

**STUDIES ON THE RESOURCE EFFICIENCY IN THE PADDY FARMS
IN KUTTANAD AND ONATTUKARA REGIONS
IN ALLEPPEY DISTRICT**

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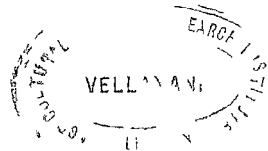


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INTRODUCTION



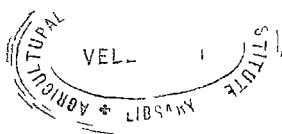
INTRODUCTION

The key role of agriculture in Indian economy can hardly be over-emphasized. Rightly, programmes of agricultural development are given high priority in the five Year Plans. In the past fifteen years of planned development, considerable progress has been made in increasing agricultural production. The foodgrains production which was 54.9 million tons in 1949-50 had reached the level of 89 million tons in 1964-65, even though the production has declined to 72.3 million tons in the last year of the Third Plan due to unprecedented drought in the country. But the agricultural production and specifically food production barely kept pace with the growth of population. While agricultural production has registered an average rise of more than three per cent during the Plan period, the population was growing at the rate of 2.5 per cent a year. The Fourth Plan visualises a rate of growth of 5.59 per cent in agricultural production. The production of foodgrains is expected to reach a level of 120 million tons by 1970-'71. The high targets present a formidable challenge which has to be faced as there appears to be no other alternative. The battle of India's economic development has to be fought in the front of agricultural production, and especially food production.

Among the foodgrains, rice occupies an important place in India's food requirements. It is cultivated in an area of 35.02 million hectares. Though rice is grown in such a large area, the production is still lagging behind the actual requirements of the country and the, problem of shortage and high prices continues to prevail. This is due to the low per acre production of rice in this country.

Rice is grown in different regions of the country and the efficiency of production varies widely between region to region. The problems of different regions may be varied and the remedies suggested should be suitable for solving the problems of each region in order to achieve higher efficiency in production. Hence studies on the efficiency of resource use in small homogeneous agricultural regions in the country will help to locate the imbalances in the existing pattern of resource use and indicate specific aspects on which efforts have to be intensified. So far such studies on the problems of different rice growing tracts within each State has not received much attention. Unless the overall requirements of farming in each region are studied and steps taken to meet all of them, agricultural development may not take place at a rapid pace.

Rice, which forms the major food crop of Kerala is cultivated in an area of 801121 hectares. The annual



production of rice is estimated to be 11.21 lakh tons which is sufficient to meet 50 per cent of the requirements estimated at 14 oz. of rice per adult per day. In addition provision has to be made for a recurring addition of 4 lakhs population every year. It is true that the physical environment of Kerala is suited to the production of commercial crops and the specialization in these crops as recommended by the Techno-Economic survey of Kerala is a logical corollary. But the Kerala economy can hardly sustain such a large volume of import of foodgrains. It is therefore, important that every effort should be made to reduce the gap between production and requirement of food.

In a State where the density of population is 1127 per square mile, which is incidentally the highest in the country, there is no scope for increasing the area under cultivation. The only possible way to meet the challenge is to increase the productivity per acre. Though rice is grown in all the districts of Kerala, Palghat is the major rice producing district. The next important rice growing tract is the 'Kuttanad' region which extends Alleppey and Kottayam districts. 'Onattukara' is another rice growing tract extending over Alleppey and Quilon districts. Rice is cultivated in these tracts under entirely different conditions. Palghat district is an area where rice is grown mostly under irrigated conditions. The problem of Kuttanad is not providing adequate irrigation, but drainage.

Controlled supply of water to the crop is possible in this region also. But in the Onattukara region, rice is cultivated entirely under rainfed conditions.

Kuttanad is an area reclaimed from the backwaters and cultivation has been in progress over a century. During the monsoons the entire area is flooded with rain water, while in summer, the sea water enters the area and floods it. The scope for further reclamation is limited and efforts are being made to raise a second paddy crop in this region. In this context, the study of the economics of paddy production and the resource efficiency in the paddy farms in this region will be of much assistance to the farmers for improving their economic conditions.

The problems of rice production in Onattukara are entirely different from the Kuttanad region since there are no hazards of sea water etc. Therefore a separate study on the economic aspect of paddy production and resource productivity will benefit the farmers in this area in maximising their farm income.

The aim of this study, in general, is to investigate the economics of paddy production and to evaluate the resource productivity in the paddy farms in Kuttanad taluk representing the 'Kuttanad' region and in the Mavelikkara and Karthikappally taluks representing the 'Onattukara' region in the Alleppey district. The specific objectives are:

(1) To investigate the distribution of various input factors for paddy production in the 'Kuttanad' and 'Onattukara' regions in Alleppey district.

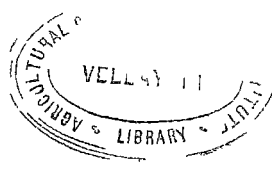
(2) To estimate the unit cost of production of paddy in the above two regions.

(3) To study the efficiency of resource use in the paddy farms in the above regions by fitting a Cobb-Douglas model.

Scope of the study

The results of the study would be useful to the paddy cultivators in the two regions in locating the weak spots in the present pattern of resource use and enable them to reallocate the resources to attain maximum profits. Information on the cost structure would be of use to planners and policy makers in formulating programmes and policies for achieving the object of increased production.

REVIEW OF LITERATURE



REVIEW OF LITERATURE

Farm management research in the early stages was concentrated on the production costs of crops. Though cost of production studies will be helpful in the policy decision regarding incentive prices to farmers, the ultimate welfare of the community as a whole depends upon the increase in productivity. This aspect of farm management study is of recent origin.

Cost of production studies

Cost studies on agricultural products were taken up as early as 1870 in U.S.A. The economic depression in the last two decades of the nineteenth century and the fall in prices of agricultural products resulted in an effort to find out ways to reduce cost of production. Special investigations were then made into the cost of different products. But only in the nineties, such studies became numerous and were supplemented by those of many State Boards and experimental stations. Roberts (1874) studied the financial nature of farm business by taking inventories. Andrew Boss and Hays (1895) made studies on the economic aspect of various crop rotation. The secretariate of Swiss peasants published the results of farm accountancy as early as 1901.

The year 1902 was a turning point in the systematic treatment of studies on production cost. Hays (1902) was

the pioneer in this field who worked out the cost of production of crop by the "Route method".

Baily and Craig (1903) conducted the first large scale farm survey in U.S.A. The results of the survey were published in 1911. Warren (1912) evolved the "Survey method" for conducting farm management enquiries.

The establishment of the Agricultural Economics Research Institute at Oxford in 1913 was the beginning of farm management studies in England. Orwin (1913) advocated the analytical method of cost accounting.

Cost accounting got greater fillip after the reorganization of the office of farm management in the U.S.A. under Taylor in 1919. Hall (1927) conducted studies on the cost of production of rice in Arkansas farms and suggested adjustment in area and other efficiency measures for reducing the cost of production. King (1927) stressed the importance of cost accounting applied to agriculture.

In India, no organised attempts were made in this direction till 1923. Studies on the cost of production of important crops in Deccan were conducted from 1925-26 onwards to ascertain the net profit or loss. Patil (1933) attempted farm cost study and scientific allocation on the basis of opportunity cost was effected for the first time in India.

The Indian Council of Agricultural Research conducted the first All India study on cost and return during the period 1933 to 1936. This study was confined to the principal crops grown in selected sugarcane and cotton tracts in India. The results of the study were published in 1938.

The Gokhale Institute of Politics and Economics had conducted surveys on farm business in Wai Taluka in 1937-38. An enquiry into the economics of mixed farming was undertaken by the Indian Council of Agricultural Research during 1941-46 in Uttar Pradesh, Berar, Sind and the North-west Frontier Province. The Indian Central Jute Committee had been conducting enquiries into the economics of Jute cultivation since 1948-49 in Bengal, Bihar, Assam and Orissa. In 1949, the Vijayaraghavachariar Committee was appointed by the Government of India, to enquire into the cost of production of sugarcane in various parts of the country.

Recent study in this aspect is the pilot enquiry into the cost of production of Jowar, Cotton and Groundnut in the Akola district in Madhya Pradesh carried out by the Indian Council of Agricultural Research in collaboration with the Indian Central Oilseeds Committee and the Indian Central Cotton Committee during the year 1953-54.

A new approach to the study of farm management has been undertaken by the Directorate of Economics and Statistics in the Ministry of Food and Agriculture, Government of

India and the Research programmes Committee of the Planning Commission (1954). The first series of Farm Management studies was sponsored in 1954-55 in six typical regions of the Country and spread over a period of three crop years. The objective was to study the relative merits of cost accounting and survey method of investigation, besides collecting experimental data necessary for study of scientific methodology. Another object was to provide information on the input-output relations. This study provided some useful information about the input-output relations in agriculture.

The Punjab Board of Economic Enquiry had conducted studies on the cost of production of wheat and wheat gram mixture for the period 1954-55 to 1956-57 in Amritsar and Ferozpur districts.

Pilot studies on the influence of Mettur Irrigation and Hydro Electric Project on agriculture and agro-industries were made in 1956-57 by the Research Programmes Committee of the Planning Commission and had estimated the average cost of production of paddy, groundnut and other important crops in the Madras State.

The Directorate of Economics and Statistics in the Ministry of Food and Agriculture was conducting studies in the economics of Farm Management in the States of Andhra Pradesh, Bihar and Orissa from 1957-58 onwards.

Studies on the economics of production of irrigated crop of sugarcane, potato and wheat in the Rohtak district of the Punjab were conducted by Ram Dhar Singh and Dilip Singh Lohan (1960). The Punjab Board of Economic Enquiry (1961) computed the cost of production of rice in the districts of Amritsar and Ferozpur. Dasgupta (1961) worked out cost and profit in relation to size of rice farms in the Bhubaneswar area in Orissa State.

Pillai and Panicker (1965) studied the economics of "Kayal" cultivation in Kuttanad during the year 1961-62. This study was limited to the "Kayal" zone in Kuttanad in Kerala State. Kaimal (1966) studied the impact of the package programme for paddy in the Palghat district of Kerala. In the present study an attempt is made to work out the economics of paddy production in the two rice growing tracts, viz., 'Kuttanad' and 'Onattukara' in Kerala State.

Efficiency studies

Efficiency of farm can be measured by different methods. The first is the conventional method where the efficiency is measured with reference to individual input factor like land or labour with estimated efficiency factors like net farm income, gross income, labour income and the like. This method was largely employed by the early workers in the field of farm management.

Heady (1946) suggested that management return and labour income are more convincing than the net farm income. Khusro (1964) described the disadvantages of using gross income per acre as a measure of farm efficiency. He suggested farm business income as a better measure of efficiency. Rao (1965) pointed out the complications in the measurement of farm efficiency in family based agriculture. According to him, total cost based on imputed values would give an unrealistic picture regarding profitability of farm business. He suggested net farm income and farm business income as better measure of efficiency.

Eventhough the conventional method has certain limitations, it is commonly used in different studies conducted by the Directorate of Economics and Statistics (1954-57) for assessing farm efficiency. Randhava (1960) Khusro (1964), Rao, (1965) adopted such measures in studying efficiency.

Resource productivity

Usually two methods are adopted to estimate the resource productivity. The average productivity of resources is one of the methods. This method was developed by Warren (1910). This method or modified systems of these procedures were adopted by Clark (1940), Ducoff et al. (1944) Barton et al. (1945) and Schultz (1949).

The marginal productivity is another method which is derived from the production function.

Functional analysis

The application of production function analysis in farm management studies is of recent development. The production function analysis reveals the productivity of individual factors of production when used in varying proportions.

Leibig (1855) was the first to attempt a definition for the functional relationship between input and output. But, it was Bondorff (1924) and Plessing (1943) who were responsible for developing algebraic type of such relationships.

$$Y = ax$$

Where, Y is the yield response; X is the supply of nutrients and 'a' is the constant.

Afterwards, many types of production function were evolved and used to estimate productivities of different categories of input.

In the field of farm management the algebraic form of agricultural production function was defined by Mitscherlich (1909). A single variable polynomial of quadratic form was used by Fleiffer and Frolich (1912). Spillman (1923) developed an exponential type of Mitscherlich production function. A modified type of Mitscherlich production function was worked out by Crowther and Yates (1941). Cobb and Douglas (1928) developed an

exponential production function for American Manufacturing industries. The general form of this equation is shown below:

$$Y = a x^b$$

where, Y denotes output;

x denotes the input;

a represents a constant;

b denotes the transformation ratio of x at different magnitudes.

This equation can be converted into linear form by using logarithm and is written as

$$\log y = \log a + b \log x$$

In recent years production functions have been widely used by research workers in the field of farm management. Heady (1946) derived whole farm production function using such variables as real estate, machinery and equipment, labour, livestock and cash or operating expenses. Heady (1954) fitted two production functions separately for livestock enterprise and crop production enterprise. Others who fitted production function for farm management studies include Heady and Allen (1951), Heady and Swanson (1952), Heady and Shaw (1954), Clark (1954), Bhattacharjee (1955), Robinson (1955), Wright (1956), Darcouich (1958), Olson (1959), Hildebrand (1960), Mundlok (1961), Fuller (1962) Herdt and Millor (1964) and Wang (1965).

In India, production function study was made by Singh (1940) for estimating the total productivity of the farms. Sukhatme (1941) fitted a quadratic function to fertilizer data for estimating the optimum dose of nitrogen for paddy. Zacharias et al. (1957) studied the economics of resource use in the production of three major crops in Madras State by fitting a power function.

Suryanarayana (1958) fitted Cobb-Douglas production function for wet, dry and mixed farms separately to study resource returns in Telengana farms. Driver and Desai (1958) Shastri (1958), Tandon and Dondyal (1958) have all fitted production function for studying resource efficiency.

Agrawal and Foreman (1959), studied resource productivity in Uttar Pradesh farms by fitting production functions. Others who studied resource productivity by fitting production function include Randhawa (1960), Gupta (1961), Patil and Heregounder (1963).

Naik (1965) studied productivity of various input factors by fitting a Cobb-Douglas type production function to a sample of farms in Ankodia village. Robello and Desai (1965) studied the efficiency of production of wheat in the farms in Kanjhawala Block by fitting a Cobb-Douglas model production function.

Sharma (1965) observed that the association of rainfall and productivity has been negative in the rice

regions with higher levels of rainfall and irrigation by fitting Cobb-Douglas production function. It was further observed that the marginal productivity was positive and significant in the case of hired labour considering all the rice regions in the country.

Abraham and Bokil (1965) studied resource productivity in agriculture with special reference to labour by fitting a Cobb-Douglas function.

Rao (1965) studied the resource productivities in Hyderabad farms by fitting a Cobb-Douglas production function. He observed high elasticity for labour input in Hyderabad farms. Tambad and Baliga (1966) estimated the supply function for transplanted paddy in Mandya district by fitting a Cobb-Douglas production function.

Ashok Parikh (1966) made a state-wise analysis covering the states of Bihar, Kerala, Madhya Pradesh, Madras, Rajasthan, Mysore, Uttar Pradesh and West Bengal to measure the contribution to the growth of output of land, extent of irrigation, rate of fertilizer application etc., by fitting a production function of the Cobb-Douglas type.

Giri et al. (1966) fitted production function for studying the components of crop output growth in India. Ramesh (1966) examined the return to investment for different items of input in paddy production

in Thanjavur by fitting a Cobb-Douglas production function. The present study is to evaluate the productivity of resources in the paddy farms in the Kuttanad and Onattukara regions of Alleppey district.

METHOD OF INVESTIGATION



METHOD OF INVESTIGATION

The present study was undertaken in the Alleppey district of Kerala State. "Kuttanad" and "Onattukara" are two distinct paddy growing tracts in the district. Paddy is grown in the Kuttanad region under peculiar conditions and the type of cultivation is unique. This special type of cultivation requires separate study from the method of cultivation practised in "Onattukara" region. Since the whole of the district is under the package programme, financial and technical help provided to agriculturists are the same in both the regions.

Kuttanad taluk was selected for the study of the Kuttanad region. This taluk represents the major part of Kuttanad region in Alleppey district. There are two types of lands in this taluk viz., the "Kayal" and "Karappadam" lands. Out of the 12 villages in the Kuttanad taluk three are in the "Kayal" area and nine are in the "Karappadam" area. The villages were arranged in alphabetical order and one village in the Kayal area and two villages in the Karappadam area were selected at random. A list of paddy cultivators in the selected villages were obtained and 30 farms each in the Kayal and Karappadam areas were selected for detailed enquiry.

The two taluks of Mavelikkara and Karthikappally represent the 'Onattukara' region in the Alleppey district.

These villages which are included in the 'Omattukara' region of the above two taluks were listed. There were 29 such villages. These villages were arranged in alphabetical order and three villages were selected at random. The list of paddy cultivators were obtained and thirty farms were selected from among them for detailed study.

The average size of the farms selected in the Kuttanad area was 3.24 acres and in the Omattukara area it was 1.79 acres. The selected holdings were then divided into two groups viz., Group I with an area of 2.5 acres and less and Group II with an area of above 2.5 acres. Thus there were 37 farms in size Group I and 33 farms in size Group II in the Kuttanad area. In the Omattukara area, 20 farms were in the size Group I and 10 farms in the size Group II. The distribution of villages and number of farms selected are given in Table 1.

Collection of data

The paddy cultivators selected for the study were interviewed during the year 1965 and details pertaining to the year 1965-66 were collected in the schedule of questionnaire specially prepared for the purpose. The objectives of the study were clearly explained to the farmers so as to get reliable information. Most of the farmers were not maintaining detailed accounts of cultivation expenses, but they were able to give reliable information from their memory. The data thus collected were processed, tabulated and analysed statistically.

Table 1. Distribution of the selected villages and the paddy farms

Name of village	Taluk	Area under paddy in hectares	Number of farms selected
<u>Kuttanad region</u>			
1. Kainakary	Kuttanad	2249	30
2. Muttar	"	778	15
3. Veliyanad	"	1330	15
Total		4357	60
<u>Onattukara region</u>			
1. Kannamangalam	Mavelikkara	324	10
2. Cheppad	Karthikappally	798	10
3. Keerikkad	"	276	10
Total		1398	30

Method of Analysis

Unit cost of production

The cost of production per quintal of paddy was calculated taking into account, the value of all input factors including the interest on the value of land, depreciation of deadstock, taxes paid for the land etc. The data were tabulated and computed on per acre basis separately for each village under the two size groups. The intervillage and inter group variation in respect of different items of input were tested for significance.

Efficiency measures

For the study of efficiency of farms in the two regions, the conventional methods were employed. In this study, the gross farm income, farm business income and net profit or loss were calculated. The efficiency of farming was studied by fitting a linear regression equation with total cost and gross income.

Resource productivity

The productivity of labour and capital were studied by calculating the average labour productivity, average residual labour productivity, the average capital productivity and the average residual capital productivity.

Production function analysis is suited to those questions involving the optimal combination of factors and/or products. In the present study, an attempt is made

to estimate the efficiencies of different inputs on the production of paddy in the two regions by fitting a Cobb-Douglas type of production function. The advantages of this function are that the coefficients of the function are equal to the elasticities of production in respect of the inputs. The function permits diminishing marginal productivity while still using linear regression analysis. By summing the elasticities the return to scale can be determined. However, it assumes constant elasticity of production over the entire range of inputs and hence successive areas of increasing, decreasing or negative returns are not reflected by this function. According to McAlexander (1956) production function analysis using Cobb-Douglas function is a rough approximation for examining resource efficiency and it provide suggestions for direction of resource allocation.

Production functions can be derived from observations measured either in value or physical units. Irrespective of whether the observations are physical or value units, the production function must correspond with the technical conditions of production. Even if all the factors are measured in monetary terms, the technical relationships are the same as if observations were in physical units. This statement applies only where price is a constant, as it is in the purely competitive condition of a farm (Hoady, 1956).

The gross income of the farms on analysis of variance did not show significant differences between the two size groups and between the villages in each of the region. Two functions were fitted for the farms in the two regions. In order to fit the production function for the sample farms, the input factors like land, human labour, bullock labour, nitrogen content in the manures and fertilizer and other factors which include seed, plant protection and dewatering charges were taken into consideration. The efficiency of resource was measured by their marginal value productivities estimated from the Cobb-Douglas type of production function. The general model for this function may be written as

$$Y = a x_1^{b_1} x_2^{b_2} x_3^{b_3} \dots x_n^{b_n}$$

where Y denotes output; x_i 's denote input factors; 'a' denotes a constant; b_i 's denote elasticities of production.

Average value productivity

The average value productivity of each resource was estimated by dividing the mean output which is in monetary terms by the mean input of that resource. The average value product thus obtained is the return of all the input factors and not the return attributable to any single factor.

Marginal value productivity

The marginal value productivity indicates the returns which on an average, is expected from the addition

of one more unit of that production factor, keeping the other factors at their mean levels. The marginal productivity is derived as follows:

$$Y = a x_1^{b_1} x_2^{b_2} x_3^{b_3} \dots x_n^{b_n}$$

$$\begin{aligned} \text{Marginal value} & \left\{ \begin{aligned} \text{productivity} & = \frac{\partial Y}{\partial x_1} = ab_1 x_1^{b_1-1} x_2^{b_2} x_3^{b_3} \dots x_n^{b_n} \\ \text{of } x_1 & \end{aligned} \right. \\ & = \frac{ab_1 x_1^{b_1} x_2^{b_2} x_3^{b_3} \dots x_n^{b_n}}{x_1} \\ & = \frac{b_1 Y}{x_1} = b_1 A \end{aligned}$$

where 'A' is the average value product. The marginal value productivity of an input is calculated by multiplying the average value product of that input factor with the corresponding elasticity of production.

Statistical significance

The statistical significance in all the analyses in the study was set at five per cent probability level.

DESCRIPTION OF THE AREA SELECTED

DESCRIPTION OF THE AREA SELECTED

The areas selected for the present study are the two rice growing tracts in the Alleppey district viz., "Kuttanad" and "Onattukara". The geographical entity known as "Kuttanad" is virtually the man-made granary of Kerala. It is a supreme example of land reclamation from water through ages. The whole of Kuttanad is a homogeneous area of about 334 square miles. The region possesses common physical characteristics and has common problems. Though this region extends to Alleppey and Kottayam districts, only the Kuttanad taluk in the Alleppey district is taken up for the present study.

'Onattukara' is the name given to the narrow strip of coastal region of about 32 Kms in length and 8 to 11 Kms in breadth lying in Mavelikkara and Karthikappally taluks of Alleppey district and Karunagapally taluk of Quilon district. For the present study, the Mavelikkara and Karthikapally taluks representing the Onattukara tract in Alleppey district are taken up.

Climate and rainfall

The climate of Kuttanad is equable, the temperature ranging from 23.3°C to 33.1°C. The dry season extends from December to April and the rainy season from May to November. This region receives an annual rainfall of 4815 milli metres on an average and 80 per cent of this is

Table 2. ^{**} Average monthly rainfall in Alleppey district
(in millimetres)

Month	1963-64	1964-65
July	671.1	755.0
August	416.5	304.4
September	355.9	379.9
October	310.7	430.5
November	154.1	221.1
December	48.6	1.4
January	9.1	38.6
February	16.3	2.4
March	103.5	42.0
April	94.5	84.2
May	142.3	339.9
June	293.3	511.8
Total	2615.9	3111.2

Table 3. Monthly Mean Temperature in Alleppey district

Month	Maximum °C	Minimum °C
April, 1965	33.1	25.6
May, 1965	31.5	24.7
June, 1965	29.9	24.1
July, 1965	29.5	23.6
August, 1965	28.9	23.4
September, 1965	29.9	24.0
October, 1965	31.1	24.5
November, 1965	31.7	24.1
December, 1965	30.5	23.5
January, 1966	32.3	23.3
February, 1966	32.5	24.4
March, 1966	32.8	25.2

FIG.1

List of selected villages

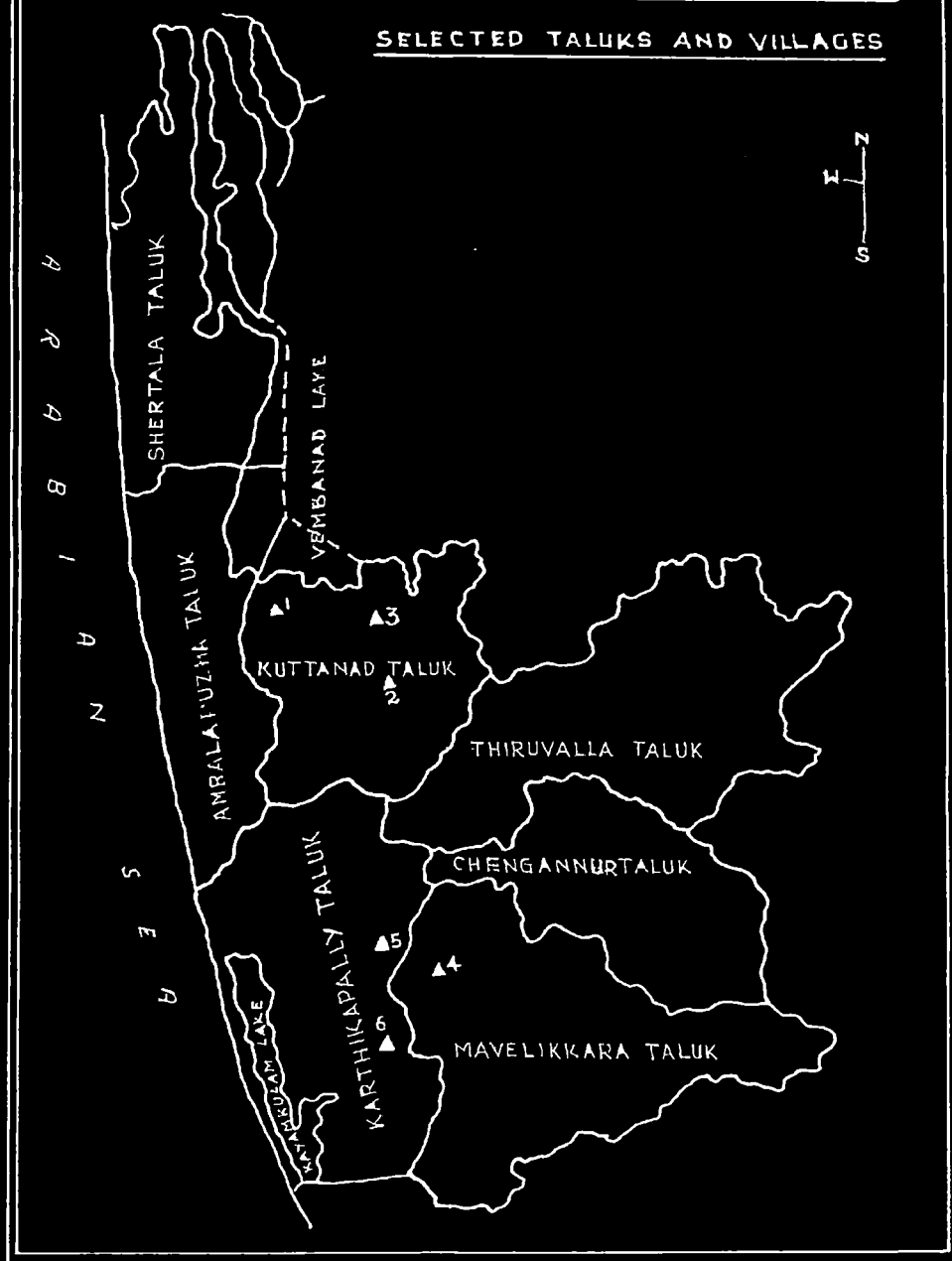
Kuttanad region

- 1. Kainakary**
- 2. Muttar**
- 3. Veliyanad**

Onattukara region

- 4. Kannamangalam**
- 5. Cheppad**
- 6. Keerikkad**

FIG. I
MAP OF ALLEPPEY DISTRICT SHOWING
SELECTED TALUKS AND VILLAGES



received from June to November. This region is drained by four rivers viz., Meenachil, Manimala, Pampa and Achenkoil. The whole of this area is about 1.2 metres below the mean sea level. The monsoon floods sometimes do havoc in Kuttanad region destroying crops, sub-merging houses and rendering thousands homeless and desolate. During floods, all normal activities are brought to a standstill and the whole area is transformed upto a vast concourse of water.

Onattukara is a flat region and lies about 3.5 metres above mean sea level. The climate and rainfall are almost the same as that of the Kuttanad region.

Soil

The soil in Kuttanad is generally fine alluvial with a strong admixture of organic matter. It is mostly acidic with a low pH value. The soil in Onattukara region is sandy to sandy loam with a pH of 5.9.

Features of Kuttanad paddy cultivation

In Kuttanad, there are three types of lands under rice cultivation viz., "Kayal", "Karappadam" and "Kari" lands. The Kayal lands are new reclamations lying 10 to 20 feet below the mean water level. This area is of about 20000 acres and is divided into large blocks or "padasekharams". A "padasekharam" is a contiguous area bounded by canals, rivers or other partitions, its size ranging from 10 acres to 2400 acres.

The "Karappadams" are old reclamations extending over an area of 102700 acres. These fields are comparatively shallow. The upper "Karappadams" are 1 foot to 3 feet below the water level while the depth of lower "Karappadams" is 3 feet to 7 feet. They are periodically replenished by the deposit of silt carried by the rivers in flood. The individual fragment in this area has become comparatively small through the process of sub-division of holdings.

"Kari lands" are swampy areas with black peaty soils and high acidity. This type of lands lie in the Southern and Northern extremities of Kuttanad.

The dry lands in Kuttanad are limited in extent. These lands have been raised from the low wet lands over years and they have an elevation of 3 to 4 feet only above the mean water level and are generally submerged during the monsoon floods.

Rice and coconut are the two main crops in Kuttanad. Single crop of rice is grown in the low lying fields and it forms the major crop. Coconuts are planted on the dry lands. Plantain and arecanut are grown in the interspaces of coconut trees. In some fields in the upper reaches, a second crop of rice known as "Kolappala" is raised in April-May. But this is not common all over the area.

Rice is cultivated in this region under unique conditions and the type of cultivation is known as "Panja"

cultivation. The hallmark of a "Punja" field is that it lies submerged under water during the major part of the year. As a method of cultivation, the characteristic features of "Punja" are the bunding and bailing out of water before the fields are recovered for cultivation. Before the commencement of cultivation, the entire paddy lands form a vast sheet of water. Cultivation is done after draining the fields and the crop is protected by ring bunds encircling the "padasekharams". The difference between the "Kayal" lands and "Karappadams" in the conduct of the above operation is only one of degree and not of kind. The "Kayal" lands being deeper requires more amount for bunding and dewatering than the "Karappadams".

Rice cultivation in this region is a very risky operation since the rice is grown in fields surrounded by mud embankments; outside of which there is water standing five to seven feet above the field level. Heavy rainfall may result in the breaking of the bunds, thus causing complete loss of crops.

Agriculture in this area suffers from heavy floods during monsoons and from scarcity of fresh water for irrigation during the summer months due to the entry of salt water through the bar at Cochin. The step already taken for the regulation of water course such as the spill way at Thottapally is helpful in the control of floods. The salt water barrier at Thanneermukhom which

is under construction will prevent the entry of salt water into this area. It will be possible to raise one more crop in this region when all the schemes envisaged in the Kuttanad development scheme are completed.

Another feature of agriculture in this region is that co-operative farming is practised here in respect of certain operations. The large blocks or "padasekharams" are extensive in area but divided into large number of fragments are cultivated by small holders with slender resources. Pumping operation can start only after the entire length of the outer bunds are repaired and are in tact. If any farmer fails to construct his portion of the ring bund, the commencement of agricultural operation in that whole block will be delayed. So, unless there is co-operation among the farmers at least in respect of operations like repairing of bunds, dewatering and irrigation, cultivation is not possible in the area.

Dewatering has to be done by common pumpsets for a block. The irrigation water for cultivation has to come from the common sluices. The dewatering operations and other incidental items of work are carried out on the basis of contract given out by auction by the Punja Special Officer, specially appointed by the Government. A part of the cost of dewatering i.e., 50 per cent is borne by the Government and is given to the cultivators in the form of subsidy.

Agricultural operation starts in Kuttanad area after the South-West monsoon has subsided i.e., in September-October. The ring bunds encircling the 'pada-sekharam' get submerged during monsoon season and some repairs will be required before starting dewatering operation. So the first operation is repair of bunds and then starts the dewatering operation. After dewatering, other normal agricultural operations are carried out.

Kuttanad, being subject to heavy rainfall and floods, is not ideal for cattle rearing. The facilities for conserving adequate quantities of farmyard manure and compost are also poor. Hence the production of organic manure is very limited in this region. The time available for applying such organic manures in the vast area of paddy fields is also limited. Because of the above conditions, the application of organic manure to the field is meagre, but application of fertilizer is commonly practised by all in the area. Further, the clayey soil of Kuttanad receives some deposit of silt due to the flooding of the fields in June-July.

The labour problem of Kuttanad requires special mention. In this area, there is high demand of labour during the short period of agricultural operations. When the vast expanses of water suddenly become beehives of activity, the local labour can meet only

PLATE I

**Kuttamad paddy fields before the
commencement of cultivation**

PLATE I



PLATE II

**Cultivation in Kuttanad commences
with the repairing of bunds**

PLATE II

**Cultivation in Kuttanad commences
with the repairing of bunds**

PLATE II



PLATE III

Threshing of paddy in Kuttanad

PLATE III



a small fraction of the demand. Agricultural labourers from the surrounding district regularly migrate to this area and stay there for short periods, extending from 4 to 6 weeks. Thus, there is a large floating population of agricultural labourers in this region. Batches of these labourers move from one "padasekharam" to another. The movement of labour force is facilitated by the slightly different timings of sowings in different "padasekharams".

The attached labourers are indispensable factor in Kayal cultivation which demands eternal vigilance. The bunds have to be watched day and night and protected, dewatering has to be done from time to time, water has to be let in and pumped out to remove salinity of soil and watch and ward duties of an arduous nature have to be performed especially during the harvesting season. All these require the services of labourers who know the job and are devoted to it. But there is a great scarcity for attached labour and many farmers do not have such labourers. The unique feature of agricultural labour in this region is that it is highly organized. It is doubtful whether there is any other part in India where trade Unionism has taken such a deep root among the agricultural labourers.

Onattukara paddy cultivation

In this region two crops of paddy are raised. The

first crop known as the "Virippu" is sown as soon as the summer showers are received towards the end of March or beginning of April. This will be harvested in July - August. The second crop known as the "Mundakan" is sown in the nursery in June - July and transplanted in August - September. This crop is harvested in December - January. Though the annual rainfall is about 2800 millimetres in this region, it is not dependable. So cultivation of paddy cannot be carried out efficiently in the two seasons due to the uncertainty of rainfall.

RESULTS

RESULTS

COST STUDIES

As in the case of any other business concern, the cost in agriculture can also be classified into two viz., the fixed cost and variable cost. The fixed cost in agriculture includes land, buildings, equipment, live-stock and other permanent improvements on the farm. The amount invested on labour, seeds, feeds, fertilizers and manures and other expenses incurred for the operation of the farm constitute the variable cost.

Fixed cost

Land

The most important item of fixed cost in agriculture is the investment on land. The value of land in Kuttanad is almost uniform in all the farms and it ranges from Rs. 2840 to Rs.3100 per acre. The average value of land in this area is Rs. 2977 and Rs.2967 per acre for the size Groups I and II respectively. In the Onattukara region, the value of wetland ranges from Rs.7900 to Rs.8200 per acre with an average of Rs.7917 and Rs.8000 per acre for the farms in size Groups I and II respectively. Almost uniform price exists in

Table 4. Value of land per acre

Sl. No.	Villages	Average value per acre		
		Group I farms	Group II farms	Average for the village
		Rs. ps.	Rs. ps.	Rs. ps.
<u>Kuttanad region</u>				
1.	Kainakary	2850.00	2840.00	2845.00
2.	Muttar	3100.00	3080.00	3090.00
3.	Veliyanad	2980.00	2980.00	2980.00
	Average	2976.67	2967.67	2971.67
<u>Onattukara region</u>				
1.	Kannamangalam	7950.00	8200.00	8075.00
2.	Cheppad	7900.00	7900.00	7900.00
3.	Kerrikkad	7900.00	7900.00	7900.00
	Average	7916.67	8000.00	7958.33

all the areas in this region. The high price of land in this part is due to the fact that two paddy crops can be raised in this area. The high demand for land also increases the market value of land. The difficulties and risks involved in paddy cultivation is more in the Kuttanad region and this also contributes to the low value of land in that region when compared to the Onattukara region. The average value of land in different villages is given in Table 4.

Building

Investment on buildings which are intended solely for farming was negligible. The houses in which the farmers reside were also used for storing the equipment, seeds etc. Hence investment on buildings was not evaluated separately.

Farm equipment

In the Kuttanad region, the equipments that are used are of special type, suitable for the soil and type of cultivation followed. Since the dewatering operation is done by contractors, the cultivators do not possess pumpsets for that purpose. Wooden sluices to let in water into the fields are maintained by the farmers. Country boat is a necessity in this area and most of the farmers own small country boats. Other equipments include, country plough, mammatti, Crowbar, harrows, water wheels, sprayers etc.

In the Onattukara region the equipments maintained by the farmers are country ploughs, iron ploughs, spades, mammatti, hand hoes, water wheels, levelling boards, harrows etc. A few of the farmers owned sprayers also.

The investment on equipment per farm was Rs.405.83 for the farms in the Group I and Rs.637.14 for the farms in the Group II in the Kuttanad region. There was significant difference in this investment between the two size Groups. The average investment per acre for Group I farms was Rs.162.70 and for Group II farms Rs.145.70.

In the Onattukara region, the investment on equipment was Rs.148.25 per farm in the Group I and Rs.452.12 per farm in the Group II. The per acre investment on this item was Rs.125.00 and Rs.127 for the Groups I and II respectively. The investment on equipments in the farms in different villages is given in Tables 5 a. and 5 b.

Livestock

The usual practice in the Kuttanad area is the contract system for ploughing. The ryots do not keep work animals for this operation. Among the selected farmers only one farmer maintained work animals. The other farmers entrusted the ploughing operation to the ploughmen who were available in the area. The payment for this operation is made both in kind and cash.

Table 5 a. Investment on equipments per farm

Sl. No.	Villages	Group I	Group II	Village Average
1.	Kainakary	503.00	683.70	593.35
2.	Mattar	398.50	670.80	534.65
3.	Vellyanad	316.00	556.92	436.46
	Average	405.83	637.14	521.47
Average size of farm (acres)				
		1.88	4.37	
Investment per acre Rs.				
		162.70	145.70	

Analysis of Variance

Source	D.F.	S.S.	M.S.	F value	F at 0.05
Total	5	107555.40			
Between villages	2	25134.29	12567.14	11.60	19.00
Between Groups	1	80254.16	80254.16	74.12*	18.51
Error	2	2166.95	1083.47		

Table 5 b. Investment on equipments per farm

Onattukara region

Sl. No.	Villages	Group I	Group II	Village Average
1.	Kannamangalam	186.00	488.00	337.00
2.	Cheppad	194.00	492.00	342.00
3.	Karikkad	64.75	376.36	220.55
	Average	148.25	452.12	300.18
Average size of farm (acres)				
		1.17	3.56	
Investment on equipments per acre				
		Rs. 125.00	127.00	

Analysis of Variance

Source	D.F.	S.S.	M.S.	F value	F at 0.05
Total	5	157613.21			
Between villages	2	19058.81	9529.40	396.81 **	19.00
Between groups	1	138505.47	138505.47	566.43 **	18.51
Error	2	48.93	24.40		

In the Onattukara region also, only few farms maintained bullocks throughout the year. Usually, the bullocks are purchased at the beginning of the cultivation season and immediately after the ploughing operation they are sold away. Majority of the farmers hired work animals for the preparatory cultivation. Because of the above system, the normal hire charges for a pair of animals in the locality was considered for calculating the cost of bullock labour. In the Kuttanad region, the hire charges for a pair of animals for a day of 8 hours was worked out as Rs.11 and in the Onattukara region, it was Rs.10.

Variable Cost

The variable cost includes cost of human labour, value of manures and fertilizers, bullock labour charges, value of seeds, plant protection chemicals, depreciation of equipments etc.

Human labour

Human labour employed in the farm can be classified into two viz., family labour and hired labour. The hired labour can again be categorised as casual labour and permanent labour. Human labour employed for different operations were collected separately.

There is acute scarcity of human labour in the Kuttanad region during the cultivation season and the local labour available is not sufficient to meet the demands. In the

Onattukara region, the labour is available locally. The quantity of family labour employed in the Kuttanad region is negligible, but the employment of attached labour was noticed in 24 farms out of the 60 farms studied. The attached labour attend to the routine farm operations all the year round. In the Kuttanad farms, the agricultural operations extend over a period of four to five months. During this period the attached labour will be paid wages in kind and cash. Other perquisites are also given to such attached labourer. But he is not employed throughout the year. In the Onattukara region, only one farm employed permanent labour out of the thirty farms studied. The input of family labour was low or negligible in small holdings also and 24 farms out of the 30 studied in the Onattukara region did not show any family labour input and even in those where family labour was employed, it was only a small fraction of the total labour employed. This may be due to the high literacy of the people and the social set up in the area. Most of the educated people are reluctant to work in the fields. Among the women, only certain sections of the people go for field work even though the financial condition of the other sections is poor. Labour employed per farm under different categories is shown in Table 6.

In order to have uniformity in compilation, the labour employed was standardised to a common unit of man-

Table 6. Labour employed per farm (in man-days)

	Casual labour	Family labour	Permanent labour
<u>Kuttanad region</u>			
Group I farms	84.49	1.12	28.40
Group II farms	148.50	-	51.64
<u>Onattukara farms</u>			
Group I farms	97.08	10.76	-
Group II farms	153.95	16.72	12.00

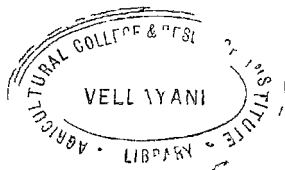
equivalent. The man equivalent was worked out on the basis of wages paid to men and women. On an average two women are considered as one man equivalent in both regions since the wage rate for a woman was half of that of a man.

The details of the labour employed for various agricultural operations in the two regions are given in Tables 6 a and 6 b.

The total labour required for the cultivation of one acre of paddy in Kuttanad region was 45.51 man days. Of this total labour, 30.56 per cent was employed for harvesting and thrashing operations, and 33.70 per cent for preparatory cultivation.

In the Onattukara region 46.64 man days were employed for cultivating one acre of paddy. 29.20 per cent of the total labour was utilized for harvesting and thrashing. For intercultivation, 25.33 per cent of the labour was employed. Preparatory cultivation and sowing required 20.18 per cent and 17.55 per cent of the total labour respectively.

The total cost of human labour per acre in Group I and Group II farms in Kuttanad area was Rs.299.05 and Rs.299.80 respectively. The average cost for the region was Rs.299.42 per acre. In the Onattukara farm, the cost of human labour worked out to Rs.176.29 and Rs.162.35 for Groups I and II respectively. The average for the region was Rs.169.32 per acre.



Wages

The payment of wages is in cash except for the harvesting operation. For harvesting and thrashing operations, the labourers get a share of the produce. In the Kuttanad region 14 per cent of the gross produce and in Onattukara region 10 per cent of the gross produce is given as wages for these operations. For all other operations, the wages are paid in cash. There is not much variation in the wage rate in the Kuttanad region. The rate of wages in the selected holdings range from Rs.3.00 to Rs.3.50 per man and from Rs.1.25 to Rs.1.75 per woman. But the rate paid by most of the farmers was Rs.3.50 per man and Rs.1.75 per woman. In the Onattukara region, the rate of wage paid by the majority of the farmers was Rs.3.00 per man and Rs.1.50 per woman. The wages for permanent labour was calculated by taking into account the total amount paid and the value of other perquisites and kind payments during the year. In the case of family labour, the existing rate for casual labourers was adopted as suggested by Singh (1952).

Manures and Fertilizers

The majority of the farmers in both the regions were fertilizer minded. In the Kuttanad area all the farmers were using fertilizers for the paddy crop. The application of organic manure was very little in this region. This is due to the non-availability of organic manures and other reasons which were discussed earlier. The Kuttanad paddy fields

receive some amount of silt from the rivers during the flooding period in July. Due to the acidity of the soil in this area, application of lime or half-burnt lime is a necessity for good crop production. Most of the farmers have realised this fact and lime application is done by a good number of farmers. Out of the 60 farms studied, application of lime was recorded in 51 farms.

In the Onattukara area, all the farmers applied organic manure to the paddy crop. Ninety per cent of the farmers applied both organic manure and fertilizers. The quantity of organic manure applied was more in this region when compared with the Kuttanad region. The expenditure was greater on organic manures than for fertilizers in this area. This is due to the sandy nature of the soil which necessitates the application of more organic manure for crop production. Another drawback in this area is the lack of assured supply of water especially during the first crop season which makes it difficult for the farmers to apply fertilizers at the proper time.

Farmyard manure and fertilizers have been valued at the purchase price. In the case of farm produced organic manures, the market rate in the locality was considered in evaluating it. The cost of manures, lime and fertilizers in the Kuttanad region was 71.10 per acre for the farms in the Group I and Rs.74.51 per acre for the farms in the

Group II. The average amount spent on this item for the region worked out to Rs.72.80 per acre. The cost of manures and fertilizers in the different farms ranged from Rs.30.00 per acre to Rs.145.50 per acre. In the Onattukara farms, the amount spent on this item was Rs.96.13 per acre in the farms in Group I and Rs.110.30 per acre in Group II. The average for the region was Rs.103.21 per acre. The cost of this item ranged from Rs.60.80 to Rs.193.75 per acre in this area. The amount spent per acre on manures and fertilizers in the different villages and size groups are given in Tables 7a and 7b. There was no significant variation in the input of this factor between the villages and size groups in each of the two regions.

Seeds

In the Kuttanad region, sowing is done mostly by broadcasting. Since suitable land for raising nursery is not available in sufficient extent, transplanting is not a common practice in this region. Because of this method of sowing farmers used a high seed rate. In the Onattukara farms, dibbling and transplanting were followed for the first crop and second crops respectively. Less seed rate was adopted in this area when compared to the other region. Improved seeds were used only by a few farmers in the Kuttanad region. This was due to the non-availability of suitable strains for this area. The farmers in this area are willing to use improved strains if they

Table 7 a. Value of manures and fertilizers per acre
Kuttanad region

Sl. No.	Villages	Group I	Group II	Village Average
1.	Kainakary	75.50	79.50	77.50
2.	Muttar	70.24	76.28	73.26
3.	Veliyanad	67.55	67.75	67.65
	Average	71.10	74.51	72.80

Analysis of Variance

Source	D.F.	S.S.	M.S.	F value	F at 0.05
Total	5	123.91			
Between villages	2	97.65	48.82	11.80	19.00
Between groups	1	17.47	17.47	4.00	18.51
Error	2	8.74	4.37		

Table 7 b. Value of manures and fertilizers per acre

Onattukara region

Sl. No.	Villages	Group I	Group II	Village Average
1.	Kannamangalam	101.52	110.00	105.76
2.	Cheppad	98.00	120.10	109.05
3.	Kerikkad	88.86	100.80	94.83
	Average	96.13	110.30	103.21

Analysis of Variance

Source	D.F.	S.S.	M.S.	F value	F at 0.05
Total	5	5474.46			
Between villages	2	2696.06	1348.03	9.56	19.00
Between groups	1	2501.86	2501.86	17.55	18.51
Error	2	276.74	138.37		

are convinced of the suitability of the seed suited for their fields. Six farms out of the sixty farms studied, were using improved seeds. In the Onattukara region, most of the farmers were using improved strains for the second crop. Twenty seven farms out of the 30 farms studied, recorded the use of improved seed in this region.

The seeds were valued at the prevailing market rate as suggested by Shirname (1952), Agarwal (1952) and Yang (1962). The amount spent on seeds in Kuttanad farms was Rs.45.21 and Rs.44.97 per acre for the Groups I and II respectively. The average for the region was Rs.45.08 per acre. In the Onattukara region, the cost of seed worked out to be Rs.39.50 and Rs.39.71 per acre for Group I and II farms respectively. The average for the region was Rs.39.60 per acre. No significant variation was found to exist in the cost of seed between the two size groups in both the regions. The amounts spent on seed in different villages and groups of farms are given in Tables 8 a and 8 b.

Intercultivation

The intercultivation operation consists of weeding and gap filling in the Kuttanad region. Women are employed for this work in this area. But in the Onattukara farms, hand hoeing and weeding are done. Hand hoeing is done by men and weeding by women labour. In Onattukara, 11.8 man-days per acre were employed for this operation, while 9.6 man-days per acre were employed in the Kuttanad farms.

Table 8 a. Cost of seeds per acre
Kuttanad region

Sl. No.	Villages	Group I	Group II	Village Average
1.	Kainakary	48.00	46.24	47.12
2.	Muttar	40.63	42.63	41.63
3.	Veliyanad	47.00	45.96	46.48
	Average	45.21	44.97	45.08

Analysis of Variance

Source	D.F.	S.S.	M.S.	F value	F at 0.05
Total	5	40.14			
Between villages	2	35.05	17.52	8.90	19.00
Between groups	1	1.11	1.11	0.58	18.51
Error	2	3.98	1.99		

Table 8 b. Cost of seeds per acre

Onattukara region

Sl. No.	Villages	Group I	Group II	Village Average
1.	Kannamangalam	37.00	37.24	37.12
2.	Cheppad	37.50	39.00	38.50
3.	Kazrikkad	44.00	42.90	43.45
	Average	39.50	39.71	39.67

Analysis of Variance

Source	D.F.	S.S.	M.S.	F value	F at 0.05
Total	5	47.35			
Between villages	2	44.65	22.32	27.50 *	19.00
Between groups	1	1.07	1.07	1.30	18.51
Error	2	1.63	0.81		

The cost of the operation varied from Rs.10.50 to Rs.80.50 per acre in the Kuttanad farms and from Rs.18 to Rs.66 per acre in the Onattukara farms. In some 'padasekharams' in the Kuttanad region more labour was required for the weeding operation and hence the high degree of variation in the cost of this operation. The average cost per acre in Group I and Group II farms in Kuttanad region was Rs.36.08 and Rs.34.17 respectively. The overall average was Rs.35.12. In the Onattukara region, the cost for this operation was Rs.35.53 and Rs.36.19 for the Groups I and II respectively. The overall average worked out to be Rs.35.86 per acre. There was no significant variation in the cost between the two size groups in both the regions. The expenses under this item for the different villages and size groups are given in Tables 9 a and 9 b.

Plant Protection

Paddy crop in the Kuttanad region is invariably affected by pests and diseases and almost all the farms adopt plant protection measures. A total of 58 farms of the 60 studied adopted plant protection measures. In the Onattukara region, plant protection measures were adopted by 12 farms out of the 30 studied. The average cost for this operation in the Kuttanad region was Rs.11.67 and Rs.10.56 per acre for Groups I and II respectively. The overall average worked out to be Rs.11.12 per acre. In the Onattukara farms, the cost under this

Table 9 a. Cost of intercultivation operations per acre
Kuttanad region

Sl. No.	Villages	Group I	Group II	Village Average
1.	Kainakary	46.74	43.72	45.23
2.	Muttar	29.50	27.50	28.50
3.	Veliyanad	32.00	31.28	31.64
	Average	36.08	34.17	35.12

Analysis of Variance

Source	D.F.	S.S.	M.S.	F value	F at 0.05
Total	5	315.37			
Between villages	2	288.09	144.04	18.81	19.00
Between groups	1	21.97	21.91	2.98	18.51
Error	2	15.31	7.65		

**Table 9 b. Cost of intercultivation operations per acre
Onattukara region**

Sl. No.	Villages	Group I	Group II	Village Average
1.	Kannamangalam	40.72	42.82	41.77
2.	Cheppad	36.75	38.75	37.75
3.	Kerikkad	29.13	27.02	28.07
	Average	35.53	36.19	35.86

Analysis of Variance

Source	D.F.	S.S.	M.S.	F value	F at 0.05
Total	5	204.64			
Between villages	2	197.21	98.60	34.40 *	19.00
Between groups	1	1.65	1.65	0.61	18.51
Error	2	5.78	2.89		

was very small. In Group I farms Rs.2 per acre and in Group II farms Rs.3.84 per acre were the expenses under this item. The overall cost for the region was Rs.2.92 per acre. The high cost in the Kuttanad region is due to the larger number of sprayings undertaken in order to save the crop from pests.

Irrigation and dewatering

The peculiarity in Kuttanad paddy cultivation is that irrigation charges are negligible while dewatering is a cost to reckon with. Dewatering is carried out at the beginning of the cultivation season. As discussed earlier, after the repair of bunds, dewatering is taken up. Electric motors are mostly used for this purpose and the entire area is provided with electricity so as to facilitate the use of electric motors and thus, reduce the cost of the operation.

The expenses under this item vary from "padasekharam" to "padasekharam" since the depth of water differs from place to place. After the main dewatering operation before sowing, drainage of the field is necessary at periodical intervals throughout the cropping period. Water is let into the field occasionally to wash off the acidity in the soil. This water has to be later drained off. This operation of letting in water and draining is done two to four times depending upon the soil condition. The actual amount paid by the farms for initial

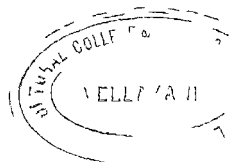


Table 10. Dewatering charges per acre

Kuttanad region

Sl. No.	Villages	Group I	Group II	Village Average
1.	Kainakary	31.70	33.76	32.73
2.	Muttar	31.90	29.70	30.80
3.	Veliyanad	32.40	32.80	32.60
	Average	32.00	32.08	32.04

Analysis of Variance

Source	D.F.	S.S.	M.S.	F value	F at 0.05
Total	5	9.27			
Between villages	2	3.65	1.82	<1	19.00
Between groups	1	1.01	1.01	<1	18.51
Error	2	4.61	2.30		

pumping and the charges for subsequent pumping were calculated under this item. The cost under this item was Rs.32.00 per acre for the farms in Group I and Rs.32.08 for the farms in Group II. Since the total cost of this operation in one "padasekharam" is divided by the number of acres in that "Padasekharam", the cost under this item may not vary according to the size of farms. But the cost in "Kayal" area was slightly higher than the "Karappadam" area, and the variation was however not statistically significant as can be seen in Table 10.

In the Onattukara region, no irrigation facilities existed and hence there was no cost under this item.

Harvesting

Expenses under harvesting, thrashing and transporting formed a major portion of the total cost of production. Payment for harvesting and thrashing are made in kind in both the regions. The conventional payments for this operation in Kuttanad include two kinds of payments known as "Patham" and "Theerppu". "Theerppu" represented partial payment for harvesting and the rate used to be one sheaf of paddy for every day of harvest. "Patham" constituted of residual payment for harvesting and thrashing. These two items of payment still exist but the rate varies. The present rate is $\frac{1}{9}$ of the gross produce as "Patham" and $\frac{1}{4}$ th of the "Patham" as "Theerppu". Thus about 14

per cent of the gross produce is given away as harvesting and thrashing charges. The price of paddy in the locality at the time of harvest was considered for computing the value of produce given as harvesting charges. The transporting of paddy and straw from the distant fields to farmer's home is another item of additional expense in the Kuttanad area. Usually, country boats are used for this purpose. The cost of harvesting, thrashing and transporting was Rs.199.23 per acre for the farms in Group I and Rs.199.56 per acre for the farms in Group II. The overall average worked out to Rs.199.38 per acre.

In the Onattukara farms, the rate of payment for harvesting was 10 per cent of the gross produce in most of the farms, but some farms were giving higher rates. Transporting charges was not much in this area since the fields are not far away from the farmer's houses. The price of paddy in the locality was taken for computing the value of paddy given as harvesting and thrashing charges. The expense under *this* item was calculated as Rs.87 per acre for the farms in Group I and Rs.87.20 per acre for the farms in Group II. The overall average for this item was Rs.87.10 per acre in the region.

The expenses under this item in different villages and size groups are presented in Tables 11 a and 11 b. The variation in the cost of this operation between the size groups was not significant in both the regions.

Table 11 a. Harvesting, threshing and transporting charges per acre

Kuttanad region

Sl. No.	Village	Group I	Group II	Village Average
1.	Kainakary	200.90	202.94	201.92
2.	Muttar	198.80	196.92	197.86
3.	Veliyanad	198.00	198.80	198.40
	Average	199.23	199.56	199.38

Analysis of Variance

Source	D.F.	S.S.	M.S.	F value	F at 0.05
Total	5	23.61			
Between villages	2	19.44	9.72	4.83	19.00
Between groups	1	0.15	0.15	0.07	18.51
Error	2	4.02	2.01		

Table 11 b. Harvesting, threshing and transporting charges per acre

Onattukara region

Sl. No.	Village	Group I	Group II	Village Average
1.	Kannamangalam	86.62	84.72	85.67
2.	Cheppad	86.58	88.48	87.53
3.	Keerikkad	87.80	88.40	88.10
	Average	87.00	87.20	87.10

Analysis of Variance

Source	D.F.	S.S.	M.S.	F value	F at 0.05
Total	5	10.41			
Between villages	2	6.46	3.23	1.66	19.00
Between groups	1	0.06	0.06	0.002	18.51
Error	2	3.89	1.94		

Cost of production per acre

For computing the cost of production, a number of estimates have to be made. Certain arbitrary procedures have to be adopted for allocation of different costs since there is no satisfactory method for imputing costs.

Evaluation of land was necessary for the purpose of imputing the cost of production since interests on investment on land is an item of cost. In case rent is paid, this can be considered as an item of cost. But when rent is not paid and cannot be ascertained, the interest on the value of land has to be considered. It is fair to consider the interest on the value of land as a cost entering into cost of production. In the Onattukara region all the farms were owner operated and rent could not be ascertained. So interest on the prevailing market price of land was calculated for both the regions. The rate of interest charged was the bank rate prevalent at the time of enquiry which was 6 per cent. Since two crops are raised in Onattukara lands, the interest on the value of land has been apportioned to the two crops equally.

The imputed interest per acre in the Kuttanad region was Rs.178.60 for Group I farms and Rs.178.00 for Group II farms. Similarly in the Onattukara region, the interest per acre worked out to Rs.237.50 and Rs.240.00 for the Groups I and II respectively.

Table 12 a. Total cost of production per acre

Kuttanad region

Sl. No.	Item	Group I farms		Group II farms		Average for the region	
		Rs.	ps.	Rs.	ps.	Rs.	ps.
1.	Human labour	299.05		299.80		299.42	(41.4%)
2.	Bullock labour	63.90		60.70		62.30	(5.56%)
3.	Fertilizers and manures	71.10		74.51		72.81	(10.00%)
4.	Seeds	45.21		44.97		45.09	(6.19%)
5.	Irrigation & dewatering charges	32.00		32.08		32.04	(4.41%)
6.	Plant protection	11.67		10.56		11.12	(1.53%)
7.	Depreciation of implements	16.27		14.57		15.42	(2.11%)
8.	Fixed costs	189.83		189.72		189.77	(26.06%)
	Total	729.03		726.91		727.97	

FIG.2

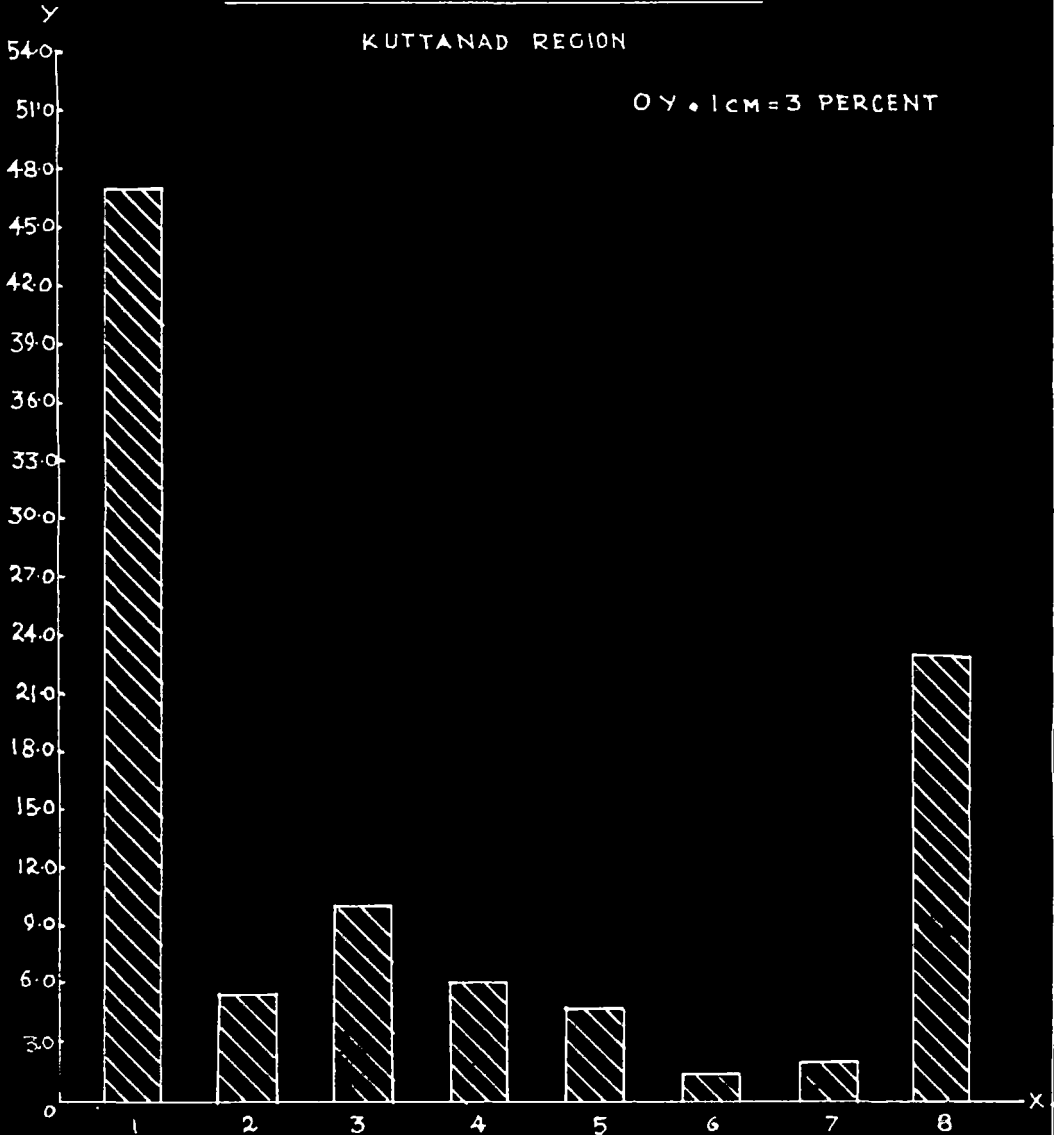
1. Human labour
2. Bullock labour
3. Fertilizers and manures
4. Seeds
5. Irrigation and dewatering charges
6. Plant Protection
7. Depreciation of implements
8. Fixed costs

FIG.2

PERCENTAGE DISTRIBUTION OF TOTAL COST
PER ACRE ON DIFFERENT ITEMS.

KUTTANAD REGION

0 Y . 1 cm = 3 PERCENT



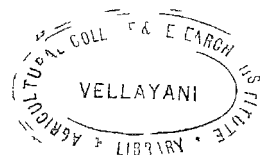


Table 12 b. Total cost of production per acre

Onattukara region

Sl. No.	Item	Group I farms		Group II farms		Average for the region	
		Rs.	ps.	Rs.	ps.	Rs.	ps.
1.	Human labour	176.29		162.35		169.32	(27.21%)
2.	Bullock labour	53.70		51.80		52.75	(8.55%)
3.	Fertilizers and manures	96.16		110.30		103.23	(16.71%)
4.	Seeds	39.50		39.71		39.60	(6.43%)
5.	Plant protection	2.00		3.84		2.92	(0.49%)
6.	Depreciation of implements	6.25		6.63		6.44	(1.04%)
7.	Fixed costs	243.27		245.82		244.55	(39.57%)
	Total	617.17		620.45		618.81	

FIG. 3

- 1. Human labour**
- 2. Bullock labour**
- 3. Fertilizers and manures**
- 4. Seeds**
- 5. Plant Protection**
- 6. Depreciation of implements**
- 7. Fixed Costs**

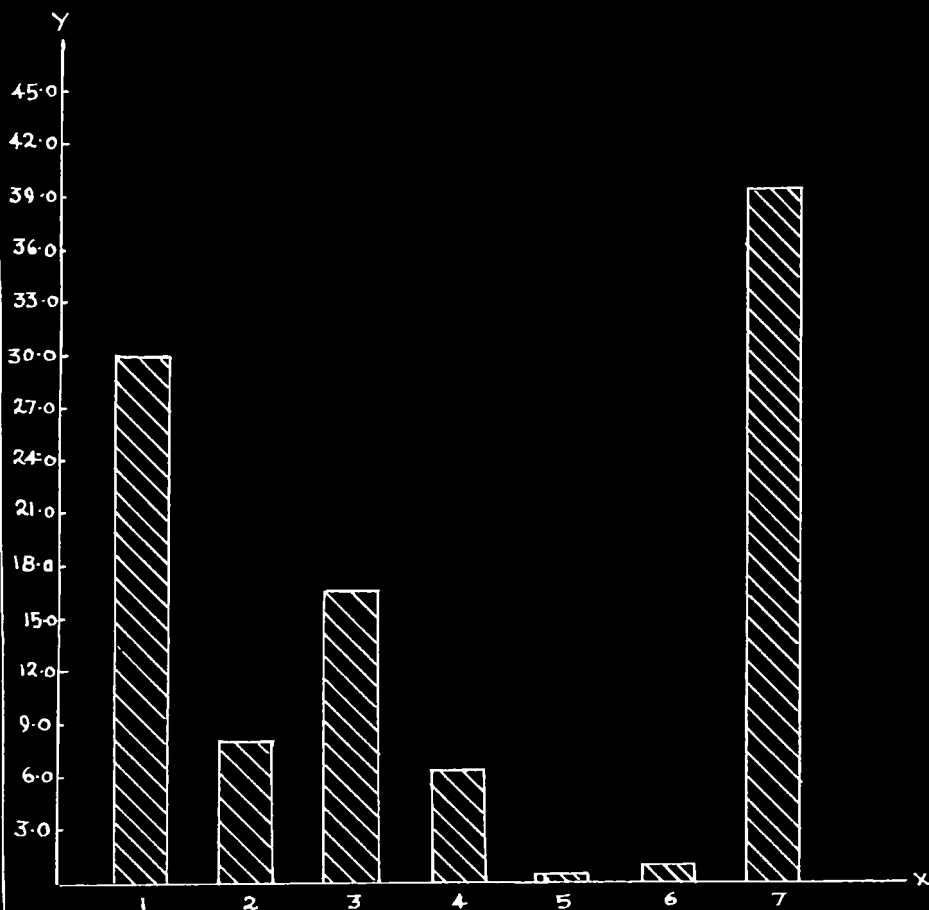
FIG. 3

PERCENTAGE DISTRIBUTION OF TOTAL COST

PER ACRE ON DIFFERENT ITEMS

ONATTUKARA REGION

O.Y. 1CM = 3 PERCENT



The depreciation charges of equipment is another item of cost entering into the cost of production. This was calculated on the basis of the life period of the equipment as suggested by Agarwal (1952, 1961), Singh (1952), Zacharias (1959). Since most of the equipments of the farm can be used for a period of 10 years, the depreciation was calculated at 10 per cent of the total investment on equipment. Interest on the investment on equipment was computed at 6 per cent.

For the allocation of the cost of bullock labour, Patil (1933) suggested that the daily cost of bullock labour is to be arrived at by dividing the total maintenance cost by the total number of bullock days worked. But in this study, most of the farmers were using hired bullocks and others maintained bullocks only for a short period during the cultivation season. Hence, it was difficult to arrive at the daily cost of bullock labour. For the purpose of allocating the cost, the daily rate of hire charges for bullock in the locality was taken into account as suggested by Panse (1952) and Yang (1962).

All the costs such as value of seeds, manures and fertilizers, wages for family and hired labour, hire charges of bullocks, depreciation of deadstock, interest on the value of land, investment on equipment etc., and taxes have been taken into consideration while imputing

the cost per acre. The total cost per acre for the two regions are given in Tables 12 a and 12 b. The total cost per acre in Group I farms in Kuttanad was Rs.729.03 and for Group II farms it was Rs.726.91 with an average of Rs.727.97 for the whole region. In the Onattukara region, the total cost per acre worked out to be Rs.617.17 and Rs.620.45 for Groups I and II respectively. The average for the region was Rs.618.81 per acre.

Cost of production per quintal of paddy

In order to estimate the cost of producing one quintal of paddy, the value of straw was deducted from the total cost and the remainder was divided by the yield in quintals. The straw was valued on the basis of market price as suggested by Shirname (1952). Similar procedure had been followed by the Punjab Board of Economic enquiry (1952) and Basak and Choudhury (1959). The cost per quintal of paddy was worked out for the two regions and presented in Tables 13 a and 13 b. The average cost of production for paddy was Rs.60.60 per quintal in Kuttanad region and Rs.67.96 per quintal in the Onattukara region.

RESOURCE PRODUCTIVITY AND FARMING EFFICIENCY

Resource productivity

In order to reallocate the resources in the most effective manner it is necessary to have the knowledge

about the productivity of resources. Usually two methods are adopted to estimate the resource productivity viz., the average and marginal productivities.

Average productivity of resources

The average productivity can be estimated in terms of gross productivity and of residual productivity.

Gross average productivity

The gross average productivity was calculated by dividing the sample average output by the sample average inputs of one resource without allocating any share to other resources. The gross average productivity for labour and capital was calculated for each size group and given in Tables 14 a and 14 b.

The gross average capital productivity in Kuttanad region was Rs.2.72 for Group I farms and Rs.2.75 for Group II farms. In the case of Onattukara region the gross average capital productivity was 1.66 and Rs. 1.68 for the Groups I and II respectively.

The gross average productivity for labour in the Kuttanad farm was Rs.26.57 and Rs.25.47 for Groups I and II respectively. In the Onattukara farms, the corresponding figures were Rs.15.96 and Rs.16.61.

Residual average productivity

In order to get a more accurate measure of productivity, the residual productivity of the resources was

calculated in respect of labour and non-labour capital services. The residual average productivity of labour was calculated by subtracting the total value of non-labour capital service from the value of gross product and by dividing the remainder with the number of man-equivalents. The residual average productivity for labour in Kuttanad farms was Rs.16.52 and Rs.16.22 for the Groups I and II respectively. In the Onattukara farms, the residual labour productivity was Rs.6.39 for Group I farms and Rs.5.91 for Group II farms.

The residual capital productivity for the Kuttanad farms was Rs.2.03 for Group I and Rs.2.05 for Group II farms. In the Onattukara farms, the residual capital productivity amounted to Rs.1.26 and Rs.1.25 for Group I and II farms respectively.

Output - Input ratio

The output-input ratio is the relationship of all the resources and the output. This ratio was calculated by dividing the value of total output by the value of total input. This ratio indicates the net loss or profit of the farm. A ratio more than unity indicates profit and less than unity indicates loss to the average farm. The output-input ratio for the Kuttanad farms 1.61 and for the Onattukara farms it was 1.18. There was no significant difference between the ratios in the two size groups as can be seen from Tables 14 a and 14 b.

Table 14 a. Resource Ratios and Gross and Residual productivity of resources

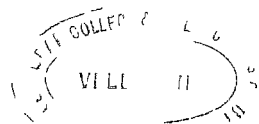
Kuttanad region

Sl. No.	Item	Group I farms	Group II farms
1.	Total cropped area (average) per farm	1.88	4.37
2.	Total value of production in rupees	2205.61	5139.86
3.	Total of all expenses	1371.08	3176.60
4.	Total labour units in man days	84.49	201.80
5.	Value of labour units including unpaid family labour	562.08	1310.12
6.	Total value of non-labour Capital Services	809.00	1866.48
7.	Gross labour productivity in rupees	26.57	25.47
8.	Residual labour productivity in rupees	16.52	16.22
9.	Capital available per worker	9.57	9.24
10.	Average capital productivity in rupees	2.72	2.75
11.	Average Residual Capital productivity	2.03	2.05
12.	Value of output per unit of input	1.61	1.61

Table 14 b. Resource Ratios and Gross and Residual productivity of resources

Onattukara region

Sl. No.	Item	Group I farms	Group II farms
1.	Total cropped area (average) per farm	2.34	7.12
2.	Total value of products in rupees	1721.84	5247.15
3.	Total of all expenses	1444.17	4417.60
4.	Total labour input in man days	107.85	336.00
5.	Value of labour unit including unpaid family labour	412.52	1155.93
6.	Total value of non-labour Capital Services	1031.65	3261.67
7.	Gross product per labourer (Gross labour productivity) in rupees	15.96	16.61
8.	Residual product per labourer	6.39	5.91
9.	Capital available per labourer	9.56	9.70
10.	Average Capital productivity in rupees	1.66	1.68
11.	Average residual Capital productivity	1.26	1.25
12.	Value of output per unit of input	1.19	1.18



Farming efficiency

The farming efficiency has also been measured by the conventional methods of farm management analysis. As suggested by Khusro (1964), the gross income, farm business income and the net profit or loss were worked out for the two size groups in the two regions. The efficiency of farming has also been studied by fitting a simple linear regression equation with total cost and gross income.

Gross income

The gross income includes the total value of grain and straw. The prevailing market rates for paddy and straw at the time of harvest were taken into account in calculating the gross income. In the Kuttanad area, the gross income per acre was Rs.1174.68 and for the Onattukara farms, it was Rs.736.46. The gross income for the villages and size groups in the two regions are given in Tables 15 a and 15 b. There was no significant difference in gross income between the villages and size groups in the two regions.

Farm business income

The farm business income was computed by deducting from the gross income the cost excluding the imputed value of family labour, interest on value of land and interest on owned capital. The farm business income for farms in Group I was Rs.632.00 per acre and for the

Table 15 a. Gross income per acre

Kuttanad region

Sl. No.	Village	Group I	Group II	Village Average
1.	Kainakary	1172.15	1181.10	1176.62
2.	Muttar	1176.45	1173.23	1174.84
3.	Veliyanad	1171.00	1174.16	1172.58
	Average	1173.20	1176.17	1174.68

Analysis of variance

Source	D.F.	S.S.	M.S.	F	F.at value 0.05
Total	5	67.31			
Between villages	2	16.63	8.31	<1	19.00
Between groups	1	13.32	13.32	<1	18.51
Error	2	37.36	18.68		

Table 15 b. Gross income per acre

Onattukara region

Sl. No.	Villages	Group I	Group II	Village Average
1.	Kannamangalam	736.40	738.50	737.45
2.	Cheppad	736.00	738.90	737.45
3.	Karikkad	735.10	733.90	734.50
	Average	735.83	737.10	736.46

Analysis of Variance

Source	D.F.	S.S.	M.S.	F value	F at 0.05
Total	5	20.40			
Between villages	2	13.27	6.63	4.33	19.00
Between groups	1	4.07	4.07	1.32	18.51
Error	2	3.06	1.53		

farms in size Group II Rs.636.98 per acre in the Kuttanad region. The average for the region was Rs.634.49 per acre. In the Onattukara farms, the farm business income was Rs.377.55 and Rs.368.59 for the farms in Groups I and II respectively. The average for the region was Rs.373.07 per acre. The farm business income per farm and per acre is given in Table 16.

Net profit

The net profit was calculated by deducting the total cost from the gross income. The net profit per acre for the farms in Group I was Rs.444.17 and for the Group II, Rs.449.26 in the Kuttanad region. The average for the region worked out as Rs.446.71 per acre. In the case of Onattukara farms, the net profit was Rs.118.66 per acre and Rs.116.65 per acre for the Groups I and II respectively. The average for this region was Rs. 117.65 per acre. The net profit per farm and per acre is given in Table 16. The net profit per farm in Group I was Rs. 805.07 and in Group II Rs.1964.26 in the Kuttanad region. In the Onattukara region, the net profit per farm worked out as Rs.277.67 and Rs.829.55 for the farms in Groups I and II respectively.

Regression analysis

Two equations were fitted for the two regions.

Table 16. Gross income, Farm business income and Net profit

size of farm	Mean size of farm (acres)	Per farm		Net Profit	Per acre		Net Profit
		Gross income	Farm business income		Gross income	Farm business income	
Kuttanad region							
2.50 acres and less	1.88	2205.61	1158.19	805.07	1173.20	632.00	444.17
Above 2.50 acres	4.37	5139.86	2783.60	1964.26	1176.17	636.98	449.26
Average	3.12	3672.73	1970.85	1384.66	1174.68	634.49	446.71
Onattukara region							
2.50 acres and less	1.17	1721.84	883.47	277.67	735.83	377.55	118.66
Above 2.50 acres	3.56	5247.15	2623.36	829.55	737.10	368.59	116.65
Average	2.36	3484.49	1753.41	553.61	736.46	373.07	117.65

FIG. 4

GROSS INCOME AND TOTAL COST

KUTTANAD REGION

$$Y = 0.46954 + 0.91599X.$$

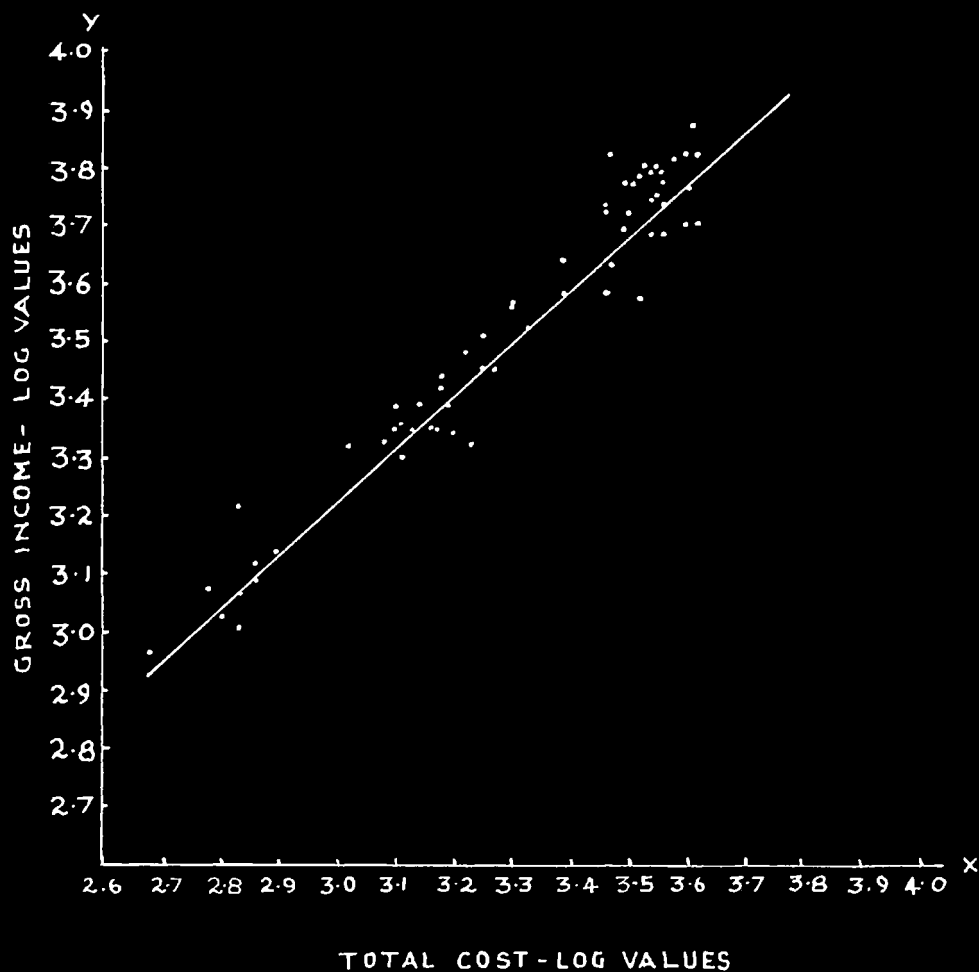
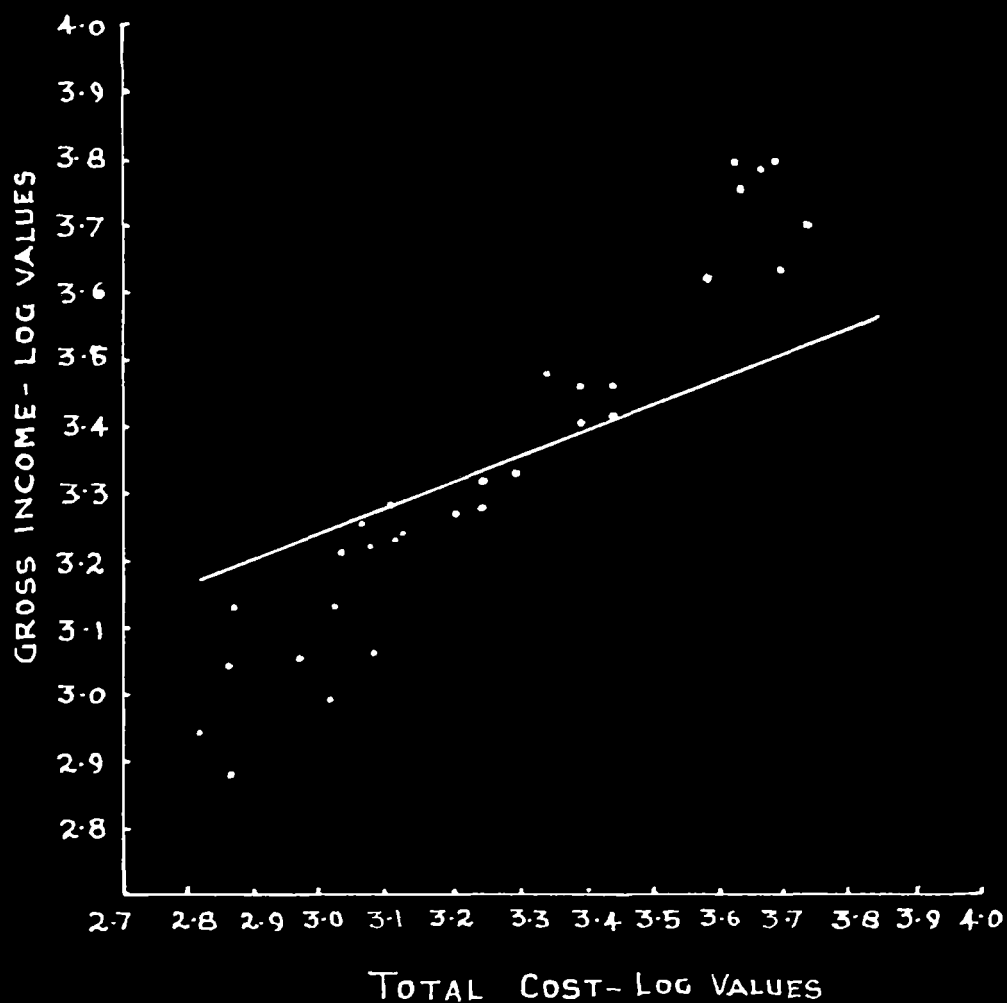


FIG.5

GROSS INCOME AND TOTAL COST

ONATTUKARA REGION

$$Y = 2.12156 + 0.37328 X$$



The linear regression equation fitted was

$Y = a + bx$ where, Y represented the gross income, 'a' a constant; 'b' the regression coefficient and 'x' represented the total cost. The equations were:

Kuttanad region

$$Y = 0.46954 + 0.91599x.$$

Onattukara region

$$Y = 2.12156 + 0.37328x$$

The linear regression functions are presented graphically in figures 4 and 5.

Production function

In this part an attempt is made to evaluate the efficiencies of different input factors on the production of paddy in the two regions. A number of methods are available for evaluating resource efficiency. In the present study, Cobb-Douglas type production function was selected for evaluating the efficiency of resources.

Within each region, the farms were homogenous as evidenced by the analysis of variance of gross income of the farm. There was no significant variation in gross income between the villages and between the size groups. Two functions were fitted for the farms in the two areas since the conditions of farming in the two regions are entirely different. The function was of the form

$$Y = a x_1^{b_1} x_2^{b_2} x_3^{b_3} x_4^{b_4} x_5^{b_5}$$

Table 17 a. Correlation matrix

Kuttanad region

Inputs	Y (yield)	X ₁ (land)	X ₂ (Human labour)	X ₃ (Nitrogen)	X ₄ (Bullock labour)	X ₅ (others)
Y	1.00000	0.97706	0.97484	0.86093	0.88061	0.93513
X ₁		1.00000	0.96259	0.82986	0.92528	0.95805
X ₂			1.00000	0.82309	0.92006	0.95117
X ₃				1.00000	0.80464	0.78820
X ₄					1.00000	0.90470
X ₅						1.00000

Table 17 b. Correlation matrix

Onattukara region

Inputs	Y (yield)	X ₁ (land)	X ₂ (Human labour)	X ₃ (Nitrogen)	X ₄ (Bullock labour)	X ₅ (Others)
Y	1.00000	0.95708	0.96665	0.80487	0.89559	0.77121
X ₁		1.00000	0.96777	0.84252	0.93449	0.81707
X ₂			1.00000	0.86337	0.96153	0.78895
X ₃				1.00000	0.77912	0.69569
X ₄					1.00000	0.77705
X ₅						1.00000

where, Y denotes gross income in rupees; 'a' is a constant, b 's - elasticities of production; x_1 denotes cropped area in acres; x_2 denotes input of human labour in rupees; x_3 denotes inputs of nitrogen in kgms; x_4 denotes input of bullock labour in rupees; and x_5 denotes other factors in rupees. The other factors include the value of seed, plant protection chemicals and expenses on dewatering operation in the Kuttanad farms and the value of seed and plant protection chemicals etc., in the Onattukara farms. The functional relationship worked out for the two regions are as follows.

Kuttanad farms

$$Y = 2.24501 x_1^{0.69835**} x_2^{0.59687**} x_3^{0.14726**} x_4^{-0.30466**} x_5^{-0.14208*}$$

Standard errors	0.1135	0.0990	0.0323	0.0562	0.0555
-----------------	--------	--------	--------	--------	--------

t	6.151	6.028	4.560	5.415	2.560
---	-------	-------	-------	-------	-------

$$R^2 = 0.98982$$

$$\leq b1 = 0.99574$$

Onattukara farms

$$Y = 1.05907 x_1^{0.40306*} x_2^{1.41431**} x_3^{-0.25571**} x_4^{-0.64577*} x_5^{0.00703}$$

Standard errors	0.1653	0.3524	0.0895	0.1879	0.0059
-----------------	--------	--------	--------	--------	--------

t	2.438	4.013	2.874	3.436	0.119
---	-------	-------	-------	-------	-------

$$R^2 = 0.97272$$

$$\leq b1 = 0.92112$$

FIG. 6

DISTRIBUTION OF OBSERVED AND EXPECTED VALUES

KUTTANAD REGION

..... OBSERVED VALUES

xxxxx EXPECTED VALUES

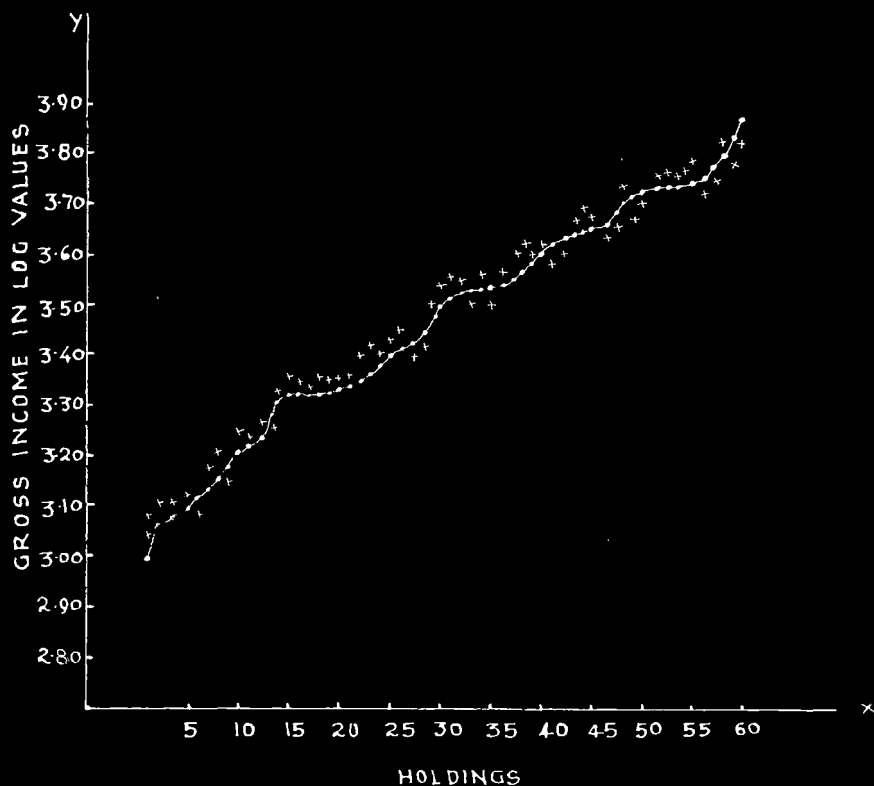


FIG. 7

DISTRIBUTION OF OBSERVED AND EXPECTED VALUES

ONATTUKARA REGION

..... OBSERVED VALUES

xxxxx EXPECTED VALUES

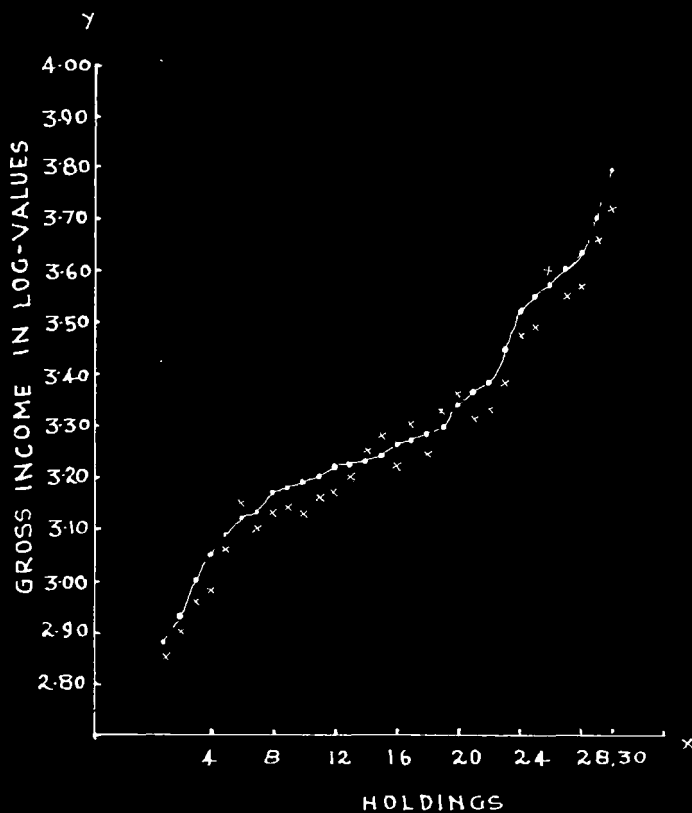


FIG.8
CLOSENESS OF FIT

KUTTANAD REGION

$$R^2 = 0.99$$

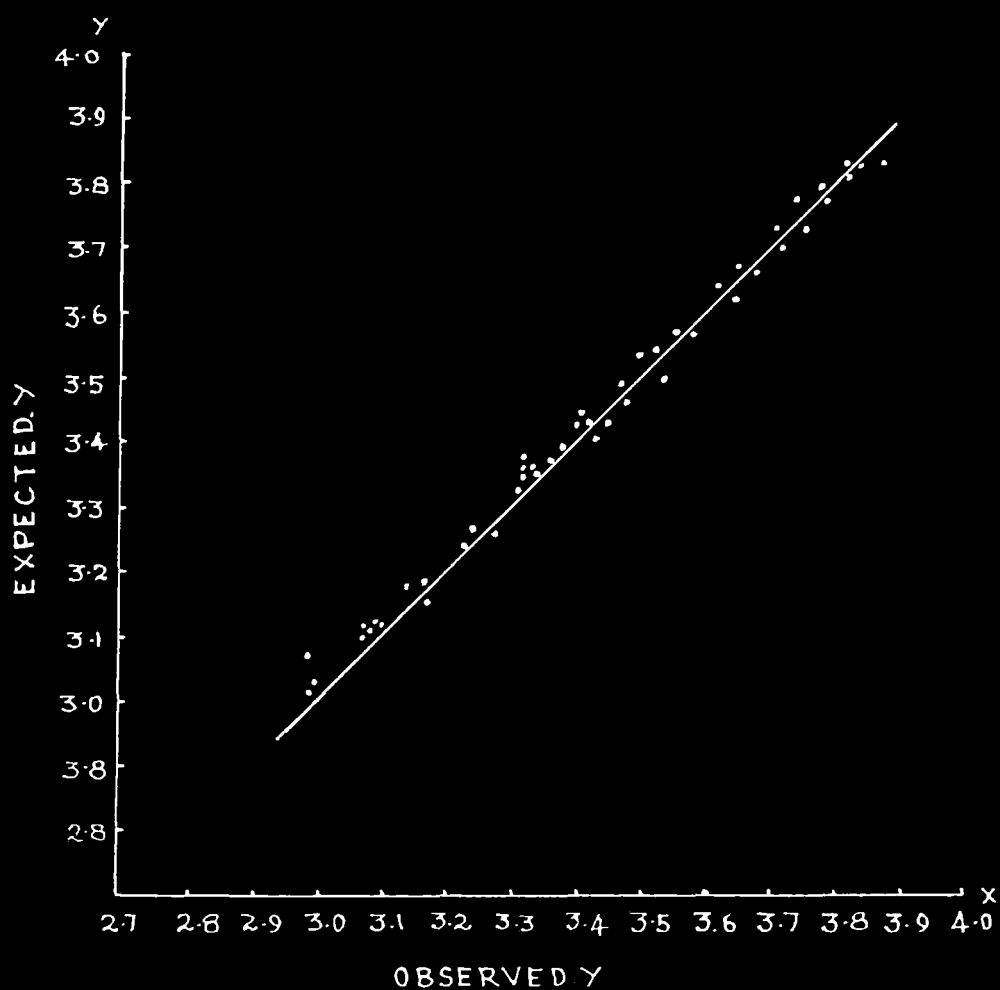
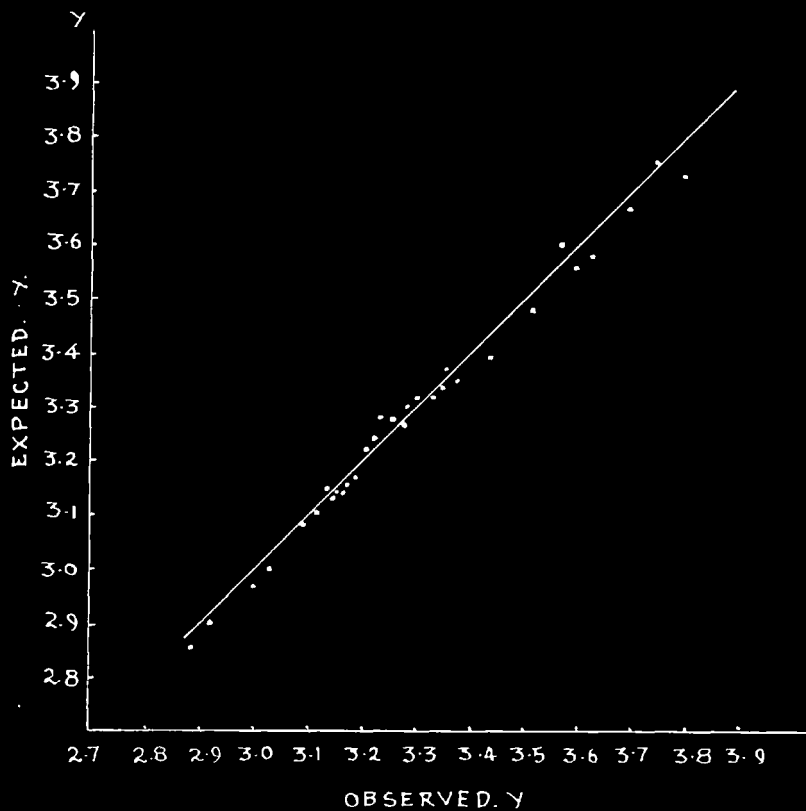


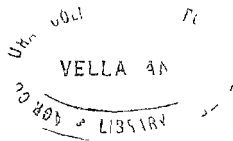
FIG. 9

CLOSENESS OF FIT

ONATTUKARA REGION

$$R^2 = 0.97$$





The partial regression coefficients explain the percentage variation in output which, on an average, is associated with the individual factors. The partial regression coefficients are the elasticities of the product with respect to the factors of production.

The elasticity for land was significant in both regions and was 0.69835 for the Kuttanad farms and 0.40306 for the Onattukara farms. In the case of human labour, the elasticity of production was 0.59687 and 1.41431, for the Kuttanad and Onattukara farms respectively. The values were significant in both cases. The elasticity of production for nitrogen was significant in both the regions, but it was negative in Onattukara region. The elasticities for this factor was 0.14726 and -0.25571 for Kuttanad and Onattukara farms respectively. In the case of bullock labour, the elasticities were significant but negative in both the regions. The elasticities were -0.30466 and -0.64527 for the Kuttanad and Onattukara regions respectively. Regarding other factors significant and negative elasticity was seen in the Kuttanad farms while it was not significant in the Onattukara farms.

Marginal value productivity

The marginal value productivity of different resources would be helpful in the optimum reallocation

of resources. This indicates the returns which on an average are expected from the addition of one more unit of the particular resource input above the mean level, keeping other inputs at their respective mean levels. The marginal value productivity of a resource input was calculated by multiplying the average value productivity of that particular resource by its elasticity. The marginal value productivity of the different resources are given in Table 18.

Table 18 Marginal Value productivities

Input	Average value product Rs. ps.	b	Marginal value product Rs. ps.
<u>Kuttanad region</u>			
Land	1166.60	0.69835	814.70
Human labour	4.06	0.59687	2.42
Nitrogen	82.33	0.14726	12.12
Bullock labour	20.16	-0.30466	Negative
Dewatering charges, Seeds, and Plant protection	13.31	-0.14208	Negative
<u>Onattukara region</u>			
Land	735.56	0.40306	296.47
Human labour	4.10	1.41431	5.81
Nitrogen	55.77	-0.25571	Negative
Bullock labour	16.53	-0.64577	Negative
Seeds and Plant protection	18.13	0.00703	0.12

DISCUSSION

DISCUSSION

The results indicate that different factors are responsible for the difference in the farming efficiency in the two regions and these factors are discussed in the following pages.

Land

Land value is higher in Onattukara region even though the per acre production is less when compared to the Kuttanad region. The high land value is due to the double cropping followed in Onattukara region and the consequent demand for land in that region. The interest on the value of land formed the major item of cost in the Onattukara region and it worked out to Rs.238.75 per acre, as against Rs. 178.82 per acre in Kuttanad. Studies in the economics of farm Management in West Godavari district by the Directorate of Economics and Statistics have also shown that the rental value is a major item of cost.

Farm equipment

Investment on equipment per farm was Rs.405.33 in Group I and Rs. 637.14 in Group II farms in the Kuttanad region. There was significant variation in the investment in the two size groups. When the size of farm increased, the investment on equipment also increased. The average investment per acre was found to decrease

as the farm size increased. The high investment on this item in Kuttanad region is due to the special condition of farming in that area. Since the area is waterlogged, country boat is necessary for moving about. The period of cultivation is short and all the operations will have to be carried out within a short period and a certain minimum equipment has to be kept by each farmer. Plant protection equipments are maintained by most of the ryots.

In the Onattukara region, the small cultivators make use of the equipments from their neighbours and hence the amount invested on equipment is low in this region, especially in the farms in size Group I. The farmers in size Group II invested relatively more amount on equipment. But when compared with the Kuttanad region, the investment on equipment is less in Onattukara region. However, in both the regions the investment on equipment was found to increase as the size of the farm increased. Similar findings were also reported by Kannan (1960).

Bullock labour

The cost of bullock labour in the Kuttanad region was Rs.62.30 per acre which formed 5.56 per cent of the total cost. In the Onattukara region, it was Rs.52.75 per acre and formed 8.55 per cent of the total cost. Most of the farmers employed hired bullock labour. In the Kuttanad region, the maintenance of animals is a problem

since it is a waterlogged area. Further the requirement of bullock is only for a short period in the year. In view of these, cultivators found it uneconomical to maintain the bullocks throughout the year. In the Onattukara region, due to the small size of the holdings, most of the farmers do not maintain bullocks throughout the year since it is not economical. Because of this condition, the hire charges of bullocks are high in both the regions, which in turn contributes to the high cost under this item.

Human labour

The cost of human labour formed 41.14 per cent of the total cost in the Kuttanad region. The high cost of human labour was mainly due to the high cost of harvesting and threshing operations, the payment of which was made in kind. The wages for human labour were also high in this region. In the Onattukara region, 27.21 per cent of the total cost accounted for the human labour input. In this region also the wages were high and the payment for harvesting and threshing was made in kind. Major portion of the cost of human labour was incurred for the harvesting and threshing operations in the two regions.

The input of human labour per acre was 45.51 man-days in the Kuttanad region. Preparatory cultivation required 33.72 per cent of the total labour. This high

labour requirement for preparatory cultivation is due to repairing of bunds etc., to be done before the dewatering operation in this area. Next major item of operation which required more labour was the harvesting, threshing and transporting of produce. Of the total labour, 30.56 per cent was employed for this operation. Since harvesting and threshing have to be completed within a short period, more labour is required for this work. For intercultivation operations, 21.62 per cent of the total labour was utilised. The growth of weeds in Kuttanad is assuming menacing proportions. Hence, weeding is a major operation in this area.

In the Omattukara region, 46.64 man days were required for cultivation of one acre. Harvesting and threshing required 29.20 per cent of the total labour. For preparatory cultivation only 21.18 per cent of the total labour was employed which is much less when compared with the Kuttanad region. For intercultivation operations, more labour was employed in this region which formed 25.33 per cent of the total. Sowing was another major operation in this region which required 17.65 per cent of the total labour employed. This is due to the dibbling of seeds for the first crop and transplanting for the second crop which again require more labour.

Studies conducted in the West Godavari district

by the Directorate of Economics and Statistics (1965) have shown that transplanting, harvesting and threshing were the chief labour consuming operations in paddy cultivation. In this study also the findings are similar.

Manures and fertilizers

The cost of manures and fertilizers formed 10 per cent of the total cost in the Kuttanad area and 16.71 per cent of the total cost in the Onattukara area. The average amount spent on this item was Rs.72.80 per acre in the Kuttanad farms and Rs.103.23 in the Onattukara farms. The high cost of manures and fertilizers in Onattukara region was due to the high value of organic manures which formed the major part under this item. Since the soil in that area is sandy to sandy loam, the application of organic manure is necessary for good crop production. But in the Kuttanad area, the soil is clayey and it contains more organic matter due to the deposit of silt during the flooding season in July. Thus, in Kuttanad area, very small quantity of organic manures are applied and hence the cost was less. The fact that all farmers were applying fertilizers in the Kuttanad area shows the willingness of the farmers in this area to adopt scientific methods of crop production.

Seeds

The average amount spent on seed was Rs.45.08 per acre in the Kuttanad region and Rs.39.60 per acre in the Onattukara region. High seed-rate is adopted in Kuttanad region since the method of sowing adopted is broadcasting. Hence the cost of seed is also more in that region. Six per cent of the total cost was incurred under this item in the two regions.

Intercultivation

The average cost for this operation was Rs.35.12 per acre in Kuttanad farms and Rs.35.86 in Onattukara farms. The cost varied from Rs. 10.50 to 80.50 per acre in the Kuttanad farms. In some "padasekharams" more labour were employed for weeding operation because of the intensity of weed growth in these areas. It is common in Kuttanad that in certain "padasekharams" the weed menace is more when compared to others. The labour employed for this operation in Kuttanad farms was 9.6 man-days and in Onattukara farms 11.8 man-days. Since the wage rate for human labour is high in these regions, the farmers are reluctant to employ more labour for these operations.

Plant protection

The cost of plant protection in Kuttanad area was Rs.11.12 per acre which formed 1.53 per cent of the total cost. But in the Onattukara farms, the cost

incurred for this item was Rs.2.92 per acre. This shows the importance that farmers attach to this operation in Kuttanad region and their acceptance of scientific agriculture for increasing production.

Irrigation and dewatering

Paddy cultivation is not possible in the Kuttanad area without dewatering operation. The cost under this item varies from "padasekharam" to "padasekharam" depending upon the depth of water. The average amount spent on this item was Rs.32.04 per acre which formed 4.4 per cent of the total cost. This cost is only 50 per cent of the actual cost since 50 per cent of the initial dewatering charges is paid by Government as subsidy. The cost of this operation in Kayal areas was slightly higher but it was not significant.

In the Onattukara region, no irrigation facilities existed and hence no cost under this item.

Cost of Production per acre

The average cost of production per acre in the Kuttanad area was Rs.727.97 and in Onattukara it was Rs.618.81. In the Kuttanad farms, 41.14 per cent of the total cost was incurred on human labour. The high cost of human labour is due to the high cost incurred for the harvesting, threshing and transporting operations and also the high labour requirement for the preparatory cultivation,

particularly for bunding. Interest on fixed capital formed 25.79 per cent of the total cost. Dewatering is an additional operation to be carried out in Kuttanad which formed 4.41 per cent of the total cost. Manures, lime and fertilizers accounted for only 10 per cent of the total cost.

In the Onattukara region, interest on fixed capital formed 39.25 per cent of the total cost. This is due to the high value of land in this area. 27.21 per cent of the total cost was incurred on human labour while value of manures and fertilizers accounted for 16.71 per cent in this region. So the major items of cost were interest on fixed capital, human labour and manures and fertilizers.

Cost of production per quintal of paddy

The average cost of production per quintal of paddy was Rs.60.60 in Kuttanad region and 67.96 in the Onattukara region. Though the cost of cultivation per acre was high in Kuttanad region, the cost per unit was less which shows the high per acre production in that area when compared with the other region. In the Kuttanad region, the good soil condition, controlled supply of water and other scientific methods adopted by most of the farms contribute to the high yield of paddy. But in the Onattukara region, even though the cost per acre was less, the unit cost was high which was due to the low production. The fertility of the soil is poor due to the



double cropping in this area. The soil is sandy loam and there is no irrigation facility. Because of these factors, the yield per acre was less in this region and hence the high cost per unit. Another cause for the high cost in Onattukara is the high value of land and thus the interest on the value of land was high.

Farming efficiency

The farming efficiency has been measured by the conventional methods of farm management analysis and also by fitting a linear regression equation with the total cost and total income. The gross income, farm business income and net profit are presented in Table 16.

The variation in gross income between the two size groups was not significant. The gross income in the Onattukara farms was very much less when compared with the Kuttanad region. In the Kuttanad region, the income is 59 per cent higher than that of the other region. This gives an indication of the high efficiency in farming in Kuttanad region.

In both the regions the farm business income did not show much variation between the two size groups. The farm business income is 70 per cent more in the Kuttanad region than in the Onattukara region. This higher income in the Kuttanad region is mainly due to the high productivity of land and also the scientific methods adopted by the farmers in that area.

The net profit is higher in the Kuttanad farms when compared to the Onattukara farms. The average net profit per acre in the Kuttanad region was Rs.446.71 and in the Onattukara region Rs.117.65. In the Kuttanad region the value of land was less and thus the interest on the value of land which formed an item of cost was also less. The soil is more productive and scientific methods of agriculture are widely adopted in that area. The provision of assured water supply is another factor which contribute to the high yield per acre. The high price of paddy prevalent during the period and other factors mentioned above contributed to the high net profit in the Kuttanad farms.

In the Onattukara farms, the per acre yield was less. The value of land was more and hence the interest on the value of land formed a major item of cost. Because of these reasons, the net profit was less in this region.

In the above analysis it can be seen that the efficiency of farming in Kuttanad is higher than the Onattukara region.

Regression analysis

In the Kuttanad farms, the linear regression equation shows that an increase in the total cost by one rupee will increase the gross income by Rs.0.91. Diminishing returns are indicated in the farms in Kuttanad region.

In the Onattukara region an increase of one rupee in the total cost will increase the gross income by Rs.0.37. Farming efficiency is less in the Onattukara farms when compared to the other region. The analysis shows diminishing returns in the farms in this region. The low productivity of land and lack of irrigation facilities contribute to the low efficiency in the Onattukara region.

Gross average productivity

The gross average productivity of labour and non-labour capital services did not show much difference between the two size groups in both the regions. This indicates that the size of the farm did not affect the productivity of these resources. It may be due to the narrow range between the average size of the farms in the two size groups. Considering the two regions, the gross productivity of labour and non-labour capital services was high in Kuttanad.

Residual productivity

The residual average productivity gives a more accurate measure of resource productivity. In the Kuttanad region the residual productivity for labour was Rs.16.52 for the Group I farms and Rs.16.32 for the Group II farms. In the Onattukara region, the residual productivity of labour was Rs.6.39 and 5.91 for the Group I and Group II farms respectively. When the two

regions are considered, the residual labour productivity was high in Kuttanad farms. Labour is more profitably utilised in this region than in the Onattukara region.

The residual average productivity of non-labour capital services was Rs.2.03 for the Group I farms and Rs.2.05 for the Group II farms in Kuttanad. The corresponding figures for the Onattukara farms were Rs.1.26 and Rs.1.25. There was not much difference in the capital productivity in the two size groups.

The high productivity of labour and capital in the Kuttanad region can be attributed to the productivity of soil, assured supply of water and the scientific methods of farming adopted by most of the farmers. As early as 1916, Warren illustrated that wide differences existed in return to labour between farming regions. According to Heady (1952) farm management studies have continued down through time to serve as a basis indicating wide differences in labour productivity and returns between farming regions.

Output-input ratio

The output-input ratio shows the output for one unit of input. In Kuttanad farms the ratio was 1.61 and in the Onattukara farms it was 1.18. This shows that the farms in both regions were running on profit during that particular year. The high market price of paddy is the

reason for the profit in all the farms. In the Kuttanad region, the output was high per unit of input when compared with the other region. This was due to the high per acre production of paddy in that region.

Production function

The production function analysis shows the elasticity of production in respect of the various input factors like land, human labour, nitrogen, bullock labour and "others" which include seed, plant protection and dewatering charges.

The elasticity for land was found to be positive and significant in the farms in both the regions. In Kuttanad farms the elasticity for this factor was 0.69835 and for Onattukara farms 0.40306. This shows that for every unit increase in the cropped area, keeping other factors at their mean levels, there would be an increase in the gross income by 0.69835 unit in the Kuttanad farms and by 0.40306 unit in the Onattukara farms. An elasticity less than unity indicates diminishing marginal returns and an elasticity greater than unity indicates increasing marginal returns. Here the elasticity of production for the land factor in both the regions was less than unity which shows diminishing marginal returns. The greater elasticity for land in the Kuttanad region shows that the input of land is less in that region when compared to the Onattukara region. Kuttanad is an area where

only one crop is raised in a year while two crops are raised in the Onattukara region. Since land is intensively utilised in the Onattukara region, the elasticity for that factor is found to be less than in the other area where land is utilised less intensively.

The elasticity for human labour was positive and significant in the farms in both the regions. The elasticity for this factor was 0.59687 for Kuttanad farms and 1.41431 for the Onattukara farms. A unit increase in the input of this factor would increase the gross income by 0.59687 units in Kuttanad farms and 1.41431 units in the Onattukara farms. This shows diminishing returns for human labour in Kuttanad farms and increasing returns in the Onattukara farms. The human labour input was less in both the regions and the income can be increased by more input of human labour. In their survey of agricultural production functions, over the world, Heady and Dillon (1961) have found that the production elasticities of labour are relatively higher among Asian farms than in their non-Asian counterparts. Rao (1965) in his studies on the resource productivities in Hyderabad farms has observed a high elasticity for labour input. Sharma (1965) observed marginal labour productivity as positive and significant in the case of hired labour in the rice regions in the country.

The input of human labour in Kuttanad farms was

45.51 man days per acre. It will be seen from the labour requirement of different operations from the Table 6a, 30.56 per cent of the total labour employed was for harvesting and threshing operations alone. In the case of Onattukara farms also, 29.20 per cent of the total labour was utilised for the last operation of harvesting and threshing. So it can be seen that the input of human labour for all other operations was much less. This low input of human labour in both the regions was due to the high cost of labour. So the high elasticity of labour input can be attributed partly to the functional significance of labour intensive techniques of agricultural production and partly due to its input being less because of the high wages of labour in these regions.

The elasticity of production for nitrogen was positive and significant in the Kuttanad farms while it was negative and significant in the Onattukara farms. The elasticity was 0.14726 for the Kuttanad farms and -0.25771 for the Onattukara farms. This shows that a unit increase in the input of nitrogen would result in an increase in the output by 0.14726 unit in the Kuttanad farms. But in the Onattukara farms, the negative elasticity shows that the present level of input of this factor is in excess. Decreasing marginal returns are indicated for this factor in the Kuttanad farms. Panse and Khanna (1964) observed that the rate

of increase in yield diminishes with larger doses of fertilizer application. Naik (1965) found diminishing marginal returns for the manure-fertilizer factor. Harpal Singh (1966) reported that the existing evidence on production relationship does not indicate increasing returns in paddy to high levels of input including the new ones like fertilizers and high yielding varieties in the different regions of the country. The present study also shows diminishing marginal returns in paddy for nitrogen factor.

The negative elasticity to the nitrogen factor in Onattukara farms shows that the input of nitrogen is too much. Excessive application of nitrogen with moisture and other elements being limited may cause total yield to decline. The present level of nitrogen application in the area which is 14.85 kgm per acre is in excess. The variety of paddy grown may not be responsive to such high doses of nitrogen. Ashok Parikh (1966) in his studies on state-wise growth in agricultural output by fitting Cobb-Douglas production function has reported that the coefficient for fertilizers in the farms in Uttar Pradesh was negative but not significant.

In their studies on the response of rice to nitrogen, Hirdt and Mellor (1964) found that the functional relationship between inorganic nitrogen

application and rice yields was strikingly different in United States as compared to India. The optimum level of fertilizer application and financial returns to use of fertilizers were much lower under Indian conditions than American conditions. The availability of water, soil difference, production practices, weed population and time of fertilizer application may affect the response of nitrogen. Excess application of nitrogen may induce lodging also. This may also account for the difference in nitrogen response.

In the case of bullock labour, the elasticity of production was negative and significant in both the regions. This shows that the input of this factor is in excess in the farms in both the regions and hence it can be reduced. This study however gives no satisfactory estimate of the degree by which this resource input should be reduced.

Regarding the other factors, the elasticity of production was negative and significant in the Kuttanad region. The other factors include seed, plant protection and dewatering charges. The elasticity shows that the input of these factors taken together is in excess. Since all the three input are taken together, the negative elasticity may be due to the excessive input of one or two factors or all factors. Considering the high seed rate adopted in this area, the negative

elasticity may be due to the excess seed rate used in this area. In the Onattukara farms, the other factors included the input of seed and plant protection. The elasticity of production to this factor was positive but not significant. Farm management studies in Madras (1955-56) fitting Cobb-Douglas production function for paddy have shown negative returns in respect of bullock labour and seeds.

The coefficient of determination (R^2) for the production function was estimated as 99 per cent for the Kuttanad farms and 97 per cent for the Onattukara farms. This indicates that 99 per cent of the variation in output is explained by the factors included in the analysis in Kuttanad farms. In the Onattukara farms 97 per cent of the variation in output is due to the factors included in the analysis.

The sum of elasticities indicates the returns to scale. In the Kuttanad farms, the sum of elasticities was 0.99574, which shows almost constant returns to scale i.e., when all the factors of production included in the function are increased by one per cent, the output also would increase by one per cent. In the Onattukara farms, the sum of elasticities worked out to 0.92112 which might indicate a diminishing trend in the returns to scale.

Marpal Singh (1966) in his studies based on the input output data for paddy for the different regions in the country has found that Kerala, Madras and Andhra Pradesh are doing most intensive cultivation and that the production has already entered into a stage of decreasing returns.

Marginal value productivity

The marginal value productivity of resource indicates the return which on an average is expected by the addition of one more unit of that particular resource above its mean level, keeping other inputs at their respective mean levels. The marginal value productivity of a resource and the cost of that resource would give an index for the reallocation of resources to maximise returns. The input of a resource can be increased till the marginal value productivity equals the cost of that resource.

The marginal value productivity of land in Kuttanad farms was Rs.814.70 while in the Onattukara farms it was Rs.296.47. This indicates that on an average, an increase in the area under paddy by one acre would yield a return of Rs.814.70 in Kuttanad farms and Rs.296.47 in the Onattukara farms in additional product, other inputs being held constant at their mean levels. The cost of this factor can be taken as the interest on the value of land. The interest on the value of

one acre of paddy land was Rs.178.82 in the Kuttanad region and Rs.238.75 in the Onattukara region. This shows that an increase in the area under paddy cultivation would result in greater returns to the farms in the Kuttanad region since the marginal value productivity was much higher than the interest on the land value. In the Kuttanad area only single crop is raised at present. If double cropping is made possible in this area, the income of the farmers can be considerably increased. In the Onattukara region where two paddy crops are raised at present, there is no scope for further increase in the cropping area under paddy and under the existing level of technology an increase in area under paddy would not result in an increased income from the farms.

The marginal value productivity of human labour shows that an additional one rupee spent on human labour would give an increase in output of the value of Rs.2.42 in the Kuttanad farms and Rs.5.81 in the Onattukara farms. The present input of this factor is very much less due to the high labour cost. Since the wage rate is high, farmers in those two regions are reluctant to employ more labour for operations which are not absolutely necessary from their point of view. In the Kuttanad region there is scarcity of labour during the cultivation season.

Because of these reasons, the ryots may not be employing sufficient labour for weeding operation in the Kuttanad region. If sufficient labour is employed for weeding operation etc., the yield may increase. In the Omattukara region also the input of human labour is less excepting for the harvesting and threshing operations. Though labour is available in this area, the poor financial condition of the small farmers does not permit them to employ more labour for paddy cultivation. More labour input for hoeing, weeding and plant protection may result in increased yield in this area. So the farmers in both the regions can increase their income by increasing the input of human labour.

In the case of nitrogen, an increase in the input of nitrogen by one kilogram would increase the output by Rs.12.12 in the Kuttanad farms i.e., an investment of Rs.2.00 on one kilogram of nitrogen would yield an additional income of Rs.12.12. This high return to the nitrogen factor can be attributed to the good soil condition and the possibility of supplying water to the crop whenever required. The alluvial soils in this area are rich in organic matter also.

In the Omattukara farms, the marginal value productivity for nitrogen was negative. This shows

that the present level of nitrogen input is very high and further application of nitrogen would reduce the income of the farms. Since this study does not give any estimate of the degree to which nitrogen input should be reduced, the only inference is that the application of nitrogen should be reduced in the Onattukara farms.

The marginal value productivity for bullock labour was negative for both the region which only indicates that the input is in excess in both region and it should be reduced.

Regarding other factors, which include seeds, plant protection and dewatering charges in Kuttanad farms, the marginal value productivity was negative. This indicates that the income of the farm will be reduced if the input of this factor as a whole is increased.

The elasticity for other factors was not significant in the Onattukara farms.

From the above analysis it can be concluded that the returns in the Kuttanad farms can be increased by increasing the input of land, human labour and nitrogen with a reduction in bullock labour and seeds. Since this area is single cropped at present, there

is scope for more intensive use of land by double cropping which will definitely increase the income of the farmer. Due to the high wages for labour, the input of this factor is not optimum. But additional amount spent for this resource input would result in increased output. Though the level of nitrogen input is high at present, still there is possibility to increase the income by the application of more nitrogen.

In the Onattukara farms, the returns from the farms can be increased only by additional inputs of human labour. The marginal value product of land is not very high when compared to the high interest on the value of land. Regarding other resources, less of bullock labour and nitrogen should be used in these farms. Under the existing level of technology the scope for increasing the income of the farms in the Onattukara region is limited.

SUMMARY AND CONCLUSIONS

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The main objectives of this study are to investigate the distribution of various input factors and their efficiency in the production of paddy and to estimate the unit cost of production of paddy in the two paddy growing tracts in Alleppey district viz., "Kuttanad" and "Onattukara".

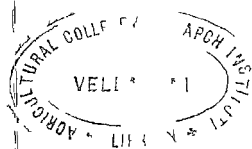
Kuttanad taluk represents the major part of the Kuttanad region in Alleppey district and hence this taluk was selected to represent the Kuttanad tract. Mavelikkara and Karthigappally taluks which represent the Onattukara tract in Alleppey district were selected to represent that region. Three villages were selected at random out of the 12 villages in Kuttanad taluk. Sixty farms were randomly selected from these three villages. Out of the 29 villages included in the Mavelikkara and Karthigapally taluks which come under Onattukara region, three villages were selected at random. Ten farms each were randomly selected from each of the selected villages.

The farms selected were divided into two size groups i.e., Group I with an area of 2.50 acres and less and Group II with an area of above 2.50 acres.

The cost studies revealed the following facts in the two regions. The land value in Onattukara was 166 percent higher than that of the Kuttanad region. The value of land between the villages in the same region did not show much variation. Investment on equipment was comparatively very high in Kuttanad farms which was Rs.405.53 and Rs.637.14 per farm in Group I and Group II farms respectively. In the Onattukara region, the investment on this item was Rs.148.25 and Rs.452.12 per farm in the Group I and Group II farms respectively. The investment on equipment was found to increase with the size of the farms.

Very few farms maintained bullocks. Hired bullock labour was employed in majority of farms in both the regions. On an average 5.69 bullock-days were required for one acre of paddy cultivation in the Kuttanad region and 5.27 bullock-days in the Onattukara region.

The input of human labour was 45.51 man-days in Kuttanad area, of which 33 per cent was utilised for preparatory cultivation and 30.56 per cent for harvesting, threshing and transporting of produce. In the Onattukara region, 46.64 man-days were required for cultivating one acre of paddy. Of this total



labour, 21.18 per cent was employed for preparatory cultivation and 29.20 per cent for harvesting, threshing and transporting of produce. For sowing, 17.65 per cent of the total labour was engaged in Onattukara region. In the Kuttanad region, more labour was required for preparatory cultivation due to the special type of operations like bunding etc., to be carried out in that area.

The majority of farms in both the regions were using fertilizers. In the Kuttanad area, application of lime to the soil to neutralise the soil acidity was a common practice adopted by most of the farmers. The quantity of organic manure applied in Kuttanad area was much less when compared with that of the Onattukara region. The average cost of manures, fertilizers and lime in the Kuttanad area was Rs.72.80 per acre which was 10 per cent of the total cost. In the Onattukara area, the average cost of manures and fertilizers was Rs.103.21 per acre which formed 16.71 per cent of the total cost. The high cost under this item was due to the high value of organic manure which formed the major ingredient under this item.

The cost of seed in the Kuttanad farms was Rs.45.09 per acre and in the Onattukara farm Rs.39.60 per acre. High seed rate is adopted in Kuttanad

farms since the method of sowing adopted is broadcast-
ing. For intercultivation operations 9.6 man-days were
employed in Kuttanad, while it was 11.8 man-days in the
other region. Irrigation and dewatering was an item of
cost in Kuttanad farms while it was not in the other
area. Of the total cost 4.41 per cent was incurred
for this operation. Plant protection measures were
adopted by all farmers in the Kuttanad area and the
average cost for this operation was Rs.11.12 per acre.
In the Onattukara area, only a small amount of Rs.2.92 per
acre was spent for plant protection work.

The total cost of production per acre of paddy
was calculated, taking into consideration all the cash
and kind expenses and indirect costs like depreciation,
interest on fixed capital etc. In Kuttanad region, the
average cost per acre was Rs.727.97 and in Onattukara
region it was Rs.618.81. This reveals that more amount
has to be spent on paddy cultivation in Kuttanad region
than in the Onattukara region. Even though the interest
on the value of land is less in the Kuttanad area, the
total cost is higher than that of the other region.
This high cost due to bunding and dewatering charges
which are additional items of cost in that area. The
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out to Rs.60.60 in the Kuttanad region and Rs.67.96 in
the Onattukara region. Though the cost per acre was

high in Kuttanad, the cost per unit was less in that area which shows the high efficiency in paddy production in the Kuttanad farms.

The gross income per acre in the Kuttanad farms was Rs.1174.68 and in the Onattukara farms Rs.736.46. There was no significant variation in gross income between the two size groups. The farm business income per acre was Rs.634.49 in the Kuttanad farms and Rs.373.07 in Onattukara farms. The net profit worked out to Rs.446.71 per acre in the Kuttanad region, while it was Rs.117.65 per acre in the Onattukara farms. There was no difference in the farming efficiency between the two size groups. Farming seemed to be carried out more efficiently in Kuttanad region than the other region.

The gross average productivity and residual average productivity for labour and non-labour capital services were calculated for the two size groups in the two regions and are presented in Table 14 a and 14 b. High labour productivity existed in Kuttanad region when compared with the other region. This may be due to the high productivity of land in that region. The average residual productivity of non-labour capital services was also high in the Kuttanad region compared to the Onattukara region. The output-input ratio was 1.61 for the Kuttanad farms and 1.19 for the Onattukara

farms. This study shows that farming is done more efficiently in Kuttanad region than in the other region.

The linear regression analysis with total cost and gross income shows that an increase in the total cost by one rupee would result in an increase in gross income by Rs.0.91 in the Kuttanad farms and Rs.0.37 in the Onattukara farms. Diminishing returns are indicated in both the regions.

Resource productivity and marginal productivity were estimated by fitting a Cobb-Douglas production function. The elasticities for the different factors are given below.

Kuttanad farms

$$Y = 2.24501 X_1^{0.69835} X_2^{0.59687} X_3^{0.14726} X_4^{-0.30466} X_5^{-0.14208}$$

Onattukara farms

$$Y = 1.05907 X_1^{0.40306} X_2^{1.41431} X_3^{-0.25571} X_4^{-0.64577} X_5^{0.00703}$$

In the Kuttanad farms, the elasticity of production indicated diminishing returns for land (X_1) human labour (X_2) and nitrogen (X_3). In the case of bullock labour (X_4) and other factors (X_5), the elasticity was negative which showed that these were being applied in excess. In the Onattukara farms the elasticity for land indicated diminishing returns while human labour indicated increasing returns. Regarding nitrogen and

bullock labour, the elasticity was negative which indicated an excess use of those factors. The elasticity for other factors was positive but not significant. Constant returns to scale existed in the Kuttanad farms while decreasing returns to scale was seen in the Onattukara farms.

The marginal productivities indicated that increase in the input of resources like land, human labour and nitrogen and reduction of bullock labour and seeds would result in increased income to farmers in the Kuttanad area. In Onattukara farms, increase in the income could be expected only by increasing the input of human labour. A reduction in the input of bullock labour and nitrogen is also possible. But appreciable changes in the income in the Onattukara farms can not be expected under the existing level of technology. Provision of assured water supply to the crops may bring about increase in the productivity of land, since the present paddy cultivation in that area is entirely dependent on the monsoon.

From the above studies the following general conclusions emerge.

(1) Paddy is produced at high cost in both the regions. Among the two regions, the cost of production per quintal of paddy is less in the Kuttanad region.

(2) The farming income of the Kuttanad farms can be increased by increasing the input like land, human labour and nitrogen at the same time reducing the input of other resources.

(3) In the Omattukara farms, income can be increased only by increasing the input of human labour. Resources, like bullock labour and nitrogen appear to be excessively used in these farms. Considering all the factors, there does not appear to be much scope for increasing the income of farmers under the existing level of technology. Provision of irrigation facilities and better strains which are responsive to higher doses of nitrogen might increase the efficiency of farming in this region.

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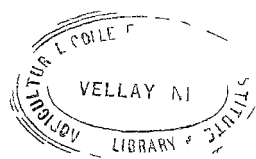
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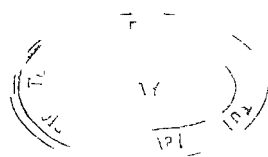
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Appendix I

Production of Rice in Kerala (1952-'53 to 1964-'65)

Year	Production (in tonnes)
1952-'53	722000
1955-'56	884000
1960-'61	1068000
1961-'62	1004000
1962-'63	1093000
1963-'64	1128000
1964-'65	1121000

Source: Agricultural Officers' Guide book. 1967



Appendix II

Area and production of rice in each district of Kerala for the year ending 30th June, 1965

Sl.No.	District	Area (in hectares)			Total	Produce- tion (in tonnes)
		Autumn	Winter	Summer		
1.	Trivandrum	18790	19812	-	38602	52964
2.	Quilon	21144	27479	816	49469	63374
3.	Alleppey	22028	17644	42239	81911	118117
4.	Kottayam	7059	19364	14352	40775	55061
5.	Ernakulam	41328	36318	5394	83040	100456
6.	Trichur	37912	60672	9002	107586	142170
7.	Palghat	115543	76325	2793	194666	343940
8.	Kozhikode	64964	43761	1119	109844	123469
9.	Cannanore	66421	27635	1172	95228	121332
STATE		395189	329010	76922	801121	1121383

Source: Bureau of Economics and Statistics, Trivandrum^x