by certain intercrops.

Cost of Production and Profitability

Study of paid maintenance costs shows that holdings above sizes of 600 cents have a lower proportion of their total paid maintenance costs spent on soil improvement such as application of manure and tilling of soil. It is mainly the holdings in size groups 51-600 cents that do substantial expenditure on tilling and application of manures. For all holdings, cost of plucking was quite substantial ranging from 21 to 56 per cent of total paid maintenance cost. This is because plucking is a semi-skilled job and all planters require hiring in of climbers.

The share of marketed nuts in total production was found to be about 79 per cent. The number of nuts marketed declined by more than 18 per cent between 1981 and 1983. Analysis of marketed surplus per acre in relation to size of the coconut gardens gave only a weak correlation co-efficient of 0.003. This implies that marketed surplus is uniformly distributed among different size-groups.

We have worked out the cost-return ratios for different size-groups. In order to see if there was any relation between cost-return ratio and its distribution size-wise, we used the correlation technique . The correlation co-efficient turned out to be 0.704. This value is significant at the 1 per cent level. Thus, we see that returns are greater compared to costs on bigger farms.

Another criterion for efficiency evaluation is the profitability of farms. Of course, there are limitations in this analysis as profitability is a biased concept which portrays the farming operation in the same way as a capitalist farm which produces with the aim of selling and for a profit. This may not be true of a coconut grower in Kerala. This is because, for most of the coconut growers, income from coconut cultivation and sales account for only a part, in some cases a small part, of the grower's net income. Most of the growers use a substantial portion of their produce for domestic consumption. In fact, for some, cultivation is mainly for domestic consumption, though they would sell the surplus. But, for many, cultivation is certainly not guided by such considerations as profit maximisation and input efficiency. Many coconut plots are, therefore, operated in conditions of low input use. We deliberately avoid usage of terms such as grown under conditions of neglect', as the rationale behind such terms need not apply in full to local conditions.

Despite the above limitations, average profits from coconut cultivation of the sample households have been compared size-wise using correlation.

Data on average profit from coconut cultivation is presented. This was arranged according to size of holdings. In order to study the relationship between average profit and size-wise distribution of holdings, we used correlation which worked out to 0.054. The value of the correlation co-efficient was not significant even at the 5 per cent level. Therefore, we cannot argue in favour of any significant relationship between size of holding and average profit per acre. As neither any significantly positive nor negative relationship exists we can only say from the data that average profit does not change significantly with differences in size of holdings.

The field survey also revealed that, among cultivable crops, coconut was still the most profitable one. This is because other crops which are profitable, such as rubber and coffee, cannot be grown on coconut land.

Competing crops such as tapioca, oil palms, yams, pepper, nutmeg, ginger, banana, plantain etc do not offer better profits.

The distribution of households of various sizes according to profit range reveals quite interesting facts. For sizes below 200 cents profit per acre is below the range of Rs.501-750. Incidently, the size 101-200 cents shows 11 cases above Rs.5000 per acre and, as expected, sizes above 600 cents have profitability above Rs. 5000 per acre. These findings are not unexpected as they are mainly large-size holdings which can have high profits per acre as the size of their marketed surplus is larger.

Coconut Prices and Marketing

A study of yearly changes in farm prices shows that farm prices of coconut have been widely fluctuating. Though unstable, the price changes have been progressive and therefore must have acted as an incentive for many farmers to adopt coconut cultivation.

An analysis of yearly trends in coconut farm prices over the 22 year period starting 1955-56 and ending 1977-78 shows that there has been an average increase of 28.11 per cent, while the average increase for all major crops was 25.33 per cent. Thus the farm price increase of coconut in these 22 years was only slightly higher than normal. In this period coconut farm prices registered the second highest increase among farm prices of other important crops. Coconut farm prices increased by 591 per cent compared to 901 per cent increase in cashewnut farm prices and fared much better than arecanut whose farm price increased only by 113 per cent.

It is clear that, though there were wide fluctuations in the prices of coconut from time to time, in general there was a substantial increase in the farm price, witnessing an increase from Rs. 137.40 per 1000 nuts in 1955-56 to Rs. 1266.40 per 1000 nuts in 1982-83.

Wholesale prices have also kept fluctuating over the period under study. As can be seen, absolute prices also witnessed a very fast rate; the price level increasing from Rs. 131 per 1000 nuts to Rs. 1410.28 in 1981-82.

In order to better analyse the changes in farm prices of coconut between 1955-56 and 1982-83 we broke down the period into three year sub-periods. Farm prices of coconut increased most rapidly between 1964-65 and 1966-67. The second highest increase was bwteeen 1955-56 to 1957-58. Price decreased in two sub-periods. Between 1973-74 and 1975-76 it was highest with a decline of 24.88 per cent. Price declined again between 1970-71 and 1972-73. There was an increase in price in other sub-periods ranging from 9.93 per cent and 12.50 per cent except in 1979-80 to 1981-82 when it increased only by 0.96 per cent.

An increase in price, other things being equal, should result in an increase in production. But this takes place with a time lag. In the case of coconut, which is a perennial crop, there are two kinds of time lags in the changes in production. These two time lags are short-term and long-term. The short-term time lag in changes in production take place as a result of changes in cultural practices such as irrigation, manuring, spading, plant protection measures etc. This time lag takes place normally within a year. The other time lag in changes in production takes place through an increase in area under coconut cultivation and the time-period involved is the gestation period of the newly planted palms begining to yield.

We measure here the changes in production taking place in the short-term. In order to study the impact of changes in prices on changes in production we have used correlation method. We have tried to measure the impact of farm price of coconut and wholesale price of coconut oil on production. On correlating farm price and production of coconut between 1955-56 to 1981-82 we got a co-efficient of 0.035. This was not significant statistically. So a definite answer cannot be given regarding the relationship between the two. But, it must be noted that the relationship is positive. A positive co-efficient would signify that a change in price is followed by a change in production in the same direction.

To see if changes in wholesale price of coconut oil had any impact on production of coconut we used correlation analysis. The resultant co-efficient was -0.187. This was not statistically significant, but we observe that the relationship is negative. A negative relation signifies that changes in price have an opposite impact on production.

Prices of coconut and coconut oil are to a large extent determined by excess demand as reflected in the quantum of imports. Production of the major oil seeds also had no influence on coconut oil prices. This may be due to limited substitutability of coconut oil by other oils, due to entrenched food habits and tastes. Moreover, production of other oils may not have a strong influence as it may be excess demand which influences price.

The parity index calculation made by us shows that coconut farmers were in a favourable position. This is because except for three years between 1955-57 and in 1975-76 prices received by coconut farmers was greater than prices paid by them.

Parity index, however, is not adequate to explain the problem faced by coconut farmers, or the absence of it. This is particularly true of the large proportion of small coconut cultivators. Only a detailed class-wise, size-group-wise analysis will give us adequate clue about the implications of the apparently favourable parity index. It is, ofcourse, true that coconut farmers are better of than farmers of many other crops in this respect.

Marketed Surplus

On analysing marketed surplus per acre for various size-classes of holdings it was seen that it gave a very weak though positive correlation. The value of the correlation co-efficient was 0.003, which is almost insifnificant. But on analysing table 6.8 it was seen that till the size-group 401-500 cents marketed surplus per acre kept increasing. It was lowest for size-group 0-50 cents with 471 nuts per acre. From the size-group 501-600 cents onwards there was no regular trend in marketed surplus. The figure of 3466 for size-group 601-700 is not taken into consideration as it is exceptional.

The trade in coconut oil is also controlled by a handful of traders, most of whom are the millers themselves, whereas the retail market for coconut oil is spread all over the country. Due to the lack of good number of wholesale traders, competition is weak and prices are not always determind by supply and demand. The markets for coconuts and coconut products are well integrated and the prices of coconuts and copra are determined by the coconut oil prices.

Only about 50 per cent of the 2.95 lakh tonnes of copra produced in Kerala is used for crushing in the local milling sector and the balance is marketed mainly to Maharashtra. The copra crushed annually in Kerala yield 96000 tonnes of coconut oil.

About 3/4 of the nuts produced in Kerala are disposed off in the form of nut itself by the cultivators after retaining 15 per cent for their own consumption. Out of this, 950 million nuts are used up in raw form in Kerala annually.

The share of marketed nuts in total production was found to be about 79 per cent. The number of nuts marketed declined by more than 18 per cent between 1981 and 1983. Analysis of marketed surplus per acre in relation to size of the coconut gardens gave only a weak correlation co-efficient of 0.003. This implies that marketed surplus is uniformly distributed among different size-groups.

The prices of coconut are largely determined by merchants. Following the import of coconut oil, the demand for coconut oil from Kerala has declined. This has had a dampening and often disturbing effect on the production of coconut.

Decline in coconut prices, even for brief periods, has undoubtedly serious implications to the survival of Kerala's economy in general and the State's agrarian economy in particular.

Hence, appropriate policy instruments have to be evolved by the government for ensuring not only remunerative prices for the coconut farmers but also to avoid undue fluctuations in coconut farm prices. This would, necessarily involve the creation of a viable market structure.

S T A T I S T I C A L   A N N E X U R E S

TABLE A. 1

Average Area Under Coconut in Different Plan Periods

State/U.T.	1950-51	Average during plans+					
		I	II	III	AP	IV	V
Andhra Pradesh	33.2 (100)	34.1 (10[illegible])	34.7 (104)	33.9 (102)	34.5 (104)	38.1 (115)	40.0 (120)
Assam	0.8 (100)	0.8 (100)	1.3 (163)	3.2 (400)	3.7 (462)	4.0 (500)	4.8 (600)
Karnataka	93.2 (100)	88.2 (95)	92.4 (99)	106.7 (114)	110.3 (118)	133.5 (143)	153.8 (165)
Kerala	409.4 (100)	434.7 (106)	478.4 (117)	546.9 (134)	644.7 (157)	729.5 (178)	694.5 (170)
Maharashtra	8.1 (100)	7.9 (98)	7.4 (91)	8.1 (100)	9.1 (112)	9.1 (112)	9.1 (112)
Orissa	4.5 (100)	4.5 (100)	4.6 (102)	7.6 (169)	8.1 (180)	10.6 (236)	13.3 (296)
Tamil Nadu	66.0 (100)	55.0 (83)	52.9 (80)	75.1 (114)	84.8 (128)	103.3 (157)	109.3 (166)
Tripura	NA	NA	NA	NA	0.2	0.4	0.8
Westt Bengal	6.9 (100)	6.8 (99)	6.8 (99)	6.9 (100)	6.7 (97)	6.7 (97)	6.7 (97)
A&N Islands	1.6 (100)	1.7 (106)	5.5 (334)	8.0 (500)	8.7 (544)	14.9 (931)	19.5 (1219)
Goa	NA	NA	NA	NA	19.7	19.3	18.7
Lakshadweep	2 .8 (100)	2.7 (96)	2.3 (82)	2.7 (96)	2.7 (96)	2.8 (100)	2.8 (100)
Pondicherry	NA	NA	1.1	1.2	1.3	1.6	1.6
INDIA	625.5 (100)	636.7 (102)	687.3 (110)	810.5 (129)	935.0 (149)	1073.7 (171)	1074.4 (172)

Note: Figures in parentheses denote indices in respect to pre-Plan year of 1950-51 as the base.

\+ I Plan : 1951-52 to 1955-56 AP (Annual plan) 1966-67 to 1968-69
II Plan :1956-57 to 1960-61 IV Plan - 1969-70 to 1973-74
III Plan ;1961-62 to 1965-66 V Plan - 1974-75 to 1977-78
(For this study 1978-79 has been included under the V plan)

Source: Prafulla K Das, "Coconut Situation in India", Agricultural Situation in India, Vol. XXXVIII, No.5, August, 1983.

TABLE A.2

Coefficient of Variation of Area, Production and Yield of Coconut in Different States in India

State/U.T.		1951-52 to 1955-56	1956-57 to 1960-61	1961-62 to 1965-66	1969-70 to 1973-74	1974-75 to 1978-79	1951-52 to 1980-81
Andhra Pradesh	A	2.29	3.14	1.84	2.79	1.10	7.69
	P	10.73	3.04	20.52	9.76	2.20	27.83
	Y	12.24	1.47	21.55	11.70	1.44	33.06
Karnataka	A	2.92	4.86	8 .85	3.41	4.09	22.99
	P	2.90	7.31	10 . 30	7.30	5.67	32.77
	Y	1.30	2.58	13.35	6.52	1.85	13.51
Kerala	A	3.14	3.36	4.85	2.00	4.31	19.05
	P	14.38	2.00	0.64	3.01	6.59	12.25
	Y	12.08	2.68	4.51	4.38	3.35	13.89
Maharashtra	A	2.31	7.44	1.21	5.32	1.50	10.14
	P	13.96	14.54	8.92	2.81	7.34	24.52
	Y	15.57	19.76	8.42	4.09	7.49	19.08
Orissa	A	0.00	4.35	18.33	1.28	14.35	13.89
	P	2.21	28.57	29.02	1.28	20.26	39.58
	Y	2.21	23.00	55.88	1.17	6.04	45.58
Tamil Nadu	A	11.94	2.86	15.87	6.36	0.46	29.49
	P	5.32	2.88	22.44	3.62	2.53	36.01
	Y	5.76	0.39	16.09	4.99	2.67	12.41
A & N Islands	A	2.38	37.69	6.74	33.92	1.43	65.24
	P	0.00	45.75	5.88	23.37	2.78	61.70
	Y	2.47	29.61	6.18	13.61	1.56	29.91
Lakshadweep	A	8.64	6.90	13.64	0.00	0.00	9.35
	P	14.29	23.53	11.11	3.70	1.89	24.58
	Y	12.68	33.33	8.02	8.02	3.70	21.20
INDIA	A	1.15	3.41	6.68	2.67	2.07	20.76
	P	8.99	2.27	4.47	1.85	3.47	14.26
	Y	8.59	1.84	3.18	3.13	2.22	9.18

Note: A = Area
P = Production
Y = Yield

Source: Ibid.

TABLE A.3

Percapita Coconut Production in Different Coconut Producing States in India

(Number of Nuts)

State/Union Territory	1951	1961	1971	1981
Andhra Pradesh	9.8	8.3	3.6	3.3
Assam	1.6	0.7	0.7	1.8
Karnataka	19.0	21.1	25.0	23.9
Kerala	149.0	190.5	186.0	119.5
Maharashtra	0.9	0.7	0.9	1.0
Orissa	2.3	3.8	1.8	3.8
Tamil Nadu	15.4	13.3	22.9	23.4
Tripura	NA	NA	0.3	0.7
West Bengal	0.8	0.6	0.5	0.6
Andaman & Nicobar Islands	100.0	500.0	316.0	515.8
Goa	NA	NA	81.4	95.5
Lakshadweep	750.0	750.0	666.7	525.0
Pondicherry	NA	32.4	34.0	25.0
INDIA	9.1	10.6	11.1	8.3

Source: Ibid.

TABLE A.4

Percentage of Area Under Coconut to the Net Area Sown (NAS)

State/Union Territory	1951-52	1971-72	1976-77
Andhra Pradesh	0.33	0.34	0.37
Assam	0.04	0.18	0.18
Karnataka	0.97	1.28	1.67
Kerala	23.69	33.39	31.58
Maharashtra	NA	0.06	0.05
Orissa	0.08	0.17	0.22
Tamil Nadu	1.27	1.80	1.81
Tripura	NA	0.18	0.33
West Bengal	0.13	0.12	0.11
Goa	NA	NA	22.50
Pondicherry	NA	NA	4.95
INDIA	0.53	0.78	0.77

Source: Ibid.

TABLE A.5

Productivity of Plantation Crops in India During the Last Three Decades

Crops (Kg/ha.)	1950-51	1955-56	1960-61	1965-66	1970-71	1975-76	1980-81
Tea	901	963	1070	1089	1221	1405	1519
Coffee	202	340	567	493	814	490	601
Rubber	284	353	365	448	653	772	790
Cashewnut	NA	720	634	596	584	465	314
Pepper	271	318	277	219	213	277	248
Coconut (nuts/ha)	5284	6523	6428	5775	5813	5449	5249

Source: M.K.Muliyar and Prafulla K.Das, "R & D Systems and their Constraints: Transfer of Technology in Smallholder Plantation Agriculture", Background Papers: Workshop on Changing Perspectives in Extension (March 12-15, 1984) National Institute of Rural Development, Hyderabad.

TABLE A.6

Yield Gap Between National Average and Best Managed Gardens in Plantation Crops

Crops	Yield (Kg/ha)		Gap	
	Best Managed Garden	National average	Actual	Percentage of National
Tea	3100	1743	1357	77.9
Coffee	1575	750	825	110.0
Rubber	2000	790	1210	153.2
Cashew	1000	314	686	218.5
Cardamom	200	48	152	316.7
Pepper	1100	233	867	372.1
Coconut	23100	5249+	17851	340.0

\+ Number of coconuts

Source: *Ibid*.

TABLE A.7

Effect of Rainfall on the Yield of Coconut

Year	Mean yield of nuts/ha.	Rainfall (mm.)	Number of rainy days
1967	921.3	2424.5	158
1968	953.3	1766.5	145
1969	872.4	3233.8	160
1970	865.3	2669.4	152
1972	982.8	2818.0	143
1973	906.7	2848.8	164
1974	719.0	2317 .5	147
1975	755.8	2500.6	143
1976	924.8	3505.9	166
Mean	884.2	2805.3	153.5

Source: Mathai, K.S. Panicker, A note on the relationship between yield of coconut and rainfall pattern in the backwater region of Kerala, Agricultural Research Journal of Kerala, 1978, 16 (2), p.254.

TABLE A.8

Effect of Irrigation and Fertilizer on Yield of WCT

Treatment	Total production of nuts/palm till 1977	Mean yield of nuts/palm in 1977
q 1	106	51
q 2	106	51
q 3	102	47
f 1	123	56
f 2	107	40
f 3	83	43
m 1	81	43
m 2	115	42
m 3	117	53

Note: q = depths of irrigation water, viz, 20,40 and 60 mm

f = Irrigation water per cumulative pan evaporation ratios: 1.00, 0.75, 0.50

m = Fertilizer mixture 500 - 300 - 750 - 170, 750-670-1500-170, and 1000-1000-2250-170 g/palm/year of N, P_2O_5, K_2O and MgO

Source: E.V.Nelliat and P.K.Padmaja, Irrigation requirement of Coconut and response to levels of fertilizer under irrigated conditions during the early bearing stage, in E.V.Nelliat (ed.), Agronomy, Soils Physiology and Economics of Plantation Crops, from proceedings of the First Annual Symposium on Plantation Crops, Placrosym-1, 1978.

TABLE A.9

Response of WCT Palms to Irrigation and Fertilizers

Treatment	Yield of nuts/palm/year 1977-78 to 1980-81
q1	65.3
q 2	60.3
q 3	55.3
f 1	66.0
f 2	60.0
f 3	54.5
m 1	55.0
m 2	62.3
m 3	63.8
q3 t1 mo	29.8
q3 t2 mo	20.8
q3 t3 mo	26.5
qo to m2	28.5
Sig effects	1 t m and tm significant at 5% level

Note: (q) 20,40 and 60 mm (f) IW/CPE ratios 1.00, 0.75 and 0.50 (m) 500-300-750-170 (gms NPK mg), 750-670-1500-170 and 1000-1000-2250-170

Source: E.V.Nelliat, P.Gopalasundaram and K.Sivaraman, "Irrigation cum fertilizer experiment from early stage of growth," Annual Report 1981, CPCRI, Kasargod.

TABLE A.10

Result of Florida Fertiliser Trials on Nut Production Characteristics

Treat- ment	Fertilizer NPK: 12-4-28 (Ib./palm)	No nuts per palm	No bunches per palm	No nuts per bunch	No flowers per inflore- scence	Percentage set
A	2	59.8	12.8	4.7	14.1	38.4
B	4	70.6	12.7	5.8	16.1	39.4
C	6	73.0	12.4	6.3	18.7	35.2
D	8	58.8	12.7	4.6	12.6	39.4
E	10	93.0	13.9	6.7	18.8	39.6

Source: Compiled from "Results from Florida Hillside Experiment F/24, 1978, C.I.Barrant, Agronomy/Crop Physiology, 18th Re/prt of the Research Department (1978), The Coconut Industry Board, Jamaica, West India, p.31.

TABLE A.11

Yield and Economic Consideration of Intercropping (1973-74)

Intercrop	Scientific name	Variety	Yield(t/ha) Gross area of coconut	Yield(t/ha) Net area of intercrop	Net return per unit amount of cost of cultivation	Energey equivalent of harvested produce/ha. (million K.Cal.)
Elephant foot yam	Amorphophalus companulatus	Local	12.85	16.06	1.28	10.15
Casaava	Manihot utilissima	H.165	10.51	11.90	1.37	16.50
Sweet Potato	Ipomoea batatus	H.42	9.53	13.61	1.00	11.46
Yam	Dioscorea alata	Local	12.72	15.90	1.70	17.14
Lesser yam	Dioscorea esculenta	Local	9.00	11.25	1.29	12.06
Coleus (Chinese potato)	Coleus barbatus	Local	6.00	9.23	1.83	2.94
Ginger	Gingiber officunarum	Rio-de-janeiro	11.57	17.80	2.46	7.75
Trumeric	Curcuma longa	Armoor	12.93	19.90	0.29	11.25

Source: P.K.R.Nair, K.V.A. Bavappa and E.V.Nelliat, "Intensive farming programmes for small sized coconut plantations", Fourth session of the FAO Technical working party on coconut production, protection and processing, Jamaica September, 1975.

TABLE A.12

Total Productivity of Coconut and Cocoa in a Four Year Oild Mixed Cropping Experiment

Treatment	Plant population per hectare		Average yield of coconut palm (nuts/palm/year)			Annual increase in productivity per ha. over the pre-experimental level	
	Coconut	Cocoa	Before planting cocoa	After planting cocoa	Response	Coconut (no. of nuts)	Cocoa (dry beans kg.)
Coconut alone	175	-	73.25	120.39	47.14	8429	-
Coconut + single hedge cocoa	175	350	66.50	112.53	45.53	7932	200
Coconut + double hedge cocoa	175	650	50.45	108.95	58.50	10237	275

Source: E.V. Nelliat, K.V.A. Bavappa and P.K.R. Nair, "Multi-storeyed Cropping: New Dimensions of Multiple Cropping in Coconut Plantations", World Crops.

TABLE A.13

Average Yield per Palm/tree from Multistoryed Cropping as Cocoa, Single Hedge with Coconut + Pepper + Pineapple/hectare

Year	Coconut (Numbers)	Cocoa (Number of pode)	Pepper (Kg.)	Pineapple (Kg.)
1.	82	-	-	-
2.	69	-	-	-
3.	108	-	-	1.100
4.	122	-	-	0.850
5.	115	3	0.280	1.000
6.	124	4	0.295	1.000
7.	81	7	0.240	1.400
8.	80	12	0.700	0.900
9.	122	27	1.000	-
10.	117	31	0.610	0.880

Source: E.V. Nelliat, K.V.A. Bavappa and P.K.R. Nair, "Multi-storeyed Cropping : New Dimensions of Multiple Cropping in Coconut Plantations", World Crops.

TABLE A.14

Yield Data During 1973-74 of Different Crops in an Observational Trial on Multistoreyed Cropping at CPCRI Initiated in 1970

Sl.No.	Treatment	Gross area Sq.m.	Coconut			Cocoa		Total yield of pineapple (Kg)
			No.of palms	Yield of nuts per palm/year		No.of plants	Total No. of pods harvested	
				Pre-treatment average	Average for 2 years 1972-73 & 1973-74			
1.	Coconut + Cocoa	1000	26	57.92	82.40	77	310	-
2.	Coconut + pineapple + cocoa	1000	20	61.35	87.53	75	945	102
3.	Coconut + cocoa + pepper	910	17	57.50	73.25	68	834	-
4.	Coconut + cocoa + pepper + pineapple	920	15	50.16	65.79	50	411	192

Source: E.V.Nelliat, K.V.A. Bavappa and P.K.R. Nair, "Multi-storeyed Cropping : New Dimensions of Multiple Cropping in Coconut Plantations", *World Crops*.

TABLE A 15

Area Under Important Crops

1	1975-76 (2)	1980-81 (3)	1981-82 (4)
1. Net cultivated area	2189172	2179590	2189850
2. Gross cropped area	2981279	2884840	2905257
3. Cultivable area	2362099	2379087	2381847
4. Cultivated area			
Area under autumn paddy	397232	349243	347077
Area under winter paddy	383706	354132	356074
Area under summer paddy	104031	98324	103700
Gross area under paddy	884969	801699	806851
Area under food grains	926069	841670	846193
Area under tapioca	326865	244990	248069
Area under coconut	692945	651370	666618
Area under arecanut	76618	61242	61251
Area under cashew	109057	141277	139960
Area under pepper	108251	108073	108242
Area under ginger	11671	12662	13447
Area under banana	11155	14318	14068
Area under banana & plantain	52280	49262	49989
Area under pineapple	8971	5419	5373
Area under fruits	316565	345679	340490
Area under vegetables	327389	312994	315675
Area under food crops	1909205	1778001	1781932
Area under tea	37698	36164	35625
Area under rubber	206686	237769	237769
Area under coffee	41778	57949	57949
Area under cocoa	-	23506	23381
Area under fodder & green manure crops	18800	12907	11818
Area under sugarcane	7596	8041	8381
Area under mango	68215	62574	60181
Area under jack	50174	61918	61037

Source: Government of Kerala, Department of Economics and Statistics, Statistics for Planning, Trivandrum, 1986 p. 7

TABLE A 15 (Contd.)

	1982-83	1983-84	1984-85
1	5	6	7
1. Net cultivated area	2179754	2180355	2184423
2. Gross cropped area	2862073	2861702	2874643
3. Cultivable area	2381847	2379756	2383400
4. <u>Cultivated area</u>			
Area under autumn paddy	342669	327783	318611
Area under winter paddy	352273	324560	326812
Area under summer paddy	83548	87743	84956
Gross area under paddy	778490	740086	730397
Area under food grains	813370	775967	764576
Area under tapioca	227617	233010	216742
Area under coconut	674378	682281	687483
Area under arecanut	60816	59604	56778
Area under cashew	141307	142339	136863
Area under pepper	107467	106143	105835
Area under ginger	12662	14883	14537
Area under banana	14126	15185	16123
Area under banana & Plantain	48038	49593	35294
Area under pineapple	4466	4703	4836
Area under fruits	335279	338345	332463
Area under vegetables	290650	300145	278809
Area under food crops	1714378	1690125	1650794
Area under tea	35205	35021	34976
Area under rubber	256283	271200	311976
Area under coffee	57905	62368	64009
Area under cocoa	18234	18052	17860
Area under fodder & green manure crops	10154	11467	10588
Area under sugarcane	7814	8084	7839
Area under mango	60205	60201	59984
Area under jack	59990	58870	58052

TABLE A 16

Area under Coconut - District-wise

District	1975-76	1980-81	1981-82	1982-83	1983-84	1984-85
Trivandrum	74074	73771	73515	73727	73568	76969
Quilon	98073	81765	84544	85178	75018	68927
Pathanamthitta	-	-	-	-	28807	25926
Alleppey	72824	63114	62118	62118	46907	45699
Kottayam	58168	51115	50751	50876	50914	48179
Idukki	11472	16617	17371	17371	16523	15036
Ernakulam	50726	60881	62317	62916	62038	55678
Trichur	50699	54030	57312	57312	58929	62438
Palghat	16994	22954	22916	23688	23186	25504
Malappuram	70269	59677	57919	60970	60739	62214
Kozhikode	97448	94466	97308	98392	100164	107599
Wynad	-	-	3535	3535	3612	3251
Cannanore	92198	72980	77012	78295	81876	90063
State	692945	651370	666618	674378	682281	687483

Source: Government of Kerala, Department of Economics & Statistics
Statistics for Planning, Trivandrum, 1986 P. 14

TABLE A 17

Production of Important Crops in Kerala

(in tonnes)

Crop	1975-76	1980-81	1981-82
1	2	3	4
Food crops			
Rice	1364867	1271962	1339393
Jowar	1438	845	525
Ragi	5001	1131	1100
Other cereals & millets	3297	1768	1798
Pulses	14900	22479	22286
Sugarcane (gur)	41831	48178	49749
Pepper (black)	24580	28519	27511
Chillies (dry)	2442	1064	1154
Ginger (dry)	28840	32039	34379
Turmeric (cured)	2608	6141	6027
Cardamom (processed)	2050	3244	2800
Betalnuts (million nuts)	11387	10805	10702
Banana & other plantain	395042	317405	327525
Cashewnut (raw)	122360	81900	78898
Tapioca	5390217	4060911	3745142
Jack fruits (in '000)	-	261764	248232
Mango	-	281873	280017
Non food crops			
Groundnut	35268	8225	8572
Sesamum	4271	3833	4000
Coconut (million nuts)	3439	3008	3006
Cotton (bales of 170Kg)	10273	9847	10724
Tobacco	1230	1015	1050
Tea	43264	50716	45467
Coffee	14395	23540	33655
Rubber	128769	140333	139455
Cocoa	-	3020	2894
Lemongrass oil	-	267	232

Source: Government of Kerala, Department of Economics & Statistics, *Statistics for Planning*, Trivandrum, 1976, P.17

TABLE A 17 (Contd.)

Crop	1982-83	1983-84	1984-85
1	5	6	7
Food Crops			
Rice	1306197	1207916	1255902
Jowar	507	661	925
Ragi	920	1028	1000
Other cereals & millets	1511	1829	1809
Pulses	19904	19912	20384
Sugarcane (gur)	82135	87062	42754
Pepper(black)	24526	24549	17350
Chillies (dry)	1143	930	913
Ginger (dry)	31581	36705	41245
Turmeric (cured)	5192	5841	5186
Cardamom (processed)	1900	1963	2850
Betalnuts (million nuts)	11027	8318	9269
Banana & other plantain	291399	316653	331192
Cashewnut (raw)	75495	77375	72294
Tapioca	3848718	3903169	3694270
Jack fruits (in '000)	254946	242417	228439
Mango	267489	190655	193327
Non food crops			
Groundnut	9074	8578	11768
Sesamum	3648	3838	3632
Coconut (million nuts)	3184	2602	3453
Cotton (bales of 170 Kg)	9336	9969	10010
Tobacco	987	1016	981
Tea	45439	44214	56329
Coffee	21785	9465	-
Rubber	152662	162212	188900
Cocoa	3173	3936	4536
Lemongrass oil	341	323	351

TABLE A 18

Production of Coconut - District-wise

(Million nuts)

District	1975-76	1980-81	1981-82	1982-83	1983-84	1984-85
Trivandrum	428	354	355	279	290	488
Quilon	485	344	356	319	223	275
Pathanamthitta	-	-	-	-	79	124
Alleppey	404	294	295	367	180	282
Kottayam	288	188	200	226	153	192
Idukki	61	43	44	45	40	44
Ernakulam	269	327	344	332	264	363
Trichur	299	347	381	355	322	297
Palghat	56	80	77	80	63	76
Malappuram	311	264	247	261	162	193
Kozhikode	523	456	443	622	549	676
Wynad	-	-	4	6	2	2
Cannanore	315	311	260	292	275	441
State	3439	3008	3006	3184	2602	3453

Source: Government of Kerala, Department of Economics & Statistics *Statistics for Planning*, Trivandrum, 1986 P. 23

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FIELD SURVEY

ON

A STUDY OF THE COCONUT ECONOMY OF KERALA

1956-1983

SCHEDULE FOR

AGRICULTURAL HOUSEHOLDS

BLOCK 1

IDENTIFICATION PARTICULARS

---

1 District

2 Taluk

3 NES block

4 Panchayat

5 Ward number

6 House number

7 Name of head of household

8 Address

9 Name of informant and his/her relationship to head

10 Date of interview

BLOCK 2

DETAILS OF HEAD OF HOUSEHOLD

---

1 Main occupation

2 Subsidiary occupation

3 Education
   a) General
   b) Technical

4 Skill

BLOCK 3

PARTICULARS OF FARM (Area in Cents)

---

1 Total net area possessed

2 Area under garden land

3 Area under wet land

4 Number of times wet land sown

5 Crops grown and their respective area or number:

	Crop	1983		1982	
		Area	Number	Area	Number
a)	Rice				
b)	Coconut				
c)	Plantain & Banana				
d)	Pepper				
e)	Tapioca				
f)	Cocoa				
g)	Pineapple				
h)	Ginger				
i)	Others(specify)				

6 Nature of cultivation Mixed /__/ Intercropping /__/

7 Area under coconut/number

1983		1982		1981	
B	N.B	B	N.B	B	N.B

BLOCK 3 (Contd.)

8	Distribution of palms according to their quality	Local		Improved/HYV	
9	Age-wise distribution of non-bearing palms				
	a) Local	1-2	3-5	6-10	11-15
	b) Improved/HYV	1-2	3-4	5-6	7-8
10	Production	1983	1982	1981	
11	Disposal of coconut	1983	1982	1981	
	a) Marketed				
	b) Consumed				
	c) Other purposes (specify)				
12	Average yeild per palm	1983	1982	1981	
13	Price per 100 nuts	1983	1982	1981	

Note: B = Bearing, N.B = Non Bearing.

BLOCK 4

DETAILS ON INCENTIVES

		1983	1982	Since 1977	Since 1960
1	Incentives received from Government/Coconut Development Board/Kerala Agriculture Development Programme.				
	a) Seedlings				
	b) Subsidy				
	c) Loan				
	d) Others (specify)				
2	Use of incentives				
	a) Seedlings				
	b) Subsidy				
	c) Loan				
	d) Others (specify)				

BLOCK 5

ROOT-WILT DISEASE

1 a) Is your holding root-wilt affected ? Yes /____7 No /____7

b) If Yes, whether

i) Severely affected

ii) Moderately affected

iii) Just affected

2 Number of trees affected

3 Measures taken against root-wilt/leaf disease

a) Spraying

b) Intensive manuring

c) Farmyard manure application

d) Application of Maroti pinnakku/Veppu Pinnaku

e) Others (specify)

4 What do you think is the best solution for root-wilt ?

BLOCK 6

INPUT COSTS IN 1983 AND ADOPTION OF MODERN PRACTICES

		Number of family labour days		Number of hired labour days		Wages per unit		Total imputed wages		Total paid wages	
1	Tilling	M	F	M	F	M	F	M	F	M	F

		Number	Price/ seedling	Cost/ Variety	Total Cost
2	a) New seedlings planted				
	i) Local ordinary				
	ii) Local improved				
	iii) Hybrids				
	iv) Other HYV				

	Charges per seedling	Number of seeds planted by family labour	Number of seeds planted by hired labour	Total imputed charges	Total paid charges
b) Planting charges					

		Type	Quantity	Cost/ unit	Cost/ type	Total cost
3	a) Fertilizer used					

	Number of family labour days	Number of hired labour days	Charges per unit	Total imputed charges	Total paid charges
b) Application charges					

BLOCK 6 (Contd.)

4 Farmyard manure

a) Purchased

Type	Quantity	Cost/unit	Cost/type	Total cost

b) Home produced

Type	Quantity	Market cost per unit	Imputed cost per type	Total imputed cost

c) Application charges

Number of family labour days		Number of hired labour days		Charges per unit		Total imputed charges	Total paid charges
M	F	M	F	M	F		

5 a) Pesticides used

Type	Quantity	Cost/unit	Cost/type	Total cost

b) Application charges

Number of family labour days		Number of hired labour days		Charges per unit		Total imputed charges	Total paid charges
M	F	M	F	M	F		

BLOCK 6 (Contd.)

6	Plucking charges	Average number of palms climbed	Number of plucking in a year	Charge per tree	Material cost	Total plucking charges

7	Gathering charges	Number of family labour days		Number ofhired labour days		Wages per day		Material cost	Total imputed cost	Tota paid cost
		M	F	M	F	M	F			

8	Other Cultural operations (specify)	Number of family labour days		Number of hired labour days		Wages per day		Material cost	Total imputed cost	Total paid cost
		M	F	M	F	M	F			

i)

ii)

9 If irrigated

a) Source

i) Lift
ii) Tube well
iii) Well
iv) River/Canal
v) Springler
vi) Pond
vii) Hand drawn
viii) Any other

BLOCK 6 (Contd.)

b) Irrigation charges

i)	Number of wettings	Number	Charge/ wetting	Total cost for wetting	Total Irrigation charges

ii)	Water cess	Number of units	Cess Charges per unit	Total cess charges

iii)	Labour charges	Number of family labour days		Number of hired labour days		Charges per unit		Total imputed charges	Total paid charges
		M	F	M	F	M	F		

iv)	Fuel	Monthly average bill	Number of months used	Total bill

v)	Other expense/ hire charges	Days used	Charges per day	Total Charges

10	Cutting of old Palms	Number of palms cut	Cost of cutting per palm	Total cost of cutting

Note: M = Male, F = Female

BLOCK 7

APPROACH TO UNPRODUCTIVE PALMS

1	a)	Have you cut unproductive palms ?	Yes /___/	No /___/
	b)	If not why ?		
		i) No special effort/cost		
		ii) Uncertainly about yield of new planted palms		
		iii) Others		
2	a)	Have you replanted ?	Yes /___/	No /___/
	b)	If yes, what variety ?		
3		Has cutting and replanting of unproductive palms increased per acre production and income	Yes /___/	No /___/

BLOCK 8

CULTIVATION ASPECTS AND PRICES

1 Varieties of Coconut palm now in the field

a) Traditional variety
b) D x T, T x D
c) Others (specify)

2 Number of Coconuts produced (average) — 1983 1982 1976 1971

a) Traditional variety
b) D x T, T x D
c) Others (specify)

3 Does application of modern pracices (fettilizers, irrigation, pesticides, weedcide) increase profits compared to traditional methods of cultivation ? Yes [ ] No [ ]

4 Prices received per coconut

a) Traditional
b) T x D, D x T
c) Others (specify)

5 Can you afford cost on modern practices ? Yes [ ] No [ ]

BLOCK 9

HOUSEHOLD EXPENDITURE AND DEBT

(In Rupees)

Sl.No.	Particulars	Quantity	Cost/Unit	Total Cost
1.	Rice			
2.	Wheat			
3.	Tapioca			
4.	Fish			
5.	Meat			
6.	Milk			
7.	Pulses			
8.	Vegetables			
9.	Condiments			
10.	Toddy & Other intoxicants			
11.	Cigarette and Beedi			
12.	Fuel			
13.	Electricity			

BLOCK 9 (Continued)

(In Rupees)

Sl.No.	Particulars	Quantity	Cost/Unit	Total Cost
14.	Newspaper			
15.	Periodicals			
16.	Cinema			
17.	Travel Expenditure			
18.	Others			
19.	Clothing			
20.	Education			
21.	Medical expences			
22.	Maintenance & Repair of house			
23.	House rent			
24.	Tax			
25.	Other items			

BLOCK 10

REASONS FOR DECLINE IN AREA, PRODUCTION AND YIELD IN 1983

---

1. a) Has production and yield declined ? Yes [ ] No [ ]

   b) Reasons

      I. Disease

      II. Lack of proper attention

         i) Irrigation
         ii) Cultural practices
         iii) Manuring
         iv) Fluctuations in output prices
         v) Rise in input prices

      III. Natural calamities : drought, floods

      IV. Declining quality of soil

      V. Ageing of palms

2. a) Have you changed coconut cultivation ? Yes [ ] No [ ]

   b) If yes, extent of reduction in area under coconut

   c) If yes, what change ?

   d) If yes, reasons

BLOCK 10 (Continued)

i) Location factor : too far
ii) Problem of theft
iii) Competition from other crops
iv) Management problems
v) Reduction in profit
vi) Others (specify)

3. a) Have you changed cultivation methods ? Yes [ ] No [ ]
b) If yes, what change ?
c) Reasons:

i) Old methods costly
ii) New methods more profitable
iii) New methods effective against root-wilt
iv) Influence from government and scientific personnel
v) Others

4. a) Have you abondoded or reduced manuring with chemical manures ? Yes [ ] No [ ]
b) If yes, extent of change
c) Reasons:

i) Unremunerative
ii) Rising cost
iii) Ineffective
iv) Adulterated

BLOCK 10 (Continued)

5. a) Have you reduced or abandoned use of farmyard manure? Yes [ ] No [ ]

   b) If yes, extent of change

   c) Reasosns:

      i) Lack of availability
      ii) Transporting cost high
      iii) Shortage of labour
      iv) Rising labour cost
      v) Other reasons

6. a) Have you reduced or abandoned irrigation? Yes [ ] No [ ]

   b) If yes, extent of change

   c) Reasons:

      i) Lack of perennial sources
      ii) Other reasons (specify)

BLOCK 11

EVALUATION OF HYBRIDS AND H Y V

1. Have you used hybrids and HYV ? Yes [ ] No [ ]

2. What is your opinion about it ?

   a) About productivity

   b) About resistance to root-wilt

BLOCK 12

EVALUATION OF INTERCROPPING

1. a) Has intercropping increased productivity ? Yes [ ] No [ ]

   b) If yes, reasons

   c) Extent of increase in productivity

2. a) Has intrecropping decreased productivity? Yes [ ] No [ ]

   b) Yes, reasons:

3. Contribution of intercrop to profit or loss

Crop	Value of Output of intercrop	Cost of intercrop

BLOCK 13

EVALUATION OF MIXED CROPPING

1. a) Has mixed cropping increased/ decreased productivity? Increased [ ] decreased [ ]

   b) If so reasons:

2. a) Has mixed cropping increased/ decreased profits ? Increased [ ] decreased [ ]

   b) Contribution of mixed crop to profit or loss

Crop	Value of mixed crop output	Cost of mixed crop

BLOCK 14

LAND POSSESSED (AREA IN CENTS) AND OTHER ASSETS

		1982-83		1981-82		1980-81	
		Wet	Dry	Wet	Dry	Wet	Dry
1	Total operational holding						
2	Irrigated						
3	Irrigable						
4	Fallow-current						
5	Fallow-other						
6	Net area sown						
7	Present value of land		Wet		Dry		Total

BLOCK 14 (Continued)

8	Other Assets			Number	Value
	i) Building				
	ii) Machinery: Tractor/Tiller/Pumpset				
	iii) Implements				
	iv) Cattle	-	Desi		
			Improved		
	v) Buffaloe	-	Desi		
			Improved		
	vi) Goat	-	Desi		
			Improved		
	vii) Poultry	-	Desi		
			Improved		
	viii) Pig	-	Desi		
			Improved		

BLOCK 15

NET INCOME IN 1983

	Sources	Quantity	Price/Unit	Total from Crop	Total
1	Crops				
	a) Rice				
	b) Coconut				
	c) Plantain & Banana				
	d) Pepper				
	e) Tapioca				
	d) Others (Specity)				

2	Dairying	Quantity/Day	Number of months	Quantity per year	Price per unit	Total
3	Poultry	Quantity/Day	Price per unit	Total		

BLOCK 15 (Continued)

4	Other agricultural activities				
	a) Tapping	Number of palms tapped	Net value/palm		Total
5	Household industry				
	a) Sale of copra	Quantity sold per month	Value per quintal	Number of months sold	Total
	b) Coconut oil	Quantity sold	Number of months sold	Value per quintal	Total
6	Wages as agricultural labour	Number of days worked	Wages per day		Total

BLOCK 15 (Continued)

7	Sale of			
	a) Cut Leaves	Value sold per month		Total
	b) Husk	Value sold per month	Number of months sold	Total
	c) Cut palm	Number of palms cut	Value per palm	Total
8	Hire charges	Number of days hired	Hire charge per day	Total

BLOCK 15 (Continued)

		Number of days hired	Hire charge/day	Total
	a) Animal labour			
	b) Equipment			
9	Rent on building			
10	Interest			
11	Pension			
12	Remittance etc			

BLOCK 16

OPINION OF FARMERS

1	a) Does coconut provide more profit than other crops which are cultivable ?	Yes [ ]	No [ ]
	b) If not, what other crops give greater profit ?		
2	Do you cultivate coconut because it satisfies your cash needs ?	Yes [ ]	No [ ]
3	Have you extended area under coconut because of government incentives ?	Yes [ ]	No [ ]
4	Is coconut labour less organised and militant compared to labour of other crops ?	Yes [ ]	No [ ]
5	Has your farm become less remunerative due to root-wilt impact ?	Yes [ ]	No [ ]
6	Have you converted coconut gardens to plantation crops due to land reforms ?	Yes [ ]	No [ ]

BLOCK 16 (Continued)

7	Do you think cultivation of hybrid palms is more profitable ?	Yes /___/	No /___/
8	When was this plot first used for cultivation ?		
9	Do you think block seedlings are reliable ?	Yes /___/	No /___/
10	a) Does Block give adequate help ?	Yes /___/	No /___/
	b) Is Block help relaible ?	Yes /___/	No /___/
11	Is there a lack of climbers ?	Yes /___/	No /___/
12	a) What are climbers' demands ? (Specify)		
	b) Do they demand compensations ?	Yes /___/	No /___/
	c) Do climbers put forward un-reasonable demands ?	Yes /___/	No /___/

BLOCK 16 (Continued)

13	a)	To whom do you sell coconut ? (Specify)		
	b)	Do you sell husk separately ?	Yes /__/	No /__/
	c)	Do you give palms on contract for cutting and disposing coconut ?	Yes /__/	No /__/
14	a)	If H Y V are used, do you think it can stop reduction in yield due to impact of root-wilt ?	Yes /__/	No /__/
	b)	Do you think it will increase average yield ?	Yes /__/	No /__/

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