INTER-DISTRICT VARIATIONS IN AGRICULTURAL GROWTH RATE OF PRODUCTION IN KERALA (1960-61—1973-74)

Dissertation submitted to the Jawaharlal Nehru University
in partial fulfilment of the requirement of the Degree of
MASTER OF PHILOSOPHY
by
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I certify that the dissertation entitled "INTER-DISTRICT VARIATIONS IN AGRICULTURAL GROWTH RATE OF PRODUCTION IN KERALA (1960-61 - 1973-74)" submitted by S. Aparna in fulfillment of twelve credits out of the requirement of twenty four credits for the Degree of Master of Philosophy (M.Phil) of the University is a bonafide work to the best of my knowledge and may be placed before the examiners for evaulation.

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C O N T E N T S

PREFACE

The true perspective of a region can be discerned by its per capita income, labour productivity, land productivity, intensity of cropping, mechanisation, fertilizer use, variability of rain, soil, concentration of scheduled castes and scheduled tribes and concentration of agricultural labourers. From these points of view, Kerala, though not a backward State, cannot also be called a developed State compared to Punjab, Haryana, Gujarat and Maharashtra. It's per capita income in 1970-71 was Rs. 586 as against all-India average of Rs. 628. Agriculture which is the predominant sector of the State's economy has not developed much. The prevailing techniques of cultivation yield a much smaller output than what is possible under the soil and climatic conditions of the State.

The present study attempts to analyse the characteristic processes or factors which will show the economic condition of the State. This will serve to analyse the inter - district variations in the agricultural growth rate (production) during the period 1960-61 to 1973-74. Factors affecting the variations in the agricultural growth rate of production could thus be identified. The unit area chosen for the study is "District". The study has been done taking into consideration the five peak periods of production (with the help of indices of production).

With deep gratitude, I am indebted to my Supervisors Dr. S. Naqvi and Dr. M.H. Qureshi for their active co-operation, thoughtful advice and constructive criticism at every stage of its preparation. I am also extremely grateful to Prof. Moonis Raza, Rector, Jawaharlal Nehru University, Prof. G.S. Bhalla, Chairman of the Centre, Dr. Aijaz Ahmad and Dr. S.K. Rao for their constant encouragement and help they have rendered for the compilation of the work. I am deeply indebted to Mr. Bhabani Shankar Malla Samanta, not only for his active and generous encouragement but also for the provision of a high quality discussion in the course of my work. My sincere thanks are to Mr. Prasanna Kumar Sahoo, Mr. Murlidhar and Mr. Taneja for their active support in the preparation of the work.

(S. APARNA)

New Delhi
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CHAPTER - I

INTRODUCTION

The understanding of the contribution of agriculture is of special significance for setting up of goals of economic development for a region. Agricultural development helps the process of economic growth in various ways. Agricultural development means higher level of production of foodgrains and other agricultural products, higher income and better standard of living for farmers. Agricultural development holds out benefit not only to farmers alone when agricultural sector grows, but its impact is also felt in other sectors of economy and accelerates the overall economy of a region.

Various economists have attempted to categorise the contribution of agriculture. Johnston and Miller[1] suggest the following important contributions of agricultural sector:

1. Increased food supply
2. Stepping up of agricultural exports
3. Increased transfer of labour resource
4. Additional capital formation
5. Additional purchasing power as a result of an increasing level of income

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1. Johnston, B.F., "The Role of Agriculture in Economic Development", American Economic Review, Vol. IV, No. 4, Sept., 1961, pp. 566-93.

Agriculture can contribute to growth by increasing efficiency of production and raising resources to other sectors and by adjusting the compensation and scale of output to demand. It provides surplus of food requirements, is an important source of raw material, a better return to the farmer (ensuring higher yields) and moreover forms the base for large number of industrial set ups in an underdeveloped economy.

The role of agriculture in rapid economic development of developing economies is now well recognised by the economists. An analysis of regional differentials in the performance of agriculture assumes a special significance in this context.

Agriculture is the backbone of the economy in a developing country like India where the total labour force employed in agriculture varies from 53 to 70 percent as against 7 to 23 percent in the case of developed countries. The table below provides an understanding to this fact.

TABLE -11

PERCENTAGE OF LABOUR FORCE ENGAGED IN AGRICULTURE IN DEVELOPED AND DEVELOPING COUNTRIES

Developed Countries	Percentage of Labour Force Engaged in Agriculture
New Zealand	16

Australia	13
Denmark	23
Canada	11
U.S.A.	7
DEVELOPING COUNTRIES	
Ceylon	53
Brazil	61
Mexico	54
India	70

Source :- John W. Mellor,"The Economics of Agricultural Development", (Cornell University), pp. 4 - 36.

It is seen that most of the developed countries produce their foodgrain requirements and export with the minimum percentage of labour force employed in agriculture. The developing countries on the other hand are unable to produce their own foodgrain requirements inspite of a higher percentage of labour force employed in this sector. In the case of the developed countries, it is due to the technological breakthrough whereas developing countries are still lagging far behind. The U.K. produces about two-third of its total agricultural requirements with only 5 percent of its labour force, U.S.A. is an exporter of agricultural commodities with

only 7 percent of its labour force engaged in agriculture.

TABLE -12

GROWTH RATES OF AGRICULTURE IN SOME DEVELOPING COUNTRIES : between 1952-56 to 1965-69

Countries	Compound Annual Rate of Increase in Percent
1	2
Mexico	4.9
Thailand	4.9
S. Korea	4.4
W. Malayasia	4.1
Taiwan	4.0
Brazil	3.9
Turkey	3.6
Philippines	3.5
Combodia	3.4
Egypt	3.0
Ceylon	3.0
Pakistan	2.9
All Developing Countries	2.8
Sarawak	2.5
India	2.1
Burma	2.0

1	2
Indonesia	1.7
Nepal	0.1

Source : Dagli, V.L., (ed.), A Regional Profile of Indian Agriculture.

It is seen from the above table that during 1952-56 to 1965-69 the average annual rate of growth of agriculture in developing countries[1] was 2.8 percent, compared to this India's growth rate was 2.1 percent which itself is quite low even as compared to the rate of growth of developing countries. Mexico, Thailand and Taiwan had a growth rate of 4.9 percent, 4.9 percent and 4.0 percent respectively. Burma Indonesia and Nepal fall even below India, with a growth rate of 2.0 percent, 1.7 percent and 0.1 percent respectively.

The need for food which is the outcome of extremely low level of efficiency in agricultural production demands that most of the labour force and land resources in developing countries should be engaged in agriculture. In the early

1. Dagli, V.L, (ed.), "A Regional Profile of Indian Agriculture.

stages of development, 60 percent to 80 percent of the population is engaged in agriculture, and 50 percent or more of of the national income is generated in the agricultural sector[3]. This is very true about India also.

Agriculture still remains as important as it was before independence. Agriculture is the source of livelihood for over 70 percent of the population in the country. The share of income generated from agriculture to the national income was 51.3 percent in 1960-61. About 43 percent of the country's total area, covering about 142 million hectares is under cultivation. With more land brought under cultivation and with increased irrigational facilities India is now able to produce about 90 percent of her total food requirements. The food and associated agricultural problems of India are thus interrelated and are the results of the interaction of various factors like high growth rate of population, technological gaps in agriculture, shortage of fertilizers and lack of capital to finance investment of agriculture with a view to improve productivity per unit of land and labour. Thus the food crisis in India has resulted because of the low productivity of crops, population growth and extremely poor development of the other sectors of economy.

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3. John W. Mellor, The Economics of Agricultural Development", (Cornell University), pp. 4 - 36.

Agricultural productivity can be analysed from the two different angles, from the point of view of productivity per acre (i.e. land productivity) and per worker productivity (i.e. labour productivity). At the outset it may be said that the Indian agriculture is characterized by both low land and labour productivity.

TABLE -1.3

AGRICULTURAL PRODUCTIVITY AVERAGE FOR 1967-68 to 1969-70

Rank	State	Net income per hectare in (Rs.)
1	2	3
1.	Kerala	2,716
2.	West Bengal	2,223
3.	Assam	2,102
4.	Himachal Pradesh	1,876
5.	Punjab	1,859
6.	Jammu & Kashmir	1,724
7.	Nagaland	1,702
8.	Uttar Pradesh	1,447
9.	Tamil Nadu	1,367
10.	Haryana	1,367
11.	Bihar	1,247

1	2	3
12.	Orissa	1,555
13.	Andhra Pradesh	1,058
14.	Karnataka	834
15.	Gujarat	774
16.	Maharashtra	583
17.	Madhya Pradesh	539
18.	Rajasthan	461
	ALL INDIA	1,037

Source : Commerce Annual, 1972, pp. 14.

From the above table it is seen that the average land productivity for the years 1967-68 and 1969-70 in India was Rs. 1,037. At State level, the higest was in Kerala (Rs.2716) and lowest in Rajasthan (Rs. 461)[4]. Land productivity is very much dependent on the environmental factors, viz., physiography, quality of the soil, climatic factors, technological facilities, economic conditions etc. It is also dependent on government efforts in improving agricultural inputs and the necessary infrastructure facilities. Differences

4. Commerce Annual, 1972, pp. 14.

in natural endowments can be overcome or neutralised by human efforts as it is not possible to eliminate them completely.

TABLE -1.4

AGRICULTURAL PRODUCTIVITY PER WORKER:
AVERAGE FOR 1967-68 to 1969-70

Rank	State	Average net output per worker (Rs.)
1	2	3
1.	Punjab	3,195
2.	Haryana	2,922
3.	Kerala	2,072
4.	West Bengal	1,819
5.	Assam	1,707
6.	Gujarat	1,457
7.	Orissa	1,400
8.	Jammu & Kashmir	1,393
9.	Karnataka	1,321
10.	Uttar Pradesh	1,236
11.	Himachal Pradesh	1,129
12.	Rajasthan	1,114
13.	Andhra Pradesh	993

1	2	3
14.	Tamil Nadu	955
15.	Maharashtra	949
16.	Madhya Pradesh	856
17.	Bihar	755
18.	Nagaland	409
	ALL INDIA	1,213

Source : Commerce Annual, 1972, pp. 14.

Labour productivity in the Indian agriculture is low. According to the National Income Committee, average productivity per worker engaged in agriculture for the year 1950-51 was Rs. 500 as against Rs. 1700 in large industrial establishments and Rs. 1500 in commerce, transport and communications. In other words, labour productivity on land was the lowest of all the sectors in the country. Labour productivity is calculated by taking average yield per hectare of land and the average number of agricultural workers employed on a hectare of land.

From the above table it is seen that the average labour productivity for the years 1967-68 to 1969-70 was Rs. 1213 for India. It was highest in Punjab Rs. 3195 and lowest in Bihar

Rs. 755 (Nagaland has not been taken into consideration, as the requisite data was not available). The inter-State differences in labour productivity is smaller than in case of land productivity. A careful study of the tables 3 and 4 reveal that inspite of land productivity being highest in Kerala, productivity per worker is highest in Punjab. This supports the hypothesis that wherever land productivity is high, density of population tends to be high.

The following table gives an idea of agricultural growth rate in Indian States.

TABLE -1.5

GROWTH RATE PER ANNUM IN PERCENTAGE BETWEEN 1952-53 to 1969-70

States		Compound Growth Rate Per Annum in Percentage 1952-53 to 1969-70
1.	Punjab	6.6
2.	Haryana	6.0
3.	Gujarat	5.4
4.	Tamil Nadu	4.2
5.	Himachal Pradesh	3.9
6.	Orissa	3.7

7.	Karnataka	3.4
8.	Kerala	3.0
9.	Andhra Pradesh	2.7
10.	Rajasthan	2.6
11.	Maharashtra	2.5
12.	Uttar Pradesh	2.5
13.	Madhya Pradesh	1.5
14.	West Bengal	1.5
15.	Assam	1.4
16.	Bihar	0.7
	ALL INDIA	3.1

Source : Indian Agriculture in Brief 1971 & Commerce Annual, 1972.

From the above table, it is seen that Punjab ranks first in the country while Kerala occupies eighth position and is more or less near the national average (Kerala being 3.0 & national average being 3.1).

From the above tables13,14 and15 it is seen that India has an income per hectare of Rs. 1,037, has a labour productivity of Rs. 1,213 and has 3.1 percent compound growth rate between 1952-53 to 1969-70. It can be inferred that agriculture is highly diversified in the country. For example, on one hand

it has highly developed agricultural regions, like Punjab, Haryana, Northern Rajasthan, Western Uttar Pradesh etc. and on the other hand it has some of the most backward regions like parts of Madhya Pradesh, Bihar, Eastern Uttar Pradesh etc.

A major input by and large in the Indian agriculture is still the labour force and the land. Though 80 percent of India's population depends on agriculture, there are variations in terms of pressure of population on land. The table below gives a state-wise picture of man-land ratio in India in 1970-1971.

TABLE -16

DENSITY PER SQ. KM. AND MAN-LAND RATIO IN INDIA BY STATES - 1970-71

States	Density per sq. km.	Man-Land Ratio
1	2	3
Andhra Pradesh	157	0.31
Assam	150	0.19
Bihar	324	0.20
Gujarat	136	0.38
Haryana	227	0.49

1	2	3
Himachal Pradesh	62	0.26
Jammu & Kashmir	N.A.	0.19
Kerala	549	0.14
Madhya Pradesh	94	0.49
Maharashtra	164	0.38
Mysore	153	0.37
Orissa	141	0.38
Punjab	269	0.42
Rajasthan	75	0.65
Tamil Nadu	317	0.18
Uttar Pradesh	300	0.26
West Bengal	504	0.16
ALL INDIA	184	0.30

Source*

It can be observed from the above table that the pressure on land is highest, as a result naturally the man-land ratio is lowest in the State of Kerala, i.e. 549 and 0.14. The highest man-land ratio is in the State of Rajasthan, i.e., 0.65. The above point is seen more clearly from the fact that Kerala has a population of 21,347,375 whereas Rajasthan has 25,765,806; but the total cropped area is only of the order of, Kerala

* For Column 2 - Indian Agriculture in Brief, 13th ed., 1974, Table 1.2, p. 2.

2,933,000 hectares while Rajasthan has as much as 16,729,000 hectares, but at the same time the density per sq. km. is very high in Kerala 549 persons whereas Rajasthan has only 75 persons. It would appear that the main reason for the man-land ratio might be density, but there are certain other factors as well such as physiography, soil, rain fall etc. for which there are high variations between these two states.

It may be expected that if pressure on land is very high, then the foodgrains should get a predominant share. Let us now see the actual position. The following table gives the percentage share of foodgrains to total cropped area in 1970-71, in India by States.

TABLE -1.7

PERCENTAGE SHARE OF FOODGRAINS TO TOTAL CROPPED AREA IN INDIA BY STATES - 1970-71

States	Percentage share of area under foodgrains to total cropped area
1	2
Andhra Pradesh	71.03
Assam	75.22
Bihar	89.76
Gujarat	52.21

1	2
Haryana	78.03
Himachal Pradesh	91.21
Jammu & Kashmir	89.37
Kerala	31.57
Madhya Pradesh	81.59
Maharashtra	66.93
Mysore	67.54
Orissa	68.49
Punjab	69.16
Rajasthan	77.00
Tamil Nadu	69.20
Uttar Pradesh	84.84
West Bengal	86.28
INDIA	74.46

The above table reveals that Kerala has got only 32 percent under foodgrains, the lowest among the Indian States and Rajasthan has 77 percent. This is a very unusual phenomenon, because with density of population so high and the pressure of population on land also being high the cropped area under foodgrains is the lowest of all the States. This is the reason why Kerala has been chosen to make a compara-

tive study of the agricultural position of India.

The State of Kerala poses further a very interesting problem when we look into the composition of its agricultural output in terms of foodgrains and industrial crops. It is very interesting to note that for subsistence Kerala is importing a substantial amount of foodgrains from the rest of the country whereas the farmers are continuously going more and more for cash crops. Table 8 gives Kerala's picture for dependency of foodgrains and the production. For this purpose of comparison, only rice the staple food has been taken into account as it is the main subsistence crop.

From the table (8) it is seen that the rice production and rice imports has an increasing trend. This is shown in the columns 4 and 7 (Table 8). The columns 3 and 6 show the chain index for production of rice and imports of rice respectively. This shows that a higher rate of growth of production leads to a decline in imports. The columns 9 and 10 show the proportion of rice production and rice import to the total availability of rice (total availability of rice = rice production+ rice imports) The proportion of rice imports has increased from 29.29 percent in 1960-61 to 37.41 percent in 1973-74 whereas the proportion of rice production has decreased from 70.71 percent in 1960-61 to 62.59 percent in 1973-74. The columns 11, 12 and 13 show

TABLE -18

rice imports (tonnes) and production (tonnes) in Kerala

Years	Rice Production (Tonnes)	Chain Index	Index Number	Rice Imports (Tonnes)	Chain Index	Index Number	Total availability of rice (Tonnes)	Rice net as %age to total availability	Rice Import as % to total availability	Per Capita production of Rice	Per capita import of Rice	Per capita availability of Rice
1	2	3	4	5	6	7	8	9	10	11	12	13
1960-61	1,067,587	-	100.00	442,049	-	100.00	1,509,636	70.71	29.29	62.6	25.9	88.5
1961-62	1,003,930	94.04	94.03	600,325	135.81	135.80	1,604,255	62.57	37.43	57.4	34.3	91.7
1962-63	1,093,210	108.89	102.40	621,459	103.52	140.58	1,714,669	63.75	36.25	61.0	34.9	95.9
1963-64	1,128,056	103.19	105.66	662,186	106.55	149.79	1,790,242	63.01	36.99	61.4	36.0	97.4
1964-65	1,121,380	99.41	105.03	888,000	134.10	200.88	2,009,380	55.80	44.20	59.5	47.1	106.6
1965-66	997,490	88.95	93.43	752,000	84.68	170.11	1,749,490	57.01	42.99	51.6	38.9	90.5
1966-67	1,084,060	108.68	101.54	541,000	71.94	122.38	1,625,060	66.70	33.30	54.7	27.3	82.0
1967-68	1,123,900	103.68	105.27	624,096	115.36	141.18	1,747,996	64.29	35.71	55.3	30.7	86.0
1968-69	1,251,350	111.34	117.21	905,000	145.01	204.72	2,156,350	58.03	41.97	60.1	43.4	103.5
1969-70	1,226,410	98.01	114.87	704,000	77.79	159.25	1,930,410	63.53	36.47	57.4	32.9	90.3
1970-71	1,298,010	105.84	121.58	747,000	106.11	168.98	2,045,010	63.47	36.53	59.3	34.1	93.4
1971-72	1,351,740	104.08	126.61	773,565	103.56	174,99	2,125,305	63.58	36.42	61.5	35.2	96.7
1972-73	1,376,370	101.82	128.92	793,000	102.51	179.39	2,169,370	63.44	36.56	61.2	35.2	96.4
1973-74	1,354,541	98.41	126.87	809,403	102.07	183.10	2,163,944	62.59	37.41	58.9	35.2	94.1

Source : Col.2 -Agricultural Statistics in Kerala 1975, pp., col. 5 Economic Review of Kerala, 1968,1971,1972, 1973 & 1974

the per capita production of rice, per capita import of rice and per capita availability of rice respectively in kilograms. The column 14 shows the per capita availability of cereals in India. It is seen that Kerala is far below All India average in terms of per capita availability. One very interesting phenomenon which is seen from column 11 and 12 from the table (8) is that in some years the production and import both decreases. The reason for this may be attributed as the importable quantity has decreased as is in the years of 1965-66 and 1969-70. In the years 1972-73 and 1973-74 the per capita production decreased but the per capita import has remained constant. Whereas in other years both per capita production and import has increased but is quite marginal. Only in the year 1961-62 the per capita production decreased and import increased.

The picture drawn above reflects the peculiarity of agriculture in Kerala, where notwithstanding increasing output of rice (which is the main foodgrain produced in the State), import of rice has gone on increasing. So, an interest arose to identify the factors which have been responsible for the growth rate of agricultural production. In the foregoing chapters an attempt has been made for this type of identification. For this one has to examine the technological and

other factors whose chance of inadequacy may be inhibiting a high rate of growth of foodgrain (specially rice) production, by, among other things, raising productivity to a substantial extent.

CHAPTER - II

STATEMENT OF THE PROBLEM

CHAPTER - II

STATEMENT OF THE PROBLEM

OBJECTIVE :

The present study aims at identifying the variations in the growth rate of agricultural production in Kerala during the period 1960-61 to 1973-74.

Further an attempt has been made to explore the factors, for the variations in the growth rate of agricultural production. The explanatory variables chosen here are based on the assumption that agricultural production is a three dimensional phenomenon - environmental, technological and institutional factors.

The environmental (consisting of such variables as land surface, soil and rain fall) lay down the basis for the character of agriculture in a region.

Technological inputs (such as farming techniques i.e. implements and application of irrigation, fertilizers and improved seeds) determine the pace of agricultural development.

The institutional factors (such as the size of land holding, land tenure and social background of the farming classes) permit the application of certain technology and

help to remove the environmental constraints on agricultural development or discourage the acceptance and application of technology thus retarding agricultural growth rate.

Viewed in this context, the explanatory variables chosen here may be classified as follows :

Environmental :

a. Soil rating index

b. Variability of Rain fall

Technological: (Growth Rate)

a. Consumption of fertilizers per thousand hectares of gross cropped area.

b. Mechanisation index.

c. Intensity of cropping.

Institutional : (Growth Rate)

a. Agricultural labourers as percentage to total agricultural workers.

b. Rural scheduled caste and Rural scheduled tribe population as percentage of the total rural population.

c. Rural literates as percentage of total rural population.

The choice of the explanatory variables has been determined by the availability of data at the district level from the secondary sources. The association among the variables and with that of the dependent variable i.e. the growth rate of agricultural production would also be analysed in some detail.

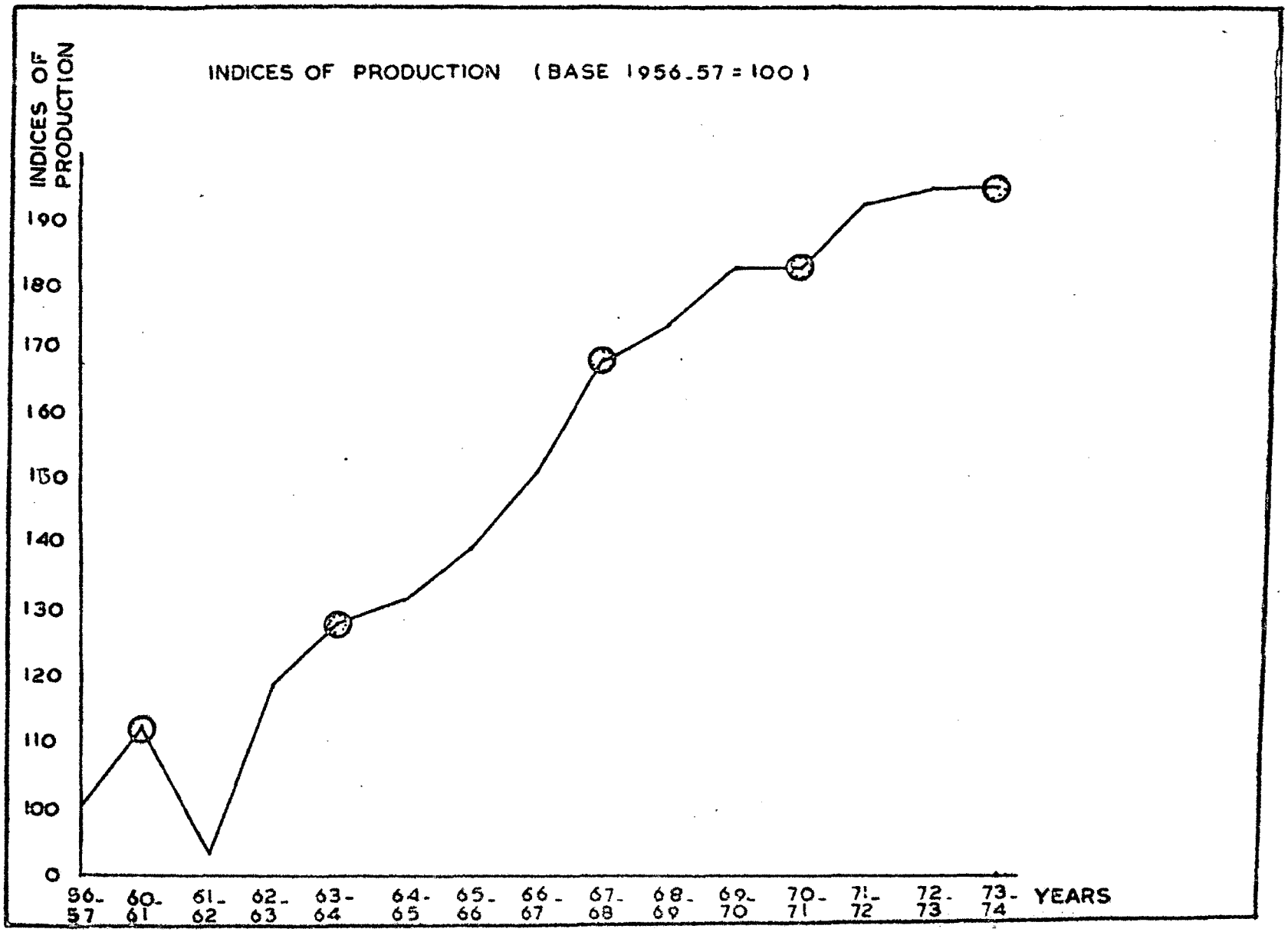
INDICES OF PRODUCTION (BASE 1956-57 = 100)
INDICES OF PRODUCTION
190
180
170
160
150
140
130
120
110
100
0
96-57
60-61
61-62
62-63
63-64
64-65
65-66
66-67
67-68
68-69
69-70
70-71
71-72
72-73
73-74
YEARS

Fig.1

Period of Study:

The present study is designed to see the variations in the growth rate at the five points of time viz., 1960-61, 1963-64, 1967-68, 1970-71 & 1973-74. These years have been chosen on the basis of the indices of the agricultural production on a logarithmic scale. The indices of agricultural production from 1960-61 are given in Appendix - 1.

In the graph, in abscissa the years are taken and in ordinate we have taken the indices of production (Fig. 1). The base for the indices of production is 1956-57. From the graph it is seen that the peak periods are 1960-61, 1963-64, 1967-68, 1970-71 and the latest year the 1973-74.

The peak periods are specifically chosen to avoid the seasonal fluctuations in the production due to weather conditions. Here the assumption is that favourable weather is a pre-requisite for high agricultural production. As a matter of fact, seasonal conditions were not adverse to the production in any one of the time periods chosen here.

DATA BASE :

The data for this study have been collected from a number of sources. The basic data on production was derived from Seasonal and Crop Reports of Kerala for the years 1960-61

1963-64, 1970-71 and 1973-74 and from Agricultural Statistics in Kerala issued in 1975 for 1967-68. The Season and Crop Reports give details regarding acreage and production for each district and harvest prices of the commodities. Data for rain fall have also been collected from these reports

The soil rating index developed by R.E. Storie (1933) and 1959 and adopted by S.P. Ray Chaudhary and K.B. Shome (1960)[1] has been taken as the index of soil fertility. The data on fertilizer consumption for the relevant years have been collected from Fertilizer Statistics[2].

The data on tractors, electrical pump sets and oil engines have been obtained from the Season and Crop Reports.[3]

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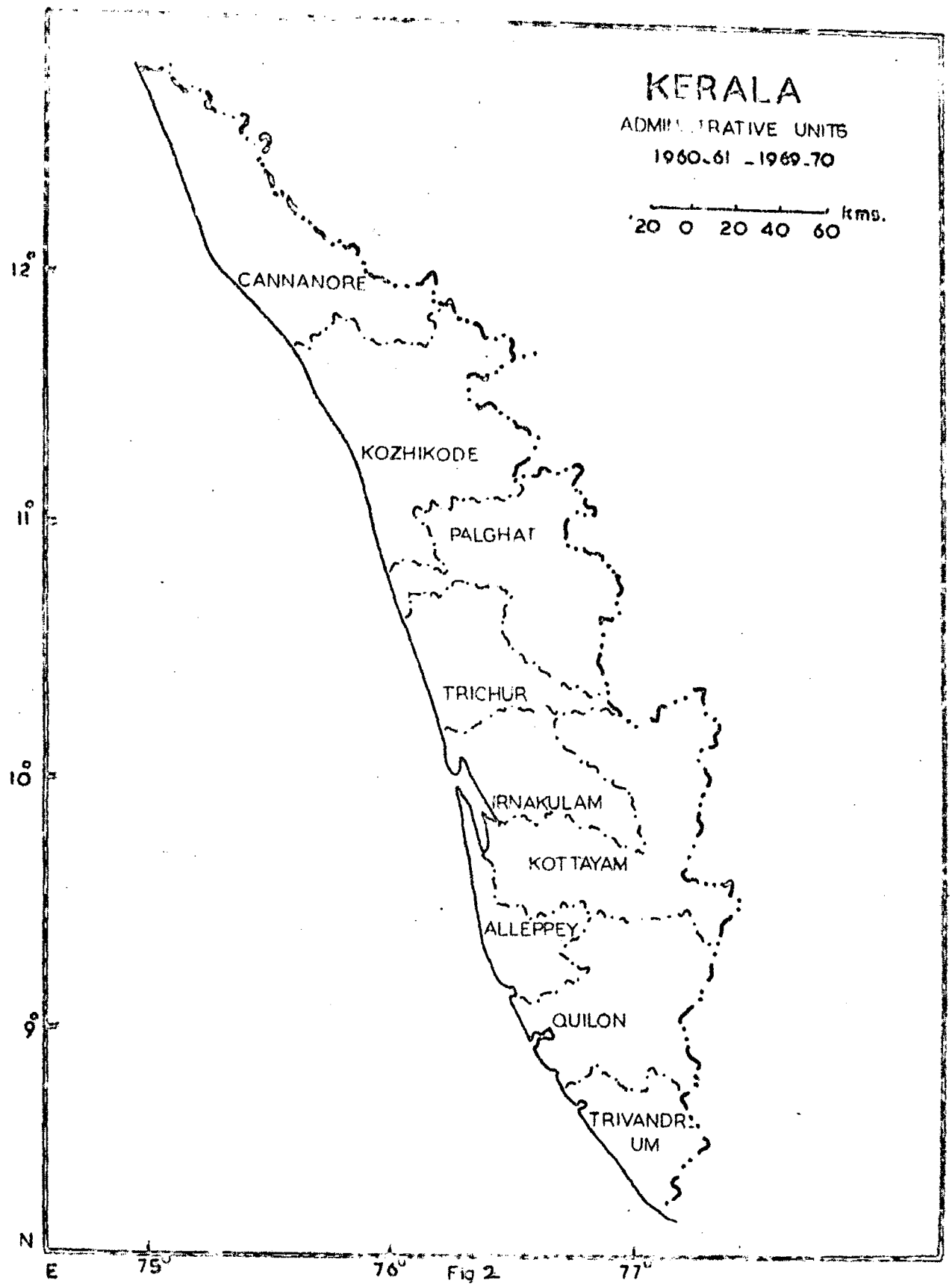
1. S.P. Ray Chaudhary & K.B. Shome, "Ratings of Soils of India", Proceedings of the National Institute of Sciences of India, vol. XXVI, Supplement 1.

2. FAI, Fertilizer Statistics, 1971-72 & 1974-75. The data for 1960-61 to 1965-66 were from "Effective demand for fertilizers in India" prepared by W.B. Donde, G.O.I., New Delhi & Dorris D. Brown, I.B.R. & D. New Delhi (Appendix Table VI entitled consumption of fertilizers from 1959-60 to 1968-69 & for the years 1970-71 & 1973-74 from Fertilizer Statistics of years 1971-72 & 1974-75 Table 6.2 entitled Districtwise consumption of fertilizers.

3. Season and Crop Reports of 1960-61, (Table 7.1, pp. 72 - 77), 1966-67 (Table 7.1, pp. 62 - 67), and 1972-73 (Table 7.1, pp. 49 - 52).


KERALA
ADMINISTRATIVE UNITS
1960-61 - 1969-70
20 0 20 40 60 kms.
CANNANORE
KOZHIKODE
PALGHAT
TRICHUR
ERNAKULAM
KOTTAYAM
ALLEPPEY
QUILON
TRIVANDRUM
12°
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77°

Fig 2.

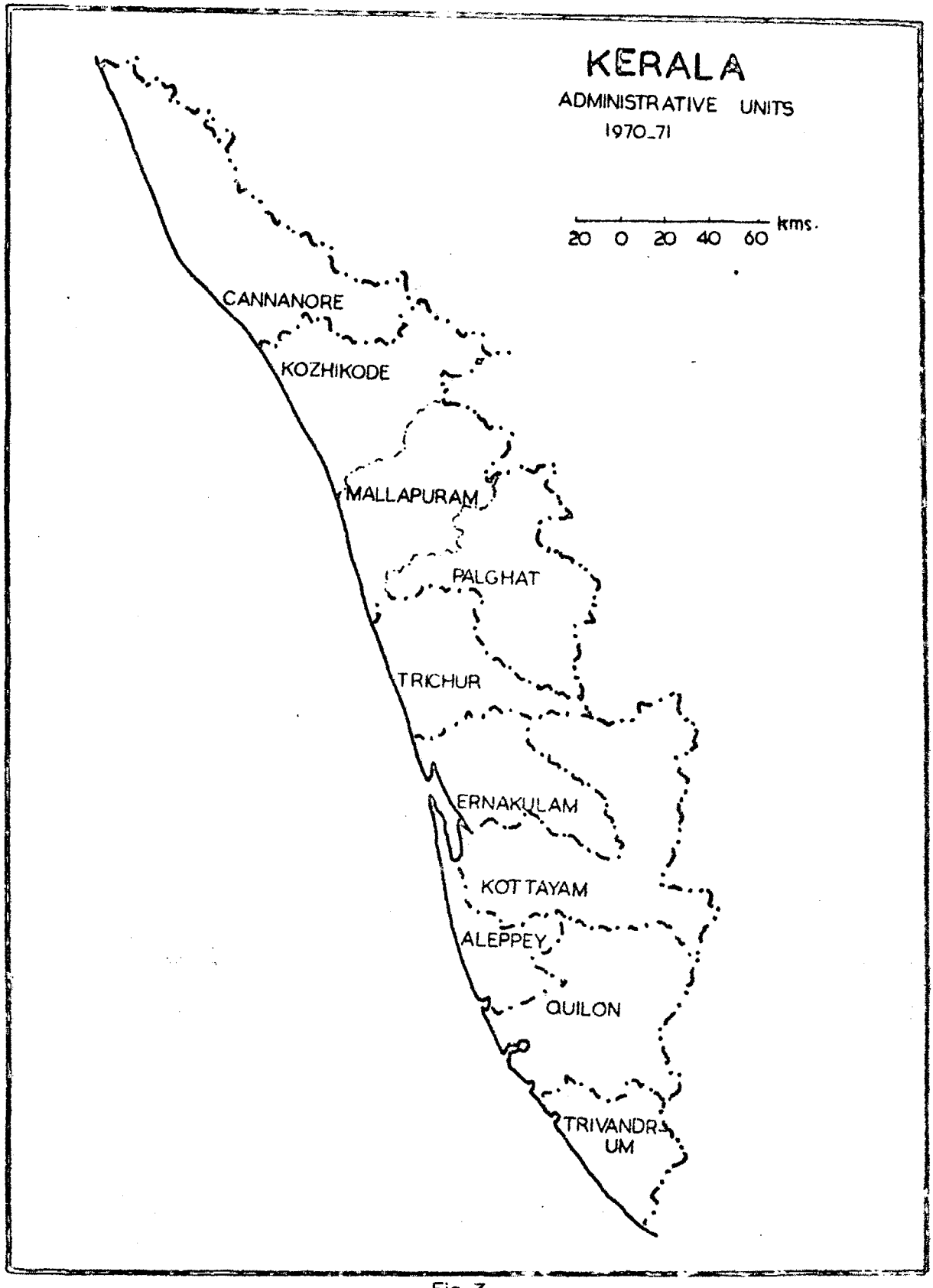
KERALA
ADMINISTRATIVE UNITS
1970_71
20 0 20 40 60 kms.
CANNANORE
KOZHIKODE
MALLAPURAM
PALGHAT
TRICHUR
ERNAKULAM
KOTTAYAM
ALEPPEY
QUILON
TRIVANDRUM

Fig. 3

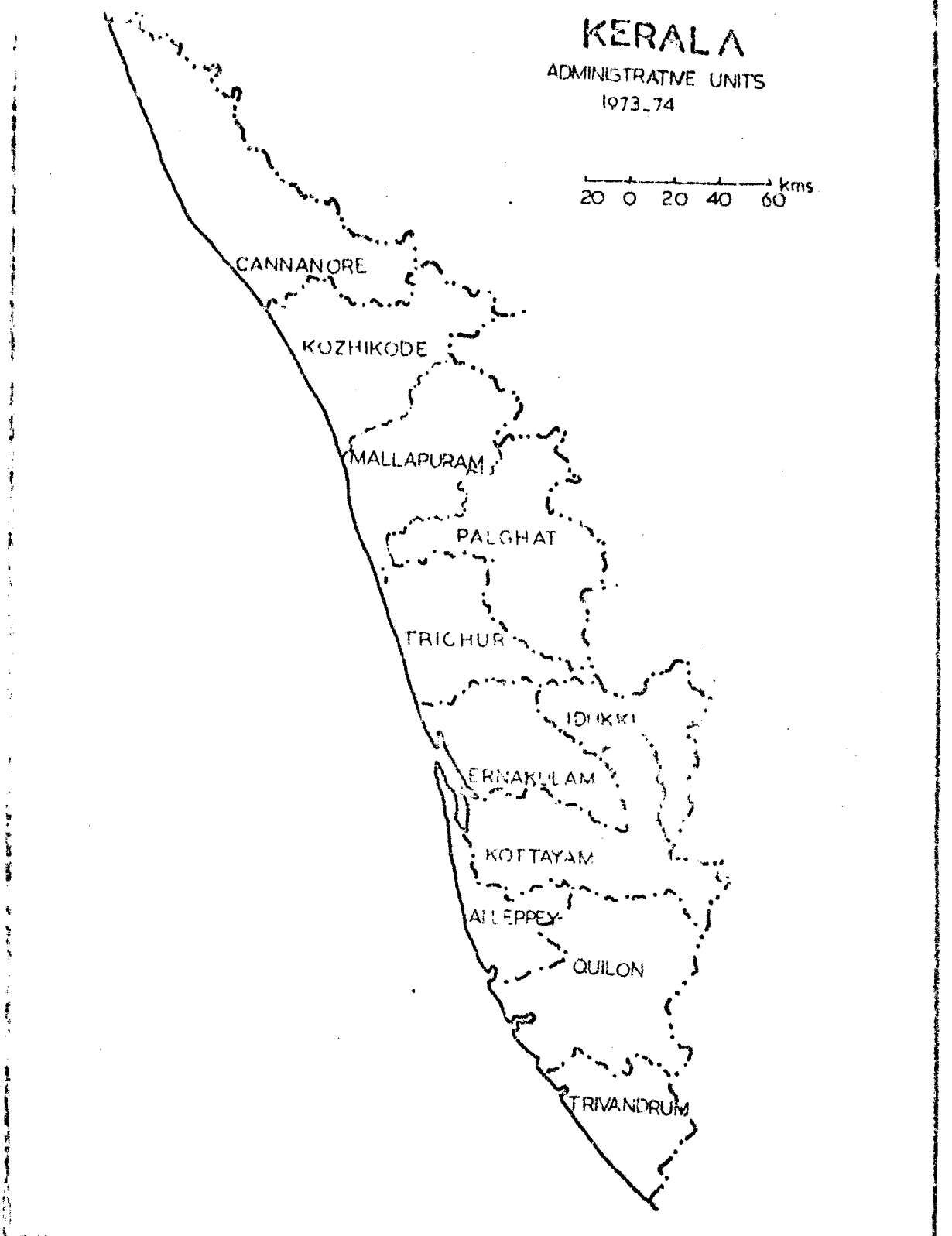
KERALA
ADMINISTRATIVE UNITS
1973-74
20 0 20 40 60 kms
CANNANORE
KOZHIKODE
MALLAPURAM
PALGHAT
TRICHUR
IDUKKI
ERNAKULAM
KOTTAYAM
ALLEPPEY
QUILON
TRIVANDRUM

Fig. 4

On aspects such as agricultural labourers, rural scheduled caste and tribes, rural literate persons and rural population, Census data have been used[4].

The major limitations of the data are as follows :

(i) The data for institutional variables and mechanisation have been computed by us. The data for the institutional variables for the periods 1963-64, 1967-68 and 1973-74 have been computed taking the average growth between 1960-61 to 1970-71. The same method has also been applied in case of mechanisation for the years 1963-64, 1967-68, 1970-71 and 1973-74.

(ii) The administrative units, however, did not remain the same at these five points. There were nine districts upto 67-68 (Fig. 2), which became ten in 1970-71 (Fig. 3) and eleven in 1973-74 (Fig. 4). This involved considerable changes in the administrative boundaries during the period 1970-71 to 1973-74. These changes created extensive difficulties in any attempt of comparative analysis between the five points of time.

As it is difficult to attempt a comparative study of the reorganised districts with its apportionment from each

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4. Census of India, 1961, Kerala General Population Tables Part II-A, Census of India, 1971, Kerala General Population Tables, Part II-A.

other of the erstwhile districts, the districts have been so modelled so as to show the original nine districts. The new districts that were created are Mallapuram in 1970-71 and Idikki in 1972-73. Mallapuram was carved out of parts of Kozhikode and Palghat, while Idikki emerged from Kottayam and Ernakulam. A scrutiny of the areas included in Mallapuram reveal that 80 percent of the area was taken from Kozhikode and 20 percent from Palghat; in the case of Idikki 80 percent was taken from Kottayam and 20 percent from Ernakulam. In order, ~~therefore,~~ to give a comparable picture of the original nine districts, the data and ~~variables~~ have been proportionally reduced or added so as to give a correct and overall picture.

(iii) Due to paucity of the data, irrigation could not be considered as one of the factors affecting the growth rate of production.

METHODOLOGY :

The following statistical techniques have been used in the present study :

I The indices for the institutional factors as discussed in Chapter IV have been worked out by taking the difference between 1960-61 and 1970-71 (substracting 1960-61 figure from that of 1970-71 figure) and being divided by the ten

(because of the ten year span) which shows the yearly increase. Assuming the figure for yearly increase to be X, we get the figure for 1963-64, this X is multiplied by 3 as the difference between 1963-64 and 1960-61 is 3. This result was added up with the base figure of 1960-61 which will give the figure for 1963-64. Similarly, to obtain the figure for 1967-68 the figure "X" is being multiplied by 7 (as the difference from the base year i.e. 1960-61 is 7) and the new result is added up with the 1960-61 figure to give the 1967-68 figure. In case of working out the figure for 1973-74, X is being multiplied by 3 (as the difference between 1973-74 and 1970-71 is 3) and is added with the 1970-71 figure which gives the figure for 1973-74.

The same method is adopted in the case of mechanisation also to get the figures for 1963-64, 1967-68, 1970-71 and 1973-74.

II The indices of agricultural growth has been calculated in the following manner, taking 1960-61 as the base year : Quantity index number (Q.I) of agricultural production =

$$X_{i_1} = \frac{Pil}{Pio} \times 100$$

where : Pij - Production of ith crop during jth year

Pio - Production of ith crop during base year

Xi_1, Xi_2 .....the subscripts refering to different crops

(b) To find out the index number of all crops, the production of each crop was converted into money value at the constant prices for the State and districts respectively. Likewise the value of production or value of output has been obtained. These are also the weights.

Weight = Value of Output = Physical Quantity X price
(Price is constant and is farm harvest prices)

W_1, W_2.....the subscripts refering to different crops

Thus, index number for all crop would be :

$$\frac{Xi_1 W_1 + Xi_2 W_2 \text{ ---------- } + Xi_n W_n}{W_1 + W_2 + \text{ ---------- } + W_n}$$

(c) Then, the estimated compound growth rate was found out by using the least Squire method. Here, the log value of the index number is used[5], and it is done between 1960-61 to 1973-74 taking into account only the peak periods chosen. (see Appendix I)

(d) Taking growth rate of production as the dependent variables and the other variables as independent (for which also growth rates were taken), a stepwise regression analysis

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5. R.G.D. Allen, "Mathematics for Economists", Estimated trend compound growth rate; Johnston, "Econometrics"; Fredrick E. Croxton, Ph.D., Dudley J. Cowden, Ph.D., & Sidney Klain, Ph.D. "Applied General Statistics", Chap.18, pp. 371 - 388 and Chap. 19, pp. 389 - 418; Allen R.G.D., "Index numbers in theory and practice", Macmillan Press Ltd., London, 1975.

was computed. The aim was to identify the respective shares of the independent variables in explaining the dependent variable.

(iii) A decomposition method of Minhas & Vaidyanathan[6] is used, so as to see the effect of area, yield, cropping pattern and the interaction of the latter two elements on growth rate of production.

Cartographic techniques used:

The main aspects of this study such as the growth rate pattern of the dependent and the independent variables have been depicted on the maps using the choropleth technique.

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6. Minhas & Vaidyanathan, "Growth of Crop Output in India, 1951-54 to 1958-61", Journal of Indian Society of Agricultural Statistics, Vol. XVII, No. 2, 1965

CHAPTER - III

SETTING AND ABIOTIC FEATURES OF KERALA

CHAPTER - III

SETTING AND ABIOTIC FEATURES OF KERALA

Kerala is one of the smallest states in the sub continent of India excluding the Union Territories. It is a narrow strip of land along the west coast of India (Fig.5) covering an area of 38,855 sq. km. The coast line extends for nearly 580 kilometers. It is bounded by Karnataka state in the north and by Tamil Nadu in east and south east. It lies between 8 51' and 12 45' N latitude and 74 50' and 77 30' E longitude. It extends from north to south for about 450 milometeres and the breadth of the state varies from 32 to 120 kilometers, as one moves from the extreme north and south towards the centre.

PHYSICAL FEATURES :

Kerala is singularly diversified in her physical features In the light of this diversity in physical features the state can be divided into 3 natural divisions (Fig.6) :

(i) The high lands touching the western ghats (height above 250 feet) ;

(ii) The plains lying below the highlands but slightly above the coastal region (height between 25 feet - 250 feet) or the piedmont plains; and

(iii) The coastal belt or the low land (height below 25 feet).

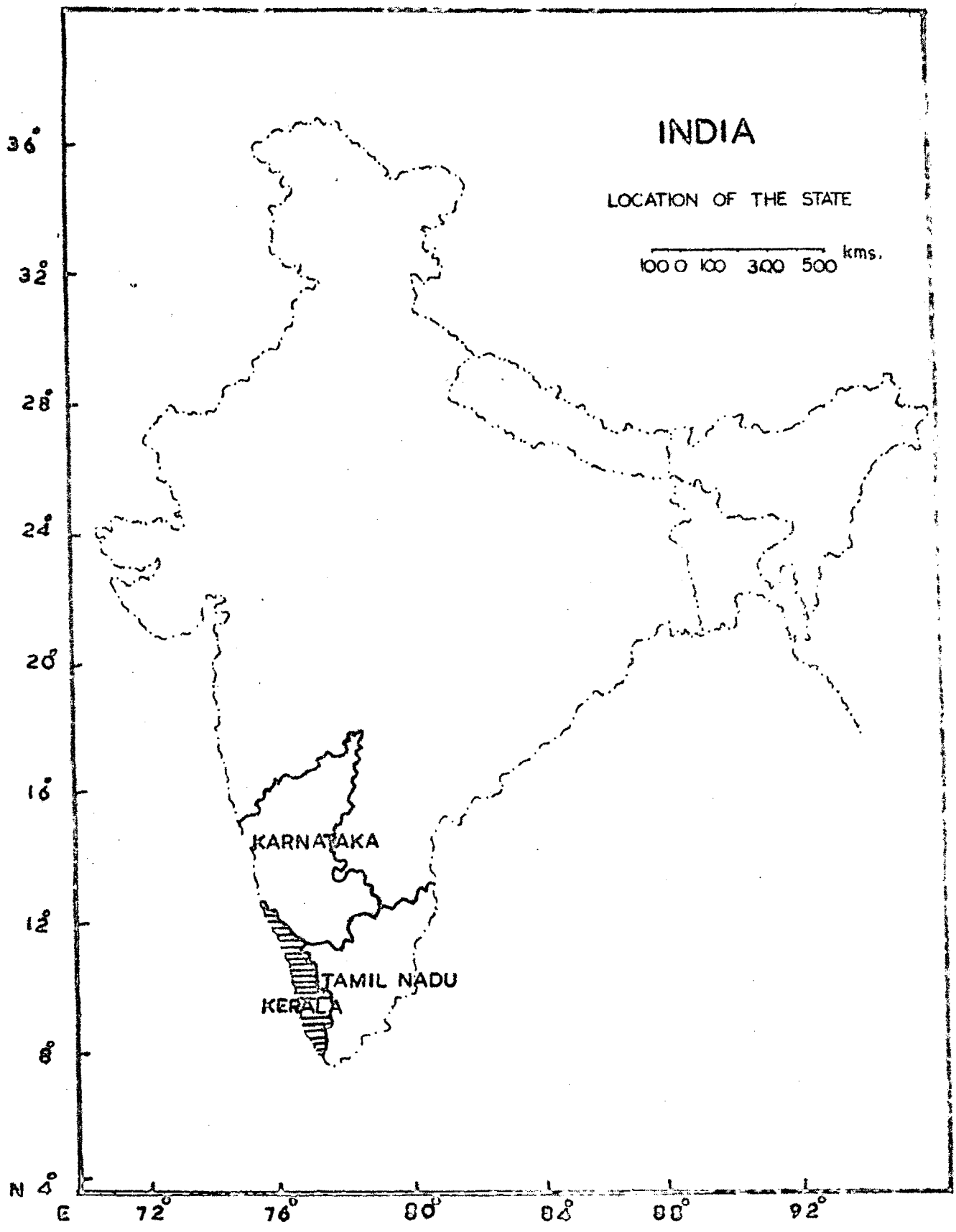
INDIA
LOCATION OF THE STATE
100 0 100 300 500 kms.
KARNATAKA
TAMIL NADU
KERALA
36°
32°
28°
24°
20°
16°
12°
8°
4° N
72°
76°
80°
84°
88°
92° E

Fig. 5

(i) The Highland:

This region has mostly a mountainous and rocky terrain varying in height from 3000 ft. to 8000 ft. Anamudi, the heighest peak in the Western Ghats (8,837 ft.) is located in Kottayam district. At some places westward flowing rivers leap over these cliffs and make water falls. The region is thickly forested in the upper ranges while in the lower ranges the forests are interspersed with tea, coffee, rubber, cardamom and other plantations.

(ii) The Piedmont Plain :

Between the highland in the east and the low coastal plain in the west lies the piedmont plain or the mid land which is essentially a highly dissected upland region having deep ravines. The soils of this region are laterite but a wide range of crops are grown. Paddy, tapioca, spices, pepper, ginger and cashewnut being some of the main crops of this region.

(iii) The Coastal belt :

This is a narrow coastal plain or low land extending from north to south in the form of a strip. It varies in width from 24 to 96 Kilometres and is interrupted by short precipitous spurs from the Western Ghats towards the Arabian Sea. Thus, river valleys alternating with spurs, give this plain an undu-

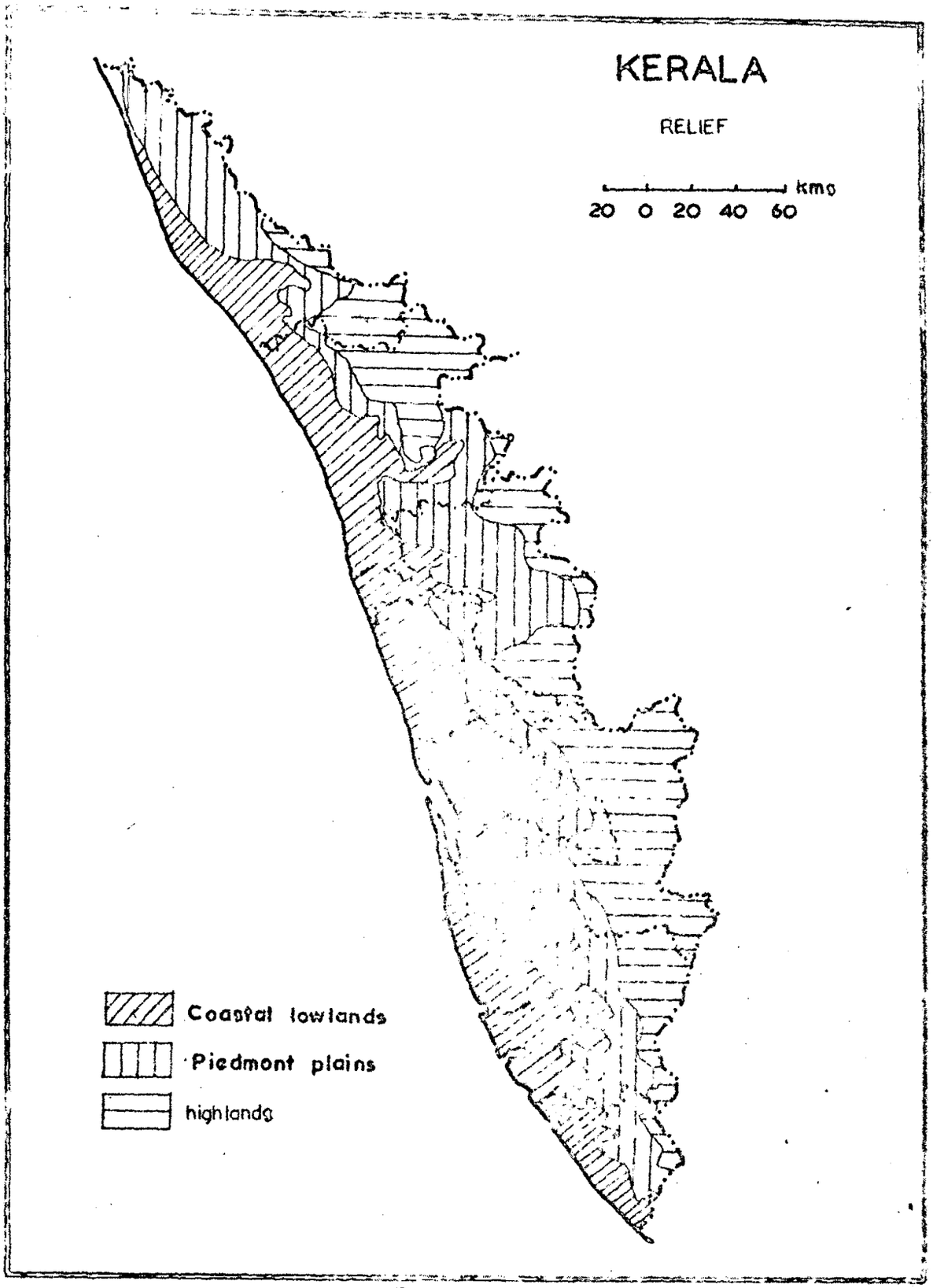
KERALA
RELIEF
kms
20 0 20 40 60
Coastal lowlands
Piedmont plains
highlands

Fig. 6

lating character. Along the Arabian Sea the plain is fringed with low mud banks ranging in width from a couple of kilometres to less than a kilometre. The river delta along the shore are tangled with dense mangroves, coconut palms, which cover west of this area and lend richness to the landscape of the region. Coir-making and fishing are the two main occupations.

CLIMATIC CHARACTERISTICS :

The same diversity which characterizes the physical features of the state, also occurs in case of the climatic conditions. The high land has a cool and bracing climate throughout the year. The temperatures vary from 44.6 F to 60.8 F in March and April and from 33.8 F to 60.8 F from November to January. The mid land has more or less a moderate climate. The temperature vary from 69.8 F to 80.6 F. The coastal plains are hot and humid. However, the range of variations in temperature is rather narrow, the normal limits being 80 F to 90 F.

RAINFALL:

The normal distribution of rainfall in Kerala has been represented in Fig. 7. Kerala is a high rainfall state, the annual rainfall being 3014.3 mms. The rainfall in Kerala is fairly spread out over the year as it has the benefit of both

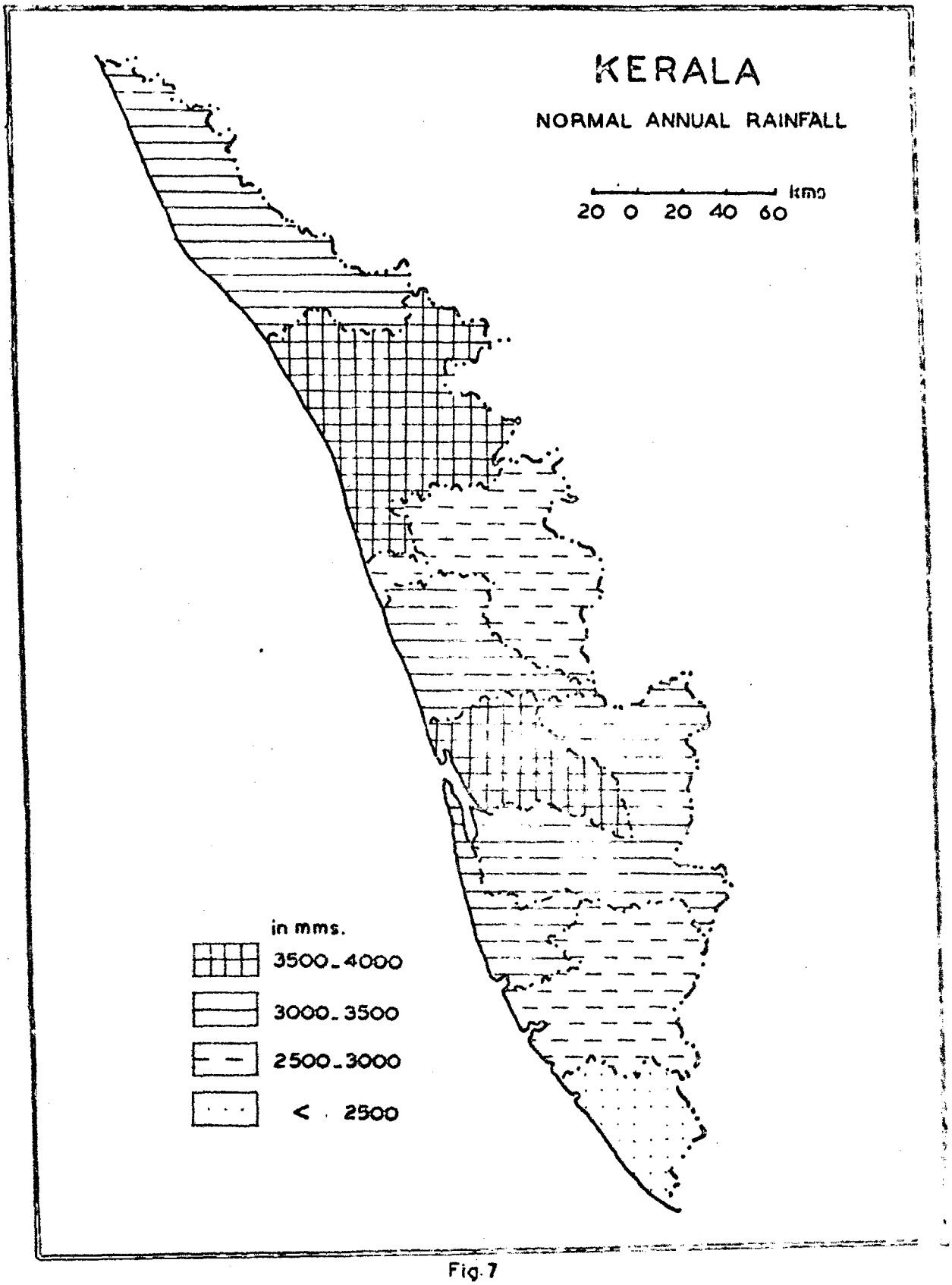
KERALA
NORMAL ANNUAL RAINFALL
kms
20 0 20 40 60
in mms.
3500-4000
3000-3500
2500-3000
< 2500

Fig. 7

south west and north east monsoons. There are some intervening dry spells. The south west monsoon commencies in June and generally ends in September. This season receives about 68 percent of the annual rainfall. Most of the area in the State gets rainfall between 2000 mms and 4000 mms. The wettest months are June, July and August while January, February and March are the driest months in the year receiving about 0.3 percent of the annual rainfall.

TABLE - 3.1

NORMAL ANNUAL RAINFALL (mms.)

State/District	Normal Annual Rainfall (mms.)
1	2
Kerala	3014.3
Cannanore	3437.9
Kozhikode	3796.0
Palghat	2977.7
Trichur	3177.4
Ernakulam	3577.5
Kottayam	3082.5
Alleppey	3012.0
Quilon	2760.2
Trivandrum	2001.4

Source : Season and Crop Report of Kerala 1959-60 to 1960-61.

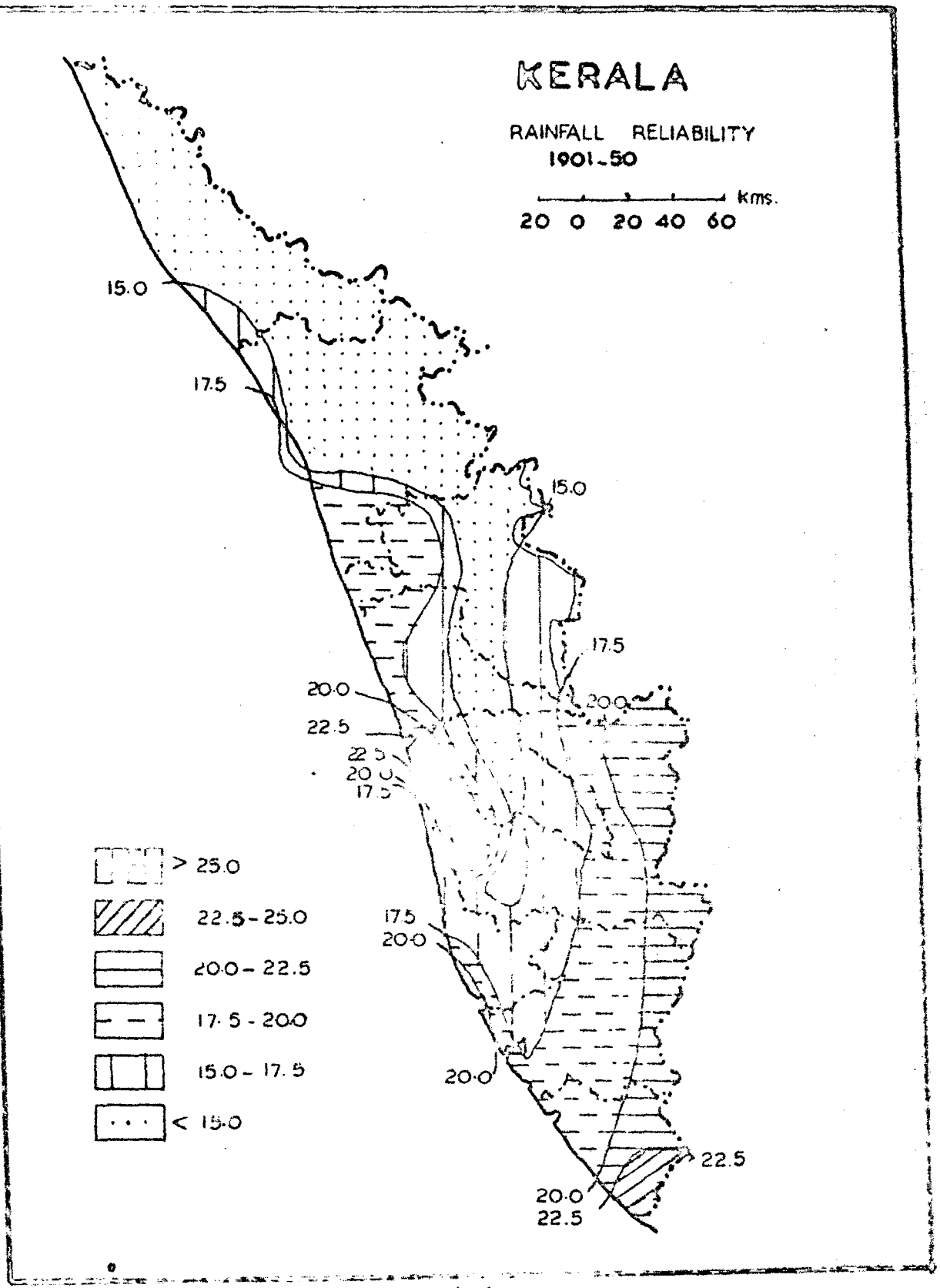
KERALA
RAINFALL RELIABILITY
1901-50
kms.
20 0 20 40 60
15.0
17.5
15.0
17.5
20.0
22.5
22.5
20.0
17.5
17.5
20.0
20.0
22.5
20.0
22.5
> 25.0
22.5 - 25.0
20.0 - 22.5
17.5 - 20.0
15.0 - 17.5
< 15.0

Fig.0

From the table 3.1 it is clear that the normal annual rainfall distribution indicates four groups of districts i.e., low, moderate, high and very high rainfall. The district falling under the category low having a normal annual rainfall of less than 2500 mm is Trivandrum. The districts having moderate rainfall (2500 mm - 3000 mm) are Palghat and Quilon. The districts falling under high rainfall category (3000 mm - 3500 mm) are Cannanore, Alleppey, Kottayam and Trichur. The districts of Kozhikode and Ernakulam are under very high rainfall (3500 mm and 4000 mm).

RAINFALL RELIABILITY :

The figure 8 [1] represents rainfall reliability (1901-50). Rainfall reliability is measured by the co-efficient of variability of annual rainfall. Variability is inversely proportional to reliability. The region which shows high rainfall variability is a region of low reliability of rainfall.

Most of the regions of the state have rainfall variability below 20.0 percent and consequently have high or very high reliability of rainfall. Slightly high reliability of rainfall (variability between 20.0 and 25.0 percent) is observed in portions Kottayam, Quilon and Trivandrum. Most of these areas lie on the top or in the eastern slopes of the western ghats. Moderate reliability of rainfall (variability above 25.0 percent) is noticed in small contiguous portions of the state.

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1. Source : Census Atlas of Kerala, 1961, Map 8, p. 20.

It is obvious that notwithstanding plenty of rains in Kerala, the incidence of rainfall in terms of season's with the spectre of dry spells, water conservation, drainage and irrigation are aspects that need special attention of the government. Thus any impression that irrigation is not particularly relevant as a factor of growth of agriculture in Kerala is not well-founded.

IRRIGATION :

A striking illustration of the importance of irrigation in agriculture is shown in the following table.

TABLE - 3.2

TOTAL AREA IRRIGATED SOURCEWISE IN KERALA
1960-61 and 1973-74

(Area in hectares)

Sources	1960 - 61		1973 - 74	
	Actual	%age	Actual	%age
1	2	3	4	5
Net area irrigated by :				
i. Government Canals	133,049	41.75	221,406	48.47
ii. Private Canals	5,738	1.80	10,160	2.22
iii. Tanks	46,952	14.73	75,851	16.61
iv. Wells	2,032	0.64	5,460	1.20

1	2	3	4	5
v. Other Sources	130,940	41.08	143,903	31.50
vi. Total	318,711	100.00	456,780	100.00
Percentage of net area irrigated to :				
i. net area sown	-	6.57	-	20.74
ii. total irrigated area	-	69.85	-	71.64
Area irrigated more than once in an year (%age to Total irrigated area)	137,545	30.15	180,859	28.36
Total irrigated area	456,256	-	637,639	-
Percentage of total irrigated area to total cropped area	-	19.42	-	21.25
Intensity of irrigation	-	143.16	-	139.59

Source : Agricultural Statistics in Kerala, 1975, p. 61

During the year 1960-61, out of a total cropped area of 2,348,860 hectares, the gross area irrigated was 456,256 hectares (19.42 percent). The net area irrigated was 318,711 hectares, it forms a percentage of 16.57 of net area sown. Of this, Government canals accounted for as much as 133,049 hectares (41.75 percent), private canals 5,738 hectares (1.80 percent), tanks for 46,952 hectares (14.73 percent), wells for 2,032 hectares (0.64 percent) and other sources for 130,940 hectares

(41.08 percent). The intensity of irrigation was 143.16.

In the year 1973-74, out of a total cropped area of 2,999,580 hectares, the gross area irrigated was 637,639 hectares (21.25 percent). The net area irrigated was 456,780 hectares, it forms a percentage of 20.74 of net area sown. Of this, Government canals accounted for 221,406 hectares (48.47 percent), private canals 10,160 hectares (2.22 percent), tanks for 75,851 hectares (16.61 percent), wells for 5,460 hectares (1.20 percent), and other sources for 143,903 hectares (31.50 percent). The intensity of irrigation was 139.59.

The intensity of irrigation decreased between 1960-61 and 1973-74 because the net area irrigated has increased. The gross area irrigated also has increased. Area irrigated by all sources except that by other sources has increased.

The following table gives gross area irrigated, crop-wise.

TABLE - 3.3

GROSS AREA IRRIGATED (CROP-WISE) IN KERALA
1960-61 and 1973-74

(Area in Hectares)

Name of Crops	1960-61 Actual	%age	1973-74 Actual	%age
1	2	3	4	5
1. Paddy	347,799	76.2	524,889	82.3

1	2	3	4	5
2. Sugarcane	3,650	0.8	4,290	0.7
3. Other Food Crops	65,310	14.3	55,690	8.7
4. Total Food Crops	416,759	91.3	584,869	91.7
5. Total non-food crops	39,497	8.7	52,770	8.3
6. All Crops	456,256	100.0	637,639	100.0

Source : Agricultural Statistics in Kerala, 1975, p.62

From the above table, it would be seen that 76.2 percent of the gross area irrigated in 1960-61 was under paddy and it increased to 82.3 percent in 1973-74. 91.3 percent of the gross area irrigated in 1960-61 was under food crops and it increased to 91.7 percent in 1973-74. The area irrigated under other food crops decreased from 14.3 percent in 1960-61 to 8.7 percent in 1973-74. The main increase has taken place in the case of paddy only.

Table 3.4 gives the area irrigated crop-wise and from this table it is seen that in 1960-61, 44.65 percent of the area under 'paddy' is irrigated and it increased to 60.01 percent in 1973-74. The area irrigated under 'sugarcane' also increased from 39.89 percent in 1960-61 to 45.02 percent in 1973-74. The proportion of irrigated area under 'other food crops' and

TABLE - 3.4

TOTAL AREA AND AREA IRRIGATED UNDER CROPS IN KERALA 1960-61 and 1973-74

(Area in hectares)

Name of Crops	1960-61			1973-74		
	Area under Crop	Area Irrigated	% Col.3 to Col.2	Area under Crop	Area Irrigated	% of Col.6 to Col.5
1	2	3	4	5	6	7
1. Paddy	778,910	347,799	44.65	874,680	524,889	60.01
2. Sugarcane	9,150	3,150	39.89	9,530	4,290	45.02
3. Other Food Crops	777,000	65,310	8.41	975,190	55,690	5.71
4. Total Food Crops	156,560	416,759	26.63	1,859,400	584,869	31.45
5. Total Non-Food Crops	783,800	39,497	5.04	1,140,180	52,770	4.63
6. All Crops	2,348,860	456,256	19.42	2,999,580	637,639	21.25

Source : (of Col. 2, 3, 5 and 6) Agricultural Statistics in Kerala, 1975, p 17, 18 and 61

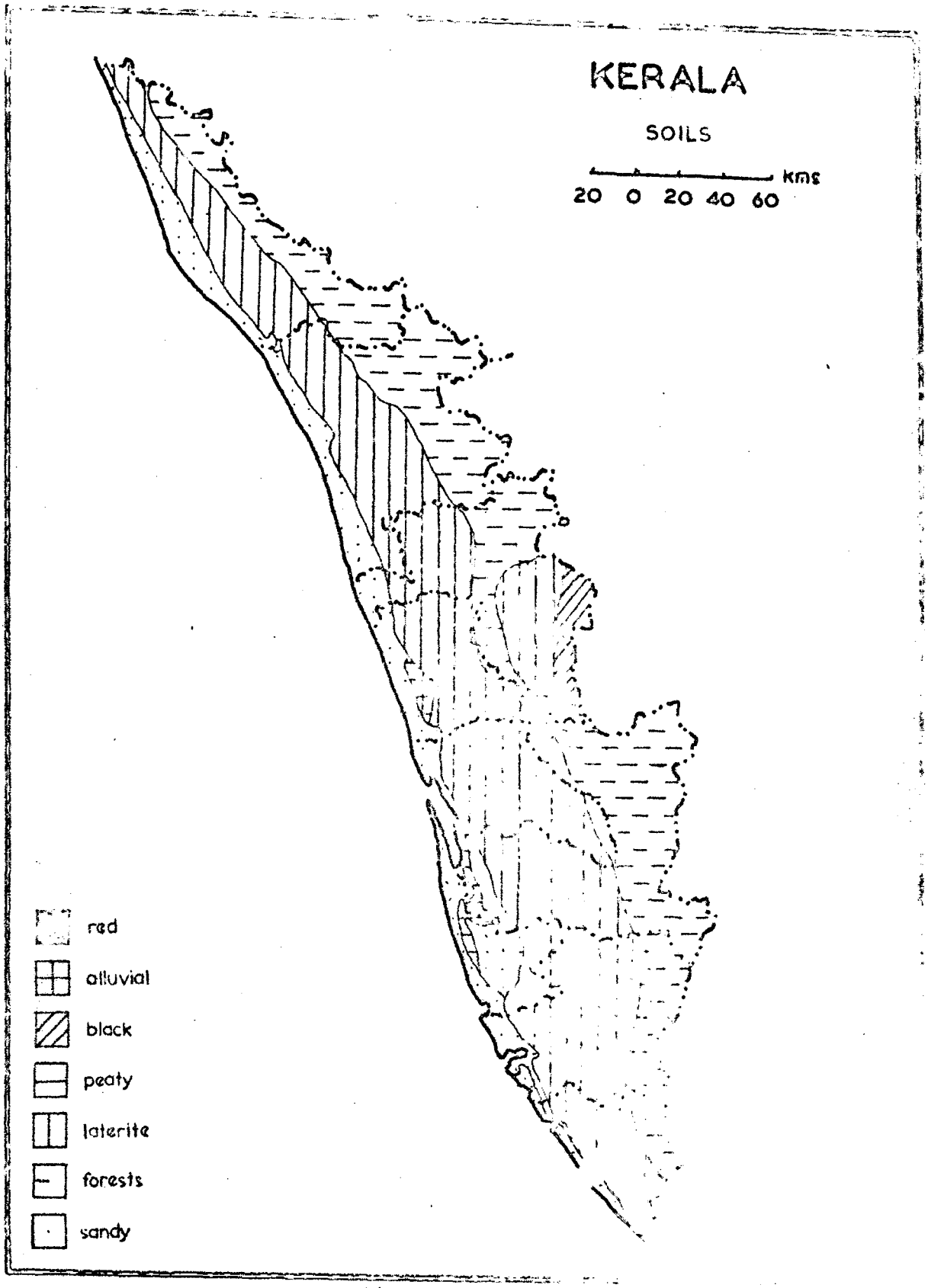
KERALA
SOILS
kms
20 0 20 40 60
red
alluvial
black
peaty
laterite
forests
sandy

Fig.9

'total non-food crops' decreased whereas the proportion of irrigated area increased under ' total food crops' and 'all crops'. But, most significant increase is in paddy.

SOILS :

The soils of the state can be broadly classified as follows into 7 categories[1]:(Fig 9)

1. Sandy
2. Alluvial
3. Laterite
4. Red
5. Peaty
6. Forest and
7. Black

The sandy soil occur as a naroow belt all along the coast. They are highly porous with low retentive capacity and are extremely deficient in all the major plant foods and lime. Coconut is the only important crop found in these soils.

The alluvial soils are transported soils and cover a small portion in the west coast of Trichur district. They

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1. Season and Crop Report of Kerala, 1960-61.

TABLE - 3.5

PERCENTAGE CONSTITUENTS (OVER DRY BASIS) OF LATERITE SOIL

Horizon	Depth (cm)	pH	Detritus	Coarse Sand	Fine sand	Silt	Clay	SiO_2	Fe_2O_3	Al_2O_3	Organic	C.E.C.
A	0 - 20	6.5	12.1	3.4	21.2	29.4	44.2	41.46	29.34	26.65	1.24	22.3
B_1	20 - 60	6.3	8.3	2.7	18.2	29.0	48.6	41.48	29.55	27.28	0.79	20.0
B_2	60 - 100	6.4	14.7	2.6	17.7	22.8	56.7	38.28	30.26	26.74	0.35	15.1
B_3	100 - 132	6.6	54.4	5.8	21.6	24.8	47.2	40.04	29.38	23.57	0.25	14.6

Source : Agricultural Year Book, New Vistas in Crop Yields, ICAR, New Delhi, pp. 212 - 213.

are generally well supported with organic matter, nitrogen and potash.

Laterite soils are the most important group of soils found in the state and cover the largest area. They cover almost the entire mid land. Though they are of low fertility, they respond well to gird cultivation and application of fertilizers.

Laterites are found under conditions of high rainfall with alternating wet and dry periods. They are formed in-situ by the leaching of bases and much of silica from the original rock. They have a special feature of compact to vesicular mass in the sub soil horizons, composed essentially of a mixture of hydrated oxides of iron and aluminium.

On higher level the soils are thin. They are poor in nitrogen, phospheric acid, potash, lime and magnesium.

Red soils are found in a small part of Trivandrum district only. They are deficient in organic matter and low in all the major plant foods and lime.

The Peaty or Kari soils occur in a small part in the district of Alleppey only. These are dry soils with poor aeration and drainage. They are rich in nitrogen and are strongly acidic.

The forest soils occupy more than one-fourth of the area of the state and occur all along the eastern border except in Palghat and Chittur taluks of the district of Palghat. They are characterized by a surface layer of organic matter derived from forest growth. Plantation crops such as tea, cardamom and rubber are extensively grown here.

Black soils are found in portions of Chittur and Palghat taluks of the district of Palghat. They are deficient in all the major plant foods. Cotton is the main crop grown in these soils.

Thus, it can be said that the soils of Kerala are not very fertile owing to its inherent fertility. Being of lateritic origin they are highly porous. More than 50 percent of the cultivated soils contain less than 15 percent of clay complex. Continuous cropping accompanied by heavy leaching (a direct consequence of heavy rainfall) has made the soils extremely deficient in phosphates, nitrogen and potash and also in calcium, magnesium and other minor elements.

CHAPTER - IV

ECONOMY OF KERALA

CHAPTER - IV

ECONOMY OF KERALA

The economy of Kerala State is predominantly agrarian, but the basic characteristics of agriculture are quite different from other States of the country. This gives rise to a peculiar situation where inspite of being agriculture based the State is deficit in the production of foodgrains and has to resort to import of its foodgrain requirements.

Kerala occupies 1.18 percent of the total area of the country but accounts for 3.90 percent of the population according to 1971 census. Consequently, it has the highest density of population of 549 persons per sq. km. in the country. This is more than three times the average density of population of India (182 persons per sq. km.). Kerala had a rate of growth of population of 26.30 percent between the decade of 1961-71 whereas the rate of growth for India as a whole has been 24.80 percent.

The State's national income contributed 32.51 percent of the national income of the country in 1961 (Kerala Rs.43222 lakhs and All-India Rs. 13,294 crores in 1961) and 33.35 percent in 1971 (Kerala Rs. 62,402 lakhs and All-India Rs. 18,708 crores in 1971) at constant prices.

The per capita income in the State was Rs. 259 in 1961 and Rs. 297 in 1971 (at constant prices) as against All-India average of Rs. 306.3 in 1961 and Rs. 345.8 in 1971 (at constant prices).

GROWTH OF STATE INCOME :

TABLE - 4.1

Average annual rates of growth (compound) in the net Domestic Product of Kerala and India at 1960-61 prices for 11 years from 1960-61 to 1971-72

(Percentage)

	Sector	Kerala	India
1.	Primary Sector	0.05	1.64
2.	Secondary Sector	6.33	4.91
3.	Tertiary Sector	5.90	4.84
4.	Net Domestic Product	3.18	3.35
5.	Per capita net domestic product	0.82	1.07

Source : Economic Review of Kerala, 1973, p. 34

The net domestic product of Kerala at constant (1960-61) prices increased by 41 percent (from Rs. 444 crores to Rs. 626 crores) during the 11 years from 1960-61 to 1971-72, while the net domestic product of India (constant prices) increased by

44 percent (from Rs. 13,279 crores to Rs. 19,171 crores). Expressed in annual rates of growth (compound) these would correspond to 3.18 percent and 3.35 percent respectively. The All-India net domestic product both the aggregate and the per capita increased at a faster rate than those of Kerala.

SECTORAL CONTRIBUTION OF STATE INCOME :

TABLE - 4.2

Percentage shares of the different sectors in the net domestic product of Kerala and India at 1960-61 prices

	Sector	Kerala		India	
		1960-61	1971-72	1960-61	1971-72
1.	Primary Sector	55	39	51	42
2.	Secondary Sector	15	21	20	24
3.	Tertiary Sector	30	40	29	34
4.	Net Domestic Product	100	100	100	100

Source : Economic Review of Kerala, 1973, P 35

From the above table it is seen that there has been a substantial decline in the percentage share of primary sector during the 11 years from 1960-61 to 1971-72, both for Kerala and India. The share of both secondary and tertiary sectors

increased between these years. The increase in the tertiary sector has been higher than that in the secondary sector.

Both in the net domestic product of India and the state domestic product the primary sector has the largest share followed by the tertiary sector, the secondary sector getting only the third place. In the State domestic product the secondary sector does not get a share as large as it gets in the net national product. While the share of the secondary sector in the State domestic product is 21 percent at 1960-61 prices, in the net domestic product of India this sector's share is 24 percent at constant prices.

The sectoral share of national income can be seen in the table below.

TABLE - 4.3

Sectoral Share in State's National Income

	Agriculture	Manufacturing	Transport	Banking and Trade	Other Services
1961	53.42	12.45	13.35	3.64	11.80
1971 (Current)	51.52	10.18	16.31	3.45	12.24
1971(Constant)	47.80	14.24	15.87	3.69	12.64

Source : Economic Review of Kerala, 1972.

It is seen that at constant prices the share of agriculture has decreased whereas that of others increased but at current prices the share of agriculture, transport and other services increased whereas that of banking and trade and manufacturing decreased.

The following table shows the occupational distribution of Kerala in 1961 and 1971.

TABLE - 4.4

Occupational Structure of Kerala in 1961 and 1971

Name of Industry	1961 Census		1971 Census	
	No. of workers (in lakhs)	Percentage	No. of workers (in lakhs)	Percentage
1	2	3	4	5
1. Cultivators	11.78	20.92	11.07	17.81
2. Agricultural labourers	9.78	17.38	19.08	30.69
3. Livestock, Forestry, Fishing, Plantation and allied activities	4.87*	8.65*	4.35	7.00
4. Mining and quarrying			0.30	0.48
5. Manufacturing, Processing, Servicing and Repairs, (a) House hold industry	4.89	8.68	2.66	4.28

* In 1961 category 3 and 4 were together

1		2	3	4	5
	(b) Other than House-hold Industry	5.29	9.40	7.12	11.46
6.	Construction	0.71	1.26	1.07	1.72
7.	Trade and Commerce	3.22	5.72	5.65	9.09
8.	Transport, Storage and Communication	1.53	2.71	2.42	3.89
9.	Other Services	14.23	25.28	8.44	13.58
	Total	56.30	100.00	62.16	100.00

Source : Census of India, Kerala Part II-A, 1961 and 1971

Note : The figures of workers for 1971 and 1961 censuse are not comparable due to definitional change.

The conspicuous change noticed in 1971 compared with 1961 is that the number of agricultural labourers has gone up in 1971 and the number of workers under other services has considerably reduced. The number of cultivators have come down.

Of the other three primary activities, viz., livestock, forestry and fisheries, the former, that is, livestock is rather poorly developed.

Forestry and fishery are the two other sectors which hold an important place in the economy of Kerala. The forests in the state are rich in some of the valuable species like teak and

rosewood. The number of workers in these also has come down in 1971 from 1961.

The number of workers in Industry has also come down in 1971 from 1961.

INDUSTRY:

Traditional industries like cashew nut, coir, bricks and tiles and handlooms continued to dominate the industrial scene. As per 1971 census, 9.78 lakh persons or 15.74% of the total labour force are in the industrial work force. The factory industries account for only about 2 lakh workers engaged in industry or form 20.4 percent of it. Cashew and other food processing industries employ about 60 percent of the factory labour. Cashew industry alone provides employment for over a lakh of workers or 10.2 percent[1].

Major groups of industries in Kerala show a tendency to cluster around specific regions. Concentrations are the result of raw material orientation in some cases while alternative factors like economies of the skill or the availability of port facilities for export are responsible for concentration in case of other industries. The most predominant concentration is in the case of the cashewnut factories around Quilon. This concen-

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1. Economic Review of Kerala, 1972, pp. 12-13.

tration seems almost entirely due to external economies of development of skill in this region. Similarly, 150 out of 180 (1960-61) handloom factories are located in the northern Kerala, mainly because of the availability of skill. On the other hand raw material concentration is the reason for the clustering of a number of rice mills in the Palghat district, tiles and bricks in Trichur and Quilon and tea and rubber factories in Kottayam district. In case of coir factories, the factor responsible for their concentration in Alleppey is the export-oriented nature of coir goods. Prior to Cochin, Alleppey was the main port of this region and coir factories thus came to be localized around Alleppey.

Alwaye is the most important centre of large scale industry in the state. Some of the important industries of Kerala viz., Indian Aluminium Company, Fertilizers and Chemicals Travencore Ltd. (FACT), Travencore Cochin Chemicals (TCC), the Indian Rare Earths and the Rayon Factory are located in this area.

Kundara, in Quilon district, is another important industrial centre for large scale industry. Kallai, Asia's biggest timber yard is located in Calicut.

The weakness of the industrial structure of Kerala is it's widespread backward technology. Small scale and cottage industries sector which is usually characterized by a high

labour - capital ratio and low labour productivity, the factory sector in Kerala also has, on an average, a lower productivity per worker in India as a whole. The table below gives the comparative position.

TABLE - 4.5

Total Employment, Net Value added per Worker and Total net Value added in Kerala and All-India

(1955-56)

	Net Value added per workers (Rs.)	Total net value added (Rs. crores)	Total employment (Lakhs)
Kerala			
(i) Non-factory sector	413	32.3	7.8
(ii) Factory sector	1,059	18.0	1.71
All-India Factory sector	2,500	780.0	31.20

Source : Techno-Economic Survey of Kerala, 1962, pp. 140.

It is seen from the above table that the industrial sector of Kerala does not occupy a very impressive place.

There were 594 industries or mills in Kerala as on 31.3.1973, out of which 460 were small scale and 134 were large or medium scale.

AGRICULTURE:

A number of distinctive features characterizes the agricultural sector of Kerala. In the first place, Kerala surpasses all other states of India in respect of the pressure of population on land (Table 1.6). (The man-land ratio being 0.14 in Kerala as against 0.30 for India in 1971, the absolute density being 549 persons per sq. km. for Kerala as against 182 for All-India). Secondly, on account of the large number of cash crops, the agriculture sector is more commercialized in the state than elsewhere. Thirdly, foodgrain production has always been far short of Kerala's requirements (Table 1.8).

Area under foodgrains constitutes a small proportion (35 percent) of the gross cropped area whereas the area under other crops (food and non food) account for the main bulk of the gross cropped area (65 percent). No more than 32 percent of the cultivable area is given to rice. 'Other foodgrains and pulses' are produced in 2 percent of the cultivated area; 65 percent of the cropped area is thus used for the production of other crops against All-India average of 74 percent under foodgrains and 26 percent under other crops. Thus, here also lies the main reason behind the shortage of foodgrains in Kerala.

Kerala's food deficit comes to around 30 to 40 percent of her requirements. As against the persistent deficit in foodgrain

production in Kerala and the need for export, one may note the fact that Kerala earns for the country foreign exchange from the export of it's cash crops which amounted to Rs. 100 crores in 1967-68[2].

Cash crops (like spices, tea etc.) are either exported in a raw state or are subjugated to the most elementary processing in the factories which are labour intensive. The value added per worker employed in the secondary sector is below All India average (539 in Kerala as against 1294 of all India)[3*]. The value added per worker in the primary sector on the other hand is higher in Kerala than the All India average (625 in Kerala compared to the All India average of 411)*4

LAND USE PATTERN :

The following table gives the land use of Kerala for 1960-61 and 1973-74.

TABLE - 4.6

Land Use - 1960-61 and 1973-74

Classification	1960-61		1973-74	
	Actual	%age	Actual	%age
1	2	3	4	5
1. Total Geographical area	3858	100.0	3858	100.00

2. Namboodripad, E.M.S, "Kerala Yesterday - Today - Tomorrow", p. 4.

3. Ibid., p. 9

* Figures refer to 1969-70.

4. Ibid., p. 9

1		2	3	4	5
2.	Forests	1056	27.37	1047	27.13
3.	Land put to non-agricultural uses	205	5.31	286	7.41
4.	Barren and uncultivable land	151	3.91	66	1.71
5.	Permanent pastures and other grazing land	45	1.16	28	0.72
6.	Land under miscellaneous tree crops not included in net area sown	204	5.28	106	2.74
7.	Cultivable waste	144	3.73	74	1.91
8.	Fallow other than current fallow	62	1.60	22	0.57
9.	Current fallow	67	1.73	28	0.72
10.	Net Area Sown	1924	49.87	2202	57.07
11.	Area Sown more than once	425	-	798	-
12.	Gross Cropped Area	2349	-	3000	-
13.	Intensity of Cropping	-	122	-	136

From the above table it would be seen that the land under forests has gone down very marginally. The land under non - agricultural uses has substantially increased. All other categories of land uses viz., Barren and uncultivable land, permanent pastures, land under miscellaneous tree crops, cultivable

* Source :- Agricultural Statistics in Kerala, 1975; p. 11.

waste, fallow other than current and current fallow the proportion and the actual have decreased considerably. Net area sown has gone up from 49.87 percent in 1960-61 to 57.07 percent in 1973-74.

Gross cropped area has also gone up and so has area sown more than once. The intensity of cropping increased from 122 percent in 1960-61 to 136 percent in 1973-74.

The following table gives the proportion of cultivable land to uncultivable land.

TABLE - 4.7

Proportion of Cultivated Land to Cultivable Land in 1960-61 & 1973-74

(Area in Hectares)

State/District	1960-61 Cultivable area	1960-61 Cultivated area	1960-61 %age	1973-74 Cultivable area	1973-74 Cultivated area	1973-74 %age
Kerala	2,197,000	1,991,000	90.6	2,326,000	2,230,000	95.
Cannanore	317,643	249,976	78.7	346,091	320,950	92.
Kozhikode	376,335	335,769	89.2	370,503	340,318	91
Palghat	284,744	251,127	88.2	349,729	337,605	96
Trichur	140,516	130,616	93.0	143,654	140,306	98

1	2	3	4	5	6	7
Ernakulam	220,258	209,484	95.1	230,450	223,606	97.0
Kottayam	313,720	288,053	91.8	334,994	321,409	95.9
Alleppey	167,809	163,999	97.7	165,104	163,453	99.0
Quilon	219,760	211,552	96.3	232,894	230,078	98.8
Trivandrum	156,219	150,280	96.2	153,617	152,510	99.3

Source : For Columns 1,2,4 and 6, Agricultural Statistics in Kerala, 1975, p.11.

It is seen from the above table that in 1960-61 the cultivable area was 2197 thousand hectares (net area sown + cultivable waste + fallow other than current + current fallow) and cultivated area was 1991 thousand hectares (net area sown + current fallow), thus 90.6 percent of the cultivable area was cultivated. In 1973-74, the cultivable area was 2326 thousand hectares and cultivated area was 2230 thousand hectares, thus 95.8 percent of the cultivable area was cultivated. The All-India average for these two years was in 1960-61, 82.4 percent and in 1973-74, 87.2 percent.

Among the districts it is seen that in 1960-61 the highest is in Alleppey (97.7 percent) followed by Quilon (96.3 percent), Trivandrum (96.2 percent), Ernakulam (95.1 percent), Trichur (93.0 percent), Kottayam (91.8 percent), Kozhikode (89.2 percent)

Palghat (88.2 percent) and Cannanore (78.7 percent). The lowest being in Cannanore.

In 1973-74 the highest is in Trivandrum (99.3 percent) followed by Alleppey (99.0 percent), Quilon (98.8 percent), Trichur (98.4 percent), Ernakulam (97.0 percent), Palghat (96.5 percent), Kottayam (95.9 percent), Cannanore (92.7 percent) and Kozhikode (91.9 percent). The lowest is in Kozhikode.

In 1960-61 Palghat, Kozhikode and Cannanore were below the State average whereas in 1973-74 Palghat improved much more than the other two districts while Palghat came above the state average, these two still lagging behind.

Kerala was high above the All-India average in 1960-61 (Kerala 90.6, India 82.4) and in 1973-74 (Kerala 95.8, India 87.2)

Thus, in terms of land use, it is clear that not only is there no wastage of cultivable land, but the Kerala farmer seems to avail of almost the entire area of cultivable land in order to earn his livelihood.

Table 4.8 gives the availability of cultivable land and cultivated land in Kerala, in 1960-61 and 1973-74.

TABLE - 4.8

Availability of Cultivated and Cultivable land Per Agricultural Worker, 1960-61 & 1973-74

(Area in hectares)

State/District	1960-61		1973-74	
	Cultivable Land	Cultivated Land	Cultivable Land	Cultivated land
Kerala	0.92	0.86	0.71	0.66
Cannanore	1.20	0.95	0.85	0.78
Koshikode	1.56	1.39	0.74	0.68
Palghat	0.79	0.70	0.69	0.66
Trichur	0.81	0.75	0.45	0.44
Ernakulam	1.03	0.98	0.84	0.81
Kottayam	1.57	1.45	0.96	0.92
Alleppey	0.74	0.72	0.55	0.55
Quilon	0.76	0.73	0.68	0.67
Trivandrum	0.79	0.76	0.51	0.50

From the table it is seen that in Kerala 0.92 hectares of cultivable and and 0.86 hectares of cultivated land is available per agricultural worker in 1960-61. In 1973-74 it has decreased to 0.71 and 0.66 hectares respectively this is because with the increase in land the agricultural workers are also increasing.

In 1960-61, cultivable land per agricultural worker is highest in Kottayam (1.57 hectares) and so is the cultivated land (1.45 hectares). The lowest cultivable land per agricultural worker is in the district of Alleppey (0.74 hectares) and cultivated land is lowest in the district of Palghat (0.70 hectares).

In 1973-74, cultivable land per agricultural worker is highest in Kottayam (0.96 hectares) and lowest in Trichur (0.45 hectares) and in cultivated land per agricultural worker, the highest is in Kottayam (0.92 hectares) and lowest is in Trichur (0.44 hectares).

Cropping Pattern:

The attached table (4.9) gives the cropping pattern of Kerala in 1960-61 and 1973-74 by districts.

The total cropped area in 1960-61 was 2,348,860 hectares. Of this, the area under food crops was 1,565,060 hectares (66.63 percent). Considering the crops separately, rice covered 778,910 hectares (33.16 percent), coconut 500,780 hectares (21.31 percent) and tapioca 242,000 hectares (10.31 percent). The other major crops are pepper, cashewnut, arecanut, ginger, tea, rubber and cardamom.

The district-wise details of the crop pattern is also shown in the table.

TABLE - 4.9

CROPPING PATTERN IN KERALA AND DISTRICTS IN 1960-61 and 1973-74

(Area in Hectares)

Crops	Kerala		Cannanore		Kozhikode		Palghat		Trichur		Ernakulam		Kottayam		Alleppey		Quilon		Trivan-
	1960-61	1973-74	1960-61	1973-74	1960-61	1973-74	1960-61	1973-74	1960-61	1973-74	1960-61	1973-74	1960-61	1973-74	1960-61	1973-74	1960-61	1973-74	1960-61
Rice	778,910 (33.16)	874,680 (24.16)	95,698 (35.77)	98,065 (28.01)	108,115 (30.24)	137,763 (28.33)	192,108 (60.30)	201,616 (51.26)	102,197 (51.91)	109,197 (44.35)	77,894 (35.05)	89,247 (34.40)	39,247 (12.86)	44,077 (12.86)	79,389 (10.79)	92,039 (38.35)	46,143 (17.94)	51,189 (13.78)	37,417 (19.03)
Other Cereal Sand Millets	11,890 (0.50)	11,630 (0.30)	930 (0.34)	944 (0.36)	2,861 (0.80)	1,520 (0.31)	2,799 (0.87)	6,873 (1.74)	1,340 (0.68)	1,212 (0.34)	765 (0.48)	27 (0.01)	47 (0.01)	797 (0.19)	42 (0.01)	- (0.0)	395 (0.15)	459 (0.12)	22 (0.01)
Pulses	44,120 (1.87)	37,420 (1.24)	3,070 (1.14)	1,256 (0.35)	5,622 (1.57)	3,286 (0.67)	13,138 (4.12)	12,498 (3.17)	6,964 (3.53)	7,825 (3.15)	2,036 (0.91)	1,693 (0.65)	723 (0.23)	1,929 (0.47)	1,929 (0.49)	1,097 (0.22)	546 (2.64)	6,809 (2.00)	7,464 (1.35)
Total Food grains	834,920 (35.53)	923,730 (25.70)	99,698 (37.25)	100,265 (29.72)	116,598 (32.61)	142,569 (29.31)	142,569 (65.29)	220,987 (56.17)	110,501 (56.12)	118,951 (47.98)	80,695 (36.30)	90,967 (35.06)	40,735 (13.10)	46,803 (11.45)	80,528 (36.27)	92,585 (38.57)	53,347 (20.73)	59,112 (15.90)	40,101 (20.39)
Pepper	99,750 (4.24)	118,250 (3.94)	43,204 (10.15)	30,897 (8.82)	16,064 (4.49)	19,693 (4.05)	3,422 (1.07)	593 (0.15)	692 (0.35)	4,199 (1.69)	6,829 (3.07)	11,088 (4.27)	14,079 (4.53)	22,781 (5.43)	1,752 (0.78)	4,265 (1.77)	5,279 (2.05)	5,782 (1.55)	8,346 (4.24)
Ginger	12,000 (0.51)	12,040 (0.40)	468 (0.17)	431 (0.12)	4,401 (1.23)	4,934 (1.01)	1,932 (0.60)	1,278 (0.32)	80 (0.04)	80 (0.03)	11,167 (0.52)	1,020 (0.39)	3,641 (1.17)	4,141 (1.01)	617 (0.02)	- (0.00)	153 (0.05)	214 (0.05)	101 (0.05)
Arecanut	54,260 (2.31)	90,700 (3.02)	8,495 (3.17)	15,872 (4.53)	18,030 (5.04)	19,727 (4.05)	5,367 (1.68)	6,558 (1.66)	4,141 (2.10)	14,681 (5.92)	4,073 (1.83)	8,084 (3.11)	4,529 (1.45)	5,161 (1.26)	2,293 (1.03)	5,108 (1.12)	3,839 (1.49)	9,197 (2.47)	3,590 (1.82)
Cashewnut	54,320 (2.31)	103,160 (3.43)	6,574 (2.48)	43,611 (2.45)	10,401 (2.90)	16,924 (3.48)	3,250 (1.02)	11,818 (3.00)	8,883 (4.51)	6,794 (2.74)	6,508 (2.92)	4,362 (1.68)	2,251 (0.72)	2,884 (0.70)	2,952 (1.33)	3,617 (1.50)	8,913 (3.46)	8,692 (2.34)	4,587 (2.33)
Tapioca	242,000 (10.31)	306,450 (10.21)	7,081 (2.64)	7,711 (2.20)	18,994 (5.31)	29,396 (6.04)	3,351 (10.5)	17,451 (4.43)	7,632 (3.87)	8,345 (3.36)	17,732 (8.98)	12,669 (4.88)	44,231 (14.23)	40,894 (10.01)	28,217 (12.71)	19,124 (7.96)	58,050 (22.52)	94,745 (25.60)	56,918 (28.94
Other Food Crops	485,610 (11.42)	305,070 (15.28)	32,638 (18.21)	25,387 (6.20)	31,704 (6.91)	36,200 (7.47)	36,655 (11.54)	36,887 (9.42)	17,355 (8.85)	21,865 (8.86)	22,809 (10.30)	31,184 (12.05)	56,767 (18.30)	84,703 (21.24)	22,721 (10.28)	(25,909) (11.84)	31,575 (12.37)	49,734 (34.40)	19,963 (10.18
Total Food	1,565,060 (66.63)	1,859,400 (61.98)	198,158 (74.07)	224,174 (64.05)	216,192 (60.49)	269,443 (55.41)	262,022 (82.25)	295,572 (75.15)	149,284 (75.84)	174,911 (70.58)	189,813 (62.92)	159,374 (61.44)	166,233 (53.50)	207,367 (51.10)	138.524 (62.42)	150.608 (62.76)	161.156 (62.67)	222.477 (59.90)	133.606 Z(67.95)
Non Food Crops																			
Coconut	500,760 (21.31)	744,830 (24.83)	48,414 (18.09)	91,223 (26.06)	99,341 (27.78)	152,419 (31.34)	18,488 (5.80)	38,500 (9.78)	35,977 (18.27)	56,869 (22.94)	44,172 (19.88)	57,286 (22.08)	58,795 (18.92)	84,836 (20.78)	75,829 (34.17)	79,941 (33.31)	64,941 (25.16)	106,798 (28.75)	55,039 (27.99)
Other non Food Crops	283,040 (12.06)	435,450 (13.19)	20,942 (7.84)	34,641 (9.90)	41,865 (11.73)	64,365 (13.25)	38,036 (11.95)	59,194 (15.07)	11,581 (5.89)	16,021 (16.48)	38,205 (17.19)	42,714 (16.47)	85,659 (27.58)	114,406 (28.12)	7,549 (3.41)	9,416 (3.93)	31,245 (12.17)	42,132 (11.35)	7,965 (4.06)
Total Non Food crops	783,800 (33.37)	1,140,180 (38.02)	69,356 (25.93)	125,864 (35.96)	141,206 (39.51)	216,784 (44.59)	56,524 (17.75)	97,694 (24.85)	47,558 (24.16)	72,890 (29.42)	82,377 (37.07)	100,000 (38.55)	144,454 (46.50)	199,242 (48.90)	83,378 (37.58)	89,357 (37.24)	95,958 (37.33)	148,930 (40.10)	63,004 (32.05)
Total Cropped Area	2,348,860 (100.0)	2,999,580 (10.00)	267,514 (100.0)	350,038 (100.0)	357,498 (100.0)	486,226 (100.0)	318,546 (100.0)	393,267 (100.0)	196,842 (100.0)	247,801 (100.0)	222,190 (100.0)	259,374 (100.0)	310,687 (100.0)	408,209 (100.0)	221,902 (100.0)	239,965 (100.0)	257,114 (100.0)	371,407 (100.0)	196,610 (100.00)

Source :- Season and Crop Reports of Kerala, 1960-61 and 1973-74.

The pattern of crops shows a marked variation from district to district. The percentage area under food crops was around the State average (66.63 percent) in Trivandrum, Alleppey, Quilon and Ernakulam, the range being 60 percent to 68 percent. The proportion of area under food crops is least in Kottayam followed by Kozhikode, the percentage being 51 and 60 respectively. The districts of Trichur, Palghat and Cannanore have a comparatively high proportion of the cropped area under food crops; 76 percent, 82 percent and 74 percent respectively. The low percentage of area under food crops in Kottayam and Kozhikode are due to the predominance of cash crops in these two districts.

All the major crops except tea, coffee, rubber and cardamom are grown in every district of the State to varying extent. Tea, cardamom and rubber are mainly cultivated in Kottayam district (tea 26,894 hectares, 8.66 percent; cardamom 24,324 hectares, 7.83 percent and rubber 43,136 hectares, 13.88 percent) and coffee and rubber in Kozhikode (coffee 11,513 hectares, 3.22 percent and rubber 14,927 hectares, 4.18 percent).

In the districts seeing the percentage share of rice, it is around the State average (33.16 percent) in Alleppey (35.77 percent), Ernakulam (35.05 percent), Kpzhikode (30.24 percent) and Cannanore (35.77 percent). The proportion is least in Kottayam, Quilon and Trivandrum, the percentages being 12.86

17.94 and 19.03 respectively. The districts of Trichur and Palghat have comparatively a high proportion of area under rice, the percentages being 44.35 and 51.26 respectively.

The total cropped area in 1973-74 was 2,999,580 hectares. Of this, the area under food crops was 1,859,400 hectares (61.98 percent). Considering the crops separately, rice covered 874,680 hectares (24.16 percent), coconut 744,830 hectares (24.83 percent) and tapioca 306,450 hectares (10.21 percent).

The pattern of distribution of crops in the districts show a marked variation. The percentage area under food crops is around the State average (61.98 percent) in Trivandrum, Alleppey, Ernakulam and Cannanore, the range being 61 percent to 64 percent. The proportion of area under food crops is least in Kottayam followed by Kozhikode and Quilon, the percentages being 51.10, 55.41 and 59.90 respectively. The districts of Trichur and Palghat have a comparatively high proportion of the cropped area under food crops, the percentages being 70.58, and 75.15 respectively. The low percentages of area under food crops in Kottayam, Kozhikode and Quilon are due to the predominance of cash crops in these three districts.

All the major crops except tea, coffee, rubber and cardamom are grown in every districts of the State to varying extent. Tea, rubber and cardamom are mainly cultivated in Kottayam

district (tea 848 hectares, 0.21 percent, rubber 52,314 hectares, 12.82 percent and cardamom 34,474 hectares, 8.45 percent), coffee and rubber in Kozhikode district (coffee 23,138 hectares 4.76 percent and rubber 16,051 hectares, 3.30 percent) and coffee and rubber in Quilon district (coffee 275 hectares, 0.07 percent, rubber 32,380 hectares, 8.72 percent).

In the two districts considering the percentage area under rice it is around the State average (24.16 percent) in Kozhikode (28.33 percent) and Cannanore (28.0 percent). The proportion is slightly above the State average in Alleppey (38.35 percent) and Ernakulam (34.40 percent). The proportion is least in Quilon (13.78 percent), Trivandrum (16-27 percent) and Kottayam (10.79 percent). The districts of Trichur and Palghat have comparatively a high proportion of area under rice, the percentages being 44.35 and 51.26 respectively.

Looking at the tables 4.8 and 4.9 i.e. availability of land per agricultural worker and cropping pattern it is seen that area per worker is greater in districts where perennial crops especially plantation crops predominate, and is less in districts where the seasonal crops, particularly paddy predominate.

Productivity: The pattern of distribution of cultivated area per agricultural worker as between the mainly foodgrain

growing districts and those concentrating on non-foodgrains, more especially plantation crops, underlines the urgency of the need for increasing output of foodgrains to such an extent specially in foodgrains-oriented districts that the foodgrains shortage in the state specially in the plantation oriented districts is substantially reduced. And in view of the fact that almost all the cultivable land is already under plough, the only hope of enhancing output, apart from bringing under cultivation, the bulk of the rest of the uncultivated cultivable land, would seem to lie in raising yield per unit of land and per agricultural worker to a much higher level than those obtaining now.

TABLE 4.10

PRODUCTIVITY OF RICE

(Kg./hectare)

Country/State	1960-61	63-64	67-68	70-71	73-74
India	1,013	1,036	1,031	1,123	1,151
Kerala	1,371	1,403	1,375	1,484	1,534
State which has highest yield	1,414 (Tamil Nadu)	1,495 (Tamil Nadu)	1,854 (Mysore)	1,785 (Jammu & Kashmir)	2,289 (Punjab)

Source : Indian Agriculture in Brief 9th edition, 10th edition, 12th edition and 14th edition for the years 1963-64, 67-68, 70-71 and 73-74. For 60-61 it was estimated area, production and yield in India, 1954-55 to 1964-65.

From table 4.10 it is seen that the productivity in Kerala is quite high and in all the years it is more than the all-India average. The highest yield was incurred in the years of 1960-61 (Tamil Nadu), 1963-64 (Tamil Nadu), 1967-68 (Mysore), 1970-71 (Jammu & Kashmir) and 1973-74 (Punjab).

Increasing yield per unit of land and per agricultural worker could be done both by (1) a higher intensity of cropping that is increase in area sown more than once and (2) use of appropriate technological, organisational and institutional methods including modern inputs.

One of the aspects of our enquiry in the present study would be to find out the potentialities of Kerala's agriculture, whose utilisation would reduce the need for imports of foodgrains, by substantial increase in foodgrains output while continuing to produce increasing quantities of plantation crops by providing adequate foodgrains to those engaged in producing non-foodgrains and thoseemployed in processing and other industries, in whose expansion, food shortage (along with low purchasing power of the bulk of the farmers) acts as a constraint.

CHAPTER - V

CHOICE OF THE VARIABLES

CHAPTER - V

CHOICE OF THE VARIABLES

In the present study, an attempt has been made to explain the dependent variables and the independent variables. The agricultural growth rate which is the dependent variable here, has been computed by taking into consideration the production figures for serven crops, i.e., Rice, Tapioca, Cashewnut, Coconut, Pepper, Arecanut and Ginger. These seven crops cover 74.16 percent of the gross cropped area. Other crops could not be taken because the harvest prices of only these seven crops were available at State level, which has been taken here. Thus, the choice of the crops is mainly conditioned by the availability of relevant data.

Explained or the depedent variable:

GROWTH RATE OF PRODUCTION :

Production may be defined as the "efficiency with which resources are produced".

MEASURING PRODUCTION :

Growth rate can be arithmetic or geometric. The arithmetic (or simple) growth rate can be expressed in absolute terms or in percentage terms, while the geometric or compound growth rate is generally expressed in percentage terms.

In recent years attempts have been made to analyse the trends in agricultural production to measure the relative contributions of various factors to the growth of agricultural production. Research workers have employed two approaches to explain the growth rate in agriculture. Some have explained the growth of agricultural production in terms of the relative contributions of the following three components, viz., (i) Area, (ii) Yield per acre, and (iii) Cropping pattern. Minhas and Vaidyanathan were the pioneers in this approach[1], to Raj Krishna's study of agricultural growth in Punjab[2]. Some researchers have adopted the production function approach to estimate the contributions of important factors like area, irrigation, fertilizers and technology to agricultural production. Ashok Parikh (1960)[3] using both

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1. Minhas and Vaidyanathan, A., "Growth of Crop Output in India : 1951-54 to 1958-61, An analysis of component Elements, "Reading in Indian Agricultural development", ed. by Pramit Chaudhuri, from Journal of the Indian Society of Agricultural Statistics, Vol. XVII, No. 2, 1965, pp. 230 - 252.

2. Rajkrishana, "Growth of Aggregate Output in the Punjab", Indian Economic Journal, Vol. XII, No. 1, July-September 1964, pp. 52 - 59.

3. Ashok Parikh, "Statewise Growth Rate in Agricultural Output - An Econometric Analysis, Artha-Vijnana, Vol. 8, No. 1, March 1966, pp.1-52.

the approaches, namely, the decomposition of growth rate by components and the production function approach analysed the trends in agricultural production in important states. In addition, a number of research workers have examined the trends in agricultural production for various periods of time employing either of the approaches, outlined above[4].

Many of the studies referred, relate to the recent post planning period for which comprehensive crop production data are readily available. Such studies were inspired by the rapid increase in agricultural production resulting from several development measures undertaken during the planning period. However, research in factor accounting for the growth of agricultural production or lack of it covering a much longer period, including the pre-planning years, is rather very less. No effort has been made except by Raj Krishna for Punjab to measure the relative contributions of either the components or the factors to the growth of agricultural production in India and its regions covering a long period. Shetty[5] has analysed the trends in agricultural production and its components covering the period 1920 - 21 to

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4. Blyn, G., "Agricultural Trends in India, 1891 to 1946 : Output, Availability and Production, University of Pennsylvania Press, Philadelphia, U.S.A., 1966

5. Shetty, "Indian Pioneer of Agricultural Economics, IJAE Vol. XXV, No. 2, April - June 1970, pp. 46.

1964-65[6].

Measuring productivity, is very easy, if it is to be measured for a single crop or a group of crops which has the same unit of measurement. But, the agricultural production of an area cannot easily be measured, because of the following reasons:

(a) the range and variety of crops being grown,

(b) the importance of crops varies with the reference to hectarage due to various reasons.

To overcome these difficulties in measuring the production, various methods have been attempted. They being :

(a) Index Method

(b) Standard Nutrition Unit (SNU)

(c) Ranking Method, and

(d) Value of Production

E. Huntington and Samuel V. Valkanburg (1935) first tried the index method and built up index values[7], taking the yield per acre of each crop for Europe as a whole as 100 and calcu-

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6. Shetty has made an attempt to find out if the trends derived from the annawari estimates are significantly different from the trends in the crop cutting estimates. He relied on data for nine important crops of the Maharashtra 1945-56 to 1963-64. He compared the annawari and crop cutting yield series of these crops.

7. Stamp, L.D., "Our Developing World", (1960), pp. 105 - 107.

lating the yield in each country accordingly. Many modifications are attempted for this method[8].

M.G. Kendall (1939) employed the ranking method[9]. The areas are ranked in order of the output for each of the selected crops. The highest value being given the lowest rank i.e., 1 and the lowest value being given the highest rank i.e., which stands for the number of observations. Then, the ranks i.e., the places occupied in each region in respect of the selected crops, are averaged to obtain ranking co-efficient of each region. L.D. Stamp[10] (1960) and M. Shafi (1960)[11] tried Kendall's method. S.G. Sapre and V.D. Deshpande[12](1964) modified this method, by taking a weighted average of the ranks.

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8. Tambod, S.B., "Spatial and Temporal Variations in Agricultural Productivity in Mysore State" Indian Journal of Agricultural Economics, Vol. XX, No. 4, 1965, pp. 35-39; S.S.Bhatia, A new measure of agricultural efficiency in U.P., Research paper Dept. of Human Geography University of Delhi, 1965; and J.G. Anand "Measurement of the actually realised Agricultural Productivities per acre and per worker in the different crop regions of India," Journal of Indian Society of Agricultural Statistics", Vol. XVII, No. 2, 1965, pp. 257.

9. Stamp, L.D., op. cit., pp. 105 - 107.

10. Stamp, L.D., op. cit., pp. 108

11. Shafi, M., "Measurement of Agricultural Efficiency in U.P.", Economic Geography, Vol. 36, No. 4, (1960), pp. 296 - 305.

12. Sapre, S.G and Deshpande, V.D., "Inter-District Variations in agricultural efficiency in Maharashtra state", Indian Journal of Agricultural Economics, Vol. XIX, No. 1 (1964), pp. 242 - 252.

M.G. Kendall devised another method[13] by which the production is measured in terms of starch equivalent or energy. The conversion of production into Nutrition calorie facilities that one can compare directly, say, a wheat diet with the rice diet or a mixed diet of almost any source[14]. L.D. Stamp[15] (1958) and M. Shafi[16] (1967) tried this method elaborately.

But, the most preferred method is the value of output method. In this method, output is expressed in money terms. By this method, the aggregation of output of different crops which is a major problem can be easily overcome. In fact, price is the best among the common units to express the output for the agricultural sector as a whole[17].

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13. Stamp, L.D., op. cit., pp. 108

14. Ibid., pp. 108

15. Stamp, L.D., "The Measurement of Land Resources", Geographic Review, Vol. XLVII, (1958), pp. 1 - 15.

16. Shafi, M., "Measurement of Food Production Efficiency and Nutrition in India", The Geographer, Vol. XIV, (1967), pp. 23 - 27.

17. Sharma, J.S., "Measurement of Agricultural Productivity - Concepts, Definitions, etc. Journal of the Indian Society of Agricultural Statistics, Vol. XVII, No. 2 (1965) pp. 253.

The method and procedure of computing agricultural production in money is stated below :

The 1960-61 farm harvest prices at the State level have been taken from the "Agricultural Statistics of Kerala", issued by the Bureau of Economics and Statistics in 1975. Taking 1960-61 price as constant agricultural production in money value for 1963-64, 1967-68, 1970-71 and 1973-74 have been computed. This method facilitates to find the growth rate considering all the five points of time.

The agricultural growth rate of a district has been worked out as follows :

(a) Index number for the physical production was found, taking 1960-61 as the base year

(b) Value of output or the weight (physical production X farm harvest price) for each crop in a district was worked out

(c) (I) The index number of crop Xi is multiplied with its weight Wi. This is done for all the crops

(II) On the other hand the weights of all the crops are added. To get the index number of all crop output I is divided by II.

(d) For these index numbers of all crop output their respective logarithms were found. This procedure has been repeated for each district for the five points of time. Then with the help of these log values the estimated compound growth rates have been found out.[18]

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18. R.G.D. Allen, op. cit.,

EXPLANATORY OR THE INDEPENDENT VARIABLES:

The growth of crops is primarily a function of mutual interaction between man and environment. The environment influences through the variations in relief, soil and climatic parameters. The human effort for the growth of crop is limited by the constraints of institutional and level of technology. These three factors interact between themselves and together affect agricultural production and make variations in time and space. Thus, the regional differences in agricultural production is the result of the interaction of these three factors.

Each element affects growth of crop in it's own way. The form of crops is influenced by the pattern of land use and by the physical conditions particularly by ruggedness of slope, high mountains, variation in rainfall etc.. Soil also is important as it sets the stage for the plant growth[19]. Climatic factors especially temperature and rainfall affect the crop growth with their variations in space. So it can be said that environmental factor, (soil and rainfall) is the most crucial one in the growth of crops[20].

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19. Shona, P.V., "Agricultural Development in India— A New Strategy on Management", pp. 153.

20. "Soil of India", F.A.I., ed. by T.M. Alexander, pp. 144.

Technology can be defined in a broad sense as, "a technology is the employed, or operative knowledge of means of production of a particular group of goods or services. A change in technology is affected by means of additions to the sets of inputs employed in production"[21]. The technology that comes in agriculture are farm machineries, pesticides, high yielding seeds, fertilizers, irrigation, credit, insecticides and marketing facilities. But, out of all these the basic inputs are irrigation, fertilizers and high yielding seeds. But, out of these three basic inputs, only the second one has been taken here i.e. the fertilizers, as the data for irrigation and the pattern of consumption of high yielding seeds were not available. Mechanisation has also been taken as the latest innovation augmented for the agricultural production and these include agricultural machineries and implements. The indicators that have been taken to see the process of mechanisation of agriculture are tractors, oil engines, electric pumps, plough (iron) and sugarcane crushers (power). The intensity of cropping has also been considered here : Intensity of cropping is the ratio between gross cropped area and the net area sown which shows the degree to which a given piece of land is cultivated[22].

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21. Montague Yudelman, et al, "Technological change in Agriculture and Employment in developing countries," (1971), pp. 36 - 37.

22. N.C.A.E.R., Techno Economic Survey of Kerala, pp. 10.

An increase or decrease in production is also an increase or decrease or production per man hour in the agricultural sector which in turn depends on the institutional factors. The technological factor may even fail if the cultivators do not use it whereas the recent diffusion studies have established the importance of institutional factors. The social background of a farmer, the prevailing socio-economic conditions, caste-tribe affiliation, and educational level affect his performance in the growth of agricultural production. But, as the necessary data for all the institutional factors were not available, the present study limits itself with the population of scheduled castes, scheduled tribes, agricultural labourers and literate persons to represent the institutional factors. Agricultural labour force is important both from the points of economic and institutional factors. As labour demand in agricultural sectoris supplied by it which is economically important because it may be directly, related with the agricultural production. On the other hand, as the agricultural labourers are generally either land less or they have uneconomic size of holdings, they become important, from the institutional point of view. The larger proportion of agricultural labourers in an area is a constraint for the agricultural development of that area. The proportion of rural scheduled castes, scheduled tribes to rural population may be treated as an index of the level of social deprivation operating as an institutional institutional constraint on the effective exploitation of

agricultural resource base.[23]

Thus, the explanatory or the independent variables chosen in the present study to explain the variations in agricultural growth rate of production include variability of rainfall, soil rating index, fertilizers use, level of mechanisation, intensity of cropping, rural literacy rate, the proportion of rural scheduled castes and scheduled tribes to rural population and the proportion of agricultural labourers to agricultural workers.

ENVIRONMENTAL FACTORS:

SOIL RATING INDEX :

The quantities and proportions of the factors of growth present in the soil are expressed as the fertility of the soil[24]

Soil fertility is an extremely complex property, as it results from physical and chemical conditions of the soil[25]. So, it varies widely in space. Its' measurement in quantitative terms is difficult. However, a soil productivity rating method has been evolved which although a fairly satisfacting method, is not a perfect one.

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23. Desai, A.R., Rural Sociology of India, (1969), p. 40.

24. Viswanathan, A.R., "Soil Fertility and their Properties", (1954), pp. 39.

25. ibid, pp. 40.

R. Earl. Storie (1950) of the California agricultural experimental station developed a soil rating index. His rating index is known as Storie index which is derived from the multiplication of four factors. A X B X C X D where these factors are based on soil characteristics viz.,

Factor A - Soil profile - (a) Depth of the soil
(b) Permeability

Factor B - Texture of the soil

Factor C - Slope

Factor D - Miscellaneous, i.e., factors that can be modified by management.

The important factors that govern the production of the soil are the soil texture, temperature, rainfall, soil management, drainage, salinity, or alkalinity and nutrient status. The soil productivity rating is defined as the capacity of the soil to produce crops[26].

The rating index done by Storie is independent of other physical and economic factors that determine the desirability of growing certain plants in a given location[27].

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26. Shome, K.B and Ray Chaudhary, S.P., "Rating of Soil of India" - Proceedings of national institute of sciences of India, Vol. 26(2) (Supplement 1), 1960

27. Ibid., pp. 201.

K.B. Shome and S.P. Ray Chaudhuri[28] (1965) calculated the soil rating index at the district level for all-India based on Storie's method. This soil rating index at the district level has been used here as an explanatory variable. But, they have attempted to evaluate soil index rating of Indian soils using only three factors :

Factor A - Character of the soil profile

Factor B - Topography, texture and structure

Factor C - (i) Degree of climatic stability

(ii) Salinity

(iii) Stoniness, and

(iv) Tendency to erode

Each of these factors is evaluated on the basis of 100% for the most favourable conditions. The soil rating index is obtained by the product of the factors A, B and C and final rating index is expressed in percentages.

The hypothesis in this study is that the higher the soil rating index the higher is the growth rate of agricultural production.

RAINFALL:

Seasonal variations in the production rate depnds to a great extent on weather factors especially on rainfall. Rain-

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28. Ibid., pp. 201.

fall is very important in a country like India whose agriculture mainly depends on the monsoons and also 75% of the cropped area is unirrigated, though in case of Kerala 21.25% (73 - 74) of the gross cropped area is irrigated.

The influence of rain on output cannot easily be quantified, because firstly, rain affects crop-growth at all phases. Secondly, the total amount of rainfall and its variability are very important characteristics of rainfall. It is the distribution rather than total amount in a season that affects the production. That is why it is seen that production is sometimes high in an year of low rainfall and vice-versa[29]. The influence of rainfall differs from crop to crop. The quantification of rainfall and allowances to be made in the rainfall data are difficult. The recorded average rainfall as such cannot be used as a measure, as a portion of it is lost through run-off, drainage and evaporation[30].

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29. Ralph W. Cummings, Jr. and Ray, S.K., "1968-1969 Foodgrain Production : Relative Contribution of the weather and new technology," E.P.W. (Sept., 1969), pp. 163.

30. Ralph W. Cummings, Jr. & S.K. Ray, op. cit., p. A-174.

Various methods have been evolved to relate rainfall with yield[31]. Whereas it is very difficult to have a perfect method of finding the relationship between rainfall and production. For this purpose the total amount of rainfall of a district in the five points of time were taken and co-efficient of variation of the total rainfall have been found out. This has been named as the variability of rainfall (in percentages) which has been taken as an explanatory variable. The hypothesis here is that wherever the variability of rainfall is high there the agricultural production is low and vice-versa.

TECHNOLOGICAL FACTORS :

MECHANISATION :

Mechanisation in its broad sense, can be defined as the use of improved types of hand tools, animal driven implements and power driven equipments[32]. It is not a direct input but is instrumental in raising the yields.

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31. Sapru, S.G., and Deshpande, D., "Inter-district variations in Agricultural efficiency in Maharashtra State", I.J.A.E., Vol. XIX, No. 1 (1964) pp. 252; Ram Dayal, "Impact of Rainfall on crop yield and acerage" IJAE, Vol. XX, No. 3 (1965), pp. 49; Ralph W. Cummings, Jr. and S.K. Ray, op. cit., pp.167, and A. Ahmad and Aslam Mahmood "Determination of critical drought limits to crop production in the Indian Desert", Mimeograph, 1972.

32. Indian Journal of Agricultural Economics, Seminar on "Problems of Farm Mechanisation", (1972), pp. 3.

As agriculture is a biological process, weather conditions and timeliness of operations are important for the growth of crop in such a situation mechanisation decreases weather risk and increases production[33]. Mechanisation influences the cropping pattern and increases the intensity of cropping both together increase land and labour productivity[34].

The present study considers oil engines, electrical pumpsets, tractors, ploughs (iron) and power driven sugarcane crushers to represent the Mechanisation. These five mechineries are put together and expressed in an index, called mechanisation index. The mechanisation index is worked out by division by mean method[35] which is as follows :

The absolute data of these mechaneries were first standardised by working out their availability per 1000 hectares of cultivated area. Then, the proportion of the standardised value to the mean per each machinery was found out. Mechani-

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33. Theodar Bergmami, "Problems of Mechanisation in Indian Agriculture", (1962 - 63), pp. 20.

34. Banerjee, C., "Mechanisation, Cropping Pattern and Cropping Intensity in West Bengal", (1953) pp. 29.

35. Kundu, A., "Construction of Indices of Regionalisation: An enquiry into methods of Analysis", Geographical Review of India, Vol. 37, No. 1, (1975), pp. 23.

sation index of a district was calculated by adding this proportion of five types of machineries available in the district.

The index thus developed suffers from the following limitations :

(a) There may be a double counting between the availability of water-lifting devices and the percentage or irrigated area;

(b) number of tractors may not be much, so it may be doubtful to find a marked influence over the productivity, when the study is on a macro level; and

(c) many other mechanical implements like tillers, reapers, sprayers and threshers which are also widely being used are not included in the formulation of index, as no data is available.

The hypothesis here is that - there is a positive relationship between the growth rate of the index of mechanisation and growth rate of agricultural production or in other words wherever growth rate of the index of mechanisation is high, the rate of production also tends to be high.

FERTILIZERS:

Soil acts as a source of plant nutrients. The nutrients are prone to be exhausted due to cultivation. Even for fertile

soils it is not possible to supply the plant nutrients in sufficient quantity[36]. For an optimum growth of crop it is necessary that an optimum condition of essential nutrients must be present in the soil during the cultivation. Thus, the depleted soil here is to be replenished with nutrients, otherwise the productivity of the soil will decline.

The fertility of the soil is maintained by the use of organic and inorganic manures. Organic manures are not available abundantly. So inorganic manures, popularly known as fertilizers, including nitrogen (N), phosphatic (P) and potassic (K) elements or their mixture (NPK) are used. The use of fertilizers is regarded as one of the quickest ways of increasing production of crops[37].

In the present study, fertilizer supply has been calculated for the cropped area and so the variable taken here is the fertilizer consumption per 1000 hectares of gross cropped area of a particular district.

After doing all these with 1960-61 as the base the growth rate of fertilizer (NPK) was found.

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36. Department of Agriculture, Government of Tamil Nadu, Report of the Committee on Agricultural Production, (1966), pp. 125.

37. Singh, D., and Rahaja, S.K., and Bapat, S.R., "Returns from Fertilizers on Farmers Yields", IJAE Vol XXV, No. 4 (1970), pp. 29.

Thus the hypothesis here is that there is a positive and a direct relationship between the growth rate of fertilizer and growth rate of production.

INTENSITY OF CROPPING :

Intensity of cropping is a ratio between gross cropped area and net area sown. It shows the extent of the utilization of a piece of land.

Thus, here, the intensity of cropping has been worked out for five years and with 1960-61 as the base the growth rate has been found.

The hypothesis here is that there is a positive relationship between growth rate of cropping intensity and growth rate of agricultural production.

INSTITUTIONAL FACTORS :

Proportion of rural scheduled castes and scheduled tribes to rural population

In the Indian villages still caste plays an important role. Caste differences determines the differences in modes of domestic and social life, types of houses and cultural patterns, and the occupational characteristics of the people[38].

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38. Desai, A.R., op. cit., (1969), pp. 38.

This social stratification based on caste influences the agricultural development to a great extent. Scheduled castes are those communities which have suffered from untouchability and scheduled tribes are those who live in isolated areas[39]. The untouchability is very severe in Kerala. As 1931 Census[40] notes, that "It is they who furnish the backbone of agricultural labour", the main occupation of scheduled castes and scheduled tribes is agriculture. But are socially backward though they play an important role in the agricultural activities.

Scheduled castes and scheduled tribes, who are basically poor, may not risk in adopting the new innovations and so tend to be more tradition oriented.

The proportion of rural scheduled castes and tribes were computed for all the five years and with 1960-61 as the base the growth rate was found.

With these in mind it is hypothesised that the area where the growth rate of scheduled castes and scheduled tribes is high, the growth rate of production would be low and the vice-versa.

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39. Census of India, Scheduled Castes and Tribes (Report and Tables), Vol. IX, Kerala, Part V -A(1) (1969), pp. 1.

40. Ibid., pp. 7.

Proportion of Agricultural labourers to Agricultural workers :

Land and labour are the main inputs of traditional agriculture. Labour is the primary instrument for increasing production within the framework of traditional agriculture. Even in modern times labour is quite important wherever the holding size is small and mechanisation is not economical[41]. If the labour force is not available at the required time the level of agriculture may be adversely affected.

In the present study agricultural labourers have been taken as a proportion to agricultural workers which is being done for all the five years and with 1960-61 as the base the growth rate of agricultural labourers was found.

Here it is hypothesised that there is a positive or direct relationship between growth rate of this variable and growth rate of production.

Proportion of rural literate persons to rural population

This variable has been taken due to a very high percentage of rural literacy in Kerala. It was 64.49 percent in 1973-74 as against 59.72 percent in 1970-71. Thus, it is

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41. Sharma, P.S., "Patterns of Land Concentration and Elasticity of per acre composite crop elasticity", 1965, pp. 330.

usually the notion that people who are educated would understand and would easily differentiate between the better and ordinary thing. As it is usually very difficult to convince the farmer to use new seeds or new machinery or new fertilizer an educated person would easily understand it better and fast.

Thus, here the growth rate was found for the proportion of rural educated persons to rural population.

But, in an underdeveloped country like India where literacy has very less impact on the social behaviour and order, literacy does not affect production. But, as Kerala has a high literacy rate it would be interesting to see the picture here.

Growth of Production due to Area and Yield :

The supreme position of agriculture from the point of view of its share in production, consumption, exports and employment remain as the hard core of Economic Planning in the country[42]. A depressed agriculture may retard the pace of industrialisation, thus geopardising the growth of economy as a whole. An increase in production which is a necessary concommitent of agricultural development is possible only in two

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42. Bajiva, M.A., "Agriculture in Pakistan", CENTO Seminar on Agricultural Planning, pp. 41.

ways :

(a) The traditional method of increasing production in an economy is to bring virgin lands under the plough. The production may also be increased by multiple cropping method which is possible only by making new inputs in the form of irrigation and fertilizers. In India, however, an increase in area is very difficult as 85% of the land is already under cultivation (the corresponding value for Kerala being 99.27% according to 1973-74 statistics). Over and above it, some very fertile and productive land is lost every year to the non-farm uses. This is very much true for Kerala where the food-crops occupy 62% (1973-74) and non food-crops 38% (1973-74) respectively. Above all the area under foodgrains occupies only 31% of the gross cropped area (according to 1973-74 statistics). During the 15 years period - 1950-51 to 1965-66, about 3 million hectares of land are estimated to have gone out of cultivation.[43]

(b) Another method to raise the production is to increase the yield per hectare. This is the best alternative now available in India as not much extension of agriculture is possible due to the reasons stated above. Higher rate of

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43. Ranganathan, C.R., Fertilizers, (1972), pp. 3 - 5.

productivity is essential in agriculture for the growth of output in agriculture[44]. But, what happens to yields depends on the technological relations between inputs and outputs and the quantum of various inputs (including fertilizer, water, seeds and labour) used.

Thus, simply to see what affects the growth of production, area, yield, cropping pattern and the interaction between the latter two elements a simple method used by B.S. Minhas and A. Vaidyanathan[45] for their paper on growth of crop output in India, 1951-54 to 1958-61 is made use of for the present study. The method being widely known as Decomposition method.

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44. Yufino Hayami and Ruttan, V.W., "Agricultural Productivity differences among countries", The American Economic Review, Vol LX, No.5, 1970, pp. 895 - 900.

45. Minhas, B.S., and Vaidyanathan, A., "Growth of Crop Output in India, 1951-4 to 1958-61", Journal of the Indian Society of Agricultural Statistics, Vol. XVII, No. 2, 1965.

CHAPTER - VI

SPATIAL DISTRIBUTION OF THE VARIABLES

CHAPTER - VI

SPATIAL DISTRIBUTION OF THE VARIABLES

The present study aims at explaining the inter-district variations in the agricultural growth rate (dependent-variable) in Kerala with the help of eight explanatory variables or independent variables. They are :

Environmental:

(i) Soil rating Index and

(ii) Variability of rainfall

Technological:

(i) Growth rate of Fertilizers use per 1000 hectares of gross cropped area

(ii) Growth rate of Mechanisation Index

(iii) Growth rate of Intensity of cropping

Institutional:

(i) Growth rate of proportion of agricultural labourers to agricultural workers

(ii) Growth rate of the rural scheduled castes and tribes to rural population

(iii) Growth rate of Rural Literacy

Besides the environmental factors viz., relief, soil, rainfall and natural vegetation, others like the institutional and technological factors are also equally important from the

point of view of their spatial distribution and impact on the growth rate of agricultural production. This study aims at finding out the spatial pattern and interaction between these factors and see how these have induced or impeded the growth rate of agricultural production. The distribution of these aspects in space and their behaviour within the regional framework figured by the environmental factors has been taken care of. All these aspects are studied separately as they reveal the areal extent of the region and contribute sufficiently to the analysis of the region, as the ultimate goal is to develop the economy (growth of agricultural production being a major part of it) which rests on the overall development and the living conditions of the people. So the spatial distribution of these variables has been dealt with greater emphasis taking the growth rate of the variables for the peak periods (1960-61, 1963-64, 1967-68, 1970-71 and 1973-74) falling between 1960-61 to 1973-74.

The dependent or the explained variable, i.e., "growth rate of agricultural production", is dealt first. The independent or the explanatory variables are then taken one by one, i.e., environmental, technological and institutional.

The dependent or the explained variable :

Growth rate of Agricultural Production:

In a developing country like India, where agriculture

contributes more than 50 percent of the national income, greate emphasis has been laid on agricultural development and to make it self-sufficient in the agricultural production, to meet the demands of the huge population. Kerala being an agricultural State, where more than 48 percent of the total population are absorbed in this sector of economy, it cannot be over-ruled from that of the problem faced by the country as a whole.

As against a density of population of 549 persons per sq. km. (1971) and a population growth rate of 26.30 percent (between the decade of 1961-71), the growth in agricultural production has been only 4.7 percent (between 1960-61 to 1973-74). It is one of the most densely populated States in India with 57.79 percent of land being put to agricultural uses in 1971 as against 51.60 percent in 1961. Compared to the rate of growth of population (26.30 percent) this growth rate of area under agricultural uses (12.00 percent) is quite low.

TABLE - 6.1

Growth Rate of Agricultural Production

(in %ages)

State/District	Growth rate of agricultural production
1	2
Kerala	4.7
Cannanore	4.2

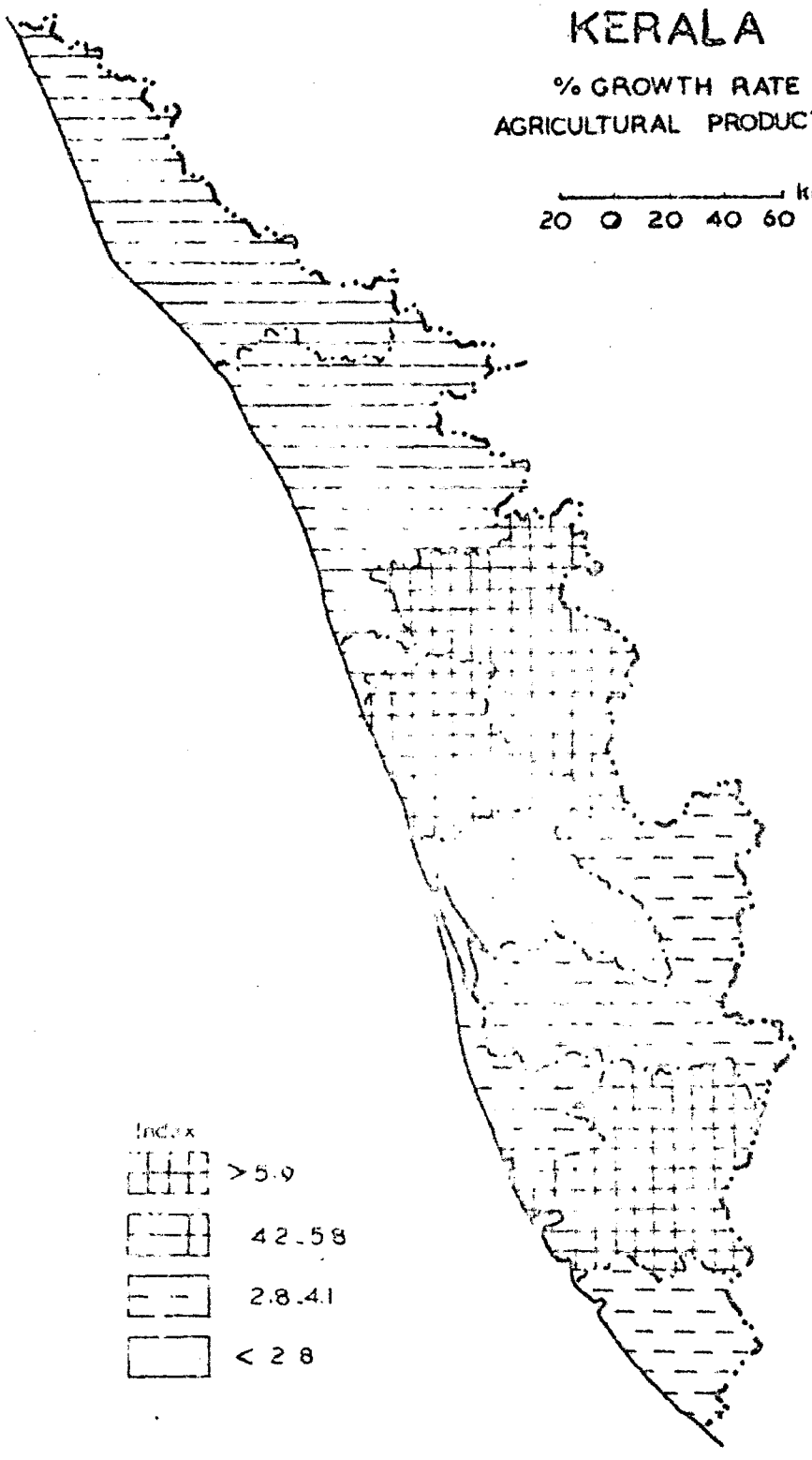
KERALA
% GROWTH RATE OF
AGRICULTURAL PRODUCTION
kms.
20 0 20 40 60
Index
> 5.9
4.2-5.8
2.8-4.1
< 2.8

Fig 10

1	2
Kozhikode	4.2
Palghat	7.9
Trichur	5.9
Ernakulam	2.3
Kottayam	3.1
Alleppey	2.8
Quilon	8.9
Trivandrum	2.9

Coming to the inter-district variations in the growth rate of agricultural production (Table 6.1) Quilon has experienced the higest rate of growth (8.9 percent), followed by Palghat (7.9 percent), Trichur (5.9 percent), Cannanore and Kozhikode with 4.2 percent each and the lowest rate of growth was found in Ernakulam (2.3 percent) (Fig. 10). Quilon and Palghat came out to be so prominent because of the more application of fertilizers, better soil rating index, less variability of rainfall. Literacy also plays an important role in the growth of agricultural production. Other variable which affects the production in Kerala and in case of Quilon, Palghat and

Trichur in particular is due to more area which has been brought under cultivation.

Environmental Factors :

Soil Rating Index :

The measurement of soil fertility in quantitative terms is difficult. This aspect has been widely discussed in chapter V. The index that has been taken here as a variable is that computed by K.B. Shome and S.P. Ray Chaudhuri[1] (1965). They had computed it at the district level for all-India, based on Storie's method. They have evaluated the soil rating index of Indian soils using only three factors : (a) character of the soil profile; (b) Topography, texture and structure and (c) degree of climatic stability, salinity, stoniness and tendency to be eroded. The soil rating index is obtained by the product of factors A, B and C and final rating index is expressed in percentages.

TABLE - 6.2

SOIL RATING INDEX

(in %ages)

State/District	Soil Rating Index
1	2
Kerala	56.00

1. K.B. Shome and S.P. Ray Chaudhuri, op. cit.,

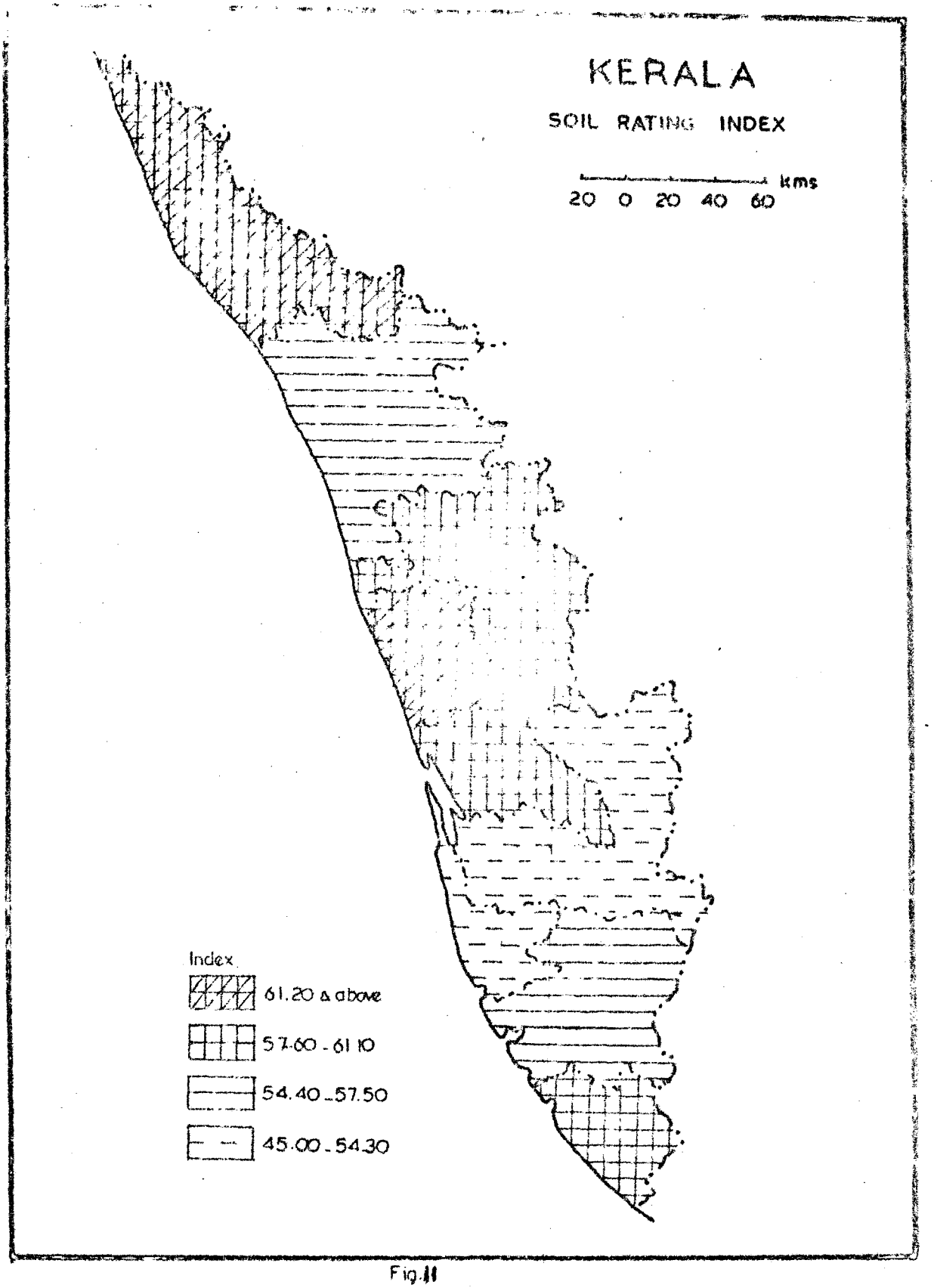
KERALA
SOIL RATING INDEX
kms
20 0 20 40 60
Index
61.20 & above
57.60 - 61.10
54.40 - 57.50
45.00 - 54.30

Fig. 11

1	2
Cannanore	65.00
Kozhikode	54.40
Palghat	57.60
Trichur	61.20
Ernakulam	57.60
Kottayam	51.00
Alleppey	45.00
Quilon	54.40
Trivandrum	57.80

The figure 11 shows the "Soil Rating Index" for Kerala and districts (Table 6.2). Kerala has an index of 56 percent. The highest rating is in Cannanore (65 percent) followed by Trichur (61.20 percent), Trivandrum (57.80 percent), Ernakulam and Palghat 57.60 percent each, Kozhikode and Quilon 54.40 percent each, Kottayam (51 percent) and Alleppey (45 percent).

The above percentages show the soil rating of the particular area. Here we have hypothesised that higher the soil rating index, higher is the growth rate of agricultural production.

Variability of Rainfall:

This factor is inversely related to the reliability of rainfall. In other words, wherever reliability is more, there the variability is less. Kerala comes under high rainfall regions of India (above 1150 mms)[2]. But, the area irrigated in Kerala was 20.5 percent in 1970-71 as against an all-India average of 23.0 percent. Around 60 percent of the area under paddy was irrigated in 1973-74 (Table 3.4). This shows the importance of irrigation. The rainfall in Kerala is not evenly distributed throughout the year. The south west monsoon brings the largest amount of rainfall (June, July, August and September are the wettest months) whereas the winter months (January, February and March have little rains) are the driest. Irrigation is the main source for water during these three months.

TABLE - 6.3

Variability of Rainfall

(in %ages)

State/District	Variability of rainfall
Kerala	23.20
Cannanore	18.17

2. Indian Agriculture in Brief, 1974, Thirteenth Edition, pp. 26 - 27.

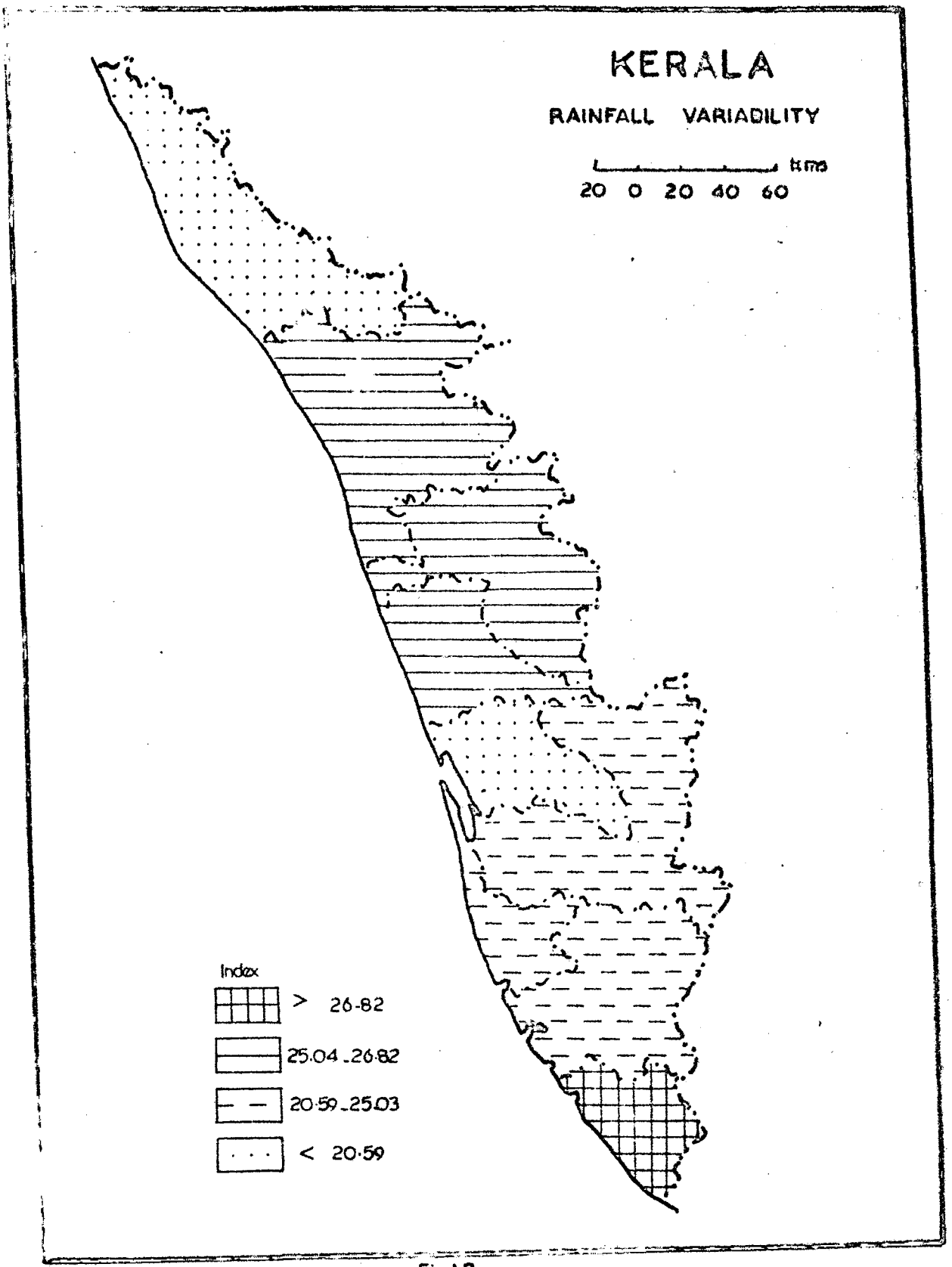
KERALA
RAINFALL VARIABILITY
kms
20 0 20 40 60
Index
> 26·82
25·04 - 26·82
20·59 - 25·03
< 20·59

Fig.12

1	2
Kozhikode	26.82
Palghat	25.04
Trichur	26.37
Ernakulam	18.35
Kottayam	22.11
Alleppey	21.57
Quilon	20.59
Trivandrum	29.94

The Fig. 12 shows the variability of rainfall in Kerala and in the districts (Table 6.3). The variability of rainfall in Kerala is 23.20 percent. The highest variability is in the district of Trivandrum 29.94 percent followed by Kozhikode 26.82 percent, Trichur 26.37 percent, Palghat 25.04 percent, Kottayam 22.11 percent, Alleppey 21.57 percent, Quilon 20.59 percent, Ernakulam 18.35 percent and Cannanore 18.17 percent.

Technological Factors :

Growth rate of Fertilizer use per 1000 hectares of gross cropped area:

In an underdeveloped economy, where agriculture is the

backbone, agricultural production is quite essential to meet the growing demands of the population. Production can be raised mainly by increasing the yield (or area or both) which is the result of the adoption of fertilizer (besides other variables) into the soil, because the fertility of the soil is being exhausted by regular cultivation which one finds in case of India as a whole, the State of Kerala being no exception. One of the main factors for increased agricultural production is the availability and use of fertilizer.

TABLE - 6.4

Growth rate of the Fertilizer use per 1000 Hectares of gross cropped area

(in %ages)

State/District	Growth rate of the Fertilizer use per 1000 hectares of gross cropped area
Kerala	1.30
Cannanore	1.14
Kozhikode	1.77
Palghat	1.37
Trichur	1.01
Ernakulam	1.39
Kottayam	1.32
Alleppey	1.26
Quilon	1.10
Trivandrum	1.32

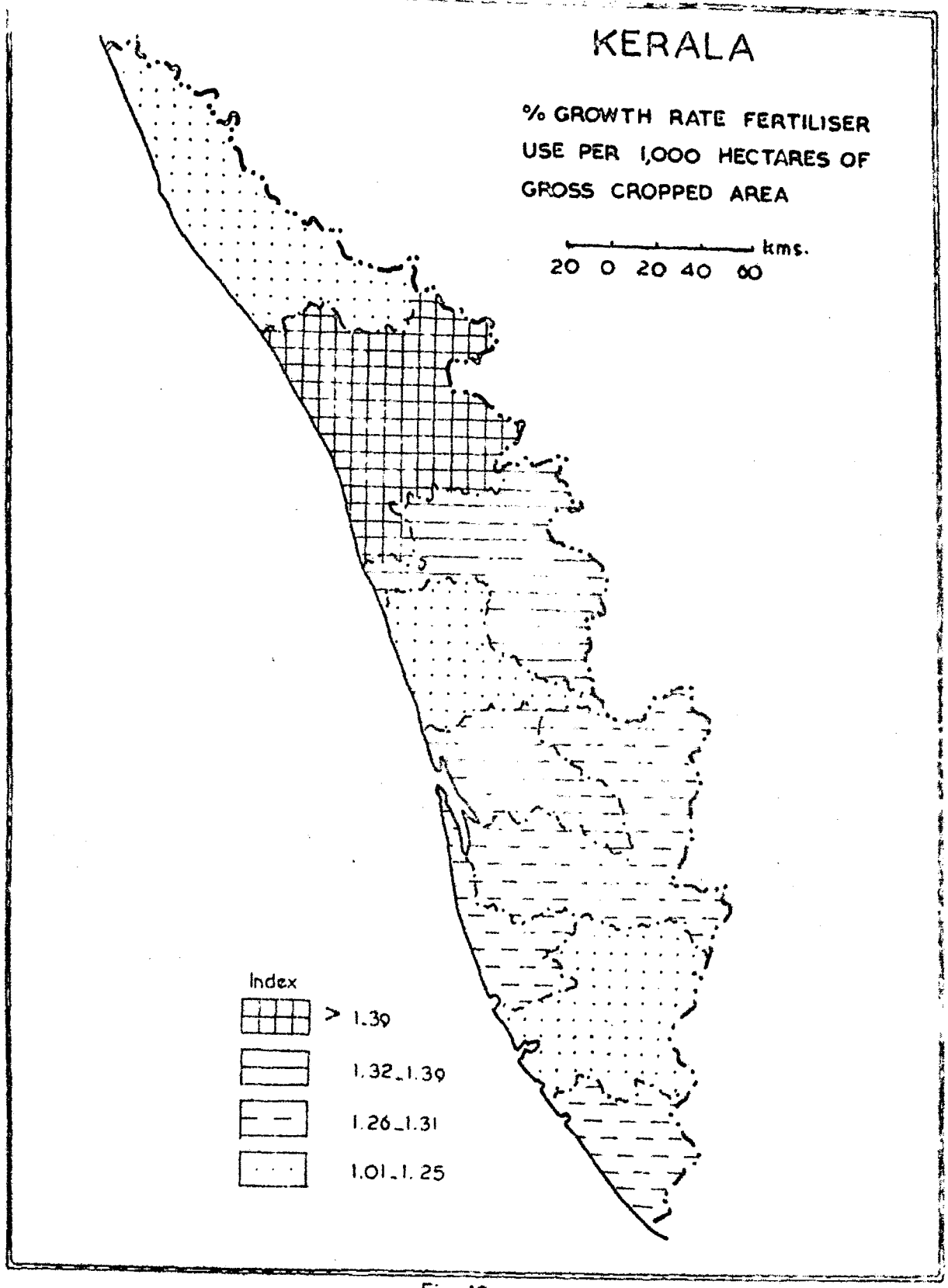
KERALA
% GROWTH RATE FERTILISER USE PER 1,000 HECTARES OF GROSS CROPPED AREA
kms.
20 0 20 40 60
Index
> 1.39
1.32_1.39
1.26_1.31
1.01_1.25

Fig. 13

From table 6.4, it is seen that in Kerala the growth rate of fertilizer use in different districts is quite uniform and stands around the State average of 1.3 percent which itself is not significant considering the proportion of net area sown to the total area. For the State as a whole, the growth rate of fertilizer stands at 1.3 percent (Table 6.4) as against Kozhikode 1.77 percent, Ernakulam 1.39 percent, Palghat 1.37 percent, Kottayam and Trivandrum 1.32 percent each, Alleppey 1.26 percent, Cannanore 1.14 percent, Quilon 1.1 percent and Trichur 1.01 percent (Fig. 13). This percentage growth rate cannot be called to be a significant one compared to that of the State's scale of agriculture. It is quite remarkable that in Quilon where the growth rate of agricultural production is 8.9 percent (highest) the growth rate of fertilizer is only 1.1 percent which is the second lowest among the districts. Trichur also shows somewhat the same picture, coming as it does in the third position among the districts in the growth rate of agricultural production (5.9 percent) and is in the lowest position so far as the growth rate of fertilizer use is concerned. Other districts have shown a considerable increase compared to that of the State average.

Growth rate of Mechanisation Index:

Technology is one of the very important factors which pushes forward the agricultural production. As a region

develops in its economic sphere, the adoption of technological knowhow is normally expected in all the sectors of economy to provide a boost to the economic development.

Table - 6.5

Growth Rate of the Mechanisation Index

(in %ages)

State/District	Growth rate of Mechanisation Index
Kerala	-1.11
Cannanore	-2.00
Kozhikode	0.03
Palghat	-2.00
Trichur	-2.01
Ernakulam	-2.04
Kottayam	-2.04
Alleppey	0.01
Quilon	0.03
Trivandrum	0.02

In the case of Kerala however, the tendency of adopting technological know-how is not very marked. Rather, the growth rate of mechanisation index is negative (-1.11 percent) over

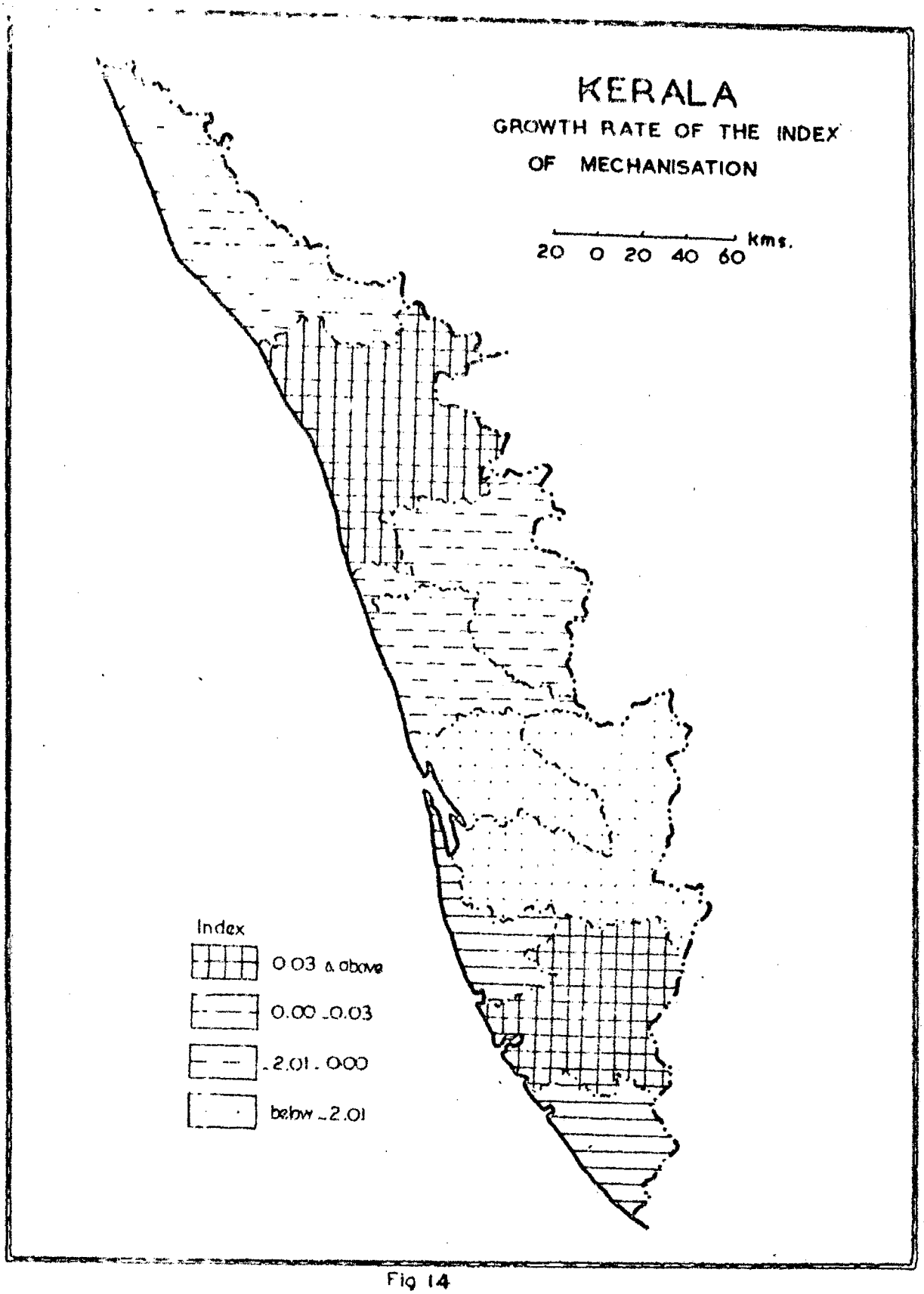
KERALA
GROWTH RATE OF THE INDEX
OF MECHANISATION
20 0 20 40 60 kms.
Index
0.03 & above
0.00 _0.03
_2.01 . 000
below _2.01

Fig 14

the period 1960-61 to 1973-74 (Table 6.5). In the three southern districts comprising of Trivandrum, Quilon and Alleppey and Kozhikode (a northern district) one finds a slight growth rate though quite negligible - being 0.02 percent, 0.03 percent, 0.01 percent and 0.03 percent respectively (Fig. 14).

The main reason for the slow adoption of improved mechanisation is the non-availability of particular implements and machinery suited to local conditions and a comparatively lower cost within the reach of ordinary farmers. The topographical conditions and techniques of cultivation are unique in Kerala and there are no implements designed and developed to suit such conditions. There is, therefore, need for developing efficient implements for rice cultivation, plantation crops and also specialised implements such as ridges and earthers for ginger and tapioca[1].

Growth rate of Intensity of Cropping :

Intensity of cropping is the ratio between gross cropped area and net area sown. It gives the extent to which a given land is utilized. To increase the agricultural production, increase in the intensity of cropping is also necessary.

---

1. Techno-Economic Survey of Kerala, 1962, p. 39.

Table - 6.6

Growth Rate of the Intensity of Cropping

(in %ages)

State/District	Growth rate of the Intensity of Cropping
Kerala	1.1
Cannanore	0.2
Kozhikode	2.3
Palghat	1.0
Trichur	1.4
Ernakulam	1.0
Kottayam	1.1
Alleppey	0.5
Quilon	2.3
Trivandrum	1.8

In Kerala, the intensity of cropping increased from 122 in 1960-61 to 136 in 1973-74 (Appendix 26). There is a constant increase throughout. This is a notable feature in Kerala i.e., the high intensity of cropping. From the previous chapter (Chapter IV) it could be seen that not only the proportion of cultivable area to total area was high in Kerala, but the degree of utilization of the cultivated area

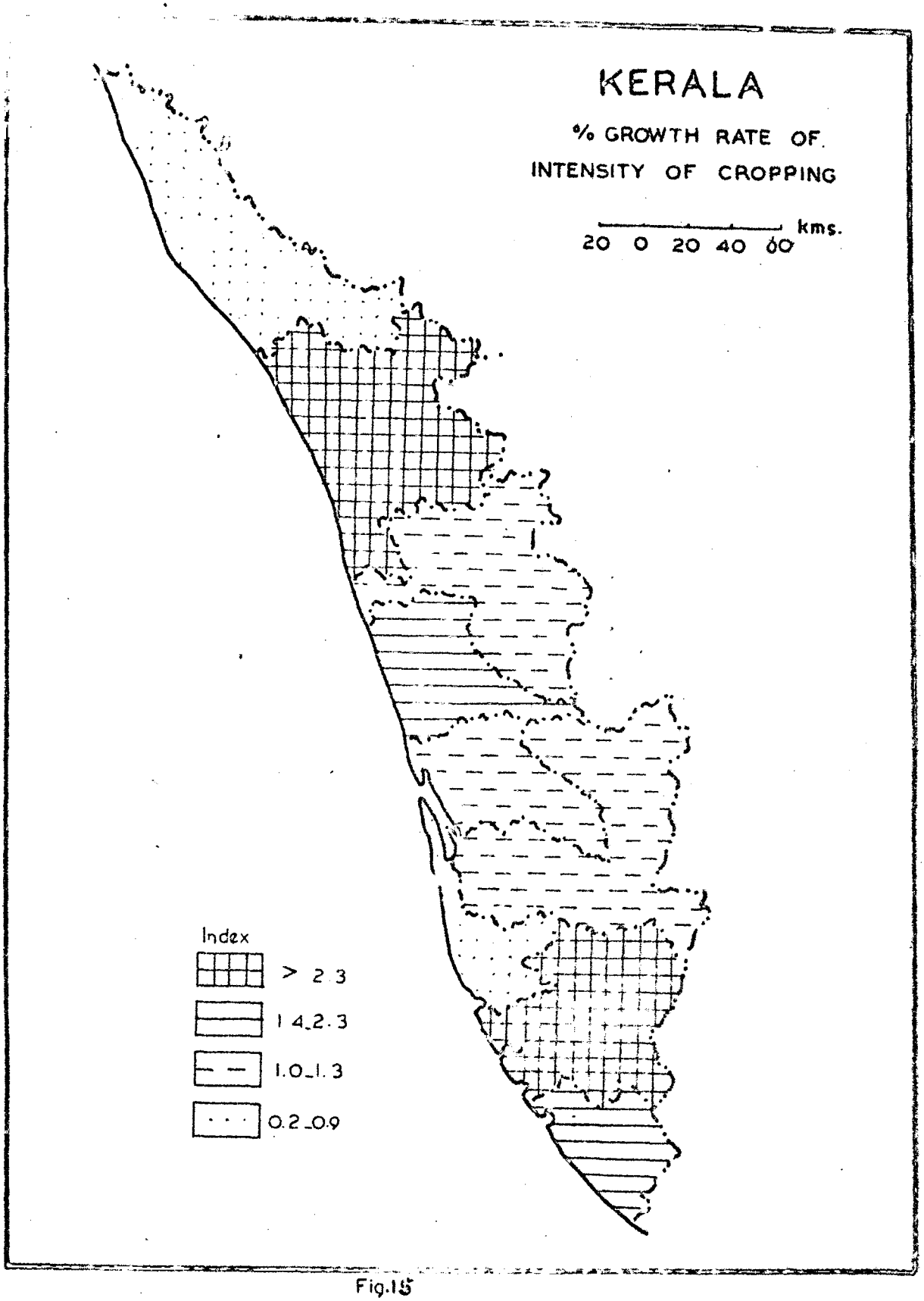
KERALA
% GROWTH RATE OF
INTENSITY OF CROPPING
kms.
20 0 20 40 60
Index
> 2.3
1.4_2.3
1.0_1.3
0.2_0.9

Fig.15

was also quite high.

The growth rate of intensity of cropping is not very high in Kerala; it is only 1.1 percent (Table 6.6). The highest growth has been recorded by Kozhikode and Quilon, 2.3 percent each, followed by Trivandrum 1.8 percent, Trichur 1.4 percent, Kottayam 1.1 percent, Palghat and Ernakulam 1.0 percent each and Cannanore 0.2 percent (Fig. 15). This shows that the intensity of cropping has recorded a steady increase, which is a good sign of progress.

Institutional Factors :

Growth rate of the proportion of agricultural labourers to agricultural workers:

Being an agricultural region, the proportion of agricultural labourers to total workers has a positive correlation with that of the agricultural production. The growth of the former directly affects the growth of the latter. In Kerala where the mechanisation or other technological factors do not provide much incentive for better agricultural production, the main input i.e., the agricultural labourers has got a very important role to play in production.

Table - 6.7

Growth rate of the proportion of agricultural Labourers to agricultural Workers

(in %ages)

State/District	Growth rate of the proportion of agricultural labourers to agricultural Workers U
Kerala	2.1
Cannanore	2.6
Kozhikode	1.7
Palghat	1.2
Trichur	3.1
Ernakulam	2.1
Kottayam	1.1
Alleppey	1.5
Quilon	2.3
Trivandrum	3.0

As against the State average of 2.1 percent (Table 6.7) (growth rate), the growth rate of agricultural labourers in Trichur was 3.1 percent followed by Trivandrum 3.0 percent, Cannanore 2.6 percent, Quilon 2.3 percent, Ernakulam 2.1 percent, and in the other districts it is less than 2 percent.

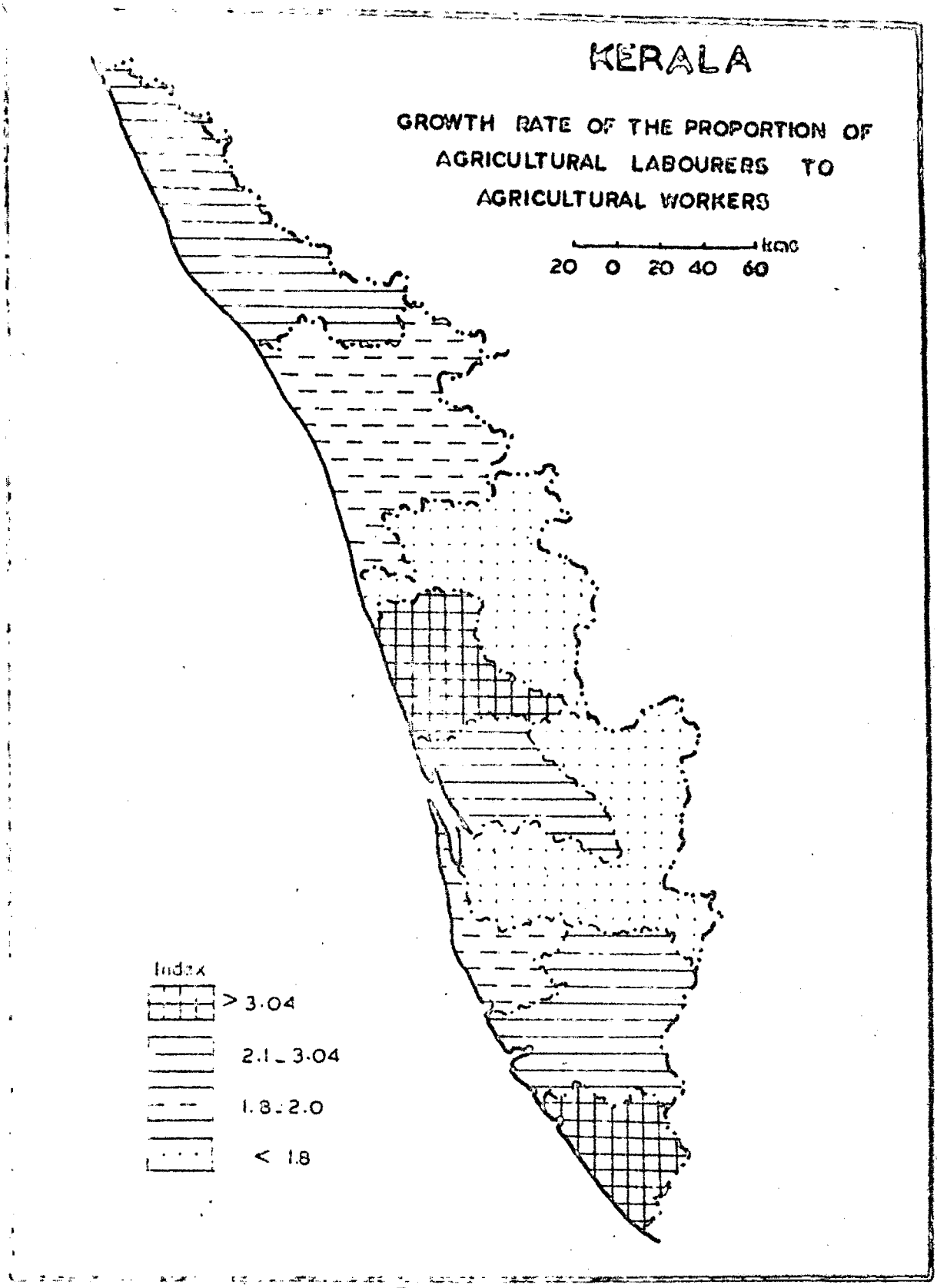
KERALA
GROWTH RATE OF THE PROPORTION OF AGRICULTURAL LABOURERS TO AGRICULTURAL WORKERS
kms
20 0 20 40 60
Index
> 3.04
2.1 - 3.04
1.8 - 2.0
< 1.8

Fig.18

The higest percentage is found in Trichur (3.1 percent) and the lowest in Kottayam (1.1 percent) (Fig. 16). This might be due to the concentration of more land in few hands which leads to the regional disparity in land holding, thereby throwing more people out of their land who are compelled to to work in the field of the landlords as the labourers. The increase in the growth rate of agricultural labourers is due to the low technological know-how which leads to the labour intensive in this sector of economy.

Growth rate of the proportion of rural scheduled castes and tribes to rural population :

A statement showing the growth rate of scheduled castes and tribes is given in Table 6.8. From the census data provided, a marked concentration of scheduled castes is found in Palghat district while scheduled tribes are found in large number in Kozhikode and Cannanore districts. The scheduled castes and tribes are mostly agricultural labourers living in conditions of economic dependency and social inequalities. Lack of initiative, educational backwardness and lack of land and capital to undertake productive operations are among the important factors that contribute to the backwardness of this section of population. The concentration of scheduled castes, specially, is found in the areas of agricultural practice where they are mostly engaged as agricultural labourers

struggling for their survival and livelihood whereas scheduled tribes are found mostly in the areas, negative from the point of view of development. From this analysis it can be said that these two factors have got a negative correlation with that of agricultural production. So, the more the concentration of these factors in a particular area, the less is the rate of growth of production and vice-versa.

Table - 6.8

Growth rate of the proportion of rural scheduled castes and tribes to rural population

(in %ages)

State/District	Growth rate of the proportion of rural scheduled castes and tribes to rural Population
Kerala	-1.33
Cannanore	-2.00
Kozhikode	-2.01
Palghat	-2.01
Trichur	-2.00
Ernakulam	0.01
Kottayam	-2.01
Alleppey	0.01
Quilon	-2.00
Trivandrum	0.01

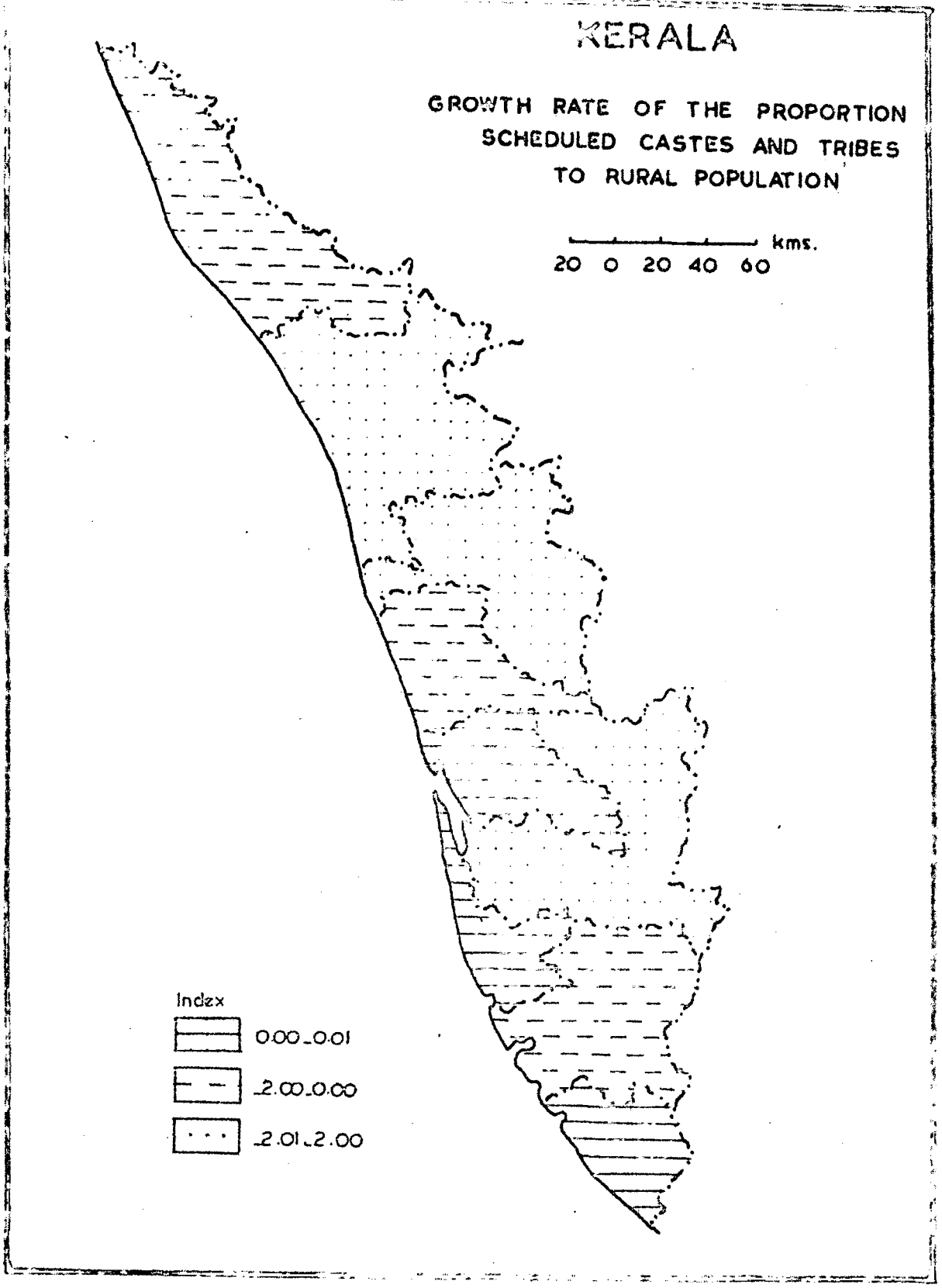
KERALA
GROWTH RATE OF THE PROPORTION
SCHEDULED CASTES AND TRIBES
TO RURAL POPULATION
kms.
20 0 20 40 60
Index
0.00-0.01
-2.00-0.00
-2.01-2.00

Fig 17

Looking at the growth rate figures for these two variables (scheduled caste and scheduled tribe) (Table 6.8), it is seen that the growth rate of scheduled castes and tribes has decreased during the period 1960-61 to 1973-74. In the districts of Ernakulam, Alleppey and Trivandrum it has a positive growth rate which can be called to have remained constant over the period of study. In the rest of the districts, the growth rate is negative being -2.00 on an average as against the State average of -1.33 percent which is quite significant from the point of view of our study. For a healthy situation, this type of growth is necessary which one finds in case of Kerala. It is quite apparent from table 6.8 that the relationship between the growth rate of agricultural production and growth rate of scheduled castes and tribes is negative. One finds that wherever there has been a considerable increase in the growth rate of agricultural production, the growth rate of scheduled castes and tribes has shown a decline. This fact can be seen from the following example. As it has already been pointed out, in three districts viz., Ernakulam, Alleppey and Trivandrum the growth of scheduled castes and tribes is becoming positive where the growth rate of agricultural production is quite low compared to other districts. Quilon, Palghat, Trichur, Cannanore and Kozhikode show a high rate of growth as against a negative rate of growth in case of scheduled castes and tribes (Fig. 17).

Table - 6.9

Growth Rate of Rural Literacy

(in %ages)

State/District	Growth Rate of Rural Literacy
Kerala	2.5
Cannanore	3.1
Kozhikode	2.9
Palghat	2.4
Trichur	2.1
Ernakulam	2.6
Kottayam	1.7
Alleppey	2.1
Quilon	2.4
Trivandrum	3.3

The above table shows the percentage growth rate of literacy for Kerala and for the districts.

As against the State average of 1.84 percent the growth rate of literacy in Palghat is 2.4 percent, Trivandrum 3.3 percent, Cannanore 3.1 percent, Kozhikode 2.9 percent, Trichur 2.1 percent, Alleppey 2.1 percent, Ernakulam 2.6 percent

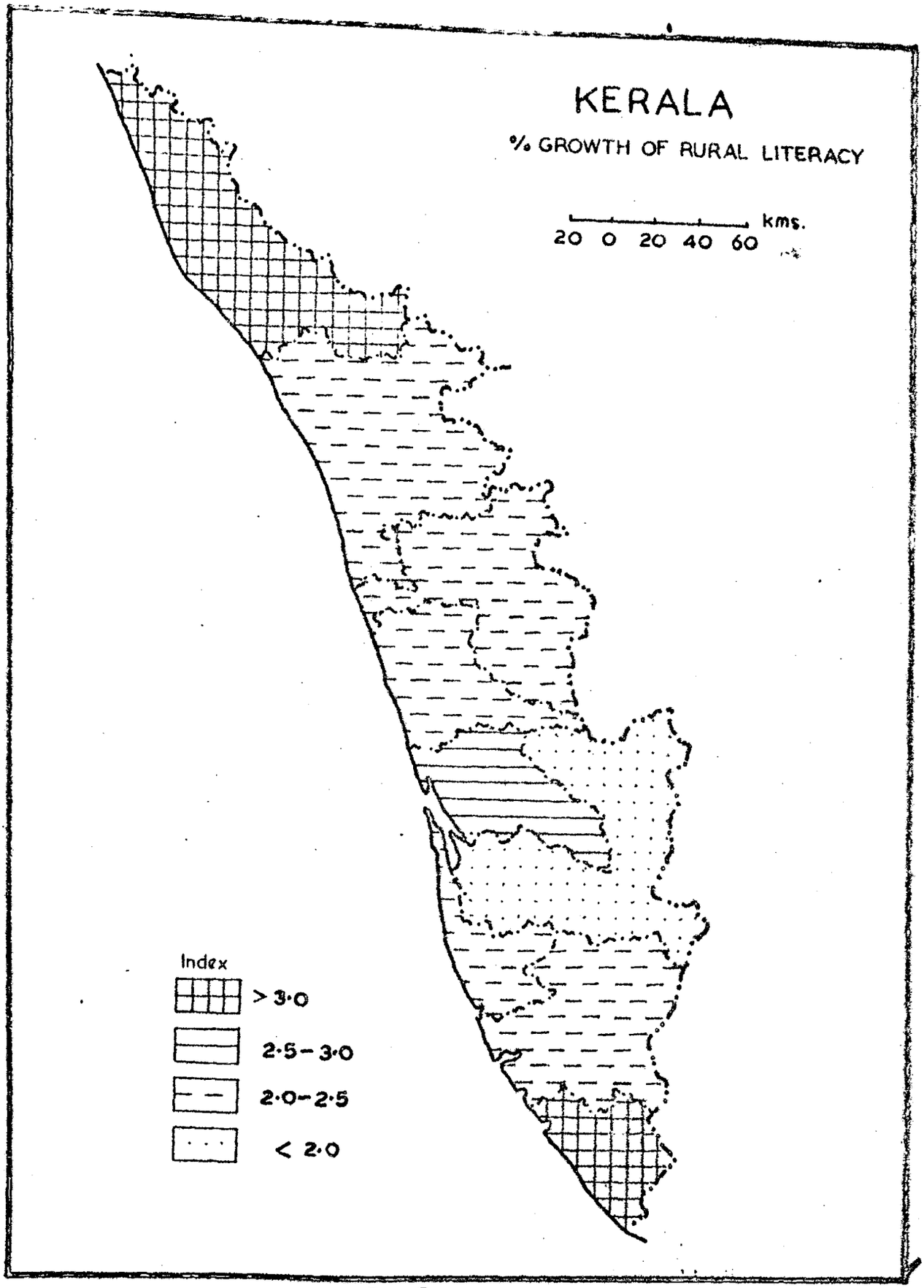
KERALA
% GROWTH OF RURAL LITERACY
kms.
20 0 20 40 60
Index
> 3·0
2·5 – 3·0
2·0 – 2·5
< 2·0

Fig.18

Kottayam 1.7 percent and Quilon 2.4 percent (Fig. 18). Looking at the figures, the northern districts comprising of Cannanore, Kozhikode, Palghat and Trichur have more growth rate of literacy compared to the southern districts except that of Trivandrum, which is because the State capital (Trivandrum) happens to be in this district. The highest growth rate of literacy is recorded by Trivandrum (3.3 percent) which is even higher than the State average (2.5 percent) and the lowest in the Kottayam (1.7 percent).

CHAPTER - VII

DECOMPOSITION OF AGRICULTURAL GROWTH

CHAPTER - VII

DECOMPOSITION OF AGRICULTURAL GROWTH

The present chapter aims at studying the variables affecting agricultural growth rate. The factors being taken in are area, yield, cropping pattern and interaction between yield and cropping pattern.

The methodology used in determining the contribution of the factors in agricultural growth is that of Minhas and Vaidyanathan[1] for detecting factor behind growth of crop output in India, 1951-4 to 1958-61. They have set out a framework of computations for assessing the contribution of different components elements to the growth of crop output in India for the period 1951-4 to 1958-61. Indices of aggregate output of twentyeight major crops have been computed for all the 14 states and also for the 268 districts belonging to 14 states. In each case, the observed increase in aggregate output has been decomposed into four-component elements, i.e., the contribution of (a) changes in area, (b) changes in per acre yields, (c) changes in cropping pattern and (d) the interaction between the latter two elements.

---

1. Minhas, B.S., and Vaidyanathan, A., op. cit.,

Methodology:[2]

A notational representation of the data used is as follows :

Crop	Weight	Proportion of area in year		Yield in year	
		0	t	0	t
C_1	W_1	C_{1o}	C_{1t}	Y_{1o}	Y_{1t}
C_2	W_2	C_{2o}	C_{2t}	Y_{2o}	Y_{2t}
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
C_n	W_n	C_{no}	C_{nt}	Y_{no}	Y_{nt}

We confine our analysis to only seven crops, the Cis; Wis are constant price weights assigned to different crops and consists of the harvest prices. C_{io}'s and C_{it}'s are proportions of area occupied by different crops in years 0 and t. This is the representation of crop pattern. Y_{io}'s and Y_{it}'s are base and final year yields.

2. Minhas and Vaidyanathan, op. cit.,

Minhas and Vaidyanathan in their paper have used for C_{io}'s and C_{it}'s, Wi's and Yio's and Yit's three - year averages on each end. But, here the period of study is only peak periods, so the averages have not been considered.

The symbols used for output and area :

Po = Crop output in year 0

Pt = Crop output in Year t

Ao = Gross crop area in year 0

At = Gross crop area in year t

Definitions:

$$Po = Ao \quad Wi\ C_{io}\ Y_{io}$$

$$Pt = A_t \quad Wi\ C_{it}\ Y_{it}$$

It is assumed here that every new gross crop acre is as good as an average acre already under cultivation[3]. The increase in crop production over the time period of our study in their component elements is in the following manner :

$$Pt - Po = (At - A_o) \lesseqgtr Wi\ C_{io}\ Y_{io} + A_t \lesseqgtr W_i\ C_{io}\ (Y_{it} - Y_{io}) + A_t \lesseqgtr Wi\ Y_{io}\ (C_{it} - C_{io}) + A_t \lesseqgtr Wi\ (Y_{it} - Y_{io})(C_{it} - C_{io})$$

---

3. Minhas and Vaidyanathan, op. cit.,

In the equation on last page, the first element in the right side of the eqation shows the area effect. That is, an increase in output could have taken place in the absence of any changes in per acre yields and the crop pattern. The second element shows the effect of yield changes for a constant crop pattern. The third element shows the effect of changes in crop patterns in the absence of any changes in per acre yields. The last element measures the effect in output which could be attributed to the interaction between per acre yield changes and the changes in crop patterns.

The interaction terms in the scheme is essentially in the nature of balancing entry; however, it is of interpretative significance. Though yields of certain crops in a region may go down, at given constant relative prices, farmers may have the acreage allocation to different crops as they were - a district possibility in a region where an overall deterioration of soil fertility takes place - or they may switch acreage to crops where yields have increased. This latter build of response would be a rational one. We may, of course, get a perverse kind of crop pattern change. One can list all the different possible combinations of positive and negative yield changes of the crop pattern shifts. Here, only the net effect of these interactions are estimated as one of the component elements of output growth[4].

---

4. Minhas, B.S., and Vaidyanathan, A., op. cit.,

RATE OF GROWTH :

A striking feature of agricultural development in Kerala during the period under study is the wide-variation in the rate of growth of output in different regions (districts). During the period 1960-61 to 1973-74, total crop output has increased by 44.08 percent, that is, a compond annual rate of 4.7 percent in the state. In the three out of nine districts the growth has been above the State average, the three districts being Palghat, Trichur and Quilon.

TABLE - 7.1

Growth of Crop Output in Kerala and Districts, 1960-61 to 1973-74

State/District	Growth of Crop Output 1960-61 to 1973-74
Kerala	4.7
Cannanore	4.2
Kozhikode	4.2
Palghat	7.9
Trichur	5.9
Ernakulam	2.3
Kottayam	3.1

Alleppey	2.8
Quilon	8.9
Trivandrum	2.9

Seeing now the overall picture between 1960-1 to 1973-4, it is noted here that six districts out of nine have had a growth rate lower than that of the State average. The highest growth rate being recorded by Quilon 8.9 percent, second highest is by Palghat 7.9 percent, and third highest by Trichur 5.9 percent. The lowest has been recorded by Ernakulam 2.3 percent.

Components of Increase in Output :

The relative contributions of component elements to the growth of crop output in different districts are presented in the following table. The numbers in the top line against each district stand for the proportion of individual output that can be attributed to changes in area, yields, crop pattern and interaction between the latter two elements, whereas the corresponding numbers in brackets express the respective contributions of each of these elements in terms of percentage points in the overall growth rate. It is

quite clear that the relative contributions of component elements vary a great deal from region to region.

Let us now one by one look at the component and their respective contributions to the overall growth rate between 1960-61 and 1973-74.

Table - 7.2

Relative Contribution of Different Elements to the Growth of Crop Output - Kerala and Districts , 1960-61 to 1973-74

State/ District	Percentage increase attributed to					Overall Rate of Growth
	Area	Yield	Crop Pattern	Inter-action	Total	
1	2	3	4	5	6	7
Cannanore	106.54 (4.47)	-36.45 (-1.53)	86.72 (3.64)	-56.81 (-2.39)	100.00	4.2
Kozhikode	36.76 (1.54)	60.91 (2.56)	-1.13 (-0.05)	3.46 (0.45)	100.00	4.2
Palghat	37.40 (2.95)	49.09 (3.88)	13.06 (1.02)	0.45 (0.04)	100.00	7.9
Trichur	43.40 (2.56)	-3.26 (-0.19)	54.69 (3.23)	5.17 (0.31)	100.00	5.9
Ernakulam	46.77 (1.08)	41.96 (0.97)	34.60 (0.80)	-23.30 (-0.54)	100.00	2.3
Kottayam	13.72 (0.43)	91.07 (2.82)	6.49 (0.20)	-11.28 (-0.35)	100.00	3.1
Alleppey	11.32 (0.32)	179.84 (5.04)	-20.82 (0.58)	-70.34 (-1.97)	100.00	2.8
Quilon	53.32 (4.75)	30.53 (2.72)	8.87 (0.79)	7.27 (0.65)	100.00	8.9

Trivandrum	50.07 (1.45)	49.49 (1.44)	2.82 (0.08)	-2.38 (-0.07)	100.00	2.9
Kerala	66.56 (3.12)	18.55 (0.87)	22.66 (1.06)	-7.77 (-0.36)	100.00	4.7

From the above table it is seen that the State as a whole had recorded a growth rate of 4.7 percent between 1960-1 and 1973-4. The component which has contributed the maximum for this growth is area 67 percent (or 3.12 percentage points), yield had contributed 19 percent (or 0.87 percentage points), crop pat'er 23 percent (or 1.06 percentage points) and interaction had a negative effect of 8 percent (or -0.36 percentage points). Thus for the state as a whole, about nine tenths of additions to output was obtained through extension of crop area and due to cropping pattern.

In four out of the nine districts the effect is due to area, Cannanore 107 percent (or 4.47 percentage points), Ernakulam 47 percent (or 1.08 percentage points), Quilon 53 percent (or 4.75 percentage points) and Trivandrum 50 percent (or 1.45 percentage points).

In four out of the rest five districts, the effect is that of yield, Kozhikode 61 percent (or 2.56 percentage

points), Palghat 49 percent (or 3.88 percentage points), Kottayam 91 percent (or 2.82 percentage points) and Alleppey 180 percent (or 5.04 percentage points).

The only district that had the effect of crop pattern is Trichur 55 percent (or 3.23 percentage points).

Thus, here we see the effect of the components of area, yield, crop pattern and interaction between the latter two elements. Now, in the following chapter the other factors which are responsible for growth rate of production would be visualized.

CHAPTER - VIII

DETERMINANTS OF GROWTH OF AGRICULTURAL PRODUCTION - A MULTIPLE REGRESSION ANALYSIS

CHAPTER - VIII

DETERMINANTS OF GROWTH OF AGRICULTURAL PRODUCTION - A MULTIPLE REGRESSION ANALYSIS

Stepwise regression procedure is a special type of multiple regression analysis which is employed here to identify the optimal form of relationship explaining the variations in the growth rate of agricultural production through its various determinants. In the stepwise procedure, a series of intermediate regression equations are obtained, one for each addition of variable. Likewise all variables are entered and the final regression equation is reached. The variables are added in order of their importance i.e., in order of their explaining the dependant variable i.e., the "agricultural growth rate of production". The intermediate regression equations provide the best values of the coefficients for the specific variables included in the equation. Thus, at each step, a regression equation is produced[1]. The cumulative sum of the squares of the multiple regression coefficient R^2 and the standard error of the estimate are also provided at each step, thus indicating the variance and the confidence limits.

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1. Hauser, D.P., "Some Problems in the Use of Stepwise Regression Research", The Canadian Geographer, Vol. XVIII, No. 2 (1974), pp. 148.

Stepwise Regression Analysis : 1960-61 to 1973-74 :

The explanatory variables are related with the growth rate of agricultural production one by one in the step-wise regression analysis. The variables are :

X_8 = Soil Rating Index

X_7 = Variability of Rainfall

X_2 = Growth rate of the proportion of Agricultural Labourers to the agricultural workers.

X_1 = Growth rate of the proportion of Literate Persons to total population.

X_4 = Growth rate of the proportion of Rural Scheduled Castes and Tribes to Rural Population.

X_5 = Growth rate of the Fertilizer use per 1000 hectare of gross cropped area.

X_6 = Growth rate of the Index of Mechanisation

X_3 = Growth rate of Intensity of Cropping

Y = Growth rate of agricultural production.

The Correlation Matrix :

The correlation matrix (Table 8.1) reveals the association between the variables i.e., between the dependent and independent variables and also between the independent variables.

The correlation matrix (Table 8.1) shows that the association of the growth rate of agricultural production is negative with the variables : (1) the growth rate of the proportion of

TABLE - 8.1

CORRELATION MATRIX

	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8
Y	1.0000								
X_1	0.432	1.000							
X_2	0.016	-0.273	1.0000						
X_3	0.362	-0.109	0.169	1.000					
X_4	-0.640	-0.194	-0.137	-0.194	1.000				
X_5	-0.319	0.157	-0.490	0.313	0.085	1.000			
X_6	0.015	-0.199	0.080	0.560	0.308	0.273	1.000		
X_7	0.049	0.355	0.214	0.529	0.012	0.278	0.356	1.000	
X_8	0.208	0.208	0.634	-0.083	-0.326	-0.270	-0.501	0.002	1.000

Y = Growth rate of agricultural production

X_1 = Growth rate of rural literacy

X_2 = Growth rate of proportion of agricultural labourers to total population

X_3 = Growth rate of Intensity of Cropping

X_4 = Growth rate of proportion of rural scheduled castes and tribes to total rural population

X_5 = Growth rate of fertilizer use per 1000 hectares of gross cropped area

X_6 = Growth rate of Index of Mechanisation

X_7 = Variability of Rainfall

X_8 = Soil Rating Index.

the proportion of rural scheduled castes and tribes to rural population and (ii) the growth rate of the fertilizer use per 1000 hectares of gross cropped area. Whereas with the rest of the variables it has a positive correlation.

The correlation of the growth rate of production with rural scheduled castes and tribes is -0.640 and fertilizer is -0.319. Except these two variables the correlation of the growth rate of production is positive with other variables: literacy 0.432; agricultural labourers 0.016; intensity of cropping 0.362; mechanisation index 0.015; variability of rainfall 0.049 and soil rating index 0.208.

From the correlation matrix (Table 8.1) it is inferred that the correlation between the static variables (Rainfall and Soil) and growth rate of agricultural production is only 0.002. The correlation of agricultural labourers (0.016) is slightly higher than that of mechanisation index (0.015) with agricultural production. The correlation between the mechanisation index and agricultural labourers is only 0.080.

Intensity of cropping and fertilizer has a correlation of 0.313. The variability of rainfall and intensity of cropping has a high correlation value of 0.529.

The mechanisation index has a negative correlation with soil rating index -0.501.

Besides the correlation matrix showing the association of the variables, an attempt has been made to scrutinise the main variables which affect the growth rate of production. For this purpose a simple linear regression (Y = a + bx) is fit and to test to find out the significance 't' (for the regression coefficient 'b')and 'F' test (coefficient of determination) have been worked out.

TABLE - 8.2

Simple regression equation	't' value	'F' value
1. Y = 5.19 - 0.20x	-0.64	1.8385
2. Y = 4.59 + 0.05x	0.12	0.0016
3. Y = 3.22 + 1.66x	29.00**	1.2044
4. Y = 2.70 - 1.50x	2.94**	5.5600**
5. Y = 9.63 - 3.80x	-12.66**	0.9029
6. Y = 4.67 - 0.02x	-0.08	0.0016
7. Y = 4.23 + 0.02x	0.28	0.0192
8. Y = 0.21 + 0.08x	2.66**	0.3595

** significant at 5% level.

Y - agricultural growth rate of all the eight equations
X_1 - Growth rate of rural literacy
X_2 - Growth rate of proportion of agricultural labourers to agricultural workers
X_3 - Growth rate of Intensity of Cropping
X_4 - Growth rate of proportion of rural scheduled castes and tribes to rural population
X_5 - Growth rate of fertilizer use per 1000 acres of gross cropped area.
X_6 - Growth rate of mechanisation index
X_7 - Variability of rainfall
X_8 - Soil Rating Index

TABLE - 8.3

CORRELATION OF MATRIX

	Y	X_3	X_4	X_5	X_8
Y	1.000				
X_3	0.362	1.000			
X_4	-0.640	-0.192	1.000		
X_5	-0.319	0.313	0.084	1.000	
X_8	0.207	-0.083	-0.327	-0.270	1.000

Y = Growth rate of agricultural production

X_3 = Growth rate of Intensity of cropping

X_4 = Growth rate of rural scheduled castes and tribes

X_5 = Growth rate of fertilizer use per 1000 hectares of gross cropped area.

X_8 = Soil rating index

From Table 8.2 it is seen that out of the eight variables only four variables are significant, they being:

(i) Rural scheduled castes and tribes,

(ii) Fertilizer use,

(iii) Intensity of Cropping and

(iv) Soil Rating Index

In these four variables the regression co-efficient is significant at 5% level and the co-efficient of determination (F value) is significant at 5% level in the case of rural scheduled castes and tribes only.

A stepwise regression analysis was done with these four variables alongwith the growth rate of agricultural production.

The correlation matrix (Table 8.3) reveals that the correlation of agricultural production is negative with two variables, viz., rural scheduled castes and tribes (-0.640) and with fertilizer use (-0.319). With the other two variables, i.e., Intensity of cropping (0.362) and soil rating index (0.207), it is positive.

The correlation coefficient between soil rating index with fertilizer and intensity of cropping is -0.270 and -0.083 respectively.

TABLE - 8.4

ORDER OF THE VARIABLES ADDED

Included variable	R	R^2x100	Increase in R^2 x 100	Standard error in %age	$\bar{R}$	$\bar{R}^2$ x 100	Increase in $\bar{R}^2$ x 100
X_4	0.640**	40.8	-	18.25	0.640	40.8	-
X_4 X_5	0.692*	47.8	7.0	19.42	0.643	41.3	0.6
X_4 X_5 X_3	0.777	60.4	12.6	19.55	0.700	49.0	7.7
X_4 X_5 X_3 X_8	0.778	60.5	0.1	23.07	0.639	40.8	-8.2

** Significant at 5% level.
* Just significant at 10% level.

Table 8.4 shows the order of the variables added.

Column 1 shows the included variables. The second column shows the variables in order of their explaining capacity of the dependent variable, and also shows the cumulative multiple correlation co-efficient. The third column shows the square of the multiple correlation coefficient which is equal to the proportion of total variance accounted for by the equation. The R^2 is expressed in percentage for convenience. The fourth column lists the increase of total variance also expressed in percentage. The fifth column lists the standard error (in %age) of the estimate for the equation in that step. The sixth column shows $\bar{R}$, seventh $\bar{R}^2$ in percentage and the eighth increase in $\bar{R}^2$ also in percentage. If the positive effect of an additional variable is more than its negative effect, the value of $\bar{R}^2$ will increase. The value of $\bar{R}^2$, however, will decrease in the reverse case.

The above results show that the scheduled castes and tribes (X_4) explains the maximum proportion of variations in agricultural production followed by fertilizers (X_5), intensity of cropping (X_3) and soil rating index (X_8). The contribution of soil rating index is however very low (0.1 percent) in increasing the value of R^2 as is clear from column 4. A study of $\bar{R}^2$ shows that it decreases (-8.2) as soil rating index is added. The intensity of cropping

is retained though being insignificant only because $\bar{R}^2$ increases (by 7.7 percent). This shows that it's contribution in increasing the value of R^2 is not strong enough to counterbalance the reverse effect on the explanatory power due to increase in the degrees of freedom (n - k). The standard error goes on increasing upto the last step.

TABLE - 8.5

RESULTS OF THE STEPWISE REGRESSION ANALYSIS

Variables	Regression co-efficient	Standard Error in percentage	t	F
1	2	3	4	5
Step 1				
X_4	-1.503	6.404	-2.347**	5.508**
Step 2				
X_4	-1.450	6.447	-2.249*@	
X_5	-2.881	29.574	-0.974	3.211*
Step 3				
X_4	-1.252	6.241	-2.006*@	
X_5	-4.252	29.579	-1.437	
X_3	1.229	8.936	1.376	3.045
Step 4				
X_4	-1.290	7.211	-1.788	
X_5	-4.369	33.135	-1.318	
X_3	1.217	9.793	1.243	
X_8	0.020	1.265	-0.160	1.919

** Significant at 5% level.
* Just significant at 10% level.
*@ Significant at 10% level.

The regression coefficients from step 1 to step 3 show a consistently significant values for scheduled castes and tribes.

The value of F ratio also becomes insignificant after step 2. But, there the relationship given in step 3 is being identified as an optimal fit because $\bar{R}^2$ increased in this step by 7.7 percent. The reason for the consistent negative regression coefficients of the variables - fertilizer and soil has to be found because it is usually expected to have a positive effect on agricultural production.

From the above analysis it can be concluded that the relationship between the growth rate of agricultural production and the explanatory variables considered here is quite weak. This may be due to the following reasons.

(a) The explanatory variables which are discussed are not so significant enough to explain the variations in the growth rate of agricultural production during the period (1960-61 to 1973-74). So, if some of the institutional factors like size of class holding, land tenure system, farmer's indebtedness and credit facilities are included in the regression model, the result would have been an encouraging one. Due to the paucity of the said data, they could not be considered here for the purpose of study.

RESIDUALS:

In a regression equation when different values of 'X' are put, we get the corresponding estimated values of y. For example in our equation when :

$X_1 = -1.33$, $X_2 = 1.30$ and $X_3 = 1.10$ (for the State of Kerala as a whole)

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$$

$$\hat{Y} = 6.978 - 1.252\ (-1.33) - 4.252(1.30) + 1.229(1.10)$$

$$= 6.978 + 1.6651 - 5.5276 + 1.3519$$

$$= 4.4674$$

Similarly when all other values of 'X' are put in the equation for different districts the corresponding estimated values of 'Y' are got (it is given in the third column of Table 8.6).

The mean of the residuals is :

$$\frac{\Sigma(Y - \hat{Y})}{n} = \frac{1.2}{9} = 0.1333$$

which is almost nearing zero. Considering the mean, the standard deviation of the residuals (also known as standard error of estimates) is given by -

$$\text{S.D. of estimates} = \sqrt{\frac{\Sigma(Y - \hat{Y})^2}{n - 1}} = \sqrt{\frac{17.80}{9 - 1 = 8}} = \sqrt{2.2250}$$

$$= 1.4916$$

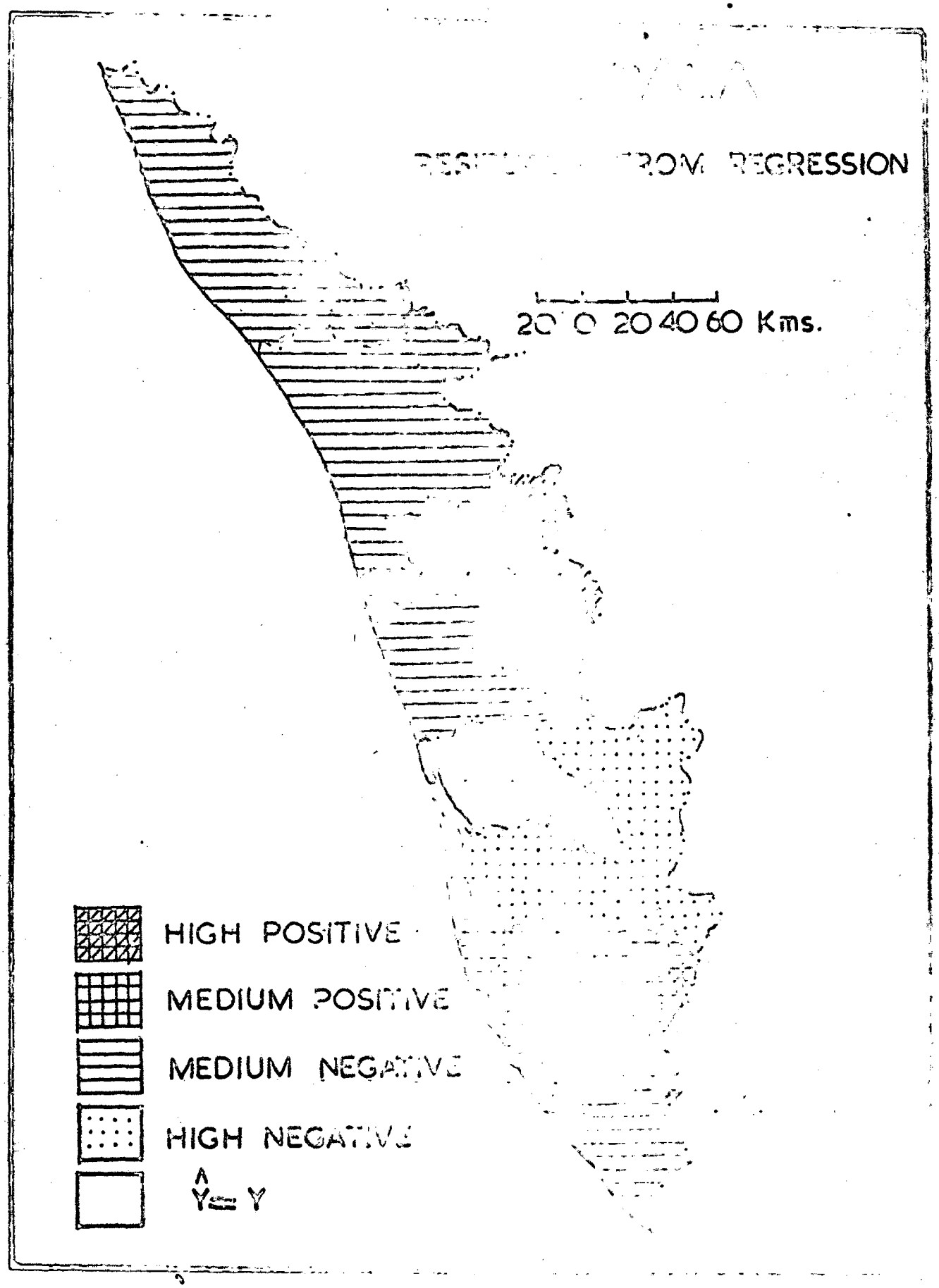
TABLE - 8.6

RESIDUALS FROM REGRESSION FOR KERALA, 1960-61 to 1973-74

State/District	Y	X	$Y - \hat{Y}$	$(Y - \hat{Y})^2$	$\frac{Y - \hat{Y}}{Y} \times 100$	Category
Cannanore	4.2	4.9	-0.70	0.49	-11.66	Medium negative
Kozhikode	4.2	4.8	-0.60	0.36	-8.57	Medium negative
Palghat	7.9	4.9	+3.0	9.00	+113.92	High Positive
Trichur	5.9	6.9	-1.0	1.00	-16.94	Medium negative
Ernakulam	2.3	2.3	-	-	-	-
Kottayam	3.1	5.2	-2.1	4.41	-142.25	High negative
Alleppey	2.8	2.2	+0.6	0.36	+12.85	Medium positive
Quilon	8.9	7.6	+1.3	1.69	+18.98	Medium positive
Trivandrum	2.9	3.6	-0.7	0.49	-16.89	Medium negative

Note :-

Categories	No. of districts	Name of the district
1. High positive	1	Palghat
2. Medium negative	4	Cannanore, Kozhikode, Trichur, Trivandrum
3. Medium positive	2	Alleppey and Quilon
4. High negative	1	Kottayam
5. $\hat{y} = y$	1	Ernakulam


RESIDUALS FROM REGRESSION
20 0 20 40 60 Kms.
HIGH POSITIVE
MEDIUM POSITIVE
MEDIUM NEGATIVE
HIGH NEGATIVE
Ŷ= Y

The standard error of estimate is used here in classifying the residuals in different categories. Assuming the distribution of residuals as normal and using the properties of the normal distribution, residuals may be divided into six categories[1] as less than - 2 S.E, -2 S.E to - S.E, -S.E to zero, zero to +S.E, +S.E. to+2S.E. and +2 S.E and above.

In the present study, as the number of observations are small, we may not get sufficient observations in each category. But even then we have more observations in 'medium negative' (0 to -S.E.) and 'medium positive' (0 to + S.E.) A map of residuals given in Table 8.6 is also prepared using the above classification and is given in Fig. 19.

From the above Table (8.6) it is seen that most of the districts (six districts out of eight as one has $\hat{Y} = Y$) fall between + 1 S.E. and - 1 S.E. The four districts which fall in the 'medium negative' category have got similar factors affecting their rate of growth of agricultural production. Similarly, for the two districts falling under 'medium positive' category the factors affecting their agricultural growth rate of production is same. The two categories 'high positive' and 'high negative' are diagonally opposite and there is one district in each, it will be interesting to find the factors in these as they would also be opposite.

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2. Mahmood Aslam, "Statistical Methods in Geographical Studies", Rajesh Publications, New Delhi, 1977, p. 149.

Thus, it is seen here that there are other factors also which affect the growth rate of agricultural production such as size of class holding, land tenure, farmer's indebtedness and credit facilities but due to paucity of data these could not be taken.

Identifying the best of factors:

(a) The set of first three variables explain 60.4 percent of the variations in the growth rate of agricultural production and the remaining variables account only for a meagre 0.1 percent of the variations.

(b) The regression coefficient is not significant except that of rural scheduled castes and tribes which is significant upto the third step and this also turns to be insignificant at the fourth step.

(c) The standard error of the estimate goes on increasing upto the last step.

(d) The R^2 (the multiple regression coefficient) and $\bar{R}^2$ thus clearly indicate that the first three variables - scheduled castes and tribes, fertilizer use and intensity of cropping are the best ones. Thus the third equation becomes the best possible one :

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + e$$

$$Y = 6.978 - 1.252\ X_1 - 4.252X_2 + 1.229\ X_3 + e$$

CHAPTER - IX

SUMMARY AND CONCLUSIONS

CHAPTER - IX

SUMMARY AND CONCLUSIONS

The foregoing analysis is an attempt in presenting the "Inter-district variations in the agricultural growth rate (production) in Kerala - 1960-61 to 1973-74." For this purpose "district" is used as the main areal unit for the compilation and processing of data on various elements which affect the agricultural growth rate of production. A study of the main characteristics of the various factors which affect agricultural production is dealth with great emphasis. For this purpose the environmental, institutional and technological factors have been taken into account. To provide for a meaningful interpretation of spatial variations in the growth rate of agricultural production, the environmental variables such as relief, soil and rainfall; institutional variables like scheduled castes and scheduled tribes, agricultural labourers and literates; and technological variables consisting of mechanisation, fertilizer and intensity of cropping were taken.

Kerala had a population of 213 lakhs in 1971 as against a population growth rate of 2.63 percent per annum during the decade 1961-71. The density of population is the highest among all the States, being 549 per sq. km. (1970-71) as

against the all-India average of 182. One marks a vast stretch of rural population of 83.8 percent in the State as against the urban population of 16.2 percent in 1971. The participation rate in the State is 29.1 percent which is lower than the all-India average of 32 percent.

The analysis of the economic structure of Kerala with other States reveals that Kerala is not that developed. It's per capita income (current prices) in 1971 was Rs. 586 as against Rs. 628 for all-India, Punjab Rs. 995, Haryana Rs. 829, Gujarat Rs. 788 and Maharashtra Rs. 775. Structurally it's economy is dependent on agriculture to a great extent. The manufacturing industry is negiligible while more than 53 percent of the State's income is derived from agriculture. Industries in Kerala are mostly small scale type. Large industrial establishments are relatively few and there is an imbalance in the structure of industries. Agriculture based industries contribute to the major part of total industrial output. Agricultural productivity both in relation to land and working force is quite high. Agricultural development has been rather slow. The growth in this sector is vital for the future development of the economy, because unless the agricultural sector grows at a rapid rate the State will face the danger of a dual economy - one sector having a very slow productivity and the other having a high productivity.

The adverse physical conditions such as rugged hills and plateau topography inhibit free exchange of goods and mobility of the people. The natural factors and the resource endowments have a priority in any study related to development in Kerala.

Looking at the land utilisation pattern, Kerala's 57.07 percent of the total area was put to agricultural practice in 1973-74 as against 49.87 percent in 1960-61 (refer Appendix II). The intensity of cropping was 136 in 1973-74 as against 122 in 1960-61. The proportion of cultivated land to cultivable area was 95.8 in 1973-74 as against 90.6 in 1960-61. The availability of cultivated land and cultivable land per agricultural worker in 1973-74 was 0.66 and 0.71 as against 0.86 and 0.92 in 1960-61. The proportion of area under foodcrops (foodgrains, rice and non-food crops) was 61.98, 30.70, 29.16 and 38.01 as against 66.63, 35.53, 33.16 and 33.36 in 1960-61. The productivity of rice in Kerala has been quite high (above all-India average, Table 4.10).

A 'decomposition' method of Minhas and Vaidyanathan[1] is used so as to see the effect of area, yield, cropping pattern and the interaction between the latter two elements on production. It was found from this method that area

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1. Minhas, B.S., and Vaidyanathan, A., op. cit.,

affects the maximum 67 percent (or 3.12 percentage points) followed by cropping pattern 23 percent (or 1.06 percentage points), yield 18.55 percent (or 0.87 percentage points) and interaction element has got a negative effect of -8 percent (or -0.36 percentage points).

The correlation matrix was worked out to find the association between the independent variables and also with that of the dependent variable. Simple linear regression ($Y = a + bx$) were fit and 't' and 'F' tests were carried out. It was found from this that only four variables out of eight were significant (at 5% level), they being : (i) scheduled castes and tribes, (ii) fertilizer, (iii) soil and (iv) intensity of cropping. Then with these four independent variables and the dependent a special type of multiple regression analysis known as the stepwise regression is employed here to get the best possible factors by which larger part of the variations in the growth rate of agricultural production can be explained. These four variables together explain 60.5 percent of the variations in the agricultural growth rate of production. The residuals were tabulated (Table 8.6) and mapped (Fig. 19) so as to see the position of the districts. Ernakulam had estimated value of 'Y' equal to actual 'Y', i.e $\hat{Y} = Y$. Out of the rest eight districts, four were in the 'medium negative' (0 to -S.E,

Cannanore, Kozhikode, Trichur and Trivandrum) category, two were in 'medium positive' (0 to +S.E, Alleppey and Quilon) category and one each in 'high negative' (-1 S.E. to - 2 S.E, Kottayam) category and 'high positive' (+1 S.E to + 2S.E, Palghat) category.

The following conclusions can be drawn from the above discussion :

(a) Pattern of growth rate of agricultural production :

Quilon and Palghat are the districts where the growth rate of agricultural production is very high, 8.9 and 7.9 percent respectively. In the district of Trivandum it is quite low, 2.9 percent for which the reason can be attributed to the fact that being the capital city urbanisation is given the priority agriculture. Ernakulam, Kottayam and Alleppey also have a low growth rate with 2.3 percent, 3.1 percent and 2.8 percent respectively. The other districts of Cannanore, Kozhikode come under high growth rate (4.2 percent each) and Trichur comes under very high growth rate (5.9 percent).

(b) Tests of hypotheses :

The eight hypotheses formulated in the study, relating to agricultural growth rate of production have been

tested in the following paragraph.

TABLE - 9.1

TESTS OF HYPOTHESES 1960-61 to 1973-74

Variables		r	b
X_8	Soil	0.208	0.020
X_7	Rainfall	0.049	
X_5	Fertilizer	-0.319	-2.881
X_6	Mechanisation	0.015	
X_3	Intensity of Cropping	0.362	1.229
X_4	Rural scheduled castes and tribes population	-0.640	-1.503
X_2	Agricultural Production	0.016	
X_1	Literacy	0.432	

r = correlation coefficient

b = regression coefficient

The correlation coefficients for the period 1960-61 to 1973-74 show that the growth rate of agricultural production is negatively correlated with scheduled castes and tribes and fertilizer use whereas with the rest it has a

positive relationship thus confirming all the hypotheses except that of the fertilizer use. Looking at the regression co-efficients obtained from the multiple regression equation, it is noted that b - values of the two variables fertilizer and scheduled castes and tribes are negative but is quite strong, it is positive in the case of intensity of cropping and soil but in the case of soil it is quite weak.

We can accept all the hypotheses seeing the simple correlation values except that of fertilizer. The regression co-efficients also show the same picture. Contrary to the hypothesis, fertilizer is inversely related to the agricultural growth rate of production. Literacy has a strong relationship (0.432) with production so is soil (0.208). Mechanisation has got a positive relationship but is quite weak (0.015) and so is agricultural labourers (0.016).

Identifying the significant factors:

TABLE - 9.2

TOTAL VARIANCE EXPLAINED

Variable	$R^2 \times 100$	Increase in $R^2 \times 100$
X_4	40.8	40.8
X_5	47.8	7.0

X_3	60.4	12.6
X_8	60.5	0.1
Total		60.5

Significant factors are identified in the stepwise regression procedure with the help of 'F' and 't' tests and personal reasoning. The above table gives the total variance (R^2 x 100) explained by the explanatory variables considered here.

All the factors (four) put together explain 60.5 percent of total variations. The best possible factors that can be taken are thus rural scheduled castes and tribes from the institutional side, fertilizer and intensity of cropping from the technological side.

The residuals show that out of the eight districts (one district Kottayam has estimated 'Y' value equal to actual 'Y' value) six districts fall in the category of 0 to - S.E (medium negative) and 0 to + S.E (medium positive) and one each in + 1 S.E to + 2 S.E (high positive) and - 1 S.E. to - 2 S.E. (high negative) category. The two districts falling under high positive and high negative

categories are opposite and thus would have opposite factors affecting their agricultural growth rate of production. The four districts in 'medium negative' would have similar factors and two districts in 'medium positive' would also have similar factors, affecting their agricultural growth rate of production. It would be interesting to find these other factors which are affecting the agricultural growth rate of production (the similar factors as well as the opposite ones).

COMMENTS

Comments are based on the 'r' and the growth rate of the selected variables. (a) It is noted here that the period of study here does not have a good mechanisation improvement but the other technological factors (fertilizer and intensity of cropping) have improved. As such the growth rate of agricultural production can be maximised only by the use of technological inputs and agricultural labourers. (b) The correlation matrix shows that there is a very strong correlation (0.560) between mechanisation and intensity of cropping. Agricultural labourers has a low correlation (0.016) with agricultural growth rate of production. These facts only strengthen the hypothesis that the technological inputs are crucial to agricultural production. But, fertiliser is negatively correlated with the agricultural growth rate of production, these should be carefully looked into.

The residuals show that out of the nine districts six districts fall in the category of + 1 S.E to - 1 S.E (0 to - 1 S.E (four) and 0 to + 1 S.E (two)) and one each in - 1 S.E to - 2 S.E and + 1 S.E to + 2 S.E and one district has estimated 'Y' value equal to actual 'Y' value. Thus, it is seen that the model fits in perfectly for the districts also.

It can be briefly concluded that the variations in the growth rate of agricultural production mostly is due to institutional (scheduled castes and tribes) and technological (fertilizer and intensity of cropping). (a) the stepwise regression helps to identify the factors contributing to the growth rate of agricultural production but the results have their own limitations owing to the constraints of the data; (b) if the detailed primary data for small administrative units say taluks are available, the results would have been more accurate and precise; (c) the irrigation which is one of the most important of the variables for explaining the agricultural growth rate of production could not be taken due to the non-availability of data at the district level; (d) tenancy, distribution of holdings by size classes, credit facilities etc. could not be taken as relevant data was not available.

APPENDIX - I

METHODOLOGY

In this context 'Index number' refers to 'quantity growth'.

The index numbers are defined in terms of ratios of value aggregates. If the quantities are called a budget, then each of the aggregates is immediately interpreted as the expenditure on a certain budget at certain prices. An index as a ratio of aggregates, is then to be interpreted as changing expenditure between the two years, the prices being fixed for a quantity index. The quantity index is the changing expenditure at fixed prices as the budget changes or in other words, "the quantity index' is the changing value at fixed'price' as the year changes".

The growth rate of different variables is worked out by the method called the "estimated compound growth rate". This is derived by the equation -

$$Y = A (1 + r)^{n}$$

Taking logarithm of the values we get,

$$\text{Log } Y = \log A + n \log (1 + r)$$

Source :- Allen, R.G.D., "Index Numbers in the Theory and Practice," Macmillan Press Ltd., London, 1975

Assuming "log A" to be "a" and "n" to be "X", and "(1+r)" to be "b", we get the linear equation as follows -

$$Y = a + bX$$

where $a = \log A$

$b = \log (1 + r)$, r = rate of growth

$X = n$

We know the other two equations derived from the linear equation as

$$\leq Y = na + b X \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$\leq XY = a X + b X^2 \quad \ldots\ldots\ldots\ldots\ldots (2)$$

Solving these two equations we get the values of 'a' and 'b'. We know that 'b' stands for 'log (1+r)'. So taking the antilog of 'b' we find the value of 'r' which denotes the rate of growth. In other words :

$$b = \log (1 + r)$$

Taking antilog we get,

$$\text{Antilog } b = 1 + r$$

$$\text{or } r = \text{Antilog } b - 1$$

APPENDIX - II

LAND USE IN KERALA BY DISTRICTS - 1960-61 AND 1973-74

From the table it is seen that more than 50 percent of the total area is sown in all the districts in 1973-74. In 1960-61, Alleppey, Trivandrum and Ernakulam had the highest share of sown area to total area of the order - 84.62 percent, 68.28 percent and 63.81 percent. The lowest proportion was in the district of Cannanore, 41.36 percent. In 1973-74, the highest proportion (more than 60 percent) of the sown area was in the districts of Palghat, Ernakulam, Trivandrum and Alleppey 65.54 percent, 68.60 percent, 70.46 percent and 87.21 percent respectively. The lowest proportion of the sown area was in the district of Trichur - 46.31 percent.

The proportion of 'forests' has decreased throughout in all the districts from 1960-61 to 1973-74 except in Ernakulam where it has increased by 0.23 percent only. The land put to non-agricultural uses has increased from 1960-61 to 1973-74 in all the districts. The proportion of land under 'barren and uncultivable land' decreased in all the districts from 1960-61 to 1973-74. The land under 'permanent pastures and over grazing land' decreased in all the districts except in Kozhikode where it increased by 0.13 percent only, from 1960-61

to 1973-74. The land under miscellaneous tree crops not included in NAS' decreased in all the districts from 1960-61 to 1973-74 except in the districts of Trichur and Alleppey where it increased by 0.59 percent and 1.61 percent respectively. The proportion of area under 'cultivable waste' decreased in all the districts from 1960-61 to 1973-74. The proportion of fallow land other than current fallow decreased in all the districts during this period except in Ernakulam where it increased by 0.16 percent. The proportion of current fallow decreased in all the districts from 1960-61 to 1973-74. The NAS gross cropped area also increased in all the districts. The intensity of cropping increased in all the districts except in Cannanore where it decreased by 1 percent.

The State picture reveals an increase in intensity of cropping, increase in gross cropped area; increase in proportion of NAS, increase in the proportion under 'land put to non-agricultural uses', and decrease in the proportions of 'forests','barren and uncultivable land', permanent pastures and other grazing land, land under miscellaneous tree crops, cultivable waste, fallow other than current fallow, and current fallow.

APPENDIX - 1

INDICES OF PRODUCTION

(base 1956-57 = 100)

Years	Indices of Production
1956 - 57	100.07
1960 - 61	113.2
1961 - 62	104.9
1962 - 63	118.0
1963 - 64	129.0
1964 - 65	132.5
1965 - 66	142.5
1966 - 67	152.0
1967 - 68	169.2
1968 - 69	175.0
1969 - 70	184.5
1970 - 71	184.5
1971 - 72	194.0
1972 - 73	196.9
1973 - 74	196.9

Note :- The underlined years have been taken for the study.

APPENDIX - 2

FARM HARVEST PRICES OF AGRICULTURAL COMMODITIES 1960-61

	Name of Crop	Unit	Prices (1960-61) in Rs.
1.	Rice	Quintal	40.51
2.	Pepper	Quintal	404.59
3.	Ginger	Quintal	117.50
4.	Coconut	1000 nuts	215.05
5.	Arecanut	1000 nuts	27.34
6.	Tapioca	Quintal	7.74
7.	Cashewnut	Quintal	77.32

Source : Agricultural Statistics in Kerala issued by the Bureau of Economics and Statistics (1975), pp. 72.

APPENDIX - 3

AREA UNDER CROPS (1960-61)

(Hectares)

State/ District	Rice	Tapioca	Cashewnut	Coconut	Pepper	Arecanut	Ginger	Total area Cropped
Kerala	778,910	242,200	54,320	500,760	99,750	54,260	12,000	1,742,200
Cannanore	95,698	7,081	6,574	48,414	43,204	8,495	468	209,934
Kozhikode	108,115	18,994	10,401	99,341	16,064	18,030	4,401	275,346
Palghat	192,108	3,351	3,250	18,488	3,422	5,367	1,932	227,918
Trichur	102,197	7,632	8,883	35,977	692	4,141	80	159,602
Ernakulam	77,894	17,732	7,183	44,172	6,829	4,073	1,116	159,050
Kottayam	39,965	44,231	2,251	58,795	14,079	4,529	3,641	167,491
Alleppey	79,389	28,217	2,952	75,829	1,752	2,293	61	190,493
Quilon	46,143	58,050	8,913	64,713	5,279	3,839	153	187,090
Trivandrum	37,416	56,918	4,587	55,926	8,346	3,590	101	166,884

Source : Kerala - Season and Crop Report, 1960-61, Table 3.1, pp. 51-59.

APPENDIX - 4

AREA UNDER CROPS (1963-64)

State/ District	Rice	Tapioca	Cashewnut	Coconut	Pepper	Arecanut	Ginger	Total
Kerala	805,083	209,910	82,370	544,990	99,690	56,690	11,960	1,798,423
Cannanore	957,738	5,861	29,353	67,239	43,766	10,665	477	253,099
Kozhikode	111,042	12,208	12,274	113,877	15,989	11,364	4,439	281,193
Palghat	194,862	2,648	7,283	20,929	3,480	8,960	1,926	240,088
Trichur	108,493	4,636	8,026	35,497	738	7,510	76	164,976
Ernakulam	83,560	13,680	6,955	46,403	6,807	4,803	1,157	163,365
Kottayam	40,691	39,263	2,162	61,698	14,081	4,715	3,665	169,275
Alleppey	82,320	26,590	2,566	69,059	1,341	3,312	60	185,248
Quilon	49,605	54,841	10,445	70,431	4,753	6,290	159	196,524
Trivandrum	38,789	50,183	3,308	56,864	8,429	4,075	-	161,648

Source : Kerala - Season & Crop Report 1963-64, Table 3.1, pp. 47-54.

APPENDIX - 5

AREA UNDER CROPS (1967-68)

State/ District	Rice	Tapioca	Cashewnut	Coconnut	Pepper	Arecanut	Ginger	Total
KERALA	809,540	297,650	94,990	638,720	99,700	76,040	11,800	2,028,440
Cannanore	93,651	6,786	26,273	78,571	43,765	11,090	483	260,619
Kozhikode	111,294	22,214	14,472	131,078	15,989	17,029	4,400	314,476
Palghat	196,968	10,757	9,067	27,658	3,480	7,030	1,814	256,774
Trichur	108,967	10,278	7,478	41,148	745	9,950	76	178,542
Ernakulam	85,987	23,072	7,516	59,273	6,807	9,200	1,128	192,983
Kottayam	41,008	32,526	1,717	70,865	14,448	5,039	3,667	211,270
Alleppey	81,708	25,113	3,211	79,675	1,275	3,773	60	194,815
Quilon	50,378	94,165	10,958	80,052	4,764	7,828	167	248,312
Trivandrum	39,583	72,735	4,298	70,501	8,429	5,205	-	200,651

Source :- Agricultural Statistics of Kerala, Table II, pp. 17-29.

APPENDIX - 6

AREA UNDER CROPS (1970-71)

(Hectares)

State/ District	Rice	Tapioca	Cashewnut	Coconut	Pepper	Arecanut	Ginger	Total
Kerala	874,931	293,552	102,713	719,140	117,540	85,820	12,170	2,205,866
Cannanore	98,692	7,136	40,361	93,235	51,590	14,022	445	305,481
Kozhikode	139,405	30,694	16,929	144,181	20,616	19,654	5,275	376,754
Palghat	201,200	15,076	12,325	36,344	3,545	6,533	1,278	276,301
Trichur	115,267	8,262	8,056	54,861	745	13,261	76	200,528
Ernakulam	93,691	14,500	6,618	64,687	7,940	9,223	1,159	197,818
Kottayam	50,034	37,120	1,311	74,839	16,858	5,149	3,729	189,040
Alleppey	85,162	19,715	3,350	81,962	1,504	4,560	-	196,253
Quilon	51,884	90,965	9,153	92,512	5,783	8,408	208	258,913
Trivandrum	39,496	70,084	4,610	76,515	10,233	5,008	-	205,946

Source : Kerala - Season & Crop Report - 1970-71, Table 3.1, pp. 40 - 45.

APPENDIX - 7

AREA UNDER CROPS (1973-74)

(Hectares)

State/ District	Rice	Tapioca	Cashewnut	Coconut	Pepper	Arecanut	Ginger	Total
Kerala	874,680	306,450	103,160	744,830	118,250	90,700	12,040	2,250,110
Cannanore	98,065	7,711	43,611	91,223	30,897	15,872	431	287,810
Kozhikode	137,763	29,396	16,914	152,419	24,466	20,127	4,934	386,019
Palghat	201,616	17,451	11,818	38,499	1,786	6,648	1,278	279,096
Trichur	109,914	8,345	6,794	56,869	4,199	14,681	76	200,878
Ernakulam	89,247	12,662	4,362	57,286	11,088	8,084	977	183,706
Kottayam	44,077	40,870	2,884	84,836	22,181	6,538	3,968	205,354
Alleppey	92,039	19,124	3,617	79,941	4,265	5,108	-	204,094
Quilon	51,189	94,745	8,692	106,800	5,783	9,197	214	276,620
Trivandrum	39,765	76,111	4,468	77,000	10,233	4,436	-	212,013

Source :- Kerala - Season & Crop Report - 1973-74,
Table 3.1, pp. 35-40.

APPENDIX - 8

PRODUCTION OF CROPS (1960-61)

(Metric Tonnes)

State/ District	Rice	Tapioca	Cashewnut	Coconut	Pepper	Arecanut	Ginger
Kerala	1,067,587	1,683,000	84,630	3,220	99,750	7,737	11,270
Cannanore	101,142	49,200	10,224	311	7,907	1,211	405
Kozhikode	116,705	131,960	16,210	639	3,242	2,571	4,227
Palghat	305,927	23,285	5,065	119	691	751	1,690
Trichur	126,115	53,030	13,844	231	295	591	145
Ernakulam	106,834	123,220	10,142	284	2,805	581	1,236
Kottayam	64,044	307,360	3,508	387	5,508	646	3,168
Alleppey	120,346	196,070	4,601	488	732	327	83
Quilon	69,212	403,368	13,890	416	2,215	547	227
Trivandrum	57,262	395,505	7,147	354	3,638	512	89

Note :- Coconut & Arecanut are expressed in million nuts

Source :- Kerala - Season and Crop Report 1959-60 and 1960-61, Table 4.1, pp. 64-67.

APPENDIX - 9

PRODUCTION OF CROPS (1963-64)

(Metric Tonnes)

State/ District	Rice	Tapioca	Cashewnut	Coconut	Pepper	Arecanut	Ginger
Kerala	1,128,056	2,523,970	92,310	3,262	22,620	8,522	11,290
Cannanore	119,095	51,500	32,960	403	6,977	1,603	407
Kozhikode	121,698	101,102	13,750	682	2,622	1,708	4,299
Palghat	332,762	24,597	8,160	125	518	595	1,687
Trichur	147,471	40,726	8,994	212	323	1,129	126
Ernakulam	110,182	202,624	7,797	278	2,030	722	1,230
Kottayam	58,893	621,016	3,424	387	4,464	709	3,229
Alleppey	112,141	233,639	2,877	413	408	498	82
Quilon	69,277	605,803	11,700	422	2,019	945	234
Trivandrum	56,537	642,520	3,707	340	3,963	613	-

Note :- Coconut and Arecanut are expressed in million nuts

Source :- Kerala - Season and Crop Report 1963-64, Table 4.1, pp. 59-62.

APPENDIX - 10

PRODUCTION OF CROPS (1967-68)

(Metric Tonnes)

State/ District	Rice	Tapioca	Cashewnut	Coconut	Pepper	Arecanut	Ginger
Kerala	1,123,900	4,198,360	106,580	3,593	21,060	11,473	11,120
Cannanore	113,673	111,901	40,698	301	6,383	1,387	410
Kozhikode	113,909	275,898	16,238	818	2,156	3,148	4,238
Palghat	333,603	73,812	10,173	108	502	888	1,601
Trichur	145,177	116,964	8,890	309	326	1,465	126
Ernakulam	113,631	299,706	8,433	348	1,985	1,112	1,177
Kottayam	49,791	597,503	1,926	342	4,496	506	3,229
Alleppey	121,486	328,980	3,603	532	305	587	83
Quilon	75,786	1,292,885	12,295	451	1,848	1,576	253
Trivandrum	56,841	1,042,293	4,822	483	3,069	809	-

Note :- Coconut and Arecanut are expressed in million nuts

Source :- Agricultural Statistics in Kerala,
Table 12, pp. 30-42.

APPENDIX - 11

PRODUCTION OF CROPS (1970-71)

(Metric Tonnes)

State/ District	Rice	Tapioca	Cashewnut	Coconut	Pepper	Arecanut	Ginger
Kerala	1,298,010	4,617,190	115,244	3,981	25,030	12,738	19,680
Cannanore	131,595	91,269	45,285	357	7,223	1,753	699
Kozhikode	163,997	479,124	18,994	840	2,850	3,291	7,878
Palghat	343,021	177,472	13,829	157	311	909	1,896
Trichur	163,397	120,956	9,039	347	589	1,973	58
Ernakulam	129,210	222,720	7,425	379	2,199	1,114	2,141
Kottayam	85,587	690,432	1,471	362	5,088	517	6,634
Alleppey	144,645	351,321	3,759	547	472	710	-
Quilon	79,685	1,649,195	10,270	522	2,521	1,693	374
Trivandrum	56,868	834,700	5,172	470	3,776	778	-

Note :- Coconut and Arecanut are expressed in million nuts.

Source :- Kerala - Season and Crop Report, 1970-71, Table 4.1, pp. 49-53.

APPENDIX - 12

PRODUCTION OF CROPS (1973-74)

(Metric Tonnes)

State/ District	Rice	Tapioca	Cashewnut	Coconut	Pepper	Arecanut	Ginger
Kerala	1,354,541	5,659,523	115,750	3,703	27,750	13,459	26,680
Cannanore	133,604	151,830	48,934	312	7,295	1,984	1,055
Kozhikode	177,832	450,762	18,978	767	6,138	3,365	11,520
Palghat	368,272	347,347	13,259	143	334	928	2,054
Trichur	148,725	160,808	7,623	335	615	2,183	70
Ernakulam	111,892	216,243	4,894	304	2,158	976	2,376
Kottayam	73,305	975,202	3,236	426	6,168	683	9,109
Alleppey	132,122	448,267	4,058	443	702	795	-
Quilon	79,738	1,761,310	9,752	528	4,995	1,852	499
Trivandrum	59,952	1,147,754	5,013	445	4,042	689	-

Note :- Coconut and Arecanut are expressed in million nuts

Source :- Kerala - Season and Crop Report, 1973-74, Table 4.1, pp. 44

APPENDIX - 13

YIELD OF CROPS (1960-61)

(Kg/Hect.)

State/ District	Rice	Tapioca	Cashewnut	Coconut	Pepper	Arecanut	Ginger
Kerala	1,371	6,949	1,558	6,430	271	142,601	938
Cannanore	1,057	6,950	1,558	6,424	183	142,554	865
Kozhikode	1,080	6,950	1,559	6,432	202	142,596	958
Palghat	1,593	6,950	1,558	6,437	202	142,586	875
Trichur	1,234	6,951	1,558	6,421	426	142,719	1,813
Ernakulam	1,372	6,950	1,558	6,429	411	142,647	1,059
Kottayam	1,603	6,980	1,558	6,429	391	142,636	871
Alleppey	1,516	6,950	1,559	6,436	418	142,608	1,361
Quilon	1,500	6,950	1,558	6,428	420	142,485	1,484
Trivandrum	1,531	6,950	1,558	6,432	431	142,618	881

Note : Coconut and Arecanut are expressed in number of nuts per hectare.

APPENDIX - 14

YIELD OF CROPS (1963-64)

(Kg/Hect.)

State/ District	Rice	Tapioca	Cashewnut	Coconut	Pepper	Arecanut	Ginger
Kerala	1,401	12,022	1,122	5,864	225	150,310	944
Cannanore	1,244	8,789	1,121	5,994	159	150,305	853
Kozhikode	1,096	8,287	1,121	5,989	164	150,299	968
Palghat	1,708	9,291	1,121	5,973	149	150,253	876
Trichur	1,360	8,789	1,121	5,972	438	150,333	1,658
Ernakulam	1,319	14 ,816	1,121	5,991	298	150,323	1,063
Kottayam	1,448	15,821	1,121	5,982	317	150,371	881
Alleppey	1,363	8,789	1,121	5,980	304	150,272	1,367
Quilon	1,397	11,049	1,121	5,992	425	150,238	1,472
Trivandrum	1,458	12,807	1,121	5,979	364	150,429	-

Note : Coconut and Arecanut are expressed in number of nuts per hectare.

APPENDIX - 15

YIELD OF CROPS (1967-68)

(Kg/Hect.)

State/ District	Rice	Tapioca	Cashewnut	Coconut	Pepper	Arecanut	Ginger
Kerala	1,388	14,105	1,122	5,625	211	150,873	943
Cannanore	1,214	16,490	1,122	3,831	146	125,068	725
Kozhikode	1,025	12,420	1,122	6,241	135	184,861	963
Palghat	1,694	12,850	1,122	3,905	144	126,316	883
Trichur	1,332	11,380	1,122	6,319	438	148,751	1,658
Ernakulam	1,321	12,730	1,122	5,871	292	120,870	1,043
Kottayam	1,214	18,370	1,122	4,826	311	100,417	881
Alleppey	1,487	13,100	1,122	6,677	239	155,579	1,383
Quilon	1,504	13,730	1,122	5,634	388	201,329	1,515
Trivandrum	1,436	14,330	1,122	6,150	363	155,427	-

Note : Coconut and Arecanut are expressed in number of nuts per hectare.

APPENDIX - 16

YIELD OF CROPS (1970-71)

(Kg/Hect.)

State/ District	Rice	Tapioca	Cashewnut	Coconut	Pepper	Arecanut	Ginger
Kerala	1,483	15,729	1,122	5,536	213	148,430	1,617
Cannanore	1,333	12,790	1,122	3,829	140	125,018	1,571
Kozhikode	1,039	16,390	1,122	6,239	139	184,555	885
Palghat	1,746	10,180	1,122	3,915	137	126,166	1,470
Trichur	1,418	14,640	1,122	6,325	791	148,782	763
Ernakulam	1,379	15,360	1,122	5,859	277	120,785	1,847
Kottayam	1,711	18,600	1,122	4,837	302	100,408	1,799
Alleppey	1,699	17,820	1,122	6,674	314	155,702	-
Quilon	1,536	18,130	1,122	5,643	436	201,356	1,798
Trivandrum	1,440	11,910	1,122	6,143	369	155,351	-

Note : Coconut and Arecanut are expressed in number of nuts per hectare.

APPENDIX - 17

YIELD OF CROPS (1973-74)

(Kg/Hect.)

State/ District	Rice	Tapioca	Cashewnut	Coconut	Pepper	Arecanut	Ginger
Kerala	1,534	18,468	1,122	4,972	235	148,389	2,215
Cannanore	1,363	19,690	1,122	3,420	187	125,126	2,448
Kozhikode	1,095	16,190	1,122	5,376	263	184,679	2,687
Palghat	1,863	21,720	1,122	3,330	162	126,264	1,644
Trichur	1,151	19,270	1,122	5,891	646	148,764	921
Ernakulam	1,245	16,660	1,122	4,906	189	120,801	2,355
Kottayam	1,282	24,030	1,122	4,939	290	100,368	2,228
Alleppey	1,416	23,440	1,122	5,529	165	155,638	-
Quilon	1,558	18,590	1,122	4,944	325	201,370	2,332
Trivandrum	1,399	15,080	1,122	5,783	213	155,320	-

Note : Coconut and Arecanut are expressed in number of nuts per hectare.

APPENDIX - 18

NORMAL RAINFALL (mms.)

State/ District	July	August	Septem-ber	Octo-ber	Novem-ber	Decem-ber	Janu-ary	Febru-ary	March	April	May	June	Total
Kerala	707.7	425.7	235.8	301.5	183.5	47.3	16.1	16.6	41.1	109.1	241.9	688.0	3014.3
Cannanore	1063.5	584.8	239.4	218.0	106.0	22.8	5.3	4.8	11.1	58.6	200.6	923.0	3437.9
Kozhikode	1117.4	599.2	262.4	290.2	163.7	34.2	10.4	7.6	20.0	92.4	254.0	944.5	3796.0
Palghat	649.9	363.0	169.5	257.2	140.9	29.7	9.8	9.3	27.0	79.6	158.4	503.4	2397.7
Trichur	761.4	458.6	250.3	307.5	158.3	30.3	9.3	8.8	28.6	86.6	274.3	803.4	3177.4
Ernakulam	785.9	523.5	296.6	365.7	216.9	54.6	18.0	23.6	54.4	136.1	310.1	792.1	3577.5
Kottayam	552.3	370.3	272.7	330.2	219.4	64.1	25.9	29.3	59.0	133.5	291.5	663.8	3082.6
Alleppey	652.9	429.5	273.2	330.6	212.8	71.7	30.3	26.3	59.8	141.3	244.9	609.3	3012.0
Quilon	449.6	318.1	226.1	344.9	242.9	64.8	24.1	32.1	83.6	166.3	260.3	547.4	2760.2
Trivandrum	257.4	204.5	168.9	280.2	210.2	70.1	26.2	18.0	48.0	118.1	213.9	391.1	2001.6

Source :- Agricultural Statistics in Kerala issued by The Bureau of Economics and Statistics (1975) Table 7, pp. 5.

APPENDIX - 19

AVERAGE MONTHLY RAINFALL (mms.) 1960-61

State/ District	July	August	September	October	November	December	January	February	March	April	May	June	Total
Kerala	693.4	329.0	389.1	244.2	377.6	25.3	19.1	35.7	10.3	106.8	533.5	969.0	3733.0
Cannanore	947.9	439.3	303.0	124.1	283.6	1.8	0.4	2.0	3.4	58.2	558.3	1091.3	3813.3
Kozhikode	919.7	300.2	321.6	197.3	362.4	5.8	-	-	-	50.9	1041.4	1479.5	4658.8
Palghat	643.8	203.9	252.8	332.5	323.5	22.8	1.6	8.8	12.2	65.6	421.1	856.4	3172.0
Trichur	865.6	287.9	415.9	296.1	218.9	2.7	-	28.0	24.8	95.3	644.0	1007.2	3886.4
Ernakulam	760.4	377.5	535.9	311.9	311.5	31.2	2.6	21.1	5.5	134.7	656.9	829.9	3979.1
Kottayam	694.0	401.7	403.6	268.3	361.9	37.5	15.0	57.6	15.6	132.7	418.1	855.2	3661.2
Alleppey	676.7	373.8	474.2	198.4	422.0	27.7	28.2	110.2	13.6	126.7	456.5	1089.4	3997.4
Quilon	495.8	283.4	411.1	251.4	571.4	35.1	48.5	58.9	15.6	143.2	368.7	864.2	3547.3
Trivandrum	389.1	201.5	362.3	207.8	480.2	38.8	67.7	48.7	9.4	75.0	466.4	912.1	3239.0

Source : Kerala - Season and Crop Report, 1959-60 and 1960-61, Table 1.2, pp. 47.

APPENDIX - 20

AVERAGE MONTHLY RAINFALL (mms.)
1963-64

State/ District	July	August	Septem- ber	Octo- ber	Novem- ber	Decem- ber	Janu- ary	Febru- ary	March	April	May	June	Total
Kerala	683.7	484.3	234.3	278.2	105.6	48.6	1.7	6.8	71.0	79.9	97.8	373.2	2465.1
Cannanore	1019.4	776.2	163.3	273.8	26.6	19.1	-	5.8	6.5	58.5	55.8	540.8	2945.8
Kozhikode	788.6	637.5	166.9	257.5	41.5	35.1	-	1.0	17.5	56.9	37.2	585.6	2825.3
Palghat	588.1	427.3	152.1	236.7	63.1	28.0	-	-	85.4	58.8	99.2	376.9	2113.6
Trichur	742.8	621.8	223.8	248.2	88.3	21.1	-	0.1	49.8	30.7	160.8	560.0	2747.4
Ernakulam	668.5	556.9	344.9	340.7	151.3	79.1	-	1.4	69.2	83.9	118.3	408.3	2822.5
Kottayam	569.9	355.0	279.4	294.6	129.3	68.5	0.7	1.8	78.2	80.6	112.2	239.6	2209.8
Alleppey	671.1	416.5	355.9	310.7	154.1	48.6	9.1	16.3	103.5	94.5	142.3	293.3	2615.9
Quilon	535.4	326.4	211.7	287.7	131.8	63.1	3.7	20.4	143.1	171.1	88.5	204.6	2187.7
Trivandrum	569.4	241.2	211.1	255.9	164.7	74.5	2.0	14.8	85.4	84.3	65.6	149.6	1718.5

Source : Season & Crop Report 1963-64 - Kerala
Table 1.2, pp. 43.

APPENDIX - 21

AVERAGE MONTHLY RAINFALL (mms.) 1967-68

State/ District	July	August	Septem-ber	Octo-ber	Novem-ber	Decem-ber	Janu-ary	Febru-ary	March	April	May	June	Total
Kerala	746.3	498.4	155.9	186.8	73.0	37.0	10.0	31.9	94.6	133.4	95.8	683.3	2746.4
Cannanore	1213.5	711.3	140.4	81.8	56.0	7.4	-	4.6	25.2	139.3	73.0	950.6	3403.1
Kozhikode	1029.2	587.6	99.3	101.4	60.0	15.4	-	2.8	61.3	110.1	86.0	757.7	2920.8
Palghat	750.2	444.3	89.2	134.6	102.7	39.8	-	8.9	66.8	133.8	75.5	467.7	2313.5
Trichur	743.1	678.4	125.7	172.7	65.8	40.4	-	44.8	74.1	109.9	114.5	726.7	2896.1
Ernakulam	192.5	631.8	191.7	207.4	102.7	25.3	4.2	47.7	115.5	152.2	174.7	710.5	3056.2
Kottayam	424.6	410.7	122.7	223.8	365.7	32.4	5.7	51.9	125.0	132.2	84.8	671.4	2350.9
Alleppey	1092.0	519.7	187.4	205.6	70.4	75.8	35.2	44.0	137.3	130.9	114.3	793.1	3405.7
Quilon	554.4	353.6	224.5	245.2	81.8	78.2	30.7	67.4	133.5	167.5	99.0	597.7	2613.5
Trivandrum	217.2	138.6	222.2	308.6	51.6	18.8	13.9	15.0	112.4	144.3	40.2	474.4	1757.2

Source : Agricultural Statistics in Kerala, issued by the Bureau of Economics and Statistics (1975) Table 8, pp. 6-10.

APPENDIX - 22

AVERAGE MONTHLY RAINFALL (mms.) 1970-71

State/ District	July	August	Septem-ber	Octo-ber	Novem-ber	Decem-ber	Janu-ary	Febru-ary	March	April	May	June	Total
Kerala	501.7	535.3	216.5	279.9	76.2	5.1	32.7	17.6	20.1	116.1	335.5	909.2	3045.9
Cannanore	745.7	891.6	807.2	161.4	25.9	-	-	-	4.7	40.2	331.5	1043.2	3451.5
Kozhikode	953.5	974.6	240.3	209.4	78.2	-	-	-	2.0	121.9	356.9	1324.4	4261.2
Palghat	532.1	426.3	142.8	310.5	94.4	-	6.9	-	1.5	95.7	190.2	979.8	2780.2
Trichur	342.5	548.8	225.5	190.2	44.3	-	1.8	4.4	-	101.5	348.5	1207.4	3014.9
Ernakulam	576.0	55.7	266.9	285.6	48.4	-	39.0	21.8	29.6	132.5	498.7	917.1	3371.3
Kottayam	408.7	502.3	214.4	349.8	129.2	12.7	40.9	36.5	28.2	116.3	290.5	745.6	2875.1
Alleppey	293.5	319.0	264.9	293.8	48.6	6.2	61.2	30.5	21.3	107.8	418.2	708.6	2573.6
Quilon	262.0	351.7	258.5	374.3	120.9	17.7	58.4	59.3	50.5	195.6	310.1	648.5	2707.5
Trivandrum	137.8	204.2	138.0	374.9	107.2	14.4	118.5	20.5	63.2	136.6	264.6	547.5	2127.4
Malappuram	764.9	576.7	208.4	249.4	64.1	-	-	2.4	-	112.7	344.9	969.7	3293.2

Source : Kerala - Season & Crop Report, 1970-71, Table 1.2, pp. 37.

APPENDIX - 23

AVERAGE MONTHLY RAINFALL (mms.) 1973-74

State/ District	July	August	Septem ber	Octo- ber	Novem- ber	Decem- ber	Janu- ary	Febru- ary	March	April	May	June	Total
Kerala	541.2	467.4	63.4	276.5	61.8	56.5	0.8	7.4	17.5	154.6	243.1	263.1	2183.3
Cannanore	753.8	727.5	55.6	162.7	33.3	32.2	-	-	4.2	44.4	233.7	330.3	2377.7
Kozhikode	901.5	802.4	20.9	163.3	91.0	13.9	-	0.8	19.7	173.2	228.2	278.1	2698.0
Palghat	526.9	357.9	30.8	303.7	110.5	58.7	-	-	14.5	111.9	127.6	203.6	1846.1
Trichur	555.9	455.1	42.1	243.9	25.5	27.9	0.9	2.7	12.9	87.0	100.5	367.2	1921.6
Ernakulam	617.4	584.8	81.9	290.6	104.3	44.7	1.7	-	25.1	157. 7	234.6	289.6	2432.4
Kottayam	438.8	384.0	63.0	237.4	93.1	69.9	0.3	19.7	27.6	251.9	453.0	229.8	2268.5
Alleppey	486.3	405.5	128.0	403.6	112.0	62.6	1.7	12.6	16.8	236.3	403.0	276.0	2542.4
Quilon	329.0	279.7	87.5	388.5	150.4	101.2	1.7	21.2	29.7	215.7	261.8	177.7	2044.1
Trivandrum	203.3	137.4	50.1	353.5	101.4	62.6	-	23.0	28.4	159.7	245.7	135.4	1500.5
Malappuram	557.7	450.6	24.1	269.9	101.2	11.0	-	-	9.2	155.2	173.2	319.0	2071.1
Idikki	582.1	556.3	113.7	224.0	87.0	132.3	2.9	1.9	4.0	109.6	212.7	287.5	2314.0

Source : Kerala - Season and Crop Report 1973-74, Table 1.2, pp. 32

APPENDIX - 24

INDEX OF MECHANISATION

District/ State	1960-61	1963-64	1967-68	1970-71	1973-74
Kerala	5.53	4.40	3.82	4.80	4.25
Cannanore	3.97	3.17	3.06	3.67	3.52
Kozhikode	2.02	2.23	2.06	2.51	3.05
Palghat	7.19	6.58	6.09	7.63	6.57
Trichur	7.21	9.20	15.60	6.64	6.38
Ernakulam	6.22	5.63	5.44	8.06	9.29
Kottayam	5.01	3.14	1.82	2.84	2.63
Alleppey	8.06	7.62	7.37	7.60	8.23
Quilon	3.89	4.10	3.14	4.84	4.86
Trivandrum	1.51	3.03	1.40	2.33	2.45

APPENDIX - 25

FERTILIZER USE PER 1000 HECTARES OF GROSS CROPPED AREA

(Metric Tons)

State/ District	1960-61	1963-64	1967-68	1970-71	1973-74
Kerala	4.55	11.32	18.80	19.01	28.47
Cannanore	2.95	7.06	9.71	9.79	16.24
Kozhikode	1.92	5.23	13.33	13.06	21.26
Palghat	3.93	12.83	16.00	14.87	34.39
Trichur	6.15	12.85	22.06	11.14	37.97
Ernakulam	6.28	10.46	18.33	27.15	35.23
Kottayam	4.91	14.79	28.36	30.88	30.78
Alleppey	7.52	21.58	34.17	35.30	47.27
Quilon	3.63	11.93	13.42	13.32	13.99
Trivandrum	3.73	5.21	13.84	15.63	19.17

Source :- "Effective Demand for Fertilizers in India": Prepared by D. Brown, I.B.R & D., New Delhi Dorris D. Brown, I.B.R. & D., New Delhi, Appendix Table VI, 1959-60 to 1968-69, pp. for the years 1970-71 and 1973-74, it was taken from "Fertilizer Statistics", 1971-72 and 1974-75, Fertilizer Association of India, pp. 211 and 1 to 85.

APPENDIX - 26

INTENSITY OF CROPPING

State/ District	1960-61	1963-64	1967-68	1970-71	1973-74
Kerala	122	122	130	135	136
Cannanore	112	113	114	122	111
Kozhikode	116	110	117	145	145
Palghat	132	132	134	132	133
Trichur	156	150	157	177	179
Ernakulam	110	115	126	126	119
Kottayam	111	111	112	116	129
Alleppey	140	138	142	142	147
Quilon	124	127	149	149	162
Trivandrum	133	131	158	160	160

APPENDIX - 27

PERCENTAGE OF AGRICULTURAL LABOURERS TO AGRICULTURAL WORKERS

State/ District	1960-61	1963-64	1967-68	1970-71	1973-74
Kerala	44.80	51.38	58.55	62.75	67.24
Cannanore	41.84	50.57	59.58	64.93	69.42
Kozhikode	46.92	55.21	62.21	65.80	68.53
Palghat	60.76	65.57	70.82	74.09	76.92
Trichur	47.90	57.22	65.89	70.64	84.87
Ernakulam	40.63	45.44	55.08	60.30	62.92
Kottayam	42.89	46.43	49.81	51.69	53.20
Alleppey	51.60	56.47	62.06	65.69	68.94
Quilon	30.19	34.62	39.97	43.62	47.00
Trivandrum	40.51	50.86	61.59	67.99	73.37

APPENDIX - 28

PERCENTAGE OF RURAL LITERATES TO TOTAL RURAL POPULATION

State/ District	1960-61	1963-64	1967-68	1970-71	1973-74
Kerala	45.65	52.64	60.42	59.72	64.49
Cannanore	39.46	63.70	89.25	53.99	70.98
Kozhikode	38.64	43.87	49.63	53.26	56.42
Palghat	32.96	36.34	40.30	42.94	45.33
Trichur	47.16	51.94	57.23	60.57	63.49
Ernakulam	48.30	53.46	59.57	63.67	67.41
Kottayam	55.50	59.38	63.94	66.97	69.71
Alleppey	56.55	61.23	66.77	70.46	73.90
Quilon	49.94	55.08	60.96	64.77	68.18
Trivandrum	42.35	48.83	56.16	60.87	65.04

APPENDIX - 29

PERCENTAGE OF RURAL SCHEDULED CASTE AND TRIBE TO TOTAL RURAL POPULATION

State/ District	1960-61	1963-64	1967-68	1970-71	1973-74
Kerala	10.57	10.55	10.15	10.47	10.38
Cannanore	6.97	6.87	6.77	6.70	6.65
Kozhikode	9.15	9.11	5.97	9.05	8.47
Palghat	13.84	13.80	13.26	13.05	12.86
Trichur	11.39	11.34	11.29	11.25	11.22
Ernakulam	9.86	9.93	10.02	10.07	10.13
Kottayam	10.94	10.74	10.52	10.36	10.22
Alleppey	10.16	10.24	10.35	10.41	10.47
Quilon	12.20	12.12	12.18	12.17	12.17
Trivandrum	10.62	10.81	11.04	11.17	11.30

APPENDIX - 30

DEMOGRAPHIC ASPECTS
1961

State/ District	Total Population	Total Rural Population	Total Scheduled Caste/Tribe	Cultivators	Agricultural Labourers	Agricultural workers	Literates and educated Persons
Kerala	16,903,715	14,349,574	1,516,521	1,178,103	978,396	2,156,499	7,919,220
Cannanore	1,780,294	1,480,177	103,284	152,971	110,051	263,022	735,038
Kozhikode	2,617,189	2,184,682	200,030	127,844	113,024	240,868	1,063,295
Palghat	1,776,566	1,604,716	222,112	140,505	217,567	358,072	604,978
Trichur	1,639,862	1,454,210	165,635	90,276	83,031	173,307	794,782
Ernakulam	1,859,913	1,464,603	144,513	126,789	86,773	213,562	940,226
Kottayam	1,732,880	1,567,411	171,486	113,397	85,170	198,567	980,273
Alleppey	1,811,252	1,500,821	152,591	109,566	116,834	226,400	1,029,930
Quilon	1,941,228	1,796,992	219,246	200,403	86,691	287,094	980,460
Trivandrum	1,744,531	1,295,962	137,674	116,352	79,252	195,604	790,238

Source : Census of India 1961, Kerala General Population Tables, Part II (A).

APPENDIX - 34

DEMOGRAPHIC ASPECTS
1971

State/ District	Total Population	Total Rural Population	Total Scheduled Caste/Tribe	Cultivators	Agricultural Labourers	Agricultural workers	Literates and educated Persons
Kerala	21,347,375	17,880,926	1,859,125	1,106,663	1,908,114	3,014,777	12,898,072
Cannanore	2,365,164	2,040,260	136,901	130,878	242,383	373,261	1,297,023
Kozhikode	3,475,538	2,833,960	256,530	150,320	289,284	439,604	1,859,027
Palghat	2,172,415	1,913,492	249,718	122,204	349,585	471,789	1,022,451
Trichur	2,128,797	1,878,952	211,527	82,354	198,203	280,557	1,311,643
Ernakulam	2,383,178	1,726,288	174,007	100,547	152,759	253,306	1,555,952
Kottayam	2,085,134	1,871,990	194,008	150,655	161,214	311,869	1,412,141
Alleppey	2,126,722	1,766,026	183,896	96,798	183,481	279,279	1,497,370
Quilon	2,412,821	2,222,918	270,686	185,620	143,647	329,267	1,567,532
Trivandrum	7,198,606	1,627,040	181,852	88,287	187,558	275,845	1,374,933

Source : Census of India 1971, Kerala General Population Tables Part II (A).

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