RESOURCE USE EFFICIENCY OF PADDY CULTIVATION IN KUTTANAD

By

K. J. JOSEPH

THESIS

Submitted in partial fulfilment of the
requirement for the degree of

Master of Science in Agriculture

Faculty of Agriculture
Kerala Agricultural University

Department of Agricultural Economics
COLLEGE OF HORTICULTURE
Vellanikkara - Trichur

1982

DECLARATION

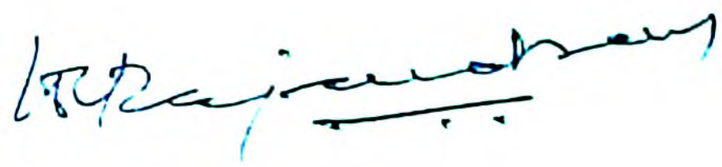
I hereby declare that this thesis entitled "Resource Use Efficiency of Paddy Cultivation in Kuttanad" is a bonafide record of work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or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

Vellanikkara,
November, 1982.

K.J.JOSEPH

CERTIFICATE

Certified that this thesis entitled "Resource Use Efficiency of Paddy Cultivation in Kuttanad" is a record of research work done independently by Sri.K.J.Joseph under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.



D.V.Rajendran,
Chairman,
Advisory Committee,
Assistant Professor of Agricultural Economics,
Kerala Agricultural University.

Vellanikkara,
November, 1982.

University

CERTIFICATE

We, the undersigned members of the Advisory Committee of Sri.K.J.Joseph, a candidate for the degree of Master of Science in Agriculture with major in Agricultural Economics, agree that the thesis entitled "Resource Use Efficiency of Paddy Cultivation in Kuttanad" may be submitted by Sri.K.J.Joseph in partial fulfilment of the requirements for the degree.

D.V.Rajendran,
Chairman,
Advisory Committee.

Dr.V.Radhakrishnan,
Member

Dr.K.C.George,
Member

K.P.Ramachandran Nair,
Member

ACKNOWLEDGEMENT

The author wishes to place on record his deep sense of gratitude and indebtedness to:

Sri. D.V.Rajendran, Assistant Professor of Agricultural Economics, College of Horticulture, Vellanikkara and Chairman of the Advisory Committee for his valuable guidance during the entire course of research work and preparation of this thesis.

Dr. V.Radhakrishnan, Professor and Head, Department of Agricultural Economics for his expert advice and constructive criticism.

Dr. K.C.George, Professor and Head, Department of Agricultural Statistics, College of Agriculture, Vellayani for his constructive comments and suggestions.

Sri. K.P.Ramachandran Nair, Assistant Professor of Agricultural Extension for his constant encouragement and goodwill.

Sri. V.K.Gopinathan Unnithan, Associate Professor of Agricultural Statistics for the immense care taken during the statistical analysis.

Sri. M.S.N.Panicker, Additional Director of Agriculture for his valuable advice during the research work.

all his friends for their sincere assistance both during the research work and thesis preparation.

and to his parents for their earnest and sustained encouragement.

Vellanikkara,
November, 1982.

K.J.JOSEPH

C O N T E N T S

LIST OF TABLES

Sl.No.	Table No.	Title
31	4.27	Expenditure per hectare on fertilizers and application.
32	4.28	Expenditure per hectare towards plant protection operations.
33	4.29	Cost of plant protection chemicals and application charges as percentages of the total cost.
34	4.30	Use of human labour and expenditure towards post harvest handling.
35	4.31	Total cost of cultivation per hectare.
36	4.32	Cost of cultivation per hectare - operation wise.
37	4.33	Repair of outer bunds.
38	4.34	Removal of salvinia.
39	4.35	Repair to inner bunds and forming channels.
40	4.36	Cost of preparatory cultivation.
41	4.37	Seeds, seed preparation and sowing.
42	4.38	Gap filling and weed control.
43	4.39	Expenditure on irrigation/dewatering.
44	4.40	Cost and application charges of liming materials.
45	4.41	Expenditure on manures and manuring.
46	4.42	Fertilizers and application.
47	4.43	Expenditure on plant protection

LIST OF ILLUSTRATIONS

Introduction

INTRODUCTION

Paddy, the most important food crop in Kerala, accounts for about 30 per cent of the gross cropped area in the State. Area under paddy in Kerala was 8.02 lakh hectares in 1965-66 and it increased to 8.75 lakh hectares in 1970-71 and to 8.76 lakh hectares in 1975-76. Since then, area under paddy has been declining and during 1979-80, it was only 7.93 lakh hectares. The total annual production of rice in the State, which was ten lakh tonnes in 1965-66, increased to 13 lakh tonnes in 1970-71 and 13.3 lakh tonnes in 1975-76, but it declined to 13 lakh tonnes in 1979-80. The per capita annual production of this 'staple food' in Kerala is only 51.18 kg which is far below the requirement. The rapid increase in population and the expanding demand for food, together with the paucity of farm resources, call for a thorough examination of the input-output relationship of this important crop so as to explore the possibilities of increasing the efficiency of resource use in its production.

Among the paddy growing regions in Kerala, Kuttanad occupies a pride of place. It extends over an area of about 874 square kilometres. Paddy cultivation is undertaken in about 54,000 hectares. Considering the importance of Kuttanad in the rice economy of the State in the one hand, and the peculiar problems involved in paddy cultivation there, on account of the fact that the fields mostly are below sea level, the present study on resource use efficiency in paddy cultivation is undertaken with reference to Kuttanad.

The study

With a given amount of resources and technical know-how, if the farmer is found not utilizing the resources at hand in production, that implies the existence of an unexploited potential for increasing production with a re-allocation of the resources. This inexpensive possibility for increasing production assumes greater significance for a country like India, where lack of capital is a major obstacle for economic development. Paddy cultivation in Kuttanad has, by and large, become an unattractive enterprise and the farmers are, of late, seen converting the paddy fields for cultivation of better paying crops like coconut, cocoa etc. Conversion of agricultural land from growing food grains to other cash crops may hinder the total development over a long range. The Government have enforced land utilization acts, which prevent such conversions, by law.

The present study is intended to explore the resource allocation efficiency of Kuttanad paddy cultivation. An attempt is also made to workout the economics of paddy cultivation. The broader objectives of the study are:

1. To estimate the extent of use of resources in paddy cultivation in Kuttanad area.
2. To estimate the efficiency of resource use.
3. To estimate the cost and returns of paddy cultivation.

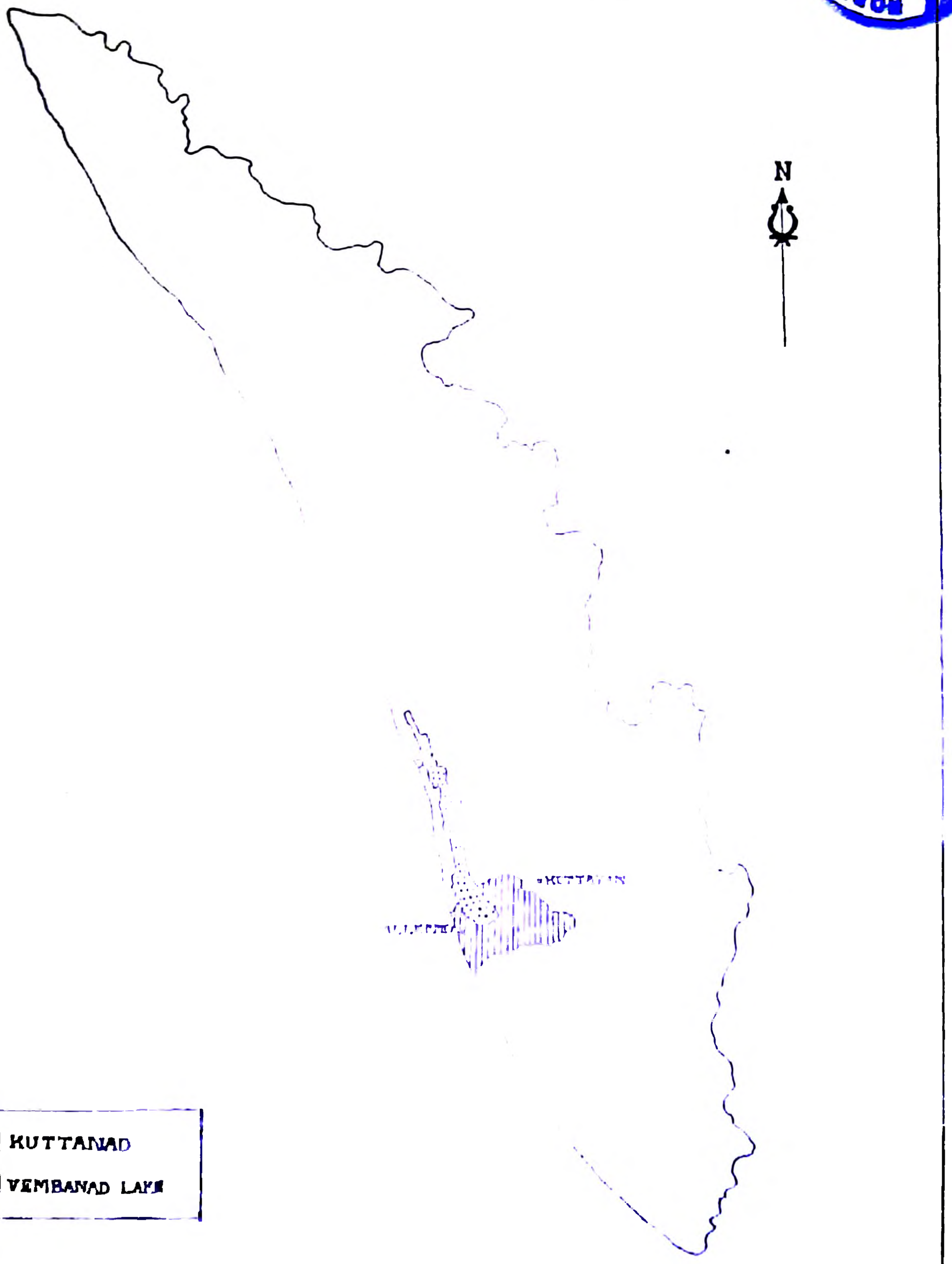
Scope of the study

Findings of this study would be useful to the paddy cultivators of Kuttanad in locating the weak spots in the present pattern of resource use and help them to re-allocate the available resources in the cultivation of paddy such that together they yield the maximum returns. Information on the cost structure would be of use to the policy makers in the formulation of plans and programmes for attaining the objective of enhanced production.

Limitations

The conclusions of the study are drawn based on analysis of farm level data for a single season. The season studied may not be a normal season for the area. Hence the findings of the study cannot be generalised fully. Moreover, due to lack of farm records, the data were collected from the farmers recalling from their memory.

FIG 1. MAP OF KERALA INDICATING KUTTANAD



Kuttanad, the rice-bowl of Kerala, encompasses the low lying lands measuring approximately 25 kilometres east-west and 60 kilometres north-south on the west coast of the State. It lies between 9° 8' and 9° 52' north latitude and 76° 19' and 76° 44' east longitude. It is separated from the Arabian sea by a narrow strip of land. The port town of Alleppey is on its west and the towns Kottayam and Changanacherry are on the east.

According to the report of the Kuttanad Enquiry Commission, 1971, Government of Kerala, which is widely accepted as an authoritative study on Kuttanad, the present day Kuttanad is co-terminus with the jurisdiction of the Punja Special Officer, Alleppey. It extends over 79 revenue villages spread over seven taluks of Alleppey district and three taluks of Kottayam district. It covers an area of 874 square kilometres, of this about 304 square kilometres lie about one metre above mean sea level (MSL) and the remaining area is submerged.

The list of different taluks in Kuttanad, indicating number of villages in each, the number of 'padasekharoms' and the total area under paddy are given in Table 1.1.

Kuttanad comprises some villages of Kottayam, Changanacherry and Vaikom taluks in Kottayam district and Thiruvalla, Chengannur, Ambalapuzha, Mavelikkara, Karthigappalli and Shertallai taluks and all the villages in Kuttanad taluk of Alleppey district. The Vembanad lake, the largest lake in Kerala, is in Kuttanad occupying an area of about 80 square kilometres. Four major rivers namely Meenachil, Achankoil, Manimala and Pamba flow through Kuttanad.

History of Kuttanad

References about Kuttanad are reported to exist since 1st century A.D. In the early Tamil literatures like 'Venpai' and 'Tholkappiyom', Kuttanad is mentioned as one of the 12 nadus (principalities) where people spoke 'Kodumthamil'. There are references to Kuttanad in the great Tamil work 'Thiruvaymozhi' written in the 8th century A.D. and 'Periyapuranam' of the 11th century A.D.

Origin of Kuttanad

A popular legend about the origin of Kuttanad says that 'Khandava vana' mentioned in the epic of

'Mahabharatha' was situated in Kuttanad and that the remnants of that burnt forest still lie deep in the soil. Logs of burnt and charred wood are still found in the Karinilams of Thakazhy, Vaikom etc. As such, it is said that this place was originally known as 'Chutta nadu' which later got transformed to 'Kuttanadu'.

According to geologists, there are two theories about the origin of Kuttanad. One says that this region represents a recent sedimentary formation. It has been established that the Arabian sea once extended as far east as to the eastern boarder of Kuttanad region. The upheaval of the 'Varkalay Laterite Formation' provided an extensive bay into which discharged the waters of many rivers. The silt carried by these rivers was deposited at the mouth tract. The lagoon gradually silted up and gave rise to the paddy lands which now characterize Kuttanad. The deeper portions of the lagoon formed the Vembanad Kayal.

According to the other theory, millions of years ago these lands were forest areas abounding in different varieties of trees. In the succeeding geological age, the Arabian sea advanced and engulfed

not only these lands, but extended in many places upto the foot of the Western ghats. Years later, the sea receded exposing the land which now forms part of the middle land and coastal regions of Kerala. During these upheavals the entire forest areas were submerged far below the ground level and there after were silted up to varying levels giving rise to saline marshes and the low-lying lands of Kuttanad. Soils in these areas have vast organic matter deposits and also fossils of timber and shell fish in varying depths, reminiscent of submersion under the sea for geological periods.

Lake and Rivers in Kuttanad

The largest lake in Kerala, the lake Vembanad, is in Kuttanad. It extends from Alleppey to Cochin covering an area of about 80 square kilometres. The lake opens into the Arabian sea at Cochin. Water in the lake is saline, except during the monsoon, when the flood waters keep the surface water sweet. However, after the commissioning of the Thanneermukkom barrier, the water in the lake is sweet throughout the year.

The rivers Achankoil, Pamba, Manimala and Meenachil discharge their waters into Kuttanad region.

These rivers after flowing through a network of channels and canals join the Vembanad lake, draining an area of about 5000 square kilimetres in the upper hilly regions. The catchment area has an annual rainfall varying from 2800 mm to 3800 mm. Nearly 60 to 70 per cent of the rainfall is received during the south-west monsoon resulting in floods in this region. The north-east monsoon also causes floods, though on a lesser scale. The flood discharges during the monsoon keep the surface water in Kuttanad sweet, inspite of its direct connection to the sea. When the flow of the rivers dwindles from December, saline water from the sea pervades the entire area due to tidal action and density currents. Before 1974, when the salt water barrier at Thanneermukkom was installed, the salinity in the northern parts of Kuttanad went beyond the limits of tolerence for paddy cultivation from January, and it spread rapidly to the southern parts. The water remained saline till the first floods of the succeeding south-west monsoon in June.

Climate

A uniform climate prevails throughout the Kuttanad area with the temperature ranging from

21°C to 36°C. The humidity is very high. The average annual rainfall is about 3250 mm. The rainy seasons are from June to August (south-west monsoon) and from October to November (north-east monsoon). The dry months of January and February are followed by summer, approximating tropical severity during the months of March, April and May.

Soil and soil fertility

The soil in Kuttanad is a mixture of sand and clay in varying proportions. In some parts, presence of dragnic matter has been observed. In most of the areas soil is highly acidic and contains toxic salts. The pH of Kuttanad soil ranges from 5 to 6.5. The paddy fields which are situated near the rivers in their upper reaches get a good deal of silt during the monsoon and those situated lower down or away from the rivers, get silt in lesser quantity. The more fertile upper fields were cultivated annually, while those in lower reaches were cultivated once in two years. In Kari lands cultivation was done only once in three years. With the introduction of high yielding varieties of paddy and other modern inputs, all the paddy fields in Kuttanad are now cultivated every year and in some areas twice a year.

The paddy lands of Kuttanad are classified under three broad categories considering the soil type. They are Kayal lands, Karappadoms and Kari lands.

Kayal lands

These consist of the lately reclaimed beds from the Vembanad lake and cover an area of about 8000 hectares. The fields are situated about 1 to 2 metres below mean sea level. The soil is seriously affected by salinity and is most susceptible to floods. Crop failures are common in Kayal lands. These lands are referred to as Lower Kuttanad.

The Karappadams

These are situated along the water ways and rivers and are spread over an area of about 65200 hectares. Most of the area are now double cropped and lie in the interior of the villages on the eastern and southern periphery of Kuttanad. The fields lying along the water ways are replenished every year with silt carried by the flood waters. The Karappadoms are generally known as Upper Kuttanad.

Kari lands

Kari lands are situated in taluks of Ambalapuzha, Shertallai and Vaikom. These extend to an

area of about 4800 hectares. The name 'Kari' is derived from the intense black colour of the soil. Most of the lands are at or below sea level. The soil is peaty or marshy in nature and is over grown with wild weeds and grasses.

Communication

The National Highway-47 is on the western side of Kuttanad and the Main Central Road on the eastern side. Ettumannoor-Vaikom road passes along the northern side and Thiruvalla-Mavelikkara road is on the southern side. A balapuzha-Thiruvalla road and Alleppey-Changanacherry road traverse through Kuttanad from west to east. These roads are intercepted by rivers which are unbridged in some places. Vaikom-Kumarakom-Kottayam road passes through the North-east portion of Kuttanad. Communication in the area is mostly by mechanised boats and country boats (valloms) which carry passengers and cargo along the net work of rivers and channels. The State Water Transport Department also operates in Kuttannd.

Population

Kuttanad, which has only 4.2 per cent of the area of Kerala, supports eight per cent of the State's

population. The density of population is 1128 per square kilometre. It has a high literacy percentage also. About 30 per cent of the population constitute the labour force and of this about one half is agricultural labourers. There are over one lakh agricultural labour families in Kuttanad.

Paddy cultivation in Kuttanad

Cultivation practices for paddy in Kuttanad are unique and distinctly different from the rest of the State. By and large, cultivation is undertaken in fields which lie below mean sea level. These fields remain submerged during most part of the year and water is drained off before cultivation is undertaken. Paddy cultivation in this area is popularly known as 'puncha cultivation'.

The reclamation of back waters of Kuttanad for paddy cultivation is not a recent phenomenon. Reports dating to 1833 A.D. give evidences that the process existed in those days. Encouraged by the then Government, through tax exemptions and loans for reclaiming and bringing under cultivation portions of Vembanad lake, large areas had been reclaimed during the latter half of the 19th century.

The process of Kayal reclamation is as follows. Shallow areas of the lake (where depth is below eight feet) are marked. Coconut trunks are driven into the soil in two rows, about one metre apart, along the boundaries of the area to be reclaimed. In between the trunks, a special type of bamboo frames are fixed. The space is then filled with clods, clay, leaves and tree branches to build a strong foundation for the bund. The bund is raised above water level. Both sides of the bund are reinforced by plastering with sand and clay, so as to withstand the pressure of flood water during monsoon. The water within the bund is then bailed out and the land cultivated. After the season, water is let into the plots through sluices on the bunds and left submerged till the next cultivation season, which starts with the repair of the bunds. The Kerala Land Development Corporation now provides facilities, by way of advances, for the construction of permanent granite outer bunds.

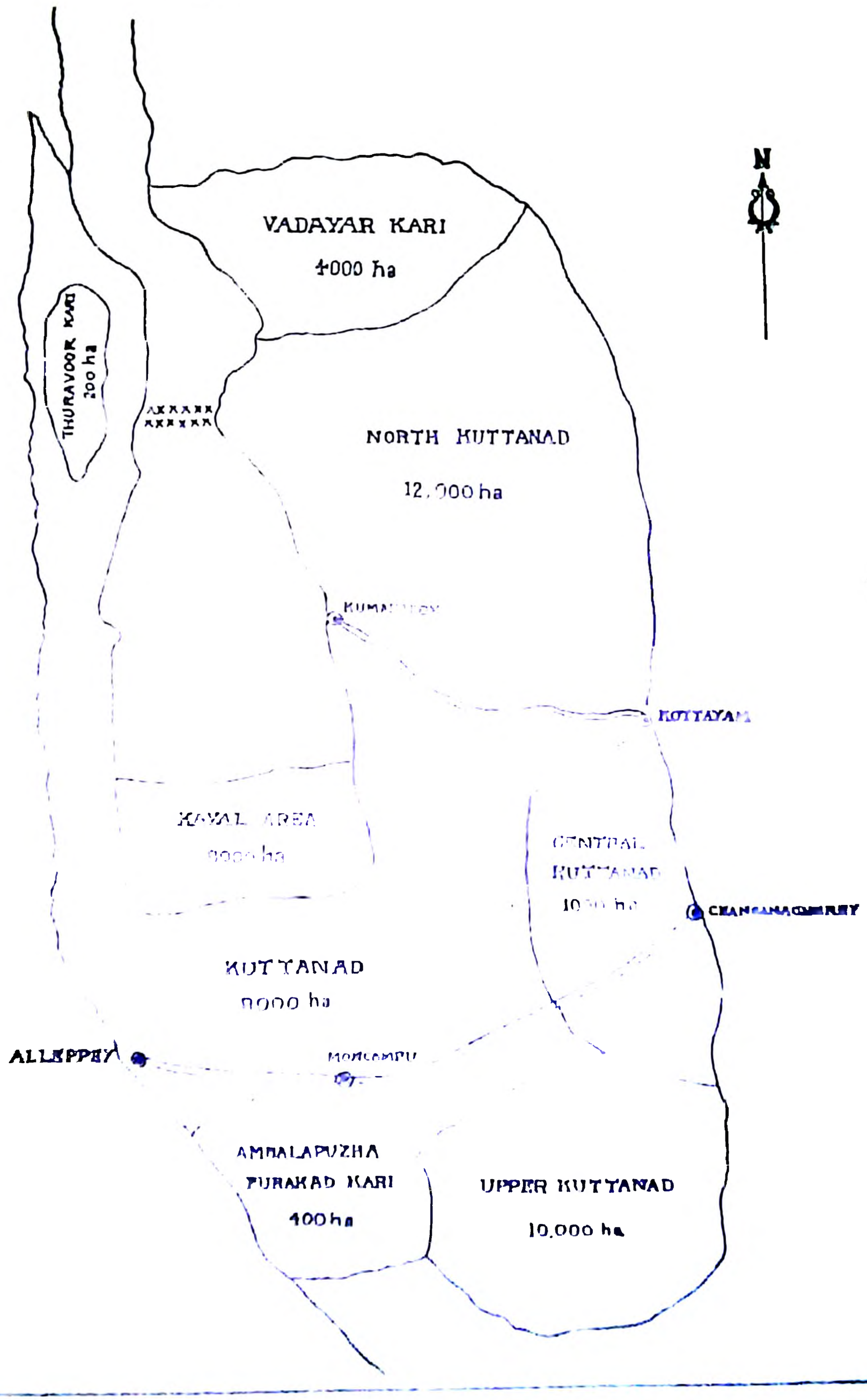
The paddy fields of Kuttanad are separated into blocks of contigous area, bounded by canals. Such blocks are known as 'Padasekharoms'. The size of padasekharoms ranges from a few hectares to over thousand hectares.

Table 1.1 Area under paddy in Kuttanad

District	Taluk	No. of villages	No. of padasekharams	Area (acres)
Alleppey	1. Kuttanadu	12	427	56878.35
	2. Ambalapuzha	5	69	10841.77
	3. Shorthallai	7	36	4917.46
	4. Karthigappally	8	80	9980.89
	5. Mavelikkara	11	49	5355.27
	6. Thiruvalla	6	30	4887.78
	7. Chengannur	5	7	1215.63
	Total for the District	54	698	94077.15
Kottayam	8. Kottayam	11	275	26867.25
	9. Vaikom	7	151	13347.63
	10. Changanacherry	7	107	8444.79
	Total for the District	25	533	48659.67
	Grand total	79	1231	142736.82

Source: Report of the Kuttanad Enquiry Commission (1971)

FIG 2. KUTTANAD



Incidences of pests and diseases often assume serious proportions. Pests of paddy like the brown plant hopper (BPH) and rice stem borer and diseases such as sheath blight and sheath rot are frequently reported. Grain shedding has also been observed to be high. Of late, occurrence of salvinia weed (African Payal) is also found to affect the economics of cultivation. Timely dewatering, control of pests and diseases etc. can help in making paddy cultivation more lucrative.

There are 1231 padasekharoms in Kuttanad. Total area of these come to 142736.82 acres. A break up of the total number of padasekharoms and area into Kayal, Karinilam and Karappadom is given in Table 1.2.

Table 1.2 Padasekharoms under different catagories (Number and extent)

Sl.No.	Name of category	Number of padasekharoms	Area in acres
1	Kayal lands	47	20138.08
2	Karinilams	61	11978.78
3	Karapadoms	1123	110619.96
	Total	1231	142736.82

Source: Kerala Land Development Corporation, Alleppey

Pattern of land holdings

The contigous blocks of paddy fields - padase-kharams - are owned by a number of cultivators. The pattern of holdings of agricultural land in Kuttanad is given in the following table.

Table 1.3 Pattern of land holdings in Kuttanad (as on June, 1973)

Sl. No.	Size group of holdings	Alleppey district		Kottayam district		Total	
		No.of cultivators	Extent of holdings in hectares	No.of cultivators	Extent of holdings in hectares	No.of cultivators	Extent of holdings in hectares
1	Below 0.42 hectare (below one acre)	10112	4166	6464	2556	16576 (36.0)	6722 (11.7)
2	Between 0.42 and one hectare	7723	6667	4460	3981	12183 (26.1)	10648 (18.5)
3	Between one hectare and two hectares	6203	9841	4957	7182	11160 (24.0)	17023 (29.5)
4	Between two hectares and four hectares	3816	8696	1215	3505	5031 (10.7)	12199 (21.2)
5	Between four hectares and six hectares	1013	4312	238	1072	1251 (2.6)	5384 (9.3)
6	Above six hectares	201	4333	141	1323	342 (0.6)	5656 (9.8)
	Grand total	29068	38015	17475	19617	46543 (100.00)	57632 (100.00)

(Figures in parantheses are percentages of the total)

Source: Report on Kuttanad Development Project (1974)

Cultivation practices

The main crop of paddy in Kuttanad, known as 'Punja' is cultivated from September to January in areas nearer to Vembanad lake (Lower Kuttanad). In areas comprising of the deltaic region of the rivers, away from the lake, called Upper Kuttanad, the crop is raised from November, soon after the north east monsoon. Since the commissioning of the Thanneermukkom barrage in 1974, a second crop is also being tried in Kuttanad.

Large holdings are generally seen in the reclaimed areas of Lower Kuttanad, while small holdings predominate in the other regions. Cultivation practices followed are more or less the same throughout Kuttanad. A brief discription of the practices followed is attempted below.

1) Dry ploughing

Two ploughings, one lengthwise and the other cross-wise, are given soon after the harvest of the crop. Powdered burnt lime is then applied and fields are flooded by leting in water through sluices in the bunds and the water remains in the field till the end

of south west monsoon. Flooding prevents the capillary rise of salts in soil.

ii) Repair to outer bunds

During August-September, when water recedes to manageable levels, the work on the repair of the outer bunds of the padasekharoms are initiated. Breaches might have developed on the existing outer bunds resultant of floods during monsoon. These breaches are plugged suitably using indegenous materials and strengthened with clay.

iii) Wet ploughing

The fields are then ploughed, in waist-deep water. This helps to stir up the soil and allow fresh water to percolate into the soil.

iv) De-watering

A special type of device called 'petty' and 'para', operated by electric motor, is used for pumping out water. The padasekharoms get completely drained in about 20 to 30 days. The dewatering is now fully subsidised by the Government.

v) Repair to inner bunds and channels

The padasekharoms are often owned by a set of farmers. Bunds are made to demark individual plots. Repairs on these bunds are carried out and the operation is known as 'edavarambukuthal'. Along with this work small channels are made, wherever necessary for irrigation as well as drainage. The channels are known as 'vachals'.

vi) Raking

The top soil in the fields is raked up using harrows called 'palli'. The process is known as 'pallickadi'.

vii) Breaking clods and levelling

The small clods are broken by hand and the weeds and stubbles are removed, so that the soil obtains a fine tilth. The operation is known as 'kaipoottu', and generally carried out by women labourers. Fresh water is let into the fields.

viii) Sowing

Sprouted seeds are broadcast in the prepared fields in ankle-deep water. Seeds are prepared at a rate of

of about 100 kg per hectare. Seeds are packed in long cylindcrical screw-pine bags. These are kept immersed in fresh water for about eight to twelve hours. The water is drained and kept for about two to three days for the seeds to sprout.

Three to four days after sowing, the fields are completely drained and kept for about a week with the soil moist and not dry completely. Rarely, in certain parts of Kuttanad, transplanting is also practised.

ix) Water management

Water is let in and drained occasionally (every 10 to 15 days) so as to maintain a continuous water level of about 5 cms in the field. Field is completely drained about 10 days before harvest.

x) Gap filling

Twenty five to thirty days after sowing the over crowded portions in the field are thinned out and the gaps filled. A weeding is also given along with this. Top dressing with fertilizers is also carried out soon after gap filling. In some places liming materials are applied along with this operation,

and after two to three days, the field is washed out and fertilizers applied.

xi) Soil ameliorants/liming

In areas where the pH of soil is below six, liming materials like calcium carbonate, lime, dolomite etc. are applied. Liming materials are applied either during raking up (pallickadi) or along with gap filling or both, considering the extent of acidity.

xii) Weeding

Usually weeding is done twice in a season. First weeding is along with gap filling about 30 days after sowing. Second weeding is given 15 to 20 days after the first. A third weeding is given in some places to remove weeds like wild rice (Oryza sativa var. fatua) and kavada (Echinoclon colonum).

Chemical weed control is also popular in Kuttanad. Weedicides like Stam F.34, 2,4-D etc. are applied to the crop in about two to three weeks after sowing.

xiii) Manuring

Farm yard manure (cow dung or green leaves or both) are applied to the field along with 'pallickadi'.

Manuring is not common because of the distance between the cultivators home and their paddy fields.

Fertilizers are the main source of nutrients for paddy in Kuttanad. Usually fertilizers are applied in two dozes. First application is made after about 10 days from sowing when the plants are at two leaves stage. Half the quantities of nitrogenous and potassic fertilizers and full of phophatic fertilizers are given as the first doze. Remaining quantities of nitrogen and potash are given about five to ten days after gap filling. The fields are drained before application of fertilizers and kept moist for about two days after. Small quantities of nitrogenous fertilizers may be applied in patches where plant growth is found to be poor.

xiv) Plant protection

The cultivation of high yielding varieties have increased the incidence of pests and diseases. This has necessitated intensive use of control measures. A regular pattern for plant protection is not seen adopted. Sporadic outbreaks of pests and diseases are seen which require intensive application of chemicals.

xv) Harvesting

Only the earhead below the flag leaf is cut and collected in harvesting unlike in other areas where the plant is cut two to three inches from the ground. This type of harvest is known as 'thalakoithu'. The earheads are tied to bundles known as 'kutta'. Threshing is accomplished by trampling on the 'kattas'. Winnowing is generally using winnowing machines. Many 'padasekharoms' are provided with threshing and drying floors. The cleaned, dried paddy is either sold at the threshing floor or transported to the farmers house where it is stored in rooms known as 'ara'.

In Kuttanad, cultivation of paddy is undertaken in extensive areas. Hence the available labour in the locality is insufficient to meet the demand. During the cultivation season labourers from neighbouring areas migrate to Kuttanad, especially during harvest season. Payment of wages, except for harvest, is made in cash. For harvest, wages are paid in kind. A portion of paddy harvested referred to as 'pathom and theerpu' which is a little above fifteen per cent of the paddy harvested and threshed by a labourer is given as wages.

Problems of paddy cultivation in Kuttanad

Paddy cultivation in Kuttanad is undertaken under adverse natural conditions. A series of problems crop up from time to time, such as occasional floods and tides, intrusion of salt water and salnity and lack of communication facilities. Many steps have been taken by the Government to solve the problems. Among them the following programmes need special mention. Construction of a spill way at Thottappally, construction of permanent outer bunds to padasekharoms, construction of the 'Thanneermukkom barrage' and construction of a road and a channel connecting Alleppey and Changanacherry.

A spill way, 368 meters long, was commissioned in 1955 at Thottappally, about twenty kilometres south of Alleppey town. It was designed to discharge about 64000 cusecs of water during the monsoon season so as to avoid flood in Kuttanad. But the spill way could only discharge about 20000 cusecs of water. Repair to outer bunds is a major item of cost in Kuttanad, especially in Lower Kuttanad. The Kerala Land Development Corporation has taken up a programme to construct permanent granite outer bunds around padasekharoms

using institutional finance and the work is in progress.

To prevent the intrusion of sea water during summer months, a barrier was constructed 1402 metres long, at Thanneermukkom, about 22.5 kilometres north of Alleppey town. The barrage was commissioned in 1974. Although salinity intrusion was prevented, the Thanneermukkom bund has brought with it a number of allied problems consequent on the change in eco-system of Kuttanad. The Alleppey-Changanacherry road connecting the National Highway 47 and the Main Central Road, has been completed except for two major bridges at Pallathuruthy and Nedumudi. Construction of a canal 110 feet wide, intended for quick transport and communic tion facilities in Kuttanad, is also in progress.

Review of Literature

REVIEW OF LITERATURE

The present study is aimed at determining the resource-use efficiency of paddy farmers of Kuttanad and also work out the economics of paddy cultivation. Production function studies, using a linear model, are attempted. Brief review of similar works reported is made in this chapter.

Heady and Shaw (1954) measured the marginal value productivity of resources used in different farming regions of the United States. The marginal value productivity for labour was found to be lower in small farms where less quantity of capital per worker was used. Marginal value productivity of land varied with respect to the soil type, rainfall and climatic conditions. Marginal value productivity for capital was greater in highly mechanised farms.

Driver and Desai (1958) suggested that input-output relationship in agriculture might be studied with a view of increasing farm returns. Shastri (1958) has reported diminishing returns to scale in Indian agriculture. Gupta (1958) has

emphasised the importance of input-output studies in determining the optimum resource allocation in agriculture.

Agrawal and Foreman (1959) held that production function studies should be aimed at determining the productivity of each resource employed in agriculture and its change over different levels of combinations of inputs.

Inefficient resource use was reported by Desai (1960) in a study of 160 farms in Bombay, using linear programming. The results indicated the existence of a substantial potential for increasing farm income and production with the existing resource supplies and technical know-how.

Inverse relationship between farm size and productivity was reported from Punjab by Randhwa (1960). The reasons given for the inverse relationship were better soil fertility and irrigation facilities of small farms.

Desai (1961) studied and reported that farm incomes could be increased by 68.77 per cent in Ahamednagar and 145.76 per cent in Nasik over the

present incomes, if the farms in those areas were to adopt optimal resource allocation.

Samuel (1963) studied in detail the resource use efficiency of paddy farms in Kuttanad and Onattukara regions of Alleppey district. The efficiencies of the independent variables or factors were evaluated by fitting a Cobb-Douglas model. The yield measured in terms of gross value was regressed on the area of farm in acres, cost of human labour, nitrogen in kilograms of N, value of bullock labour and other factors such as value of seed., plant protection chemicals and dewatering in terms of value. Farm size and human labour gave significant and positive coefficients and bullock labour was found to have negative elasticity. Diminishing returns to scale was noticed in Kuttanad. The input-output ratio was 1.61. Cost of production studies of paddy revealed that bulk of the cost (41.14 per cent) was spent on human labour.

Kushro (1964) observed constant returns to scale in Indian agriculture. He found the gross returns per acre to vary inversely and net returns to vary directly with farm size.

A study on the economics of cultivation and marketing of paddy made by Srinivasan (1965) brought out increasing returns to scale. A definite relationship was established between yield and farm size. The marginal value productivity of land was found to increase by increasing the intensity of cropping. A high marginal value product for labour, much more than the wage rate, was reported in the same year from Punjab (Abraham and Bokil, 1965). Sharma (1966) also reported a positive correlation between the average number of agricultural workers per acre and productivity with a significant coefficient for paddy and millets.

A state wise analysis of farm data covering Uttar Pradesh, Madhya Pradesh, Bihar, West Bengal, Kerala, Tamil Nadu and Karnataka was made by Giri *et al*. (1966) with an objective to measure the contribution of land, extent of irrigation, rate of fertilizer application and time trend, representing other minor factors towards the growth of crop output. Cobb-Douglas type of model was fitted to the data. Coefficient on land was significant everywhere

except in Tamil Nadu. Irrigation gave positive elasticities for southern states. Contribution of fertilizer input alone to the growth of output was estimated to be 49 per cent for Kerala. The study concluded that land continued to be the major contributor to the growth of crop output in India, and that irrigation and fertilizer were the chief motivating forces.

Kaimal (1966) conducted a comparative study on the resource use efficiency of paddy farms in the area where the package programme for paddy was introduced and in non-package areas (Kerala State). The marginal value productivity for land was much more in package area, but that of labour and manures and fertilizers was more in non-package area farms. The elasticity coefficient for manures and fertilizers was as high as 1.041 in non-package areas.

Chennareddy (1967) studied the production efficiency in South Indian agriculture and reported that under the existing technology, the farmers were efficient in resource allocation. He opined that a rapid and massive development of agriculture

in India could be brought about only by breaking through the traditional state of arts and introducing modern technology.

Ramamoorthy (1967) brought out the influence of farm size on resource productivity after analysing the resource use pattern among different size groups of farms. Intensity of resource wase was more in small farms. All size groups invariably gave diminishing returns to scale. In another study on the efficiency of resource use in owner, tenant and owner-cum-tenant operated wet land paddy farms of South Arcot district, significant differences in the resource-use efficiency were obs rved among the tenure classes but not with respect to size of holding. Constant returns to scale operated in fully and partly owned farms (Srinivasan, 1967).

Sahota (1968) analysed the resource allocation in Indian agriculture and reported that farms were mostly efficient in the allocation of resources with the existing technology.

Constant returns to scale in paddy farms of Utter Pradesh was reported by Saini (1969). The output

was found to be highly responsive to land and somewhat less to human labour. Farmers were rational in resource allocation.

Radhakrishnan (1969) studied and reported greater marginal value productivity of resources in large farms of Coimbatore, as compared to small farms. He held that farmers were not efficient in resource allocation and pointed out the scope for increasing farm incomes of the farmers by re-organising the existing resources.

Subbaramaraju (197) attempted a study on the resource use efficiency and economics of paddy farms in Andhra Pradesh. Net profit per unit area as well as input-output ratios were found to increase with farm size, indicating bett r utilization of resources in larger farms. The relationship between allocation efficiency and risk in traditional agriculture was studied by Dillon and Anderson (1971). They concluded that the traditional agriculture was efficient in a profit maximisation sense but the element of risk or fear of adoption of new technology played an important role in catalysing the recent

rapid adoption of new crops varieties in some parts of Asia.

A comparison of the resource use efficiency of a set of selected farms in Chittoor district of Andhra Pradesh was conducted by Naidu (1971). Efficiency analysis was conducted by estimating the intensity of cropping, farm business income, labour-earnings per employed man-day, returns to capital invested and marginal value product of factors. Sub-optimal resource allocation was observed indicating possibilities for better farm incomes by a re-organisation of the existing resources. Sub-optimal use of resources except for land and seed was also reported from the paddy farms of Nellore district, Andhra Pradesh (Harinath, 1971).

Subramanian, Rammoorthy and Varadarajan (1973) compared the economics of IR-8 paddy with that of a local variety in the Madurai region of Tamil Nadu. Cultivation expenses for IR-8 was 58 per cent more than that of local variety. IR-8 was found to be more profitable and the farms growing this variety showed an increasing returns

to scale. The marginal value productivities of inputs showed that it was profitable to increase the use of fertilizers than other factors in the cultivation of IR-8 paddy.

An exhaustive study on the resource-use, farm size and returns to scale of the farms of eastern Utter Pradesh was made by Singh (1973). Functional analysis, taking land, human labour, bullock labour, manures and fixed capital as explanatory variables, indicated that there were only a few significant inefficiencies in the use of factors in the farms of eastern Utter Pradesh. Constant returns to scale was observed. Educational level of farmer as well as size of holding showed positive correlation with efficiency in resource-use.

According to Gordon and Mc-Clelland (1974), the important factors responsible for variation in productivity among districts in India are irrigation, farm size and human resource development. Rice was found to be more productive in small farms where labour use was intense. They emphasised the need for technical education of Indian farmers to improve production.

Mukundan and Dasgupta (1977), while studying the comparative economics of irrigated and unirrigated paddy lands in Palghat, observed that seeds and manures gave significant negative elasticities in irrigated farms.

Chadha (1978) studied the farm size-productivity relationship of Punjab agriculture in the post green revolution years and reported that small farmers could compete with large farmers in all aspects of production technology except in the investment on size-based machinery. He suggested the idea of co-operative community sector of small farmers to be the best suited to make up for the input deficiencies and give small farmers the competetive base they need in Indian agriculture.

Khan and Maki (1979) studied and reported that the marginal productivity of labour in small farms of Punjab was less than the wage rate. From Sao Paulo (Brazil), Silva et al. (1979) reported that labour was the most restrictive factor for production.

Sampath (1979) analysed the economic efficiency of farms in Deoria district of Utter Pradesh for the year 1967-68. He identified the existence of considerable economic inefficiency in Indian agriculture. The differences between the potential output and the actual output as a percentage of the potential output was 36.53 per cent. The major component of the economic inefficiency was observed to be technical inefficiency rather than allocative inefficiency. As disaggregate analysis of the data, based on size of land revealed that the difference between the small farmer and the larger farmer in terms of the level of economic efficiency achieved iwas insignificant.

Rao and Chotigeat (1981) disproved the general concept of inverse relationship between farm size and productivity. If hired labour was employed in preference to family labour and if more non-traditional capital was used than traditional capital, large sized holdings and higher productivity could go together.

Selvarajan and Subramanian (1981) identified sub-optimal resource use in farms of Parambikulam-Aliyar project area in Tamil Nadu. A re-allocation of the resources in the optimal direction would increase the gross income of farms by 25.97 per cent, net income by 33.11 per cent and farm business income by 45.13 per cent.

A comparative study of the allocative efficiency of paddy farms of Coimbatore district growing improved variety and traditional varieties of paddy was made by Kalirajan and Flinn (1981). Constant returns to scale was observed in both farms. Inefficient resource use with respect to pest management was noticed in farms growing the improved variety which was susceptible to brown plant hopper. Singh and Jain (1981) also reported inefficient resource use in Indian agriculture.

Muraleedharan (1981) attempted to estimate the resource use efficiency in paddy cultivation in low lying lands of Kerala. He concluded that inputs such as human labour, bullock labour and fertilizers were not efficiently used.

Dutta (1962) compared the relative efficiency of paddy and wheat farms of Ranchi district (Bihar) with respect to farm size and proprietorship. Small farms were found to be more efficient in the production of paddy. Peasant farms were more efficient than capitalist farms indicating that family labour contributed greater care and attention as compared to hired labour in the raising of crops.

Materials and Methods

MATERIALS AND METHODS

The present study is based on data collected from a sample of 100 farmers of Kuttanad. Due care was bestowed to represent the three distinct regions in Kuttanad namely the Lower Kuttanad, the Upper Kuttanad and the Kari lands.

Multi-stage random sampling technique was employed for selecting the respondents. The sample size, limited to 100, was distributed among the three regions as shown below.

Lower Kuttanad	50
Upper Kuttanad	30
Kari lands	20
Total	100

Villages formed the first stage of sampling, 'padasekharams' the second stage and farmers the ultimate stage.

The revenue villages in each region were listed. Two villages were selected from Lower Kuttanad

and one village each from Upper Kuttanad and Kari lands. The 'padasekharoms' in each selected village were listed out and a number of padasekharoms were selected with probability proportional to the area of the padasekharoms in every selected village.

The list of farmers in each selected padasekharom was prepared. The farmers were divided into five groups based on the holding size. The size groups were those having 0.4 hectare (one acre) and below, 0.4 to 0.8 hectare (one to two acres), 0.8 to 1.2 hectares (two to three acres), 1.2 to 2 hectares (three to five acres) and above 2 hectares (five acres). The sample size was allotted to the different size groups in proportion to the number of farmers in the group. Farmers were randomly selected to the sample from different size groups from every selected padasekharom. The composition of the sample is given in Table 3.1.

Period of the study

The season covered in the study was the main paddy crop season of the agricultural year 1980-81. The data were collected from December 1980 to March 1981.

Table 3.1 Distribution of the sample farmers

Region	Name of village	Total No. of padasekharams	Name of padasekharams selected	Area of padasekharams (in hectares)	No.of farmers selected
Lower Kuttanad	1. Pulinkunnu	29	1. Sreemoolam Kayal	236.33	6
			2. Iyanadu Kayal	365.83	9
			3. South Mathikayal	153.04	4
			4. Madathikayal	154.06	4
	2. Champakulam	35	5. Illimuriholayiram	230.30	12
			6. Nattayam	113.49	6
			7. Chempadi	159.94	9
Upper Kuttanad	3. Kizhakkumbhagam	4	8. Ariyodichal	255.83	18
			9. Edayodichempu	175.22	12
Kari lands	4. Purakkad	14	10. Manakkal padam	268.80	8
			11. Appathikkari	324.40	9
			12. Kochuputhenkari	95.20	3

Collection of data

Farm level data were collected from the respondents by the personal interview method using a well structured and pre-tested schedule. A copy is given as appendix. Information about the family composition, educational status of the family members, occupation and income and all aspects of paddy cultivation including disposal of the produce for the season were obtained. Secondary data were collected from different published and unpublished sources on pattern of land holding, rainfall, temperature, social and economic conditions of the study area etc.

Methods of analyses adopted are given below.

Extent of resource use

The different inputs for paddy cultivation such as human labour, bullock labour, manures and fertilizers, plant protection chemicals, soil ameliorants etc. were tabulated and per hectare use of inputs in the three regions were worked out. The average for Kuttanad was also computed. The use of resources in the three regions were compared.

An operation wise analysis of the extent of resource use was also attempted to. The use of different inputs in the various operations like preparatory cultivation, seeds and sowing, application of manures and fertilizers etc. were averaged for the three regions and compared.

Cost of cultivation of paddy

The cost of cultivation per hectare of paddy in the three regions were estimated. The costs for the different resources or inputs and the expenditure on individual inputs as well as their proportion to the total cost were worked out and compared. An operation wise break up of the total cost of cultivation was also made and compared.

The output per hectare for the three regions were estimated. The efficiency of cultivation in the regions was examined by computing and comparing the gross returns per hectare, net returns per hectare, cost of production per hectare, cost of production per quintal of paddy and the cost-benefit ratios.

Efficiency of resource use

Regression analysis were conducted to determine the efficiency with which various resources were used by the paddy cultivators of Kuttanad. Both linear as well as log linear models were tried to regress the per hectare yield on the use of relevant inputs.

The models used in the analysis are:-

(1) $Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8$.

(2) $\log Y = B_0 + B_1 \log X_1 + B_2 \log X_2 + B_3 \log X_3 + B_4 \log X_4 + B_5 \log X_5 + B_6 \log X_6 + B_7 \log X_7$.

Y = Yield of paddy in kilograms per unit area

X_1 = Land area in cents

X_2 = Expenditure in rupees per unit area on animal labour/tractor

X_3 = Use of human labour in man days per unit area

X_4 = Use of nitrogen (N) in kilograms per unit area

X_5 = Use of phosphorus (P_2O_5) in kilograms per unit area

X_6 = Use of potash (K_2O) in kilograms per unit area

X_7 = Expenditure in rupees per unit area on plant protection operations.

X_8 = Use of organic manure in quintals per unit area

b_0 and B_0 - the intercept terms

b_1 to b_8 and B_1 to B_8 - the regression coefficients.

Choice of the dependent variable

In farm production function studies, the dependent variable, obviously, is the output which includes the main as well as the by-product(s) of crops grown in the farm. The value of the by-product of paddy cultivation, straw, was found to have no significant differences among the farms studied. Hence the output is taken as the quantity of paddy produced per hectare. Since the labour charges for harvest operation is invariably paid in kind throughout the study area, output has been taken as the net yield of paddy obtained after the payment towards harvest operations. By excluding the by-product, the dependent variable could be measured in physical units. Dependent variable is here measured in quintals of paddy received per hectare by the farmer after payment towards harvest operation.

Choice of the explanatory variables

The following explanatory variables were chosen to explain the variations in the quantity of output of paddy.

Land

Land, which is the most important and limiting factor of production Indian agriculture, has been measured in terms of ordinary unstandardized acres.

Animal labour/tractor

Considering the difficulty in measuring this input in physic·l terms, this has been considered in terms of the expenditure incurred per hectare for ploughing and levelling operations.

Human labour

Human labour has been defined in terms of man days of five hours for Lower Kuttanad and man days of six hours for Upper Kuttanad and K·ri lands. In Lower Kuttanad, since the paddy fields are 'kayal lands' a man day of work has been fixed as only five hours while it is six hours in the other two regions. The differences in the efficiencies of male and female labour have been adjusted by c·nverting female labour days into man days on the criterion that three female days are equal to two man days. This ratio was adopted considering the ratio between the wage rates of male and female labour.

Input of nitrogenous fertilizers

Nitrogen, an important plant nutrient, has been measured in terms of kilograms of N, applied in one hectare, by working out the quantity of the element contained in the fertilizers applied.

Input of phosphatic fertilizers

The input was defined as kilograms of phosphorus in terms of P_2O_5 applied per hectare.

Input of potassic fertilizers

This was measured as kilograms of potash in terms of K_2O applied per hectare.

Organic manure

This was measured in quintals per hectare.

Expenditure on plant protection operation

This is defined in terms of rupees expended towards the cost of all plant protection chemicals such as pesticides, fungicides and weedicides and the expenditure towards the cost of application.

Results and Discussion

RESULTS AND DISCUSSION

The observations on the general social, educational and economic conditions of the sample farmers of the three regions are presented in the following pages.

1. Size of the family

The average family size for the sample was found to be 6.62. It was 6.4 in Lower Kuttanad, 6.6 in Upper Kuttanad and 7.2 in Kari. A distribution of the sample families based on the number of persons per family showed that about half the number of families had seven to nine members. Around 30 per cent of the families had four to six members. Small families with three members or less formed eight per cent while large families with more than nine members accounted for ten per cent. A distribution of the sample according to size of family is given in Table 4.1.

2. Age and sex

The family members have been classified according to age and sex and presented in Table 4.2.

Table 4.1 Classification of the respondents based on size of family

Sl. No.	Name of region	3 members and less	4 to 6 members	7 to 9 members	More than 9 members	Total	Average family size
1	Lower Kuttanad	4 (8.00)	16 (32.00)	24 (48.00)	6 (12.00)	50 (100.00)	6.4
2	Upper Kuttanad	3 (10.00)	9 (30.00)	16 (53.33)	2 (6.67)	30 (100.00)	6.6
3	Kari	1 (5.00)	6 (30.00)	11 (55.00)	2 (10.00)	20 (100.00)	7.2
	Total	8 (8.00)	31 (31.00)	51 (51.00)	10 (10.00)	100 (100.00)	6.52

(Figures in parantheses are percentages to the total in the respective groups)

Age and sex

The family members have been classified accoording to age and sex and presented in Table 4.2.

Table 4.2 Classification of family members based on age and sex

Sl. No.	Name of Region	0 - 5 years		6 - 14 years		15 - 59 years		Above 60 years		Total number		
		male	Female	male	female	male	female	male	female	male	female	total
1	Lower Kuttanad	11 (3.44)	9 (2.81)	33 (10.31)	26 (8.13)	97 (30.31)	99 (30.94)	26 (8.13)	19 (5.44)	167 (52.19)	153 (47.80)	320 (100.00)
2	Upper Kuttanad	5 (2.53)	7 (3.54)	23 (11.62)	25 (12.63)	59 (29.80)	58 (29.29)	10 (5.05)	11 (5.56)	97 (48.99)	101 (51.01)	198 (100.00)
3	Kari	6 (4.17)	5 (3.47)	17 (11.81)	14 (9.72)	42 (29.17)	43 (29.84)	7 (4.86)	10 (6.94)	72 (50.00)	72 (50.00)	144 (100.00)
	Total	22 (3.32)	21 (3.17)	73 (11.03)	65 (9.82)	198 (29.91)	200 (30.21)	43 (6.50)	40 (6.04)	336 (50.76)	326 (49.24)	662 (100.00)

(Figures in paranthesesa arep percentages of the totals in the respective groups)

It may be observed that about 60 per cent of the population fall under the age group of 15 to 59, of which, about half are females and over 20 per cent under the age group of 6 to 14. Percentage of infants (below five years) and those above 60 years were comparatively less. The distribution within the age groups according to sex were almost equal.

3. Education

Classific tion according to education has been made, based on that of the head of the family, as well as that of the family members. Two of the one hundred respondents were illiterate, unable to read or write, while 11 were literate but had no formal education. Of the remaining 87, 15 had had University education and 72 had different levels of school education. A region wise break up showed that there were no illiterate farmers in Upper Kuttanad and Kari areas. Educational level of Upper Kuttanad farmers were comparatively better than that of the other two regions. Classification of respondents according to the level of eduction is presented in Table 4.3.

Table 4.3 Classification of the heads of the families based on level of education

Sl. No.	Name of region	Illiterate	Literate with no formal education	Primary school	Middle school	High school	Pre-degree	Graduation	Total
1	Lower Kuttanad	2 (4.00)	4 (8.00)	16 (32.00)	11 (22.00)	9 (18.00)	5 (10.00)	3 (6.00)	50 (100.00)
2	Upper Kuttanad	-	4 (13.33)	6 (20.00)	9 (30.00)	6 (20.00)	4 (13.33)	1 (3.33)	30 (100.00)
3	Kari	-	3 (15.00)	7 (35.00)	5 (25.00)	3 (15.00)	2 (10.00)	-	20 (100.00)
	Total	2 (2.00)	11 (11.00)	29 (29.00)	25 (25.00)	18 (18.00)	11 (11.00)	4 (4.00)	100 (100.00)

(Figures in parantheses are percentages to the total in the respective groups)

The educational level of the family members were examined and classified as males and females and presented in Table 4.4.

Table 4.4 Classification of family members based on the level of education and sex

Name of region	0 - 5 years		Literate with no formal education		Illiterate		Primary school		Middle school		High school		Under-graduation		Graduation		Post-graduation		Total
	male	female	male	female	male	female	male	female	male	female	male	female	male	female	male	female	male	female	male + female
Lower Kuttanad	11 (3.44)	9 (2.81)	12 (3.75)	20 (6.25)	2 (0.63)	5 (1.56)	52 (16.25)	41 (12.81)	46 (14.38)	36 (11.25)	25 (7.61)	22 (6.88)	11 (3.44)	7 (2.19)	7 (2.19)	8 (2.50)	3 (0.94)	3 (0.94)	320 (100.00)
Upper Kuttanad	5 (2.52)	7 (3.54)	7 (3.54)	11 (5.55)	1 (0.51)	5 (2.53)	17 (5.59)	25 (5.63)	27 (13.64)	25 (12.63)	22 (11.11)	17 (8.59)	10 (5.07)	9 (4.55)	6 (3.03)	2 (1.01)	2 (1.01)	-	198 (100.00)
Kari	6 (4.17)	5 (3.47)	7 (4.86)	5 (3.47)	2 (1.39)	4 (2.78)	11 (7.64)	15 (10.42)	13 (9.03)	12 (8.33)	12 (8.33)	16 (11.11)	12 (8.33)	10 (6.94)	7 (4.86)	4 (2.78)	2 (1.39)	1 (0.69)	144 (100.00)
Total	22 (3.32)	21 (3.17)	26 (3.93)	36 (5.44)	5 (0.76)	14 (2.12)	80 (12.09)	81 (12.24)	86 (12.99)	73 (11.03)	59 (8.91)	55 (8.31)	33 (4.99)	26 (3.93)	20 (3.02)	14 (2.12)	7 (1.06)	4 (0.60)	662 (100.00)

(Figures in paranthesses areperoentages to the totals in the respective groups)

The table reveals that illiteracy among the sample family members was only 2.88 per cent. About 9.50 per cent were literate with no formal schooling. The percentage of the members with primary school education was 24. Another 24 per cent had had middle school education. A little over 17 per cent possessed education at the high school level. Undergraduates accounted for about nine per cent. There were 34 graduates and 11 postgraduates. The region wise break up shows that percentage of persons with higher education was slightly more in Kari.

4. Occupation

Some of the respondents were found to have more than one occupation. A distribution of the farmers according to the number of occupations is attempted in Table 4.5.

Table 4.5 Classification of the respondents based on the number of occupations

Sl. No.	Name of region	Number of occupations				Total
		One	Two	Three	More than three	
1	Lower Kuttanad	37 (74.00)	13 (26.00)	-	-	50 (100.00)
2	Upper Kuttanad	19 (63.33	9 (30.00)	2 (6.67)	-	30 (100.00)
3	Kari	16 (80.00)	4 (20.00)	-	-	20 (100.00)
	Total	72 (72.00)	26 (26.00)	2 (2.00)	-	100 (100.00)

(Figures in parantheses are percentages of the total in the respective groups)

It can be seen that majority of the farmers, about 72 per cent, were engaged in cultivation activities full time. Twenty six per cent of the total had, along with agriculture, one more occupation like business, service etc. Two per cent took up a third occupation also. Region wise classification shows that 74 per cent of the farmers of Lower Kuttanad, 63.33 per cent of the farmers of Upper Kuttanad and 80 per cent of the Kari farmers had only farming as occupation. The two farmers with three occupations were from Upper Kuttanad. None of the respondents had more than three occupations.

Considering the incomes from different occupations, a classification of the respondents was made to know the main source of income. That occupation which contributed more than fifty per cent of the income was considered as the main occupation and such a classification based on the main occupation is given in Table 4.6.

Table 4.6 Classification of the respondents based on the main occupation

Sl. No.	Name of region	Number of farmers with main occupation				Total
		Agriculture	Trade and business	Service	Others	
1	Lower Kuttanad	39 (78.00)	3 (6.00)	8 (16.00)	-	50 (100.00)
2	Upper Kuttanad	21 (70.00)	5 (16.67)	4 (13.33)	-	30 (100.00)
3	Kari	17 (85.00)	1 (5.00)	1 (5.00)	1 (5.00)	20 (100.00)
	Total	77 (77.00)	9 (9.00)	13 (13.00)	1 (1.00)	100 (100.00)

(Figures in parantheses are percentage of the total in the respective groups)

Agriculture was the main source of income for 77 per cent of the farmers. This indicates that out of the 28 farmers with more than one occupations (Table 4.5), five had agriculture as the main occupation and for the remaining 23, agriculture had only secondary importance in the contributions towards total income.

5. Land holding

The respondents were classified according to the total land holdin s and is shown in Table 4.7.

Thirty two per cent of the farmers owned an area below 1.20 hectares (3 acres). Nu ber of large farmers with more than 2.80 hectares (7 acres) was only 17. Large farms were found to be comparatively more in Kari areas. In Lower Kuttanad 44 per cent of the farms had an area of less than 1.2 hectares. This was 26.67 per cent in Upper Kuttanad and 10 per cent in Kari. Medium farms with an area of 1.2 to 2.0 hectares (3 to 5 acres) accounted for 40 per cent in Kari and 33.33 per cent in Upper Kuttanad, whereas, this was only 22 per cent in Lower Kuttanad. Large farms with an area above 2.80 hectares constituted 25 per cent of farmers in Kari, seven per cent and five per cent in Lower Kuttanad and Upper Kuttanad respectively.

Table 4.7 Classification of the respondents based on total land owning

Sl. No.	Name of region	0 to 0.8 ha (0 to 2 acres)	0.81 to 1.2 ha (2.01 to 3 acres)	1.21 to 2 ha (3.01 to 5 acres)	2.01 to 2.8 ha (5.01 to 7 acres)	Above 2.8 ha (above 7 acres)	Total
1	Lower Kuttanad	13 (26.00)	9 (18.00)	11 (22.00)	10 (20.00)	7 (14.00)	50 (100.00)
2	Upper Kuttanad	4 (13.33)	4 (13.33)	10 (33.33)	7 (23.33)	5 (16.67)	30 (100.00)
3	Kari	1 (5.00)	1 (5.00)	8 (40.00)	5 (25.00)	5 (25.00)	20 (100.00)
	Total	18 (18.00)	14 (14.00)	29 (29.00)	22 (22.00)	17 (17.00)	100 (100.00)

(Figures in parantheses are percentages of the total in the respective groups)

A classification based on the extent of area under paddy is presented in Table 4.8. Very small paddy farms with an area of 0.4 hectares (one acre) and below accounted for 14 per cent in Upper Kuttanad. No farmer in Kari had an area less than 0.4 hectares under paddy. Among the sample farms, 22 per cent had an area ranging from 0.4 hectare to 0.8 hectare. This was 28 per cent for Lower Kuttanad and 20 per cent for Upper Kuttanad and 10 per cent for Kari. Twelve per cent of the paddy farms in Lower Kuttanad, 20 per cent in Upper Kuttanad and 15 per cent in Kari had an area of 0.8 hecture to 1.2 hectares (two to three acres), averaging to 15 per cent for the sample. Paddy farms with an area of 1.2 to 2.0 hectares (three to five acres) accounted for 32 per cent of the sample. This was 40 per cent for Kari, 33.33 per cent for Upper Kuttanad and 28 per cent ofor Lower Kuttanad. Large farms with size groups 2.0 to 2.8 hectares (five to seven acres) and above 2.8 hectares (seven acres) formed only eight per cent and 14 per cent of the total sample respectively.

Table 4.8 Classification of the respondents based on area under paddy

Sl. No.	Region	0 to.4 ha. (0 to 1 acre)	0.41 to 0.80 ha. (1 to 2 acres)	0.81 to 1.2 ha. (2 to 3 acres)	1.21 to 2.0 ha. (3 to 5 acres)	2.01 to 2.8 ha. (5 to 7 acres)	Above 2.8 ha. (above 7 acres)	Total
1	Lower Kuttanad	7 (14.00)	14 (28.00)	6 (12.00)	14 (28.00)	2 (4.00)	7 (14.00)	50 (100.00)
2	Upper Kuttanad	2 (6.67)	6 (20.00)	6 (20.00)	10 (33.33)	3 (10.00)	3 (10.00)	30 (100.00)
3	Kari	-	2 (10.00)	3 (15.00)	8 (40.00)	3 (15.00)	4 (20.00)	20 (100.00)
	Total	9 (9.00)	22 (22.00)	15 (15.00)	32 (32.00)	8 (8.00)	14 (14.00)	100 (100.00)

(Figures in parantheses are percentages of the total in the respective group)

6. Income

A classification of the respondents according to the total annual income for the family from various sources has been made. Majority of the farmers where found to have an income below Rs.3000.00. The break up of the respondents of the different regions classified under different income groups is given in Table 4.9.

Families with an annual income of Rs.1000.00 or less formed only three per cent of the sample. Twenty three per cent of the families had an annual income ranging from Rs.1001.00 to Rs.2000.00. Region-wise, that was 26 per cent for Lower Kuttanad and 20 per cent each ofor Upper Kuttanad and Kari. Thirty eight per cent of the sample families of Lower Kuttanad, 36.67 per cent of Upper Kuttanad and 35 per cent of Kari were in the income group of Rs.2001.00 to Rs.3000.00, averaging to 37 per cent for the entire sample. The income range of Rs.3001.00 to 4000.00 accounted for 15 per cent of the sample families. Four per cent of the families of Lower Kuttanad and 10 per cent each of Upper Kuttanad and Kari were found to have an annual income of Rs.4001.00 to Rs.5000.00, forming seven per cent of the sample. Another six per cent had an income ranging from Rs.5001.00 to Rs.7000.00. Number of families with higher incomes were comparatively less.

Table 4.9 Classification of the respondent based on total annual income (rupees)

Sl. No.	Region	Less than 1000	1000 to 2000	2001 to 3000	3001 to 4000	4001 to 5000	5001 to 7000	7001 to 9000	9000 to 12000	Above 12000	Total
1	Lower Kuttanad	2 (4.00)	13 (26.00)	19 (38.00)	7 (14.0)	2 (4.00)	3 (6.00)	-	1 (2.00)	3 (6.00)	50 (100.00)
2	Upper Kuttanad	1 (3.33)	6 (20.00)	11 (36.67)	4 (13.3)	3 (10.00)	2 (6.67)	1 (3.33)	1 (3.33)	1 (3.33)	30 (100.00)
3	Kari	- (	4 (20.00)	7 (35.00)	4 (20.0)	2 (10.0)	1 (5.00)	-	1 (5.00)	1 (5.00)	20 (100.00)
	Total	3 (3.00)	23 (23.00)	37 (37.00)	15 (15.00)	7 (7.00)	6 (6.00)	1 (1.00)	3 (3.00)	5 (5.00)	100 (100.00)

(Figures in parantheses are percentages of the totals in the respective groups)

7. Paddy varieties cultivated

Traditional varieties were not seen cultivated in Kuttanad. The coverage under different high yielding varieties of paddy has been tabulated and presented in the Table 4.10. Many farmers in the sample were found cultivating certain non-discript varieties with high yielding qualities, popularly referred to by certain numbers.

Jyothi was found to be the most popular variety accounting for about 56 per cent of the total area under paddy. However, in Lower Kuttanad, certain non-discript varieties known as 1009 and 1019 were found to be more popular than Jyothi. Among the other varieties, MO-5 which was released from Rice Research Station, Moncompu of the Kerala Agricultural University accounted for 4.27 per cent of the total paddy area. Varieties like H-4 which have slight tolerance to salinity were seen cultivated in Kari areas.

Table 4.10 Distribution of area under paddy, variety wise (hectares)

Sl. No.	Name of variety	Lower Kuttanad	Upper Kuttanad	Kari	Total
1	Jyothi	32.09 (37.75)	39.62 (85.35)	25.82 (61.74)	97.53 (56.29)
2	MO - 5	1.20 (1.41)	6.20 (13.36)	-	7.40 (4.27)
3	Jaya	3.80 (4.47)	-	-	3.80 (2.19)
4	Triveni	-	0.60 (1.29)	-	0.60 (0.35)
5	Culture-4	7.36 (8.56)	-	-	7.36 (4.25)
6	Bharathi	-	-	3.20 (7.65)	3.20 (1.85)
7	H-4	-	-	8.00 (19.13)	8.00 (4.62)
8	Non discript HYV	40.55 (47.71)	-	4.80 (11.48)	45.35 (26.18)
Total		85.01 (100.00)	46.42 (100.00)	41.82 (100.00)	173.25 (100.00)

(Figures in parantheses are percentages of the totals in the respective groups)

Extent of resource use

The quantity of the various resources used per hectare were measured to understand the extent of resource use. The use of family labour as well as hired labour was found involved in all the operations. Bullock labour/tractor was found to be associated with the preparation of land. As both these are used for preparation of the land, they have been clubbed together and measured in terms of the expenditure involved. Seeds were generally broadcast and measured in terms of quantity. Lime was used as a soil amelior nt. Organic manures in the form of farm yard manure and green leaves were also found used. Different forms of fertilizers were applied and they have been estimated in terms of their active nutrient content. For plant protection, various types of chemicals were used. Because the active ingredients were different, they could only be compared in terms of values. A comparison of the extent of use of these resources have been attempted to both input wise as well as the different inputs utilized for the various operations.

Human labour

Human labour consists of family labour as well as hired labour. The use of human labour as family labour and hired labour per hectare is presented in Table 4.11.

Table 4.11 Use of human labour per hectare (man days)

Sl. No.	Region	Family	Hired	Total
1	Lower Kuttanad	12.46 (8.39)	136.02 (91.61)	148.48 (100.00)
2	Upper Kuttanad	15.29 (13.55)	97.58 (86.45)	112.87 (100.00)
3	Kari	9.87 (9.25)	96.87 (90.75)	106.74 (100.00)
	Average	12.54 (9.74)	110.16 (90.26)	128.80 (100.00)

(Figures in parentheses are percentages to the respective totals)

On an average family labour contributed only less than ten per cent of the total labour use. Average use of human labour per hectare was 128.80 man days of which 12.54 man days (9.74 per cent) was supplied by

family labour. Human labour wise was highest in Lower Kuttanad, 148.48 man days, followed by Upper Kuttanad, 112.87 man days and Kari, 106.74 man days. Extent of contribution by family labour was maximum, 15.29 man days per hectare (13.55 per cent) in Upper Kuttanad. In Lower Kuttanad 12.46 man days were supplied by family members which accounted to 8.39 per cent of the total use per hectare.

Bullock labour/tractor

The payment for bullock labour and tractor was generally made based on the area ploughed. The per hectare cost involved in the use of bullock labour/ tractor is shown in Table 4.12. The physical quantities have not been compared because the extent of use of one is dependent on the use of the other since both these are used for preparation of land.

Table 4.12 Use of bullock labour/tractor per hectare (rupees)

Sl. No.	Region	Cost per hectare
1	Lower Kuttanad	521.94
2	Upper Kuttanad	252.31
3	Kari	459.11
	Average	411.12

The expenditure was the highest in Lower Kuttanad (₹.521.94) followed by Kari (₹.459.11) and Upper Kuttanad (₹.252.31). The average worked out to ₹.411.12. The expenditure for Lower Kuttanad was found to be 106.87 per cent more than that of Upper Kuttanad, that of Kari was 81.96 per cent more than that of Upper Kuttanad. The expenditure in Lower Kuttanad was 26.96 per cent more than the average, that of Kari was 16.97 per cent more. The expenses in Upper Kuttanad was 38.63 per cent less than that of the average.

Seeds

Seeds used per hectare remained more or less the same for all the three regions. Broadcasting was the general practice. The average seed rate worked out to 115.73 kg per hectare. Seed rate ranged from 122.00 kg at Lower Kuttanad followed by 118.70 kg at Kari and the lowest at Upper Kuttanad, being 106.50 kg. The quantities of seed used per hectare in Lower Kuttanad and Kari were 5.42 per cent and 2.57 per cent more than that of the average, while that at Upper Kuttanad 7.97 per cent less. Invariably in all the three regions the use of seeds was higher than the standard recommendation of 100 kg per hectare.

The information is presented in Table 4.13.

Table 4.13 Seed rate per hectare (kilograms)

Sl.No.	Region	Seed rate
1	Lower Kuttanad	122.00
2	Upper Kuttanad	106.50
3	Kari	118.70
	Average	115.73

Soil ameliorants

Invariably in all the regions, lime was applied as soil ameliorant. The extent of use varied with the intensity of soil acidity. The use of lime in the three regions are presented in Table 4.14.

Table 4.14 Use of soil ameliorants per hectare (kilograms)

Sl.No.	Region	Quantity of lime
1	Lower Kuttanad	235.60
2	Upper Kuttanad	82.90
3	Kari	253.50
	Average	190.67

In Lower Kuttanad and Kari, soil ameliorants were used in more or less the same quantity (235.60 kg and 253.50 kg respectively). Only 82.90 kg was applied at Upper Kuttanad. The use of soil ameliorants was found to be 23.56 per cent and 32.95 per cent more than the average in Lower Kuttanad and Kari respectively, while the use was 56.52 per cent less in Upper Kuttanad. In Kari it was 205.79 per cent more while in Lower Kuttanad, it was 184.20 per cent more than that of Upper Kuttanad.

Organic manure

On an average, the use of organic manure was around three quintals per hectare. It was highest in Upper Kuttanad (452.40 kg) which was about 46.61 per cent more than the average. In Lower Kuttanad the use of organic manure was 99.14 per cent of the average (305.90 kg), while in Kari it was only 167.40 kg which was 45.75 per cent less than the average. The use in all the three regions were very much less than the recommendation. This may be due to the fact that large quantities of plant materials left over after harvest-during which only the yearheads are collected - are ploughed into the soil which provides a good deal of

organic matter. Organic matter is also accumulated as silt. The high cost of transportation of farm yard manure or green manure also acts against its use. The quantities of organic manure used in the three regions are shown in Table 4.15.

Table 4.15 Quantities of organic manure applied per hectare (kilograms)

Sl.No.	Region	Quantity
1	Lower Kuttanad	305.90
2	Upper Kuttanad	452.40
3	Kari	167.40
	Average	308.57

Fertilizers

Various types of fertilizers were being used in the region. These have been converted into the quantities of actual nutrients supplied. The information are presented in Table 4.16.

Table 4.16 Quantities of nutrients applied per hectare (kilograms)

Sl. No.	Region	Nitrogen	Phosphorus	Potash
1	Lower Kuttanad	82.21 (91.35)	49.01 (108.89)	60.49 (134.41)
2	Upper Kuttanad	65.41 (72.68)	58.10 (129.11)	65.05 (144.56)
3	Kari	71.10 (78.99)	40.46 (89.92)	53.09 (117.98)
	Average	72.91 (81.01)	49.19 (109.31)	59.54 (132.32)
	Recommended dozage	90.00 (100.00)	45.00 (100.00)	45.00 (100.00)

(Figures in parentheses are percentages of the recommended dozage)

The average use of nitrogen was 72.90 kg per hectare which was only 81.01 per cent of the recommended doze (90 kg per hectare). In Lower Kuttanad, the use was 82.21 kg (91.35 per cent). In Upper Kuttanad, the use was only 72.68 per cent and in Kari 71.10 per cent of the recommendation. Except Kari, in both the other

regions, use of phosphorus per hectare was more than the recommended doze of 45 kg per hectare. It was about 49 kg in Lower Kuttanad and 58 kg in Upper Kuttanad. In Kari, however, it was 40.5 kg and was less by ten per cent than the recommended. The average use of phosphorus was 49.2 kg per hectare which was about ten per cent more than the recommended. In the case of potash, all the regions were using more than the recommendation. Highest use was recorded in Upper Kuttanad, 65 kg per hectare, which was about 45 per cent more than the recommendation. In Lower Kuttanad farms, 60.5 kg (134.11 per cent) of potash was used per hectare and in Kari 53.09 kg (117.48 per cent). The average use of 59.50 kg was more by about 32 per cent than the recommended.

Plant protection chemicals

Almost all of the respondents were adopting chemicals to control pests and diseases. A variety of chemicals with different formulations and active ingredients were being used. Hence this input could not be measurediin physical terms for comparison. The expenditure per hectare towards the cost of plant

protection chemicals applied per hectare is presented in Table 4.17.

Table 4.17 Plant protection chemicals - cost per hectare (rupees)

Sl.No.	Region	Cost of chemicals
1	Lower Kuttanad	291.53
2	Upper Kuttanad	181.46
3	Kari	370.27
	Average	281.09

The average expenditure per hectare worked out to Rs.281.09. The expenditure of Rs.370.27 in Kari was higher by 31.73 per cent, while that of Upper Kuttanad, Rs.181.46 was less by 35.5 per cent than the average. Among the region, the use in Lower Kuttanad was 60.66 per cent and in Kari 104.00 per cent more than that of Upper Kuttanad.

After the monsoons, soon the water starts receding, the paddy cultivation season begins. The work starts with the repair of outer bunds followed by

pumping out of water from the fields. Preparation of land includes removal of salvinia, repair of innerbunds, ploughing, preparation of drainage channels and levelling. Then sprouted seeds are broadcast. Transplanting is only rarely practised. Gap filling and weeding are generally carried out employing human labour. Chemical weed control is practised in many farms. Lime is seen applied usually to control soil acidity. Application of manure is found to be rare. Fertilizers are applied generally in three dozes. Plant protection measures, irrigation and dewatering are carried out as and when found required. Cultivation for the season ends with harvesting and the post harvest operations like drying, winnowing, transporting and storing.

The extent of use of various resources in the above operations is examined below.

Repair of outer bunds

This item of work employs male labour. In many areas, the work is undertaken on contract. Hence actual use of labour in man days could not be assessed. The expenditure on this operation for the different regions has been worked out. From this the use of

human labour in man days was computed for the regions and are shown in Table 4.18.

Table 4.18 Expenditure per hectare on repair of outer bunds

Sl.No.	Region	Expenditure Rs.	Human labour man days
1	Lower Kuttanad	135.22	11,27
2	Upper Kuttanad	22.32	1.86
3	Kari	81.79	6.82
	Average	79.78	6.65

The average expenditure per hectare was Rs.79.78. At Lower Kuttanad, the expenditure was about 70 per cent more than the average. At Upper Kuttanad the expense was Rs.22.32 per hectare which was only 27.78 per cent of the average. The human labour requirements were estimated considering the prevailing wage rate. On an average, it was 6.65 man days per hectare.

When compared to Upper Kuttanad region, the Lower Kuttanad and Kari areas were deeper, situated nearer to the Vembanad lake. Hence the outer bunds suffer more damages during monsoons when water level would be high. This was the reason for the higher cost in Lower Kuttanad and Kari.

Removal of salvinia

Salvinia molesta, an important water weed of Kerala, is known as the 'menace of Kuttanad farmers'. When the fields are submerged during off season, the weed enters the padasekharams and covers the whole area givin the appearance of a thick dark green mattress spread over the water expanse. When the water is pumped out, it gets accumulated in the fields. Preparatory tillage and ploughing would be difficult without removing the weed.

Removal of salvinia was generally taken up on contract basis. Hence information about the actual number of man days involved could not be ascertained. The cost incurred for this operation in the different regions are given in Table 4.19.

Table 4.19 Expenditure for removal of salvinia per hectare (rupees)

Sl.No.	Region	Expenditure
1	Lower Kuttanad	269.50
2	Upper Kuttanad	142.54
3	Kari	125.17
	Average	197.07

Highest cost per hectare of Rs.269.50 was met with in Lower Kuttanad and this is over 50 per cent more than the average cost of Rs.179.07. The reason for the higher cost was that the Kayal lands are more accessible to weed infestation since they lie adjacent to the lake. This involves the use of much more human labour per hectare for the removal than in other regions.

Repair of inner bunds and channels

The average requirement per hectare of human labour for the item was 7.6 man days and cost of labour, Rs.88.89.

Table 4.20 Human labour requirement and cost of labour per hectare

Sl.No.	Region	Man days	Rs.
1	Lower Kuttanad	7.9	95.82
2	Upper Kuttanad	7.6	81.88
3	Kari	7.5	88.96
	Average	7.6	88.89

There were no significant variations in input use among the regions. In Upper Kuttanad the wage rate was comparatively lesser.

Preparatory cultivation

After the harvest of a crop, two ploughings are given and water is let in. This would enable washing of soil as well as incorporation of stubbles. Land preparation is accomplished by ploughing using bullock or tractor or digging employing human labour. Levelling is carried out using levelling boards drawn by bullock/tractor or hand levelling. The use of bullock/tractor has already been discussed. No human labour was employed for preparatory cultivation in

Upper Kuttanad, while 10.4 and 12.7 man days per hectare were employed in Lower Kuttanad and Kari respectively. The average use of human labour was 7.7 man days per hectare.

Table 4.21 Expenditure break up for preparatory cultivation per hectare (rupees)

Sl.No.	Region	Bullock/ tractor	Human labour	Total
1	Lower Kuttanad	521.94	110.10	632.04
2	Upper Kuttanad	252.31	--	252.31
3	Kari	459.11	151.57	610.68
	Average	411.12	87.56	498.68

Seeds and sowing

Apart from the quantity of seed material and the cost therein, other resources used for this item are human labour for the preparation of sprouted seeds and transporting to the field, as also the sowing charges which were paid based on the area sown. Expenditure per hectare for these are presented in Table 4.22.

Table 4.22 Expenditure per hectare on seeds and sowing (rupees)

Sl. No.	Region	Cost of seed	Cost of seed preparation and transporting	Sowing charges	Total
1	Lower Kuttanad	244.00	15.11	25.79	284.90
2	Upper Kuttanad	228.11	15.02	25.14	268.27
3	Kari	237.47	13.40	25.00	275.87
	Average	236.53	14.51	25.31	276.35

The average cost of seeds required per hectare worked out to ₹.236.53 and there were not much variations among the regions. Cost of labour per hectare for the preparation of sprouted seeds and transporting was ₹.14.51 on the average. The sowing charges per hectare was around ₹.25.00 in all the regions. The average total expenditure per hectare came to ₹.276.35.

Gap filling and weeding

Seeds are generally sown by broadcast which necessitates thinning of seedlings and gap filling. This work is taken up along with the first weeding

about four weeks after sowing. Chemical control of weeds is also included here. The expenditure on these operations are presented together in Table 4.23.

Table 4.23 Expenditure per hectare on gap filling and weed control

Sl. No.	Region	Labour use per hectare		Weedicides, cost and application Rs.
		Man days	Rs.	
1	Lower Kuttanad	71.64	856.76	76.70
2	Upper Kuttanad	74.39	806.14	25.93
3	Kari	47.50	591.11	45.34
	Average	64.51	751.34	49.32

The average human labour requirement was 64.51 man days per hectare. It was highest for Upper Kuttanad (74.39) followed by Lower Kuttanad (71.64) and Kari (47.50). The use of human labour in Upper Kuttanad and Lower Kuttanad exceeded the average by 15.31 per cent and 11.05 per cent respectively, while in Kari it was less by 26.38 per cent. Among the regions, Lower Kuttanad used 50.83 per cent more of human labour used in Kari and Upper Kuttanad employed

56.62 per cent more than the per hectare use in Kari. The expenditure on labour was Rs.751.34 on the average. Highest expenditure was recorded in Lower Kuttanad (Rs.856.76). In Kari, it was Rs.591.11 only. However, the human labour requirement for this operation depends on the intensity of weeds. Chemical weed control was found to be more widely practised in Kayal lands (Lower Kuttanad) and less popular in the upper regions. The average per hectare expenditure on this item was Rs.49.32. In Lower Kuttanad, the expenditure was about 56 per cent more and in Upper Kuttanad, 47 per cent less than the average. The use of weedicides in Lower Kuttanad recorded about 200 per cent more and in Kari, 75 per cent more than in Upper Kuttanad.

Application of soil ameliorants

The quantity of liming material and the cost including application per hectare as shown in Table 4.24.

Table 4.24. Expenditure per hectare on soil ameliorants

Sl.No.	Region	Quantity of lime quintals	Cost ₹.
1	Lower Kuttanad	2.36	127.35
2	Upper Kuttanad	0.83	37.32
3	Kari	2.54	119.24
	Average	1.91	94.64

Liming materials were generally supplied by co-operative societies. The price per quintal of liming material charged by the societies is inclusive of application charges. The average expenditure per hectare towards the cost and application was ₹.94.64. It was ₹.127.35 in Lower Kuttanad and ₹.119.24 in Kari. The quantity of liming material depends on the intensity of soil acidity Upper Kuttanad soils are less acidic. Hence the expenditure there was about 60 per cent less than the average. The cost on liming was about 2.5 times more in Lower Kuttanad and two times more in Kari than in Upper Kuttanad.

Irrigation and dewatering

The human labour requirement per hectare was 16.2 in Lower Kuttanad, 11.5 in Upper Kuttanad and 13.4 in Kari averaging to 13.7 man days. The use in Lower Kuttanad was 18.5 per cent more than the average. Among the regions, the Kayal lands employed 41.4 per cent more of human labour than in Upper Kuttanad and 21 per cent more than in Kari. The labour use and the wages paid are given in Table 4.25.

Table 4.25 Use of human labour and expenditure towards irrigati n and dewatering

Sl.No.	Region	Man days	Wages Rs.
1	Lower Kuttanad	16.20	186.09
2	Upper Kuttanad	11.50	97.89
3	Kari	13.40	136.55
	Average	13.70	140.18

The average cost per hectare for irrigation/ dewatering was Rs.140.18. It may be noted that this operation of letting in and draining out water from the

fields are carried out by men who also keep watch on the fields and general supervision of the field operations.

Manures and manuring

Only a few farmers were seen to apply organic manure in the fields. The common organic manures used were cowdung, farm yard manure and green leaves. Manures were transported using country boats, own or hired. Table 4.26 gives the quantity as well as expenditure on this operation for one hectare.

Table 4.26 Quantity of manure and expenditure per hectare

Sl. No.	Region	Quantity quintals	Value Rs.	Man days	Wages Rs.	Hire charges of boat Rs.
1	Lower Kuttanad	3.06	38.59	0.34	6.00	0.91
2	Upper Kuttanad	4.52	41.69	0.71	8.45	2.82
3	Kari	1.67	17.94	0.30	4.00	0.96
	Average	3.09	32.74	0.45	6.15	1.56

Average per hectare use of organic manure was only 3.09 quintals. It was highest in Upper Kuttanad (4.52 quintals), followed by Lower Kuttanad (3.06 quintals) and in Kari, as low as 1.67 quintals. The price per quintals was comparatively higher in Kayal areas. The total average expenditure for this item amounted to Rs. 40.90.

Fertilizers and application

Expenses on fertilizers consumed a sizeable share of the resources. The average expenditure per hectare was Rs.778.59. The expenditure per hectare towards cost and application charge of fertilizers are tabulated below.

Table 4.27 Expenditure per hectare on fertilizers and their application (rupees)

Sl.No.	Region	Cost	Application charges	Total
1	Lower Kuttanad	783.49	60.82	844.31
2	Upper Kuttanad	710.38	51.55	761.93
3	Kari	687.58	41.95	729.53
	Average	727.15	51.44	778.59

The quantity of nutrients has been already discussed (Table 4.16). The costs on fertilizers remained more or less same for the regions. In Lower Kuttanad the total expenditure per hectare was 15.73 per cent more than that of Kari, and in Upper Kuttanad, the increase over Kari was only 4.44 per cent. Between Lower Kuttanad and Upper Kuttanad, the former recorded a higher cost of the order of 10.81 per cent.

Plant protection operations

Table 4.28 shows the cost of plant protection chemicals used per hectare and the application charges in the three regions.

Table 4.28 Expenditure per hectare towards plant protection operations (rupees)

Sl.No.	Region	Cost of chemicals	Application charges	Total
1	Lower Kuttanad	291.53	155.47	447.00
2	Upper Kuttanad	181.46	97.94	279.20
3	Kari	370.27	170.92	541.19
	Average	281.09	141.44	422.46

The cost of chemicals has been discussed before. Application was generally undertaken on contract basis. The application charges per hectare was ₹.155.47 in Lower Kuttanad, ₹.97.94 in Upper Kuttanad and ₹.170.92 in Kari averaging to ₹.141.44. The expenses were over 20 per cent more in Kari and ten per cent more in Lower Kuttanad than the average, whereas in Upper Kuttanad, it was less by about 30 per cent. Among the regions, Kari recorded 75 per cent more expenditure and Lower Kuttanad about 60 per cent more than Upper Kuttanad. The average total expenditure for plant protection was ₹.422.46 per hectare. It was ₹.541.19 in Kari, ₹.447.00 in Lower Kuttanad followed by ₹.279.20 in Upper Kuttanad.

The application costs in the three regions were more or less one third of the expenditure for plant protection. The proportional expenses are shown in Table 4.29.

Table 4.29 Cost of chemicals and application charges as percentages to the total cost

Sl. No.	Region	Cost of chemicals (percentage)	Application cost (percentage)	Total (percentage)
1	Lower Kuttanad	65.22	35.78	100.00
2	Upper Kuttanad	64.95	35.05	100.00
3	Kari	68.42	31.58	100000
	Average	66.53	33.47	100.00

Post harvest operations

The wages for harvest were paid in kind only, and the receipts from cultivation generally exclude such payments. Hence harvesting is not taken into account for the operation wise analysis of resource use.

The post harvest operations include sun drying of the main as well as bye-product, winnowing and transporting of grain. Winnowing is generally carried out hiring winnowing machine. The use of resources for these operations are tabulated below.

Table 4.30 Use of human labour and expenditure towards post harvest handling

Sl. No.	Region	Man days	Wages Rs.	Cost of hiring winnowing machine Rs.
1	Lower Kuttanad	4.12	51.40	23.00
2	Upper Kuttanad	3.45	41.28	25.20
3	Kari	3.32	41.32	24.30
	Average	3.69	44.67	24.17

The average human labour requirement was 3.69 man days. It was about 12 per cent more in Lower Kuttanad and 10 per cent less in Kari. Among the regions, the requirement in Lower Kuttanad was about 25 per cent more than that of Kari and 20 per cent more than that of Upper Kuttanad. The wages paid per human labour was Rs.51.40 in Lower Kuttanad, Rs.41.28 in Upper Kuttanad and Rs.41.32 in Kari averaging to Rs.44.67. The average per hectare expenditure as hire charges for winnowing machine was Rs.24.17.

Economics of paddy cultivation

The cost of cultiv tion of paddy has been worked out for the three regions of Lower Kuttanad, Upper Kuttanad and Kari. The total cost of cultivation per hectare is shown in Table 4.31.

Table 4.31 Cost of cultivation of paddy per hectare (rupees)

Sl.No.	Region	Cost per hectare
1	Lower Kuttanad	4239.65
2	Upper Kuttanad	3010.98
3	Kari	3571.31
	Average	3607.33

The total cost shown above does not include rental value of land. It is seen that a high degree of variation exist in the cost of paddy cultivation for the three regions. The highest cost of Rs.4239.65 was recorded in Lower Kuttanad followed by Kari and Upper Kuttanad. The cost for Lower Kuttanad was 17.53 per cent more than the average cost per hectare of Rs.3607.33.

A break up of the total cost, operation-wise, for the different regions is given in Table 4.32.

Table 4.32 Cost of cultivation - operation wise (rupees)

Sl. No.	Operations	Lower Kuttanad	Upper Kuttanad	Kari	Average
1	Repair to outer bunds	135.22 (3.19)	22.32 (0.74)	81.79 (2.29)	79.78 (2.21)
2	Removal of salvinia	269.50 (6.35)	142.54 (4.73)	125.17 (3.50)	179.07 (4.96)
3	Repair to inner bunds and forming channels	95.82 (2.26)	81.88 (2.72)	88.96 (2.49)	88.89 (2.46)
4	Preparatory cultivation	633.04 (14.93)	252.31 (8.38)	610.68 (17.10)	498.68 (13.82)
5	Seeds and sowing	284.90 (6.72)	268.27 (8.91)	275.87 (7.72)	276.35 (7.66)
6	Gap filling and weed control	933.46 (22.02)	832.07 (27.63)	636.45 (17.82)	800.66 (22.20)
7	Irrigation/dewatering	186.09 (4.39)	97.89 (3.25)	136.55 (3.82)	140.18 (3.89)
8	Application of soil ameliorants	127.35 (3.00)	37.32 (1.24)	119.24 (3.34)	94.64 (2.62)
9	Application of manures	45.50 (1.07)	52.96 (1.76)	22.90 (0.64)	40.45 (1.12)
10	Application of fertilisers	844.31 (19.91)	761.93 (25.31)	729.53 (20.43)	778.59 (21.58)
11	Plant protection operations	447.00 (10.54)	279.20 (9.27)	541.19 (15.15)	422.46 (11.71)
12	Post harvest operations	74.40 (1.75)	66.48 (2.21)	65.62 (1.84)	68.84 (1.91)
13	Interest on working capital	163.06 (3.85)	115.81 (3.85)	137.36 (3.85)	138.74 (3.85)
	Total	4239.65 (100.00)	3010.98 (100.00)	3571.31 (100.00)	3607.33 (100.00)

(Figures in parantheses are percentages of the total cost)

FIG . COST OF CULTIVATION PER HECTARE (LOWER KUTTANAD)

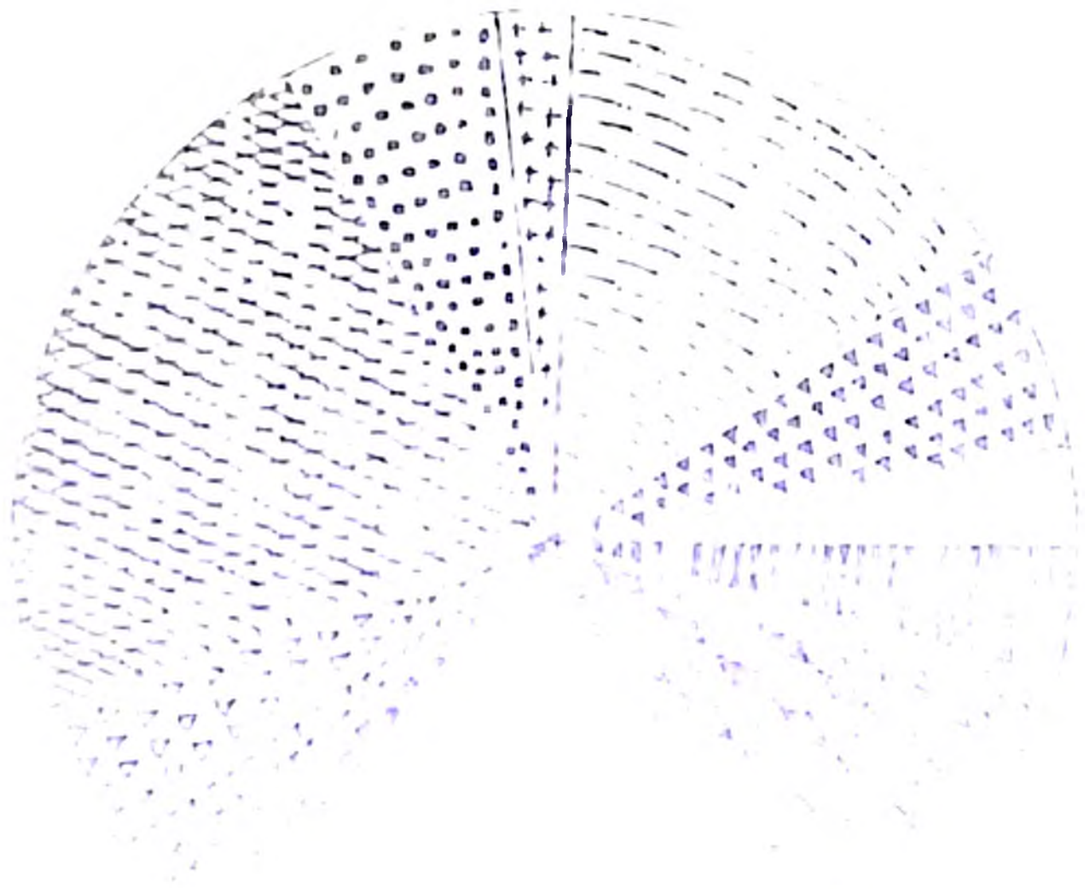


FIG . COST OF CULTIVATION PER HECTARE (UPPER KUTTANAD)

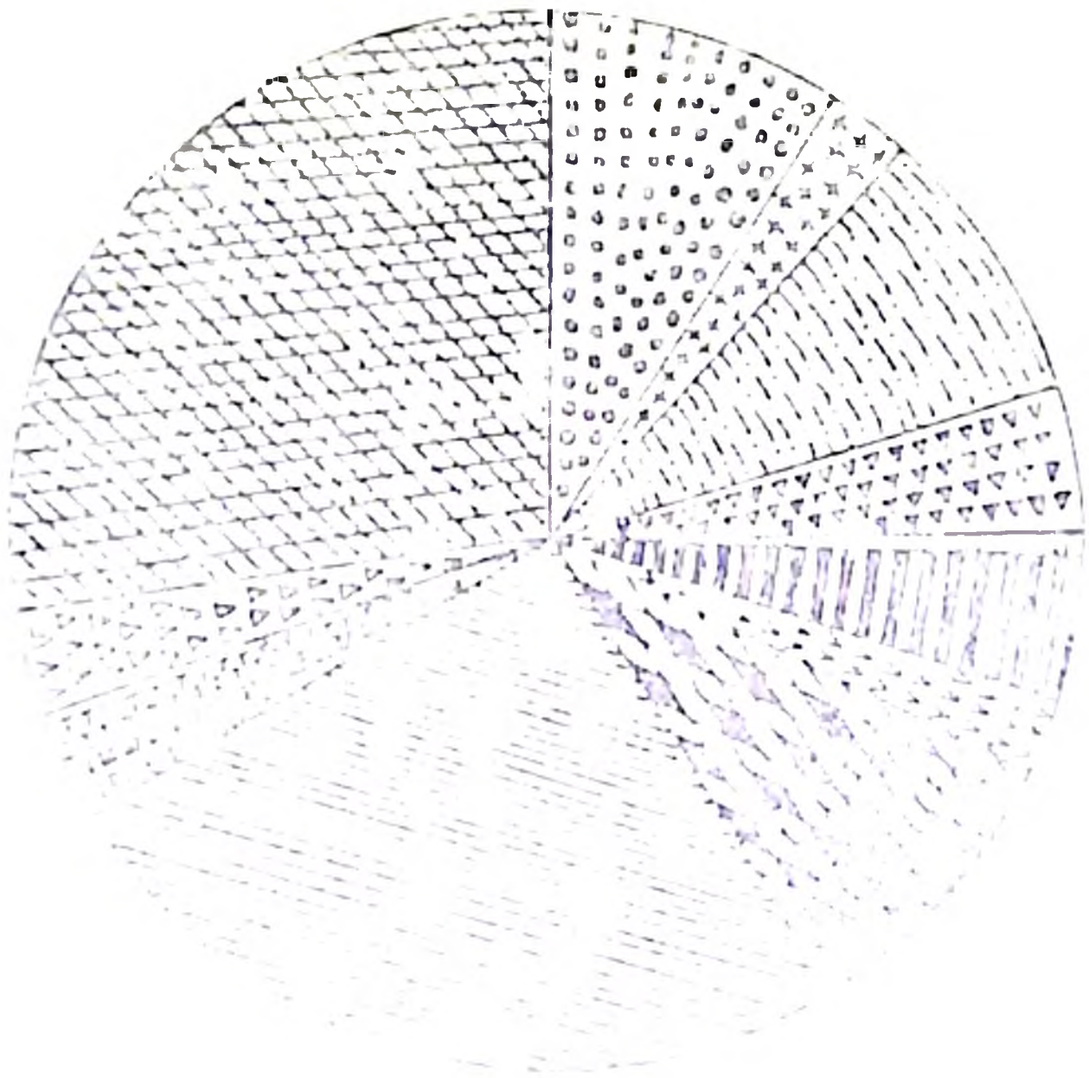


FIG . COST OF CULTIVATION PER HECTARE (KARI LANDS)

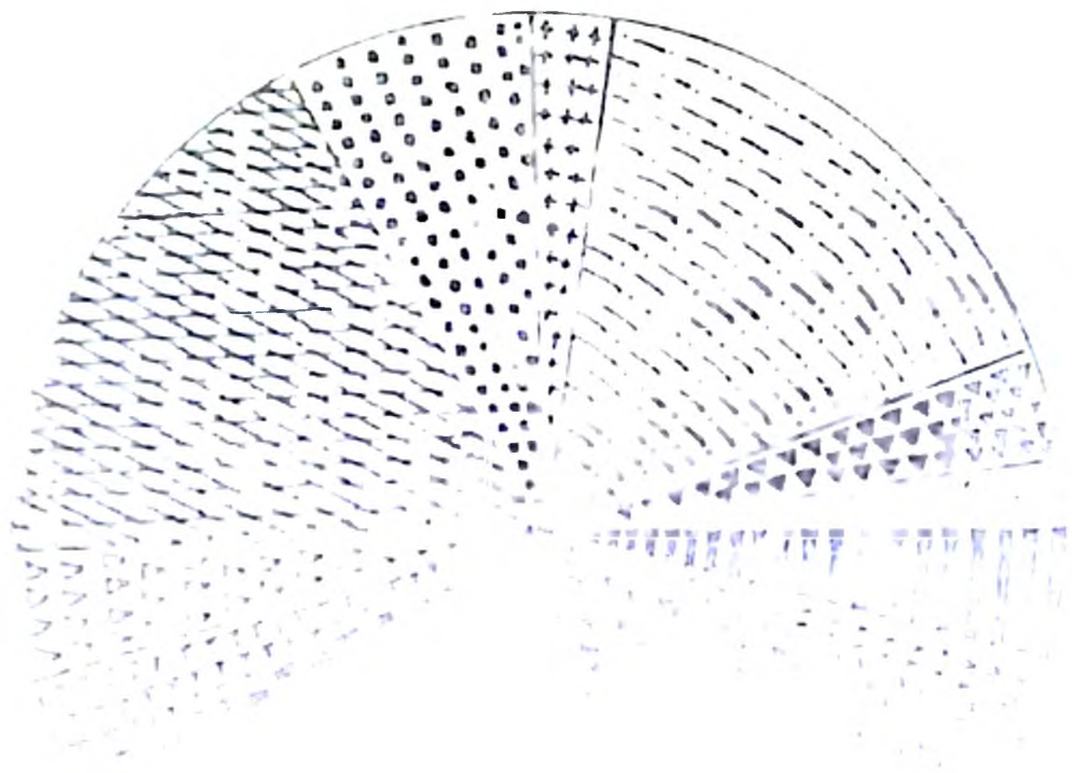
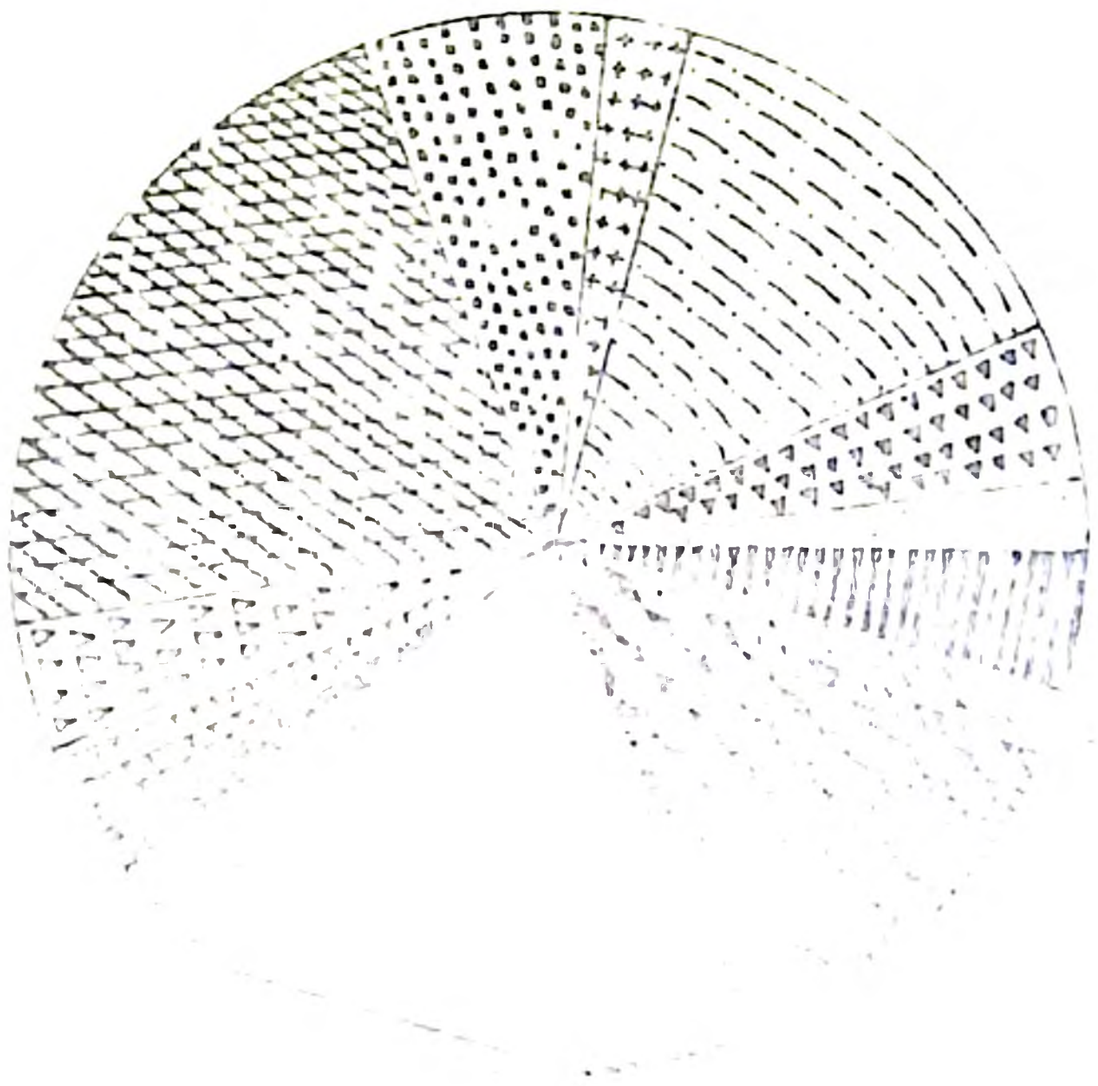


FIG . AVERAGE COST OF CULTIVATION PER HECTARE
(KUTTANAD)



The cost incurred in the three regions for the various operations are discussed below.

Repair to outer bunds

Damages to the outer bunds are caused during the monsoons. These have to be properly re-enforced before pumping out water. The cultivation operations in a season start with the repairs to outer bunds encircling the padarasekharoms. The cost of annual maintenance and repair to outer bunds for the three regions are shown in the following table.

Table 4.33 Expenditure per hectare towards repair to outer bunds (rupees)

Sl.No.	Regions	Cost
1	Lower Kuttanad	135.22 (3.19)
2	Upper Kuttanad	22.32 (0.74)
3	Kari	81.79 (2.29)
	Average	79.78 (2.21)

(Figures in parentheses give the percentages to the total cost)

The cost for this operation has been higher in Lower Kuttanad both proportionally as well as in absolute terms. The expenditure is Rs.135.22 which accounts for 3.19 per cent of the total cost. In Lower Kuttanad, the fields are comparatively lower than the other two regions. This land suffers greater damage to the outer bunds during the monsoons. In Upper Kuttanad, the fields are only slightly below water level and the repairs needed to the outer bunds are minimum. Hence the cost is only Rs.22.32 accounting for 0.74 per cent of the total cost. On an average the per hectare expenditure for this operation is Rs.79.78 which forms 2.21 per cent of the total cost of cultivation per hectare.

Removal of salvinia

Since the commissioning of the Thanneermukkom barrage in 1974 the incidence of the 'African payal' (Salvinia molesta) is reported be higher. Considering the severity of the incidence of this exotic water weed in Kuttanad fields, its removal has been considered a separate operation. Salvinia gets accumulated as a thick bed on the field when water is

drained. This has to be removed employing human labour. Expenditure on the removal of salvinia for the regions is shown in the table below.

Table 4.34 Expenditure towards removal of salvinia (rupees)

Sl.No.	Region	Cost per hectare
1	Lower Kuttanad	269.50 (6.36)
2	Upper Kuttanad	142.54 (4.73)
3	Kari	125.17 (3.50)
	Average	179.07 (4.96)

(Figures in parantheses are percentages of the total cost)

The variation in the cost per hectare among the regions can be attributed to the intensity of the weed in the regions. On an average, the cost per hectare was Rs.179.07 which accounted for about five per cent of the total cost. The expenditure was highest in Kayal lands (Rs.269.50) where the

incidence of the weed was more as compared to Kari or Upper Kuttanad.

Repair to inner bunds and forming channels

The inner bunds, demarking individual plots, are repaired before cultivation. Small and large channels are made between plots as well as within plots for irrigation and drainage. The expenditure for the operation is shown below.

Table 4.35 Expenditure towards repair to inner bunds and forming channels (rupees)

Sl.No.	Region	Cost per hectare
1	Lower Kuttanad	95.82 (2.26)
2	Upper Kuttanad	81.88 (2.72)
3	Kari	88.96 (2.49)
	Average	88.89 (2.46)

(Figures in parentheses are percentages of the total cost)

The expenditure for the three regions are more or less the same averaging to Rs.88.89 which is 2.46 per cent of the total cost.

Preparatory cultivation (Ploughing, digging and levelling)

Table 4.36 Cost of preparatory cultivation (rupees)

Sl.No.	Region	Cost per hectare
1	Lower Kuttanad	633.04 (14.93)
2	Upper Kuttanad	252.31 (8.38)
3	Kari	610.68 (17.10)
	Average	498.68 (13.82)

(Figures in parentheses are percentages of the total cost)

Land preparation is accomplished by ploughing using either tractor or bullocks or digging the land and levelling. Levelling the land is either by levelling boards or by employing women labour. The cost on this item of work is given in Table 4.36.

The average expenditure per hectare was ₹.498.68 accounting for 13.82 per cent of the total cost. Among the regions, the cost at Upper Kuttanad was much lower than those at the other two regions. This may be because in Upper Kuttanad, the tractor or tiller was not generally used for ploughing, as also, for levelling human labour was seldom employed.

Seeds and sowing

The respondents were using high yielding variety seeds. Seed rate, method of sprouting seeds, and sowing were more or less same in all the regions. Table 4.37 shows the expenditure on this item.

Table 4.37 Cost of seeds, seed preparation and sowing (rupees)

Sl.No.	Region	Cost per hectare
1	Lower Kuttanad	284.90 (6.72)
2	Upper Kuttanad	268.27 (8.91)
3	Kari	275.87 (7.72)
	Average	276.35 (7.66)

(Figures in paranthesses are percentages of the total cost)

The cost for this operation did not show much variation among the regions. The average expenditure was ₹.276.35 per hectare accounting for 7.66 per cent of the total cost.

Gap filling and weed control

Prevention of salinity intrusion in Kuttanad since 1974 caused the emergence of a number of new weeds in the area, requiring the employment of more man days than before, for weeding. Thinning/gap filling operations and first hand weeding were generally carried out simultaneously. Weedicides were also seen used in the area. The cost for the operation is shown in Table 4.38.

Table 4.38 Expenditure towards gap filling and weed control (rupees)

Sl.No.	Region	Cost per hectare
1	Lower Kuttanad	933.46 (22.02)
2	Upper Kuttanad	832.07 (27.63)
3	Kari	636.45 (17.82)
	Average	800.66 (22.20)

(Figures in parentheses are percentages of the total cost)

Expenditure on weedicides included cost of chemicals and application charges. Even with the widespread adoption of chemical weed control measures, expenditure on this item was quite substantial accounting for over 22 per cent of the total cost. The intensity of weeds was comparatively less in Kari areas.

Irrigation/dewatering

Water is let in and drained off through sluices at the bunds. This was was generally performed by labourers employed to keep watch and general supervision at the field. The expenditure for this item only is presently being met by the farmers during the main paddy season. The costs on pumping water is now fully subsidised by the State Government.

The expenditure on irrigation/dewatering per hectare is given in Table 4.39. The average expenditure per hectare was M.140.18 (3.89 per cent of total cost). The variation among the regions was due to the difference in the number of man days employed in each region.

Table 4.39 Expenditure on irrigation/ dewatering (rupees)

Sl.No.	Region	Cost per hectare
1	Lower Kuttanad	186.09 (4.39)
2	Upper Kuttanad	97.89 (3.25)
3	Kari	136.55 (3.82)
	Average	140.18 (3.89)

(Figures in parentheses are percentages of the total cost)

Soil ameliorants

Kuttanad soils are invariably acidic in reaction, the pH ranging from 5 to 6.5. The acidity is more in the Kayal lands and Kari. Majority of the farmers in these areas apply liming materials for soil conditioning. The expenditure per hectare towards the cost and application charges of liming materials are shown in Table 4.40.

The extent of use of liming materials was less in Upper Kuttanad where soil acidity was not as

severe as in the other two regions. The average expenditure for the item was Rs.94.64 per hectare accounting for 2.62 per cent of the total cost.

Table 4.40 Cost and application charges of liming materials (rupees)

Sl.No.	Regions	Cost per hectare
1	Lower Kuttanad	127.35 (3.00)
2	Upper Kuttanad	37.32 (1.24)
3	Kari	119.24 (3.34)
	Average	94.64 (2.62)

(Figures in parantheses are percentages of the total cost)

Manures and manuring

Use of organic manures in paddy fields these days are only to a limited extent. This may be due to the higher costs incurred in this area for the transport and application of organic manure.

Expenditure on this operation is given in Table 4.41.

Table 4.41 Expenditure on manures and manuring (rupees)

Sl.No.	Region	Cost per hectare
1	Lower Kuttanad	45.50 (1.07)
2	Upper Kuttanad	52.96 (1.76)
3	Kari	22.90 (0.64)
	Average	40.45 (1.12)

(Figures in parantheses are percentages of the total cost)

The expenditure on the operation accounted for only 1.12 per cent of the total cost on an average. The use of organic manure was comparatively higher in Upper Kuttanad.

Fertilizers and application

This is a major item of expenditure in the cost of cultivation of paddy in Kuttanad. All the respondents applied chemical fertilizers in their

fields. Table 4.42 shows the expenditure on this item.

Table 4.42 Expenditure on fertilizers and application (rupees)

Sl.No.	Region	Cost per hectare
1	Lower Kuttanad	844.31 (19.91)
2	Upper Kuttanad	761.93 (25.31)
3	Kari	729.53 (20.43)
	Average	778.59 (21.58)

(Figures in parentheses are percentage of the total)cost)

The average expenditure per hectare was ₹.778.59, i.e. about 22 per cent of the total cost. Among the regions, more intensive fertilizer use was practised in Lower Kuttanad, where the expenditure was ₹.844.31. In Upper Kuttanad, more than one fourth of the total cost was accounted for by this operation only.

Plant protection

During the period of study, there was a

fairly wide spread attack of brown plant hopper. Hence the expenditure towards plant protection operation during the season was quite substantial.

Table 4.43 Expenditure on plant protection (rupees)

Sl.No.	Region	Cost per hectare
1	Lower Kuttanad	447.00 (10.54)
2	Upper Kuttanad	270.20 (9.27)
3	Kari	541.19 (15.15)
	Average	422.46 (11.71)

(Figures in parantheses are percentage of the total cost)

The intensity of pest infestation was more in Kari and Lower Kuttanad which accounted for Rs.541.19 and Rs.447.00 respectively. The average expenditure was Rs.422.46 amounting to 11.71 per cent of the total cost.

Post-harvest handling

No harvesting charges have not been included in the cost of cultivation since the payment for the

work was made in kind. The quantity of paddy paid as wage has not been included in the receipts.

Expenditure on post harvest handling included labour for sun drying, winnowing and transporting of paddy and the rent for the winnowing machine and also other miscellaneous expenditure. after harvest. The table below shows the expenditure for the above operations.

Table 4.44 Expenditure on post harvest operations (rupees)

Sl.No.	Region	Cost per hectare
1	Lower Kuttanad	74.40 (1.75)
2	Upper Kuttanad	66.48 (2.21)
3	Kari	65.62 (1.84)
	Average	68.84 (1.91)

(Figures in parantheses are percentages of the total cost)

On an average, about two per cent of the total cost was accounted for by this item of work.

A comparatively higher cost per hectare of Rs.74.40 in Lower Kuttanad may be due to the greater distance the produce has to be transported in Kayal lands.

Interest on working capital

Interest was charged at the rate of 12 per cent per annum and calculated for a period of four months. The working capital included all the out of pocket expenses of the farmers for paddy cultivation. Table 4.45 shows the expenditure as interest on working capital.

Table 4.45 Interest on working capital (rupees)

Sl.No.	Region	Cost per hectare
1	Lower Kuttanad	163.06 (3.85)
2	Upper Kuttanad	115.81 (3.85)
3	Kari	137.36 (3.85)
	Average	138.74 (3.85)

(Figures in parantheses are percentage of the total cost)

The interest on working capital was Rs.138.74 for Kuttanad. It formed 3.85 per cent of the total costs in the different regions.

No depreciation charges have been included in the cost. This is because the labourers generally bring their own implements to the field and the wages they get include the rent for the implements also.

An input-wise break up of the cost of cultivation per hectare has been attempted to. Costs incurred for the various inputs have been tabulated and presented in Table 4.46. Since the farmers owned no machinery or implements of their own, the depreciation and interest on fixed capital have not been included.

Considering the costs involved, the three major inputs, in the order of importance, were human labour, fertilizer and animal labour/tractor.

About 45 per cent of the total cost of cultivation was spent as wages for human labour. Among the regions, the proportional expenditure varied from 47.07 per cent in Lower Kuttanad, 46.79 per cent in Upper Kuttanad and 41.67 per cent in Kari. The average per hectare expenditure on human labour worked out to Rs.1630.99.

Table 4.46 Cost of cultivation - input wise (rupees)

Sl. No.	Inputs	Lower Kuttanad	Upper Kuttanad	Kari	Average
1	Animal labour/ tractor	521.94 (12.31)	252.31 (8.38)	459.11 (12.86)	411.12 (11.40)
2	Human labour	1995.69 (47.07)	1408.90 (46.79)	1488.34 (41.67)	1630.99 (45.21)
3	Seed material	244.00 (5.76)	228.11 (7.58)	237.47 (6.65)	236.53 (6.56)
4	Soil ameliorants	127.35 (3.00)	37.32 (1.24)	119.24 (3.34)	94.64 (2.62)
5	Manures	38.59 (0.91)	41.69 (1.38)	17.94 (0.50)	32.74 (0.91)
6	Fertilizers	783.49 (18.48)	710.38 (23.59)	687.58 (19.25)	727.15 (20.16)
7	Plant protection chemicals including weedicides	343.53 (8.10)	198.46 (6.59)	401.27 (11.24)	314.42 (8.72)
8	Interest on working capital	163.06 (3.85)	115.81 (3.85)	137.36 (3.85)	138.74 (3.85)
9	Miscellaneous	22.00 (0.51)	18.00 (0.60)	23.00 (0.64)	21.00 (0.58)
	Total	4239.65 (100.00)	3010.98 (100.00)	3571.31 (100.00)	3607.33 (100.00)

(Figures in parentheses are percentages of the total cost)

The expenditure on fertilizers alone, on an average, accounted for about one fifth of the total cost. In absolute terms, it was highest in Lower Kuttanad, ₹.783.49 (18.48 per cent) but proportionately higher in Upper Kuttanad, 23.59 per cent (₹.710.38) of the total cost. In Kari the expenditure on fertilizers was ₹.687.58 (19.25 per cent). The average expenditure on this item was ₹.727.15 (20.16 per cent).

Animal labour/tractor accounted for about 12 per cent of the cost on the average. In Lower Kuttanad an amount of ₹.521.94 was spent per hectare for this input, while in Kari it was ₹.459.11. The farmers in Upper Kuttanad were found to use only less animal labour/tractor, where the expenditure was only ₹.252.31 accounting for 8.38 per cent of the total cost. This may be due to the special soil conditions. On the average, 11.40 per cent of the cost (₹.411.12) was spent on this resource.

The next major input was plant protection which included expenditure on chemicals used for weed control also. Highest expenditure was recorded in Kari, ₹.401.27 (11.24 per cent) followed by Lower Kuttanad, ₹.343.53 (8.10 per cent) and Upper Kuttanad,

₹.198.46 (6.59 per cent), averaging to ₹.314.42 (8.72 per cent). Cost of seed material accounted for 6.56 per cent (₹.236.53) of the total cost, on an average, ranging from 5.76 per cent (₹.244.00) in Lower Kuttanad to 7.58 per cent (₹.228.11) in Upper Kuttanad. Interest on working capital which formed 3.385 per cent of the total cost was ₹.163.06 in Lower Kuttanad, ₹.137.36 in Kari and 115.81 in Upper Kuttanad averaging to ₹.138.74. Liming materials were used in all the regions and the proportionate expenditure on this item was 2.62 per cent on the average, which was 3.34 per cent in Kari, three percent in Lower Kuttanad and 1.24 per cent in Upper Kuttanad. Expenditure on organic manures accounted for only less than one per cent of the total cost.

Yield and output

The average yield per hectare worked out to 28.30 quintals. It was 34.54 in Upper Kuttanad 29.28 in Lower Kuttanad and 21.09 in Kari. In Upper Kuttanad the yield was 22.05 per cent higher than the average, while in Kari, it was less by about 25 per cent. Among the regions, in Upper Kuttanad

the yield was over 60 per cent more than that of Kari.

The yield of paddy per hectare excluding the payments in kind is given in Table 4.47.

Table 4.47 Yield of paddy per hectare (quintals)

Sl.No.	Region	Yield
1	Lower Kuttanad	29.28
2	Upper Kuttanad	34.54
3	Kari	21.09
	Average	28.30

The yield of straw could not be quantified. The bye-product was generally sold at the field. Hence the value of straw for the three regions were estimated and presented in Table 4.48.

Table 4.48 Returns from straw per hectare (rupees)

Sl.No.	Region	Amount
1	Lower Kuttanad	235.69
2	Upper Kuttanad	250.00
3	Kari	207.34
	Average	231.01

Average returns from straw was ₹.231.00 per hectare.

The total output from paddy cultivation per hectare for the zones is shown in the table below.

Table 4.43 Total out-put per hectare (rupees)

Sl. No.	Region	Value of grain	Value of straw	Total
1	Lower Kuttanad	5302.00	230.86	5432.86
2	Upper Kuttanad	6113.42	247.00	6360.42
3	Kari	3441.31	227.86	3669.17
	Grand total	4941.31	231.51	5172.82

Gross returns were highest in Upper Kuttanad at ₹.6360.42. In Kari the total returns of ₹.3669.17 was lowest than that of the other two regions. The average gross returns per hectare was ₹. 5172.82. In Upper Kuttanad this was 23.07 per cent higher and in Lower Kuttanad six per cent higher than the average, while in Kari, it was less by 29.07 per cent. Among the regions, total value of output in Lower Kuttanad was less by about 14 per cent and in Kari, less by about 43 per cent to that of

Upper Kuttanad.

The economics of paddy cultivation in Kuttanad was examined by computing the cost of production of paddy per hectare, the net income per hectare, cost of production per quintal of grain and the cost benefit ratio.

Cost of production of paddy per hectare

Cost of production of paddy per hectare was arrived at by deducting the value of straw obtained from the total cost of cultivation. It is presented in Table 4.50.

Table 4.50 Cost of production of paddy per hectare (rupees)

Sl.No.	Region	Amount
1	Lower Kuttanad	4003.96
2	Upper Kuttanad	2760.98
3	Kari	3363.97
	Average	3376.32

The average cost of production per hectare worked out to ₹.3376.32. Cost of production of

Rs.4003.96 in Lower Kuttanad was higher than the average by 18.23 per cent. In Kari, the cost was almost same as the average.

Net income per hectare

Net income per hectare from paddy cultivation was computed by subtracting the gross expenditure per hectare from the gross returns. It is shown in the table below.

Table 4.51 Net income per hectare (rupees)

Sl.No.	Region	Amount
1	Lower Kuttanad	1243.21
2	Upper Kuttanad	3355.44
3	Kari	97.86
	Average	1565.49

The average net returns per hectare from paddy cultivation amounted to Rs.1565.49. There existed great variation among the regions in net returns. Paddy cultivation was most profitable in

Upper Kuttanad with a net income of Rs.3355.44 a hectare while it was only Rs.97.86 in Kari. In Lower Kuttanad the net income was Rs.1243.21.

Cost of production per quintal of grain

Cost of production per quintal of paddy gives an idea of the efficiency in cultivation. The cost per quintal is shown in Table 4.52.

Table 4.52 Cost of production per quintal of paddy (rupees)

Sl.No.	Region	Amount
1	Lower Kuttanad	136.75
2	Upper Kuttanad	79.94
3	Kari	159.51
	Average	119.30

Cost of production per quintal was computed by dividing the cost of production per hectare in a region (Table 4.50) by the yield of paddy in that region (Table 4.47). The average cost of production per quintal was Rs.119.30. It was higher by 14.62 per cent (Rs.136.75) in Lower Kuttanad and

33.70 per cent (Rs.159.51) in Kari while in Upper Kuttanad it was less by 33.00 per cent. Among the regions, the cost for Kari was about two times that of for Upper Kuttanad.

Cost benefit ratio

This is a common measure of efficiency. It gives the gross returns per rupee invested and is computed by dividing the gross returns with the gross expenditure. Table 4.53 gives the cost benefit ratio in paddy cultivation for the regions.

Table 4.53 Cost benefit ratio

Sl.No.	Region	Ratio
1	Lower Kuttanad	1.29
2	Upper Kuttanad	2.11
3	Kari	1.03
	Average	1.43

In Upper Kuttanad, for every rupee invested in paddy cultivation, the net return was Rs.1.11, while in Lower Kuttanad, it was only Re.0.29. In Kari, the returns just covered the cost giving

almost no net benefit. On an average, the net benefit per rupee expended worked tout to Re.0.43 which appears to be reasonable.

Resource use efficiency

Regression analysis were carried out to determine the efficiency in the use of different resources by the paddy cultivators. Since regression of total products would not give a clear picture, productivity analysis, by regressing the yield obtained per unit area on the inputs used, was attempted to. Both linear and log linear analysis of productivity were conducted.

The models used were

1. $Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8$.

2. $\log Y = B_0 + B_1 \log X_1 + B_2 \log X_2 + B_3 \log X_3 + B_4 \log X_4 + B_5 \log X_5 + B_6 \log X_6 + B_7 \log X_7$.

where

Y - Yield of paddy in kilograms per unit area

X_1 - Area of land in cents

X_2 - Expenditure on animal labour/tractor in rupees per unit area

X_3 - Use of human labour in man days per unit area

X_4 - Use of nitrogen (N) in kilograms per unit area.

X_5 - Use of phosphorus (P_2O_5) in kilograms per unit area.

X_6 - Use of potash (K_2O) in kilograms per unit area.

X_7 - Expenditure on plant protection operation in rupees per unit area

X_8 - Use of organic manure in quintals per unit area.

b_0 and B_0 - the intercept terms

b_1 to b_8 and B_1 to B_7 - the regression coefficients.

The above explanatory variables (X_1 to X_8) were chosen under the presumption that any variation in yield would be fairly explained by the variation in the use of inputs. Since many respondents did not use any organic manure, that variable was excluded in the log linear analysis.

Functional analysis were carried out independently for the three regions. The regression coefficients and R^2 are presented in Table 4.54 and Table 4.55.

From Table 4.54, it may be seen that in Lower Kuttanad, only 22.39 per cent of the variation in the yield is explained by the variables studied. The 'F' value was not significant. For Upper Kuttanad also,

Table 4.54 Regression coefficients

Model $Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8$

Sl.No.	Variable	Lower Kuttanad	Upper Kuttanad	Kari
1	Constant	0.10164	0.06896	0.03034
2	Area (X_1)	0.00001	0.00002	-0.00003
3	Animal labour/tractor (X_2)	0.00686	-0.00304	0.00833
4	Human labour (X_3)	-0.08576	0.10243	0.13036
5	N (X_4)	-0.00087	-0.01154	-0.36954
6	P (X_5)	-0.05399	-0.04791	-0.05141
7	K (X_6)	0.12936	0.13227	0.22251
8	Plant protection (X_7)	0.00891	0.00084	0.05104
9	Organic manure (X_8)	-0.03520	-0.12612	0.47915
	R^2	0.2239	0.4462	0.7487
	F	1.4063	2.1148	3.7250*

*Significant at five per cent level

Table 4.55 Regression coefficients

Model $\log Y = B_0 + B_1 \log X_1 + B_2 \log X_2 + B_3 \log X_3 + B_4 \log X_4 + B_5 \log X_5 + B_6 \log X_6 + B_7 \log X_7$

Sl.No.	Variable	Lower Kuttanad	Upper Kuttanad	Kari
1	Constant	-1.11885	-0.70071	-0.78388
2	Area (X_1)	0.08819	0.04902	-0.35414
3	Animal labour/tractor (X_2)	-0.01552	0.00172	0.46676
4	Human labour (X_3)	-0.19897	0.38681	0.87036
5	N (X_4)	-0.00246	0.11401	-0.91250
6	P (X_5)	-0.03260	-0.06724	-0.24005
7	K (X_6)	0.29055	0.19265	0.71423
8	Plant protection (X_7)	0.05627	-0.05296	1.08097
	R^2	0.1245	0.3690	0.6753
	F	0.8130	1.8380	3.2688*

*Significant at five per cent level

the 'F' value was not significant, even though 44.62 per cent of the variation in the yield was explained. For Kari, however, 'F' was significant at five per cent level of significance and the percentage of variation in 'Y' explained was 74.87.

The analysis using the log linear model also gave non significant 'F' values for Lower Kuttanad and Upper Kuttanad, while for Kari, 'F' value was significant at five per cent level of significance and 67.53 per cent of variation in 'Y' was explained by the variables X_1 to X_7.

P^2 was not significant in Lower Kuttanad and Upper Kuttanad in both analysis. The reasons may be:-

1. The relationship between the inputs and the yield in these regions may not be either linear or log linear.

2. The use of inputs by farmers in Lower Kuttanad and Upper Kuttanad have reached a stage where slight changes in input would not cause any significant changes in the yield.

3. Lack of variation in the data about the use of inputs.

For Kari lands, 'F' value was significant at five per cent level of significance. The regression coefficients b_1 to b_8 of the first model and B_1 to B_7 of the second model were tested for significance. None of the coefficients was found to be significantly different from zero. This might be because of the presence of multicollinearity and/or auto correlation among the explanatory variables.

Summary and Conclusions

SUMMARY AND CONCLUSIONS

The present study, on the resource use efficiency of paddy farms of Kuttanad, was undertaken during the year 1981. A sample of 100 farmers were selected and data were collected with the help of a well-structured interview schedule. Cultivation of paddy in Kuttanad is predominant in 'punja' season. Hence the study was confined to 'punja'.

The objectives of the study were:-

1. to estimate the extent of use of resources in paddy cultivation in Kuttanad area.
2. to estimate the efficiency of resource use.
3. to estimate the cost and returns of paddy cultivation.

Kuttanad was divided into three regions as Lower Kuttanad, Upper Kuttanad and Kari and comparative studies were made on the cultivation practices, extent of use of resources, cost and economics of cultivation etc. The number of man days per hectare was 128.80 out of which family labour contributed only

12.54 man days accounting for less than 10 per cent. Expenditure on animal labour/tractor was ₦.411.12 and it varied among the regions. All the farmers were seen to broadcast the seeds and the average seed rate was 115.73 kg per hectare which is slightly more than the recommended seed rate. Liming materials were observed to be used in all the regions, but the extent of use varied depending on differences in the soil acidity in the regions. On an average, about 190 kg of liming materials like burnt lime, calcium hydroxide, dolomite etc. were added per hectare. Use of the macro nutrients was of the order of 73:49:60 kg. NPK per hectare on an average, as against the recommendation of 90:45:45. The actual use of Nitrogen was 18.89 per cent less than the recommendation, that of Phosphorus 8.88 per cent and that of Potash 33.33 per cent more. Plant protection measures were found to be undertaken. The average expenditure towards the cost of plant protection chemicals alone was ₦.281.00 per hectare.

Extent of resource use was examined operation wise also. The first operation, namely repair to outer bunds, was carried out using male labour. The average use was 6.65 man days a hectare, but it was

as low as 1.86 in Upper Kuttanad. The expenditure per hectare on this work was Rs.79.78 on an average. Removal of salvinia, the next operation, was generally undertaken on a contract basis. The average expenditure for the operation was Rs.179.07 a hectare. It was highest for Lower Kuttanad where the expenditure was Rs.269.50. The preparatory cultivation, which included ploughing and levelling employing bullock or tractor and/or digging and levelling utilizing human labour. The average expenditure per hectare was Rs.498.68 of which Rs.411.12 was spent on animal labour/ tractor and the remaining on human labour. In Upper Kuttanad the total expenditure was only Rs.252.31 a hectare. The next operation viz., seeds and sowing included cost of seeds, cost of preparation of sprouted seeds and sowing charges. The total average expenditure was Rs.276.35. A good proportion of the total labour use was involved in gap filling and weeding. The average per hectare use was 64.51 man days and total expenditure including cost of chemicals for weed control and their application charges amounting to Rs.800.66. The average expenditure towards cost and application of soil ameliorants was Rs.94.64. The use of liming materials was less in Upper Kuttanad

where the expenditure was only Rs.37.32. Irrigation and dewatering, as well as watch on the fields required 13.7 man days per hectare and the expenditure was Rs.140.18. The extent of use of organic manure was poor with only about three quintals per hectare on the average. Expenditure on fertilizers and application was Rs.778.59. For Lower Kuttanad it was Rs.844.31 and Kari Rs.729.53. Expenditure on plant protection operations including application charges worked out to Rs.422.46 per hectare. It was higher by about 28 per cent in Kari (Rs.541.19) and less by about 34 per cent in Upper Kuttanad (Rs.279.20). Since wages for harvest were paid in kind, depending on the quantity of grain obtained, the operations could not be considered for the analysis. The post harvest operations like sun drying (of grain and straw), winnowing, transporting etc. accounted for about 3.7 man days per hectare. The total expenditure, on an average, worked out to Rs.68.84 a hectare.

Regression analysis was attempted to estimate the efficiency of resource use in the different regions, using linear as well as loglinear models. R^2 obtained was not significant in both the functions

for Lower Kuttanad and Upper Kuttanad. In Kari, R^2, however, was significant at five per cent level. But none of the regression coefficients were found significant.

The cost of cultivation was worked out both operation wise and input wise. The total cultivation expenditure per hectare was ₹.4239.65 in Lower Kuttanad, ₹.3010.98 in Upper Kuttanad, ₹.3571.31 in Kari and ₹.3607.33 on the average. Operation wise break up showed that gap filling and weed control formed the largest expenditure accounting for over 22 per cent of the cost. The average expenditure on this item was ₹.800.66. The reasons for this operation being expensive, may be that the work was generally carried out employing human labour and that the intensity of weeds in Kuttanad is high. Fertilizers and their application accounted for 21.58 per cent of the total cost. The adoption of improved cultivation practices as well as the high price of fertilizers are the reasons for this large expenditure. The preparatory cultivation practices like ploughing, levelling etc. accounted for about 14 per cent of the total cost (₹.498.68). The next major operation

was plant protection consuming about 12 per cent of the total cost. Removal of salvinia alone required a little less than five per cent of the total cost. Cost of seed materials and sowing accounted for 7.66 per cent (₹.276.35). Other minor operations contributing to the total cost were irrigation/ drainage, manures, soil ameliorants, repair of bunds, post harvest operations etc.

An input wise study of the cost of cultivation revealed the human labour use per hectare to be the most important input cost-wise accounting for about 45 per cent of the total cost. The contribution of family labour was only limited accounting for about ten per cent of the expenditure on human labour. Fertilizers assumed next in the order with a per hectare expenditure of ₹.727.15 (20.16 per cent) on the average, and plant protection chemicals, 8.72 per cent. Cost of seed materials (₹.236.53) accounted for 6.56 per cent of the total cost. Animal labour/tractor consumed 11.42 per cent of the cost. The proportionate expenditure on soil ameliorants was 2.62 per cent, while that for organic manure, was only 0.91 per cent. Interest on working capital, ₹.138.74 formed 3.85 per cent of the total cost.

The average yield of paddy per hectare was 28.30 quintals. It was 34.54 quintals in Upper Kuttanad, 29.28 quintals in Lower Kuttanad and 21-09 quintals in Kari. The value of straw was ₹.231.00 per hectare with not much inter regional variations. Total receipts per hectare was highest in Upper Kuttanad, ₹.6366.42 and lowest in Kari ₹.3669.17. The Lower Kuttanad it was ₹.5482.86 averaging to ₹.5172.82.

The economics of paddy cultivation was worked out. Cost of production of paddy per hectare worked out by deducting the value of straw from the total cost of cultivation was ₹.3376.32 on the average. There was variation among the regions, the lowest cost was recorded in Upper Kuttanad. Net income per hectare was highest in Upper Kuttanad, ₹.3355.44. In Lower Kuttanad it was ₹.1243.21 and in Kari, only ₹.97.86. The average net income worked out to ₹.1565.49. Cost of production per quintal of paddy was ₹.119.30 on the average. The lowest cost per quintal was incurred at Upper Kuttanad, ₹.79.94, followed by Lower Kuttanad ₹.136.75 and Kari ₹.160.00. The benefit cost ratio was 1.43 on the average.

References

REFERENCES

Abraham, T.P., and Bokil, S.D. (1965). Resource productivity in agriculture with special reference to labour. Indian J. agric. Econ. 21 (1): 91-103.

Agrawal, G.D., and Foreman, W.J. (1959). Farm resource productivity in west Utter Pradesh. Indian J. agric. Econ. 14 (4): 115-135.

Chadha, G.K. (1978). Farm size and productivity revisited; some notes from recent experience of Punjab. Econ. Pol. Wkly. 13 (39): A-87 - A-96.

Chennareddy, V. (1967). Production efficiency in South Indian Agriculture. J. Farm Econ. 49 (4): 816-820.

Department of Agricultural Economics, Kerala Agricultural University (1981). Cost of cultivation and economics of paddy in Kerala, 1978-79.

Department of Agricultural Economics, Kerala Agricultural University (1981). Cost of cultivation and economics of paddy in Kerala, 1979-80.

Desai, D.K. (1960). Linear programming applied to problems of Indian Agriculture. Indian J. agric. Econ. 15 (2): 59-65.

Desai, D.K. (1961). Increasing income and production on Indian farms: possibilities with existing resource supplies on individual farms. Indian J. agric. Econ. 16 (3): 1-16.

Dillon, John L., and Anderson, J.R. (1971). Allocation efficiency, traditional agriculture and risk. American J. agric. Econ. 53 (1): 26-32.

Driver, P.N., and Desai, D.K. (1958). Some input output relationship in Indian agriculture. Indian J. agric.Econ.13 (1): 50-57.

Dutta, L.N. (1982). Relative efficiency, farm size and present proprietorship - a case study of Ranchi district (Bihar). Indian J. agric. Econ. 37 (1): 76-82.

Giri, R., Sastri, A.V.K., and Somayajulu, D.S. (1966). Components of crop output growth in India. Indian J. agric. Econ. 21 (4): 183-191.

*Gordon, Donald Mc Clelland (1974). Agricultural productivity in Indian districts - an empirical analysis. Ph.D. thesis submitted to the University of Pennsylvania.

Government of Kerala (1962). A note on Kuttanad and puncha cultivation. Puncha Special Officer, Alleppey.

Government of Kerala (1971). Report of the Kuttanad enquiry commission. Government of Kerala, Trivandrum.

Government of Kerala (1980). Report of the working group on malady-remedy analysis of Kuttanad. Government of Kerala, Trivandrum.

Gupta, S.C. (1958). Some problems of input output analysis in Indian agriculture and their application. Indian J. agric. Econ 13 (1): 42-57.

Harinath, G.S. (1971). A study of management factor in the selected rice farms in Kovur block of Nellore district (Andhra Pradesh). M.Sc.(Ag) thesis submitted to the University of Madras.

Heady, E.O., and Shaw, R. (1954). Resource returns and productivity coefficients in selected farming areas. J. Farm Econ. 36 (2): 243-257.

John, A.(1980). Kuttanad. Kerala Sastra Sahithya Parishad, Trivandrum. pp. 4-15.

Kaimal, Prabhakara V.S. (1966). Study of the package programme for paddy in Palghat district. M.Sc.(Ag) thesis submitted to the University of Madras.

Kalirajan, K., and Flinn, J.C. (1981). Allocative efficiency and supply response in irrigated rice production. Indian J. agric. Econ. 36 (2): 16-24.

Kerala Agricultural University (1977). Scheme for studying the possible changes in the eco-system of Kuttanad consequent on the construction of the Thannermukkom barrier. Kerala Agricultural University, Mannuthy.

Kerala Sastra Sahitya Parishad (1978). Report of the study team on Kuttanad. Parishad Bhavan, Trivandrum.

Khan, Mahmood H., and Maki, Dennis R. (1979). Effect of farm size on economic efficiency: the case of Pakisthan. American J. agric. Econ. 61 (1): 64-69.

Kushro, A.M. (1964). Returns to scale in Indian agriculture. Indian J. agric. Econ. 19 (3): 51-80.

Mukundan, K., and Dasgupta, H.K. (1977). Management of rice farms in Palghat Taluk (Kerala State). Madras agric. J. 64 (9): 573-575.

Muraleedharan, P.K. (1981). Resource use efficiency in rice cultivation in low lying lands in Kerala. Paper presented in the seminar on agricultur l develop nt in Kerala, 1981.

Naidu, Nagarathnam M. (1971). Optimum allocation of resources in selected farms of Chandragiri block, Chittoor district (Andhra Pradesh). M.Sc.(Ag) thesis submitted to the University of Madras.

Radhakrishnan, S.A. (1969). Optimum resource allocation for maximising farm income - an application of linear programming technique. M.Sc.(Ag.) thesis submitted to the University of Madras.

Ramamoorthy, K. (1967). Influence of farm size on resource productivity. M.Sc.(Ag) thesis submitted to the University of Madras.

Randhawa, N.S. (1960). Returns to scale and co-operative farming. Indian J. agric. Econ. 15 (3):22-33.

Rao, V., and Chotigeat, T. (1981). The inverse relationship between size of land holding and agricultural productivity. American J. agric. Econ. 63 (3): 571-574.

Sahota, G.S. (1968). Efficiency of resource allocation in Indian agriculture. American J. agric. Econ. 50 (3): 419-428.

Saini, G.R. (1969). Resource use efficiency in agriculture. Indian J. agric. Econ. 24 (2): 1-18.

Sampath, R.K. (1979). Nature and measure of economic efficiency in Indian agriculture. Indian J. agric. Econ. 34 (2): 17-34.

Samuel, T.V. (1963). Studies on the resource efficiency of paddy farms in Kuttanad and Onattukara regions in Alleppey district. M.Sc.(Ag) thesis submitted to the University of Madras.

Selvarajan, S., and Subramonian, S.R. (1981). Economic impacts of resource use optimization and water augumentation in farms of Parambikulam Aliyar project region. Indian J. agric.Econ 36 (1): 89-100.

Sharma, P.S. (1966). Impact of selected aspects of labour and land on per acre productivity. Indian J. agric. Econ. 21 (3): 31-43.

Shastri, C.P. (1958). Input output relations in Indian agriculture. Indian J. agric. Econ.13 (1): 35-42.

*Silvia et al. (1979). A regional analysis of the production and utilization of resources in Sao Paulo agriculture by means of a programming model. Agricultura em Sao Paulo 26 (2): 1-121.

Singh, J.P. (1973). Resource use, farm size and returns to scale in a backward agriculture. Indian J. agric. Econ. 28 (2): 32-46.

Singh, K., and Jain, K.K. (1981). The normative land use pattern, resource allocation and tractor absorption capacity of a growing economy: a closed model approach. Indian J. agric. Econ. 36 (2): 1-15.

Srinivasan, N. (1967). An investigation into the efficiency of resource use in owner, tenant, and owner cum tenant operated wet land paddy farms. M.Sc.(Ag) thesis submitted to the University of Madras.

Srinivasan, R. (1965). Economics of cultivation and marketing of paddy in the boarder taluks of Tanjavur and Thiruchirappally districts. M.Sc.(Ag) thesis submitted to the University of Madras.

Subbaramaraju, K. (1970). Resource use study of paddy farms in IADP areas of Visakodera block of West Godavari district (Andhra Pradesh). M.Sc. (Ag) thesis submitted to the University of Madras.

Subramonian, S.I., Rammoorthy, K., and Varadarajan, S. (1973). Economics of IR-8 paddy - a case study. Madras agric. J. 60 (3): 192-195.

*Original not seen

Appendices

APPENDIX - 2

INTERVIEW SCHEDULE

Code No. Date of interview:

I. Identification

1. Name of the farmer :

2. Address :

3. Name of the village :

4. Name of the block :

5. Religion :

II. Composition of the family

Sl. No.	Name	Relation to the head of the family	Sex	Age	Marital status	Educational level	Occupation		Income (annual)	
							Main	Subsidiary	Main	Subsidiary
1	2	3	4	5	6	7	8	9	10	11

III. Land holding

	Wet land			Garden land	Total	Present price per hectare of paddy land
	I Season 2	II Season 3	III Season 4			
1				5	6	7
Total area under						
Land under building						
Land uncultivated						
Net area cultivated						
Number of fragments						

IV. Implements and machinery owned

Particulars of the Machinery/ Implement	Number	Year of purchase	Original value	Present value	Remarks
1	2	3	4	5	6

V. Live stock

	Number	Bread	Year of purchase	Age	Value at present
Bullock					
He buffaloe					
Cows					
She buffaloe					
Goat					

VI. Area under paddy

Engage-ment No.	Area of the fragment	Area in cents for Ist crop	II crop	III crop	Distance from residence	Remarks
1	2	3	4	5	6	7

VII. CULTIVATION OF PADDY

Seed preparation and sowing charges Seed variety

Cost of seed preparation	Men	Women	Rate	Remarks	Cost of seed Rs./kg	qty. kg.	Value Rs.
Sowing charges							
Chemical		Quantity			Value		

NURSERY

i. Preparation of Nursery

Operations	Family labour Men	Women	Hired labour Men	Women	Wage rate Men	Women
Land preparation						

ii. Bullocks/tractor are used for nursery preparation: No.of hours bullock is operated/day

	No.of bullock days	Rate	Cost	No.of tractor hours	Rate	Cost

Manuring the nursery

1. Farm yard manure:	Quantity	Rate/quintal	Value

Application cost	Family labour Men	Family labour Women	Hired labour Men	Hired labour Women	Wage rate Men	Wage rate Women
Labour						
Transportation						

2. Fertilizers:

	Type of fertilizer	Quantity	Value
1.			
2.			
3.			

Application	Family labour Main	Family labour Women	Hired labour Men	Hired labour Women	Wage rate Men	Wage rate Women

3. Plant protection if any in the nursery

Name of pesticide/fungicide	Quantity	Price
1.		
2.		
3.		

Application charges:	Rate	Cost	Remarks

4. Irrigation:	Water charges					
	Labour hours required	Family labour		Hired labour		Wage rate
		Men	Women	Men	Women	Men Women

MAIN FIELD

Preparation of main field: Rate/acre Total cost

A. Cost of construction/repair of outer bunds

B. Land preparation: Labour hours

1.Removal of Salvinia

	Family		Hired		Rate	
	Men	Women	Men	Women	Men	Women

If given on Contract Rate per acre
Total cost

C. Ploughing the land	Family		Hired		Wage rate	
	Men	Women	Men	Women	Men	Women
1.						
2.						
3.						
4.						
5.						

Puddling clods
if done on contract Rate/acre Total cost

3. Ploughing	Bullock pair Own	hired	Hrs Rate	Tractor/ tiller hour	Rate per hour	Remarks
1.						
2.						
3.						
4.						
5.						
6. Levelling						

C. Construction of inner bunds and channels

	Family		Hired		Rate	
	Men	Women	Men	Women	Men	Women
Labour						

D. Soil ameliorants applied:

Sl. No.	Name of ameliorant	Quantity	Value	Reasons for applying	Remarks
1.					
2.					
3.					
4.					
5.					

Transporting and
Application charges:

Cost of transporting to the field at each time

1.
2.
3.
4.

Application charges:

	Family Men	Family Women	Hired Men	Hired Women	Rate Men	Rate Women	Remarks
Labour hours							

E. Seeds and sowing: Seed variety Rate/kgs.

Quantity of seeds Value (N.)

a. Seed preparation	Hours of family labour Men	Hours of family labour Women	Hours of hired labour Men	Hours of hired labour Women	Wage Rate Men	Wage Rate Women
1. Soaking the seed						
2. Transporting						
3. Sowing						

b. If nursery is raised	Family labour Men	Family labour Women	Hired labour Men	Hired labour Women	Wage rate Men	Wage rate Women
Uprooting the seedlings						
Transporting to main field						
Transplanting						

c. Gap filling/thinning:	Cost of seedlings if purchased			
	Labour hours	Family		Hired	
		Men	Women	Men	Women

F. Manures and fertilizers:

1. Manures:

	Quantity				Value		
Farm yard manure							
Green manure (if obtained by collection, total cost involved)							
Application of manure	Family labour Men	Women	Hired labour Men	Women	Rate Men	Women	Hire charges of boat.
Application							
Cost of transporting							

2. Fertilizer:

	Name of fertilizer	Quantity	Price
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Cost of transporting from depot to the field:

	Farm labour		Hired labour		Rate	
	Men	Women	Men	Women	Men	Women
Application charges						

G. Plant protection

Name of chemical	Quantity purchased	Price
1.		
2.		
3.		
4.		
5.		
6.		

Cost of transportation

Application charge/ No.of application	Mode of payment	Total amount paid
1.		
2.		
3.		
4.		
5.		

H. Watering

	Family		Hired		Rate	
	Men	Women	Men	Women	Men	Women
1. Labour						

Cost of transporting from depot to the field:

	Farm labour		Hired labour		Rate	
	Men	Women	Men	Women	Men	Women
Application charges						

G. Plant protection

Name of chemical	Quantity purchased	Price
1.		
2.		
3.		
4.		
5.		
6.		

Cost of transportation

Application charge/ No.of application	Mode of payment	Total amount paid
1.		
2.		
3.		
4.		
5.		

H. Watering

	Family		Hired		Rate	
	Men	Women	Men	Women	Men	Women
1. Labour						

2. Dewatering charges:

Per acre (Rs.)

For total area (Rs.)

I. Irrigation

	Family		Hired		Rate	
	Men	Women	Men	Women	Men	Women
1. Labour hours						
2. Fuel cost for irrigation						

J. Weeding (Manual)

No.	Family hours		Hired hours		Rate	
	Men	Women	Men	Women	Men	Women
1.						
2.						
3.						

If weedicides are used

Sl.No.	Name of weedicide	Quantity	Value	Remarks
1.				
2.				
3.				

Application cost	Family Men	Family Women	Hired Men	Hired Women	Rate Men	Rate Women	Ramrks

K. Watching

	No.of Mandays	Rate/day	Amount Rs.

L. Harvesting

	Quantity in kg	Rate/kg	Value in Rs.
Paddy given as wages			

M. Post harvest handling

Particulars	Family labour hours Men	Family labour hours Women	Hired labour hrs. Men	Hired labour hrs. Women	Rate Men	Rate Women
Sundrying						
Transporting & storing						
Winnowing						

Winnowing machine is hired

No.of hours	Rate/hour	Total rent	Fuel charges	Total

Store facilities

	Type	Capacity	Value	Remarks

Receipts

Area	Quantity		Value at post harvest price		Remarks
	Paddy	Straw	Paddy	Straw	

Utilization of paddy:

1. Home consumption (quantity):

2. Quantity sold Price Total value of sales (.)

3. Disposal of the balance quantity if any.

If marketed:

Where did you sell it

Rate:

Quantity:

Value

Borrowings for paddy cultivation

Sl.No.	Source	Amount	Rate of interest	Repayment terms	Remarks

Subsidies obtained:

Dewatering

Fertilizer

Pesticides

Labour

Current charges

Reasons for selecting the particular variety

1. Keeping quality
2. Cooling quality
3. Colour of bran
4. Taste/preferences
5. Tolerence to pest or disease
6. Tollerence to adverse weather
7. Amount of risk
8. Any other (Specify)

Reasons for not adopting recommended practices

1. Lack of knowledge
2. Financial constraint
3. Non availability of
   a) Fertilizers in time
   b) Pesticides in time

4. Lack of co-operation among farmers

5. High cost of inputs

Method of fertilizer application you follow:

Quantity applied as

a. Basal

b. Top dressing: 1.

2.

Soil ameliorant

RESOURCE USE EFFICIENCY OF PADDY CULTIVATION IN KUTTANAD

By

K. J. JOSEPH

ABSTRACT OF A THESIS

Submitted in partial fulfilment of the
requirement for the degree of

Master of Science in Agriculture

Faculty of Agriculture
Kerala Agricultural University

Department of Agricultural Economics
COLLEGE OF HORTICULTURE
Vellanikkara - Trichur

1982

ABSTRACT

An investigation on the resource use efficiency and economics of paddy cultivation in Kuttanad region of Kerala State was conducted to measure the extent of resource use, resource use efficiency and to estimate the cost and returns of paddy, during 1980-81. Data were collected from a sample of 100 farmers selected at random.

All of the respondents were cultivating high yielding paddy varieties. The average per hectare use of human labour was 128.80 man days, out of which, family labour contributed only about ten per cent. The expenditure on animal labour/tractor was Rs.411.12 per hectare, on an average. The average seed rate in Kuttanad was 115.73 kg per hectare, which was more than the recommended rate of 100 kg. Majority of the respondents were found to apply lime to correct soil acidity. Fertilizers were found to be applied by all the respondents and the use of N P K worked out to 73:49:60 kg per hectare, on an average, as against the standard recommendation of 90:45:45 kg per hectare. The use of phosphorus and potash was observed to be

higher than the standard recommendation for the region.

The total cost of cultivation per hectare, on an average, was ₹.3607.33. An operation-wise analysis of the cost of cultivation revealed that gap filling and weed control, fertilizers and application and preparatory cultivation were incurring proportionately higher expenditure, accounting for about 58 per cent of the total cost. Input-wise, human labour alone accounted for about 45 per cent of the total cost, followed by fertilizers accounting for about 20 per cent. Regression analysis, carried out to estimate the efficiency of use of resources, gave no significant results.

The average yield of paddy was 28.30 quintals per hectare. Total receipts per hectare, including the value of straw, was highest in Upper Kuttanad, ₹.6366.42 and lowest in Kari, ₹.3669.17. In Lower Kuttanad, it was ₹.5482.86 averaging to ₹.5172.82. The cost of production of paddy per hectare and the net income per hectare were found to vary considerably among the regions. The cost of production per quintal of

grain was Rs.119.30, on an average, and it was Rs.79.94 in Upper Kuttanad, Rs.136.75 in Lower Kuttanad and Rs.160.00 in Kari. The benefit cost ratio worked out to 2.11 in Upper Kuttanad, 1.29 in Lower Kuttanad and 1.03 in Kari. The average benefit cost ratio was 1.43.