MOVEMENT OF INPUT AND OUTPUT PRICES OF RICE IN KERALA AND ITS IMPACT ON AREA, YIELD AND OUTPUT

Thesis submitted to the Cochin University of Science and Technology
for the award of the Degree of Doctor of Philosophy in Economics
under the Faculty of Social Sciences

THRESSIAMMA [redacted]

Under the supervision of

Dr. K. C. SANKARANARAYANAN
Professor & Head of the Department

DEPARTMENT OF APPLIED ECONOMICS
COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY
COCHIN - 682 022, KERALA

MAY, 1988

Dr. K. C. SANKARANARAYANAN
PROFESSOR

HEAD OF THE DEPARTMEN
DEPARTMENT OF APPLIED ECONOMIC
COCHIN UNIVERSITY C
SCIENCE AND TECHNOLOG
COCHIN-682 0
PHONE: OFF. 85-60
RES. 85-63

2nd May, 1988.

C E R T I F I C A T E

Certified that the thesis "Movement of Input and Output Prices of Rice in Kerala and its Impact on Area, Yield and Output" is the record of bona fide research carried out by Sr. Thressiamma K.V. under my supervision. The thesis is worth submitting for the degree of Doctor of Philosophy in Economics.

Dr. K.C. Sankaranarayanan.

DECLARATION

I declare that this thesis is the record of bona fide research work carried out by me under the supervision of Dr. K.C. Sankaranarayanan, Professor and Head of the Department of Applied Economics, Cochin University of Science and Technology, Cochin-22. I further declare that this thesis has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or other similar title of recognition.

Thressiamma K.V.

Thressiamma K.V.

Cochin-682 022,
2nd May, 1988.

"Happy is the man who finds wisdom,

and the man who gets understanding,

for the gain from it is better than gain from silver

and its profit better than gold.

She is more precious than jewels,

and nothing you desire can compare with her.

Long life is in her right hand;

in her left hand are riches and honour.

Her ways are ways of pleasantness,

and all her paths are peace.

She is a tree of life to those who lay hold of her;

those who hold her fast are called happy"

Proverbs 3: 13 - 18.

ACKNOWLEDGEMENT

This thesis is the outcome of the continuous research work conducted under the able and edrudite direction of Dr. K.C. Sankaranarayanan, Professor and Head of the Department of Applied Economics from 10-12-1984 onwards. My boundless gratitude is due to him for his invaluable guidance, vast scholarship, benign personality and persistent interest without which this thesis would not have been completed.

I am deeply indebted to Dr. M.K. Sukumaran Nair, Reader, Department of Applied Economics, who helped me at every stage in the preparation and presentation of the thesis. My sense of obligation to him for his helpful criticisms and unstinted assistence especially in the verification of the statistical part of the thesis is too deep for words.

My sincere thanks are due to the Cochin University of Science and Technology for providing facilities for research. I also thank the staff members of the administrative office, who took real interest to get the things done during the course of this study.

Thanks are due to Dr. Jose, T. Payyapilly, Professor and Dr. Mary Joseph, School of Management Studies and Dr. Rajasenan, Department of Applied Economics for their timely help.

I express my deep sense of gratitude to Miss. Elizabeth Abraham (Librarian), Mr. Chandradath and Mr. George, C.V. (Office staff), Department of Applied Economics for their profound help and assistance.

I owe a lot to the University Grants Commission for awarding me the Teacher Fellowship under the F.I.P. for pursuing this course. I also thank the Director of Collegiate Education and the Secretary to Government for sanctioning the deputation.

I extend my sincere gratitude to Dr. L.S. Venkataramanan (Ex-Director), Dr. V.M. Rao (Director), Dr. Abdul Aziz (Professor and Head of the Economics Unit), Dr. Rayappa, (Professor, Demography Unit), Dr. Hemlata Rao, Dr. K.N. Ninan and Dr. Prahladachar of the Institute for Social and Economic Change (ISEC) Bangalore, with whom I had enlightening discussions. I am thankful to Dr.Deshpande and Mr.Krishnachand for assisting me to do computation work. I also extend my sincere thanks to Mr.A.M.Jose and Mr. Jose Thomas for their friendship and help during my stay there.

I am much obliged to Dr. P.G.K. Panikar (Ex-Director) for making available all the facilities of the Centre for Development Studies, Trivandrum. I sincerely thank

Dr. T.N. Krishnan (Director) and Dr. Chandan Mukherjee for permitting me to do the calculations using the computer of the centre. I recollect with gratitude the inspiring discussions I had with Dr. P.S. George (Senior Fellow), Shri. Michael Tharakan and Dr. Thomas Isaac. I gratefully thank Dr. Jessy John, Smt. Sujana, Mr. Sivadas and Mr. Kesavan Nampoothiri for assisting me in the statistical analysis and computation work. I am grateful to Mr. Anand and Miss. Soudhamini for their kind and sincere help.

My heart felt thanks are due to the Librarians and other staff of the Institute for Social and Economic Change (Bangalore), Centre for Development Studies, Directorate of Economics and Statistics, Directorate of Agriculture, Farm Information Bureau, State Planning Board, Kerala University Library, Department of Economics, University Centre and Civil Supplies Department (Trivandrum), Kerala Agricultural University (Vellanikara), University Library and School of Management Studies, CUSAT (Cochin-22) and St. Joseph's College (Irinjalakuda).

I will be failing in my duty, if I do not express my deep sense of gratitude to Rev. Sr. Franco, Principal, St. Joseph's College, Irinjalakuda, who inspired me with the idea of doing research. Had it not been for her constant encouragement and abundant good will, I would not have been able to embark as this ambitious programme. I express my deep sense of obligation to her. Words would be inadequate to express my gratitude to my beloved Professors, Mrs. Rose Williams and Rev. Sr. Joshua for their unfailing love and sustained encouragement. I acknowledge the co-operative and helpful attitude of my colleagues especially my dear Sr. Rose Ann, Prof. and Head of the Department of Economics. I owe a lot to Rev. Sr. Cleopatra, Senior Supdt. and other office staff of St. Joseph's College for their kind and sincere services in all kinds of official correspondence.

I acknowledge my deep sense of gratitude to Rev. Mother Prosper, Superior General, Rev. Sisters Bianca, Annie Palathingal and Ambrose, the successive managers, sisters of my community and congregation and all beloved ones in my family for their kind help, encouragement and prayers.

I gratefully express my deep sense of gratitude to Smt. A.K. Suseela (Matron, Aiswarya, CUSAT) and sisters of Santhi Nikethan (Trivandrum) for their loving encouragement and prayers.

I also cherish fond feelings of gratitude to my fellow research scholars and friends especially Lizy, Sisy, Dr. Harikumar, Saly, Usha, Rose, Profs. K.G. Jose and George Zachariah for their wholehearted support and generous help.

My sincere thanks are also due to Smt. V. Alamma, Office Supdt., for typing the work neatly and correctly.

Last but not the least, I am thankful to the authors and publishers, whose books, journals and articles were used for the preparation of this thesis.

Thressiamma, K.V.

C O N T E N T S

LIST OF TABLES

Statistical Annexure

Appendix

LIST OF DIAGRAMS

LIST OF MAPS

Chapter 1

INTRODUCTION

1.1 Statement of the Problem

1.2 Objectives of the Study

1.3 Review of Literature

1.4 Hypotheses

1.5 Data and Methodology

1.6 Limitations

1.7 Scheme of the Study

Chapter 1

INTRODUCTION

Today a sizeable portion of paddy lands are left idle. Moreover lands suitable for raising food crops such as paddy, tapioca etc., are being converted to grow cash crops, especially rubber. Rubber is being substituted for paddy on the basis of profitability criterion. But, in the long run, this may go against the interests of the State when we consider the fact that Kerala has deficiency in food. Therefore it is time for the Government and the people of Kerala to give serious consideration to their present land use and crop-raising policy.

There are 111 rice growing countries in the world. They include all Asian countries, most countries of West and North Africa, most of the South and Central American countries, Australia and at least four states in the United States. Although the bulk of rice production is centred in the west tropical climate, the crop flurishes in humid regions of the subtropics and in temperate climates such as Japan, Korea, China, Spain, Portugal, Italy, France, Romania, Czechoslavakia, USSR and the United States.

Japan and Spain have historically produced the highest average rice yield per hectare (six tonne per hectare). In 1977, however, the Republic of Korea took the lead with an average of 6.8 tonne per hectare.

Among the 111 rice producing countries, three countries produce an average of six tonne per hectare or more, 17 countries produce four tonne per hectare or more, 78 countries produce three tonne per hectare or less - 57 produce two tonne per hectare or less - and 13 produce less than one tonne per hectare.

Rice is the most extensively cultivated crop in the world, particularly concentrated in Asia and the Far East. Asian countries together make up for as much as 91.80 per cent of the world production (in 1986) can be seen from the figures in Table 1.1.

Of the countries in Asia, India occupies the first place in area, China in production and Japan in productivity. In 1986 China and India together contributed to about 56.74 per cent of the total area under rice in Asia and 61.16 per cent of the total production. As is seen from Table 1.2; India, China, Indonesia, Thailand, Burma, Philipines, Japan and Pakistan together contributed 81.63 per cent of total rice area and 84.65 per cent of the production in 1986.

In India though Uttar Pradesh leads in area, the productivity per hectare was the highest in Punjab. In 1982-83 Andhra Pradesh came first in total production among Indian states as can be seen from Table 1.3. Punjab, Haryana, Goa, Daman and Diu, Andhra Pradesh, Jammu and Kashmir, Karnataka, Tamil Nadu, Andaman and Nicober Islands, Kerala, Dadra and Nagar Haveli, Pondicherry, Tripura, Delhi, Manipur and Maharashtra were having yield rate above the all India average. Kerala ranked seventh in yield rate among the states in India.

Kerala has been cultivating rice from very ancient times. But rice production per unit area on an average has remained low in Kerala compared to the neighbouring states. Official sources of statistics on the area under rice give us only the total gross cropped area under rice in each year, not the net sown area (ie., the actual physical area under rice). The gross area may increase either due to an increase in multiple cropping or due to an increase in the Physical area under the crops during a particular production cycle. From the regular official figures it is not possible to separate those two components and to measure only the changes in the physical area.

Cochin was merged with Travancore in 1948 and thereafter, data are not readily available separately for these two units. We get data on gross area from 1952-53 onwards. In general, the gross area under rice has been declining in both absolute and relative terms. However, while the proportion of area under rice to total area started falling from 1952-53, the decline in absolute terms began only from 1975-76.

The relative area under rice, on the other hand, fell almost continuously throughout the period of study in the whole of Kerala. After 1974-75, both the absolute and relative rice area fell. Table 1.4 shows the change in land area under rice.

It is clear from Table 1.4 that between 1952-53 and 1968-69, when the proportion of area under rice declined significantly, the absolute gross area rose sharply. This implies that the area under some other crops, coconut and rubber, increased more rapidly than rice area (Tables 2.11 & 2.15) from 1969-70 to 1974-75, the period in which the state-wise gross area under rice stagnated, total cropped area and net area sown increased significantly. This also indicated that the area under some other crops like coconut, rubber, etc. have increased during this period also (Tables 2.10 & 2.14).

After 1974-75, not only the absolute and relative rice area but also total cropped area and net sown area fell. This may be due to fall in absolute and net area under some other crops also such as coconut, tapioca etc. (Tables 1.4 & 2.4).

Now let us see the productivity of rice per hectare in Kerala. It is significant to note that the increase in productivity prior to the period of High Yielding Variety (HYV) Era (1965-66) was from 973 Kg. per hectare in 1952-53 to 1401 Kg. per hectare in 1964-65. The average productivity in spite of the spread of HYV and other developmental efforts has been 1243 Kg. per hectare in 1965-66 and 1729 Kg. per hectare in 1985-86 (Table 1.5). The rise in productivity between 1952-53 and 1964-65 was 43.99 per cent while that between 1964-65 and 1985-86 was only 23.41 per cent.

Now let us turn to the position of total output of rice in Kerala. It was in the year 1972-73 the state recorded the all time high production of 13,76,370 tonnes of rice. The highest productivity of 1729 Kg. per hectare of rice was recorded during the year 1985-86.

Table 1.6 indicates the production trends of rice crop in Kerala from 1952-53 to 1985-86.

It can be seen from table 1.6 that production of rice in Kerala had registered a moderate increase upto 1972-73. Production in all the subsequent years has been however below the 1972-73 level.

We can have a look at the average farm price of paddy and average agricultural wages in Table 1.7. The rising trend of farm harvest price of paddy, which continued over the major part of the period since 1952-53, was reversed from 1974-75 and the cost of production began to rise.

1.1. Statement of the Problem

The Third world countries today show an increasing trend of commercialisation of the agricultural sector. It may be seen against the background that these countries do not produce adequate food to meet their requirements. In the case of Kerala also such a trend is quite pronouncedly observed. Available data indicate that the area under rice, the most prominent food crop in the State, has been declining in both absolute and relative terms. Similar is the case with regard to the area under pulses, millets and other supplementary food-grain crops. In contrast to this, the area under important plantation crops such as rubber, cardamom, coffee etc., has registered substantial increases. This shows a clear shift in the cropping pattern, a shift in favour of plantation crops, possibly at the expense of some foodgrain crops.

To illustrate, the area under rice has decreased from 881.47 thousand hectares in 1974-75 to 678.47 thousand hectares in 1985-86 and its share in the total cropped area has declined from 29.11 to 23.65 per cent respectively. The decline in area under rice since 1974-75 has been steady. There have been year to year fluctuations in the area, though of a mild order, during the earlier periods but in the subsequent period a steady decline is observed. The extent of the decline in rice area over eleven years since 74-75 worked out to 203.19 thousand hectares, i.e., by about 22.87 per cent, whereas the area under plantation crops has increased during the corres-ponding period by 156.21 thousand hectares from 323.10 to 479.31 thousand hectares ie., by about 48.35 per cent. In relative terms the share of the area under plantation crops in the total cropped area has expanded from 10.67 per cent in 1974-75 to 16.72 per cent in 1985-86. The relative gain in area registered by plantation crops among others may largely be due to the relative profitability of the plantation crops.

The declining trend in area under rice observed in recent years needs special investigation. Data show that the rising trend of farm harvest price of paddy which started in 1952-53 continued upto 1974-75. Ever since 1974-75 the trend was reversed. The worst part of it is that when the rising trend of farm harvest price of paddy was reversed, the cost of production of paddy began to rise. For example, the average farm price of paddy in Kerala rose to the peak level of Rs.246 per quintal in 1974-75. Since then it dropped almost steadily and touched a low level of Rs.128/- per quintal in 1978-79. Thereafter it increased at a slow rate and reached the 1974-75 level of Rs.246/- per quintal in 1985-86. During the same period, the average wage rate of paddy farm labour registered an almost steady increase from Rs.1.78 in 1952-53 to Rs.2.22 in 1961-62, to Rs.5.44 in 1971-72 and to Rs.25.96 in 1985-86.

The production of rice in Kerala recorded a moderate increase upto 1972-73. Production in all the subsequent years has been, however, below the 1972-73 level. The yield rate of even the high-yielding varieties for the period after 1974-75 seems to be stagnant when compared to the preceding five years. All these have apparently affected the relative profitability of rice cultivation in Kerala. Therefore, a detailed study of the trends in input and output prices of rice and their impact on area, yield and total production is called for, particularly for Kerala, a state with chronic rice deficit.

1.2. Objectives of the Study

The main objective of the present study is to analyse the rice economy of Kerala over time and space at the State, district and taluk level. The specific objectives are the following:

1. To analyse the trends in area, yield and total production of rice during the three seasons in the state, districts and taluks.
2. To study the trends in input and output prices of rice and coconut in the state, districts and taluks.
3. To estimate the impact of input and output prices on area, yield and total output of rice in the state, districts and selected taluks.
4. To examine the conversion of paddy field into coconut garden and rubber plantation.

1.3. Review of Literature

A number of empirical studies were conducted to assess the Indian farmer's responsiveness to price changes. Most studies were concerned with acreage response of individual crops in different regions to changes in their price relative to that of their substitutes. Studies on response of level and composition of input use or of yield rate to changes in prices of crops relative to prices of their substitutes or prices of inputs are limited to a very few crops and regions. Hardly any study has been conducted on acreage, yield or output response at the aggregate level (comprising all crops) to changes in the ratio of output to input prices. The scope for such studies is limited owing to lack of reliable time series data regarding the quantum of inputs used on different crops and regions. It is clear, however, that in the absence of such studies confident assertions about the efficacy of price policy, and more particularly the policy of providing incentive prices to farmers in stimulating a high rate of agricultural growth rest on rather weak foundations.

Studies on acreage response of individual crop have used a variety of techniques and models which can be broadly grouped as graphical method, traditional econometric model and 'Nerlovian' econometric model.

Two pioneering studies by Dharm Narain (1965) and S.C. Gupta and A. Majid (1962) used the graphical method for analysis. Dharm Narain's study was an important and extensive study of supply response of several major crops grown in different regions of India. It covered the period from 1900 to 1939. His analysis indicated the existence of a stronger positive relationship between changes in acreages and in prices in case of non-food crops than that in food crops.

Gupta and Majid considered sugarcane acreage for Deoria district in U.P. for 13 years, 1949-50 to 1961-62 with data partially got from a survey. They found that though no systematic trend emerged in the relative price of sugarcane to paddy, the acreage under sugarcane relative to paddy increased continuously during this period. After removing the trend, through link relatives, they found that in seven out of eleven observations, the direction of change in the relative acreage and relative price was the same. But they maintain that though this evidence suggests a positive acreage response, the increase in the relative acreage of sugarcane was due to other factors. They found that the gross returns per acre of sugarcane was about 3 to 4 times higher than that of paddy and net returns per acre of sugarcane in a like-wise higher amount. Sugarcane was also very highly commercialised at about 80 per cent. Further the Government encouraged Sugarcane production by providing credit, giving developmental and co-operative marketing facilities and guaranteeing market for sugarcane at a fixed price announced in advance. The authors hold that all the factors, more than prices, led to an increase in sugarcane acreage.

In contrast to the graphical method the econometric techniques give a summary measure of the relationship between acreage and price. They also have the advantage of being able to segregate the effect of variables other than price on acreage and study the relationship between acreage and price. The expected values of some of the variables (like price) and not the observed values in the current year affect the acreage under a crop. In the traditional econometric models, expected values are assumed to be equivalent to the observed value with a definite time lag (usually taken as one year). In these models, the desired change in acreage is also assumed to be taking place within one season itself.

The traditional econometric studies on the responsiveness of acreage to changes in relative output price include those of Zvi Griliches (1959, 1960), Felcon W.P. (1964), Jekhade and Majumdar (1964), Mangahas et.al (1965), John P.V. (1965), George M.V. (1965), Kamaladevi and Rajagopalan (1965), Acharya and Sengupta (1966), Subharao (1969), Pillai P.P.(1969), Lalitha Sud and Kahlon (1969), Reddy (1970), Suhay (1971), Bansil (1973) Acharya and Batia (1974), Evans (1978), Hrishikesh Panda (1985) and many others. These studies differ from one another with regard to the specification of supply decision model, the crops and states covered and the period of coverage.

The Nerlovian econometric model specifies the mode of expectation of a variable. In this case, unlike in the case of traditional econometric models, all past values of a variable determine its expected value. The Nerlovian model also considers long term adjustment (adjustment over more than one year) of the desired acreage. Most studies in India especially since the mid-sixties have considered only the latter part of the model, the lagged adjustment part, as the expectation-cum-lagged adjustment model has identification problem.

Studies based on partly or fully Nerlovian Econometric Model on the responsiveness of acreage to changes in relative output price include those of Marc Nerlove (1956, 1958), Stern (1962), Raj Krishna (1963), Sawhney (1968), Behrman (1968), Robert Herdt (1970), Maji and Jha (1971), Sidhu and Kaul (1971), Subramanian et.al. (1971), Venkataramanan (1971), M.C. Madhavan (1972), Tomak (1972), Misra and Radhakrishna (1973), J.T. Cummings (1975), Balwinder Singh et. al (1977), Jhala M.L. (1979), Nandakumar Menon (1982), K.N. Ninan (1987) and many others.

The results of these econometric studies, which mainly tested the hypothesis on the normal, rational, output response of farmers to output and input price changes, indicate that Indian farmers do respond to relative price changes as hypothesised and that the price elasticity is, in general, low for foodgrain crops which occupy large areas, and relatively high for cash crops like jute, cotton and sugarcane which occupy relatively smaller areas.

1.3.1. Studies on Yield Response of a Crop

Only very few studies have been conducted on yield response to price compared to acreage response. This is because research workers generally consider that yield level depends on so many factors such as rainfall, level of inputs, occurrence of pests and diseases and hence it is difficult to find yield response. Some research workers also consider variability of inputs with land in backward agriculture and so the magnitude acreage response and output response to price will be the same (Raj Krishna, 1963). It is, however, an empirical question to be found out. The allocation of traditional inputs (especially manures and labour) may be varied in the same proportion as that of area to a crop. But with modern inputs like fertilisers which are wholly purchased, it is likely that the quantum used will not vary proportionately with acreage. In that case output and acreage response will be different. In studying yield response to price, one must, however, 'net out' the influence of disturbing factors like rainfall, pests and diseases etc. on yield. One such attempt is the study by D.S. Sidhu (1978).

The studies mentioned above in general show that farmers in different parts of India at different periods of time have responded to price changes. They change the area under a crop in response to changes in its relative price. Moreover, at least in advanced regions like Punjab, they vary the yield level of the crops in response to output-input price changes. The studies by Dharm Narain, Raj Krishna, and M.C. Madhavan point out that the acreage response of commercial crops to price is higher than that of subsistence crops. This suggests that the subsistence crops are not treated as if the whole of the output of those crops were meant for the market, that is, farmers do not value the whole output of those crops at the market price. If they did so, there is no reason why the acreage response of these crops in general should be lower than that of commercial crops.

1.3.2. Farmers output Response to Price

In the case of many crops, farmers retain a significant part of their produce for self-consumption. Therefore, their response to a price change is noted at two levels: (i) marketed supply; and (ii) production. The price responsiveness of marketed supply and output need not be the same. For instance, within a very short period when the level of production cannot be changed, output response will be zero. However, farmers may change the marketed supply with respect to a price change by adjusting the amount for self-consumption accordingly. Moreover, when the prices change, the income of farmers changes and there will be an income effect on marketed supply which is very likely to make the marketed supply response and output response different. T.N. Krishnan (1965) found that due to a higher income than substitution effect, farmers' marketed supply response of foodgrains to change in price was negative in the short run when the output of foodgrains is given. Fixed requirement of money by small farmers, it is argued, makes their marketed supply response negative. But this would be accompanied by a zero or positive output response (Mathur and Ezakiel 1961).

For policy purposes both marketed supply response and output response are important. Output response to price can take place either through change in acreage or yield or both. Output response can also be at the aggregate level comprising all crops or at a crop level.

When prices of crops change vis-a-vis price of inputs, the profitability of crops as a whole will change. So if farmers are profit maximizers, they would respond to this by changing the total gross cropped area (brought about through changes in net sown area and/or cropping intensity) and/or through change in overall yield per hectare (by changing the intensity of input use). Similarly, when prices of crops change disproportionately, there will be reallocation of total GCA and other-inputs among the crops.

1.3.3. Farmers' Acreage Response to Price

Farmers' aggregate acreage response to price depends largely on availability of land and possibility of increasing cropping intensity. In a situation of relative increase in crop prices (relative to input prices) if neither net sown area nor cropping intensity can be increased (ie., total GCA cannot be increased) then aggregate acreage response will be zero. Therefore aggregate output response will be restricted to the extent of increase in overall productivity of land through more intensive use of other inputs.

However, at a crop level this need not be the case, even if total G C A cannot be increased, there can be substitutior among crops for one another's area. The acreage response of a crop may, however, be limited by the extent of substitutability between that crop and other crops (determined by the suitability of land to that crop). The share of a crop in a region is also important in the sense that once a crop occupies a large proportion of total G C A, the possibility of such a crop being substituted for other crops, given an increase in its relative price (vis-a-vis other crops), gets limited thereby giving rise to a low acreage response.

In order to be able to measure the acreage response of a crop, we have to get the effect of price on area after netting out the effect of other factors. This can be done by considering a multiple regression with area under the crop as the dependent variable and price and other variables as the independent variables. Therefore, we have to identify the factors having significant influence on area under a crop. These factors can be different for the irrigated, unirrigated and total area under a crop.

Change in the profitability of a crop depends on the relative movement of the price of the crop to that of its output. However, area allocation to a crop will depend on the relative profitability among the crops. If the profitability of a crop goes up vis-a-vis that of other crops, one can expect that more area will be allocated to that crop and vice versa. Therefore, depending on the relative cost per unit of output (determined by the level of composition of input use and input prices) and relative price there will be competition among crops for share in the new total G C A. Even when total G C A remains the same there can be change in the area allocation to a crop depending on the movement of its price and cost relative to that of other crops. This has to be distinguished from the changes in area under a crop attributable to a change in total G C A which could occur as a response to growing demographic pressure and/or when prices of crops in general are changing at a different rate from prices of inputs.

1.4. Hypotheses

1. Input and output prices are important factors which influence farmers' decision to change area, productivity and production of paddy in the state.

2. The area under rice in the state has been progressively declining due to faster rise in wage rate, farm price of coconut and fertiliser price. There has been conversion of rice fields into coconut gardens and coconut gardens to rubber plantation.

3. The total production of rice in the state also has been declining mostly owing to very rapid decline in area. Again, increase in productivity has been only marginal mainly because of lesser coverage under punja crop and high-yielding

varieties of seeds, slow growth of irrigation facilities and paucity of fertiliser consumption.

1.5. Data and Methodology

The data for the study have been mainly collected from the official publications such as Agricultural statistics in Kerala, Economic Review, Statistics for planning etc. Taluk level price and wage data were taken from the official book of the Price Section, Directorate of Economics and Statistics, Trivandrum. Taking into consideration the data availability, state and district level analysis has been carried out for 26 years ie., from 1960-61 to 1985-86 and taluk level analysis for 12 years only ie., from 1974-75 to 1985-86.

The period of study is divided into three sub-periods because these three periods indicate three phases of Kerala's rice crop. They are: (i) 1960-61 to 1968-69, (ii) 1960-61 to 1974-75 and (iii) 1974-75 to 1985-86. In addition, the entire period is taken as combined period. Hence altogether we have four periods for the purpose of analysing the secondary data.

In order to study the trends, growth rates and variability of input prices, output prices, area, yield and total production of rice, the statistical data are used to calculate percentages, ratios, co-efficient of variation, R^2 values, 't' statistics, growth rates etc. and to draw diagrams and maps. Again multiple regression technique is used to measure the acreage, production and yield response of rice in order to identify the regressors having significant influence on those dependent variables. Current year estimates ('t') using current year dependent and independent variables and previou year estimates ('t-1') using current year dependent and previous year independent variables were made use of with regard to the calculations of acreage, yield and production response.

Farm harvest price and cost of cultivation are considered as the important factors which directly affect the farmers' decision. Hence farm level price of paddy and coconut in the case of farm harvest price and fertiliser price and wage rate in the place of cost of cultivation have been taken as four important explanatory variables.

1.6. Limitations

Data on wage are available only for 20 centres and these centres represent 20 taluks. These 20 taluks represent 10 districts ie., two taluks in each district. Hence the data collected by the Directorate of Economics and Statistics from these 20 centres with regard to the agricultural labour cost were taken as representative data for the 20 taluks. And the average of the two centres in each district were taken as the wage rate representing that district. Since the data on wage rate were available only for 20 taluks, only 20 taluks were taken for the analysis.

Data on farm price of coconut from 1961-62 to 1965-66 for Palghat district and wage rate for the year 1960-61 for

Ernakulam district were not available and hence state average was taken for these years for the purpose of making the time series data continuous and comparable over time.

Fertiliser prices are almost uniform throughout the country except for minor regional differences. Hence the All India Fertiliser Price Index is used in all kinds of analysis.

Data on area under coconut and rubber were not available for taluks and hence the analysis related to the area of these crops was restricted to the State as a whole and the districts.

Since the period of study is from 1960-61 onwards, only the old nine districts which existed at that time are taken for the present study, even though five more districts were added afterwards in different years. Hence in order to bring the entire area in the state under these nine districts, area in Malappuram is redistributed between Palghat and Kozhikode, Idukki between Kottayam and Ernakulam, Wynad between Kozhikode and Canannore, Pathanamthitta among Quilon, Kottayam and Alleppey and Kasargode in Canannore district.

In spite of these limitations, adequate care has been taken in analysing the data with a view to minimising the impact of the inadequacies of the data on the conclusions of the study.

1.7. Scheme of the Study

The study is organised under six chapters. The first chapter provides a brief introduction to the study. It contains the statement of the problem, objectives, hypotheses, methodology, limitations of the study and a brief review of literature.

The change in the cropping pattern in the state and districts during the period from 1960-61 to 1985-86 is discussed in chapter two. Growth rates of area under paddy, coconut and rubber have been estimated and the shift of acreage from rice to cash crops analysed.

The third chapter deals with trends, growth rates, growth and stability of area, yield and total output of rice as a whole and during the three seasons at the state, district and taluk level. Season-wise growth rates of high yielding and local varieties have also been estimated.

The trends and growth rates of input and output prices of rice and coconut at the state, district and taluk levels are discussed in the fourth chapter.

The variables used in the Multiple Regression Model is dealt with in the fifth chapter. This chapter also throws light on the supply response co-efficient obtained by applying Multiple Regression Model to the data pertaining to rice crop. A comparative analysis of the results obtained for the four periods under study is also attempted.

The concluding chapter, besides dealing with the summary of the study, highlights some of the policy implications emerging from the study.

In the end appendix tables and selected bibliography are given.

Table - 1.1 Area, Production and Yield of the Continents and the world as a whole during 1964-65, 1974-76 and 1986.

(Area in 1000 hectare, Production in Million Tonnes, Yield Kg. per hectare)

Sl.No.	Continents/ World		1964-65	Percent-age to world total	1974-76	Percent-age to world total	1986	Percent-age to world Total
1	2		3	4	5	6	7	8
1.	Asia -	Area	84420	68.14	126678	90.09	130337	89.66
		Production	154480	60.30	316031	90.94	436562	91.80
		Yield	1830		2495		3349	
2.	Europe -	Area	340	0.27	382	0.27	406	0.28
		Production	1580	0.62	1829	0.53	2216	0.47
		Yield	4650		4792		5455	
3.	North & Central America -	Area	1320	1.07	1856	1.32	1646	1.13
		Production	4250	1.66	7301	2.10	8265	1.74
		Yield	3220		3934		5021	
4.	South America -	Area	4870	3.93	6661	4.74	6905	4.75
		Production	7470	2.92	11987	3.45	15323	3.22
		Yield	1530		1800		2219	
5.	Africa -	Area	3220	2.60	4449	3.16	5325	3.66
		Production	5730	2.24	7955	2.29	9847	2.07
		Yield	1780		1788		1849	
6.	USSR -	Area	--	--	--	--	617	0.43
		Production	--	--	--	--	2600	0.55
		Yield	--	--	--	--	4214	
7.	Oceania - (Australia & Fiji Islands)	Area	35	0.03	84	0.06	122	0.09
		Production	179	0.07	429	0.12	720	0.15
		Yield	4860		5122		5883	
	World -	Area	123900		140615		145358	
		Production	256200		347506		475533	
		Yield	2070		2471		4569	

Source: FAO Production Year Book, 1965, 1984, 1986.

Note: Percentages are calculated from the absolute figures.

Table - 1.2 Area, Production and Yield of Rice in Major Rice Growing Countries in Asia during 1974-76 and 1986.

(Area in 1000 hectares, Production in 1000 Million Tonnes, Yield in Kg./hectare)

Sl.No.	Countries/Asia		1974-76	Percentage to Asian Total	1986	Percentage to Asian Total
1	2		3	4	5	6
1.	India	- Area	38625	30.49	41000	31.46
		Production	65351	20.68	90000	20.62
		Yield	1692		2195	
2.	Japan	- Area	2756	2.18	2303	1.77
		Production	16116	5.10	14559	3.33
		Yield	5848		6322	
3.	Burma	- Area	9442	7.45	4800	3.68
		Production	9037	2.86	15000	3.44
		Yield	1829		3125	
4.	China	- Area	36568	28.87	32948	25.28
		Production	128435	40.64	177000	40.54
		Yield	3512		5372	
5.	Indonesia	- Area	8458	6.68	9871	7.57
		Production	22705	7.18	39275	9.00
		Yield	2685		3979	
6.	Pakistan	- Area	1688	1.33	2041	1.56
		Production	3834	1.21	5[illegible]41	1.20
		Yield	2272		2567	
7.	Philippines	-Area	3555	2.81	3471	2.66
		Production	6092	1.93	9350	2.14
		Yield	1713		2694	
8.	Thailand	- Area	7952	6.28	9970	7.65
		Production	14585	4.62	19100	4.38
		Yield	1834		1916	
	Asia	- Area	126678		130337	
		Production	316031		436562	
		Yield	2495		3349	

Source and Note: Ibid.

Table - 1.3 Area, Production and Yield of Rice in India and the States and Union Territories in India.

Sl.No.	States/India		1974-75	Percentage to Indian Total	1982-83	Percent-age to Indian Total	Gross Area sown	Share of state to All India GCA %
1	2		3	4	5	6	7	8
1.	Andhra Pradesh	A	3553.5	9.38	3594.5	9.51	13047	7.4
		P	5700.3	14.40	7583.2	16.31		
		Y	1604		2110			
2.	Assam	A	2057.8	5.43	2301.8	6.09	3439	1.9
		P	1983.7	5.01	2579.8	5.55		
		Y	964		1121			
3.	Bihar	A	5228.3	13.80	4496.3	11.90	10628	6.0
		P	4539.6	11.47	3059.8	6.58		
		Y	868		681			
4.	Gujarat	A	367.0	0.97	476.1	1.26	10903	6.2
		P	177.8	0.45	488.9	1.05		
		Y	484		1027			
5.	Haryana	A	275.5	0.73	489.0	1.29	5826	3.3
		P	393.0	0.99	1275.0	2.74		
		Y	1426		2607			
6.	Himachal Pradesh	A	92.1	0.24	88.2	0.23	949	0.5
		P	96.8	0.24	73.0	0.16		
		Y	1051		828			
7.	Jammu & Kashmir	A	238.0	0.63	274.4	0.73	978	0.6
		P	456.0	1.15	574.5	1.24		
		Y	1916		2094			
8.	Karnataka	A	1173.0	3.10	1076.2	2.85	11228	6.3
		P	1985.5	5.02	2062.0	4.44		
		Y	1693		1916			
9.	Kerala	A	881.4	2.33	797.9	2.11	2905	1.6
		P	1333.4	3.37	1308.8	2.82		
		Y	1513		1640			
10.	Madhya Pradesh	A	4525.8	11.95	4784.2	12.66	21756	12.3
		P	2421.4	6.12	3402.1	7.32		
		Y	535		711			

Contd.....

1	2		3	4	5	6	7	8
11.	Maharashtra	A	1307.9	3.45	1486.3	3.93	20386	11.5
		P	1398.9	3.53	1948.8	4.19		
		Y	1070		1311			
12.	Manipur	A	176.5	0.47	158.5	0.42	--	--
		P	274.7	0.69	219.2	0.47		
		Y	1556		1383			
13.	Meghalaya	A	100.1	0.26	107.9	0.29	--	--
		P	106.7	0.27	123.0	0.26		
		Y	1066		1140			
14.	Nagaland	A	64.8	0.17	110.9	0.29	--	--
		P	38.6	0.10	108.4	0.23		
		Y	596		977			
15.	Orissa	A	4432.0	11.70	3979.2	10.53	8743	4.9
		P	3166.0	8.00	2897.0	6.23		
		Y	714		728			
16.	Punjab	A	569.0	1.50	1319.0	3.49	--	--
		P	1179.0	2.98	4147.0	8.92	6429	3.9
		Y	2072		3144			
17.	Rajastan	A	130.0	0.34	119.4	0.32	18596	10.5
		P	100.2	0.25	89.6	0.19		
		Y	771		750			
18.	Sikkim	A	--	--	14.7	0.04	--	--
		P	--	--	11.6	0.06		
		Y	--	--	789			
19.	Tamil Nadu	A	2238.8	5.91	1775.0	4.70	--	--
		P	3574.7	9.03	3300.0	7.10	6909	3.9
		Y	1597		1859			
20.	Tripura	A	298.8	0.79	296.2	0.78	--	--
		P	326.0	0.82	423.5	0.91		
		Y	1091		1430			
21.	Uttar Pradesh	A	4529.8	11.96	4958.7	13.12	--	--
		P	3523.4	8.90	5529.2	11.90	24773	14.0
		Y	778		1115			
22.	West Bengal	A	5419.5	14.30	4861.5	12.86	7402	4.2
		P	6543.4	16.53	4949.1	10.65		
		Y	1207		1018			

Contd....

Sl.No.	Union Territory/ India		1974-75	Percent-age to All India total	1982-83	Percent-age to All India total	Gross Area Sown	Shares of All India GCA %
1	2		3	4	5	6	7	8
1.	A & N Island	A	11.9	0.03	12.0	0.03	--	--
		P	17.7	0.04	21.6	0.05	--	--
		Y	1487	--	1800	--	--	--
2.	Arunachal Pradesh	A	66.0	0.17	90.1	0.24	--	--
		P	57.0	0.14	94.2	0.20	--	--
		Y	864	--	1046	--	--	--
3.	Chandigarh	A			--			
		P			--			
		Y			--			
4.	Dadra, & Nagar Haveli	A	9.1	0.02	12.0	0.03	--	--
		P	7.7	0.02	18.5	0.04	--	--
		Y	846	--	1542	--	--	--
5.	Delhi	A	1.9	0.005	2.5	0.006	--	--
		P	1.2	0.003	3.5	0.007	--	--
		Y	632	--	1400	--	--	--
6.	Goa, Daman, Diu	A	53.9	0.14	53.2	0.14	--	--
		P	71.3	0.18	118.7	0.26	142	0.09
		Y	1323	--	2231	--	--	--
7.	Lakshadweep	A			--			
		P			--			
		Y			--			
8.	Mizoram	A	57.8	0.15	29.0	0.08	--	--
		P	40.2	0.10	28.3	0.06	--	--
		Y	696	--	976	--	--	--
9.	Pondicherry	A	29.0	0.07	29.1	0.08	--	--
		P	64.2	0.16	42.5	0.09	51	0.03
		Y	2214	--	1460	--	--	--
	All India	A	37888.4	100.00	37793.8	100.00	--	--
		P	39578.9	100.00	46480.8	100.00	177041	100.00
		Y	1045	--	1230	--	--	--

A - Area in thousand Hectares.
P - Production in Thousand Tonnes.
Y - Yield per Hectare in Kg.

Source: <u>Estimates of Area and Production of Principal Crops in India</u>, 1978-79, 1981-84, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, Table - 1.4 Area under Rice in Kerala (Area in '000 hectare)

Year	Cropped Area under rice	Yearly change	Annual Percent-age change	Percentage to gross crop	Total cropped area in the state	Total net Area sown in the State
1	2	3	4	5	6	7
1952-53	742.16	--	--	35.53	2089.11	N.A.
1953-54	760.85	+18.69	+2.56	35.25	2158.62	N.A.
1954-55	763.20	+ 2.35	+0.26	35.16	2170.24	N.A.
1955-56	759.35	- 3.85	-0.52	34.86	2178.31	N.A.
1956-57	762.02	+ 2.67	+0.40	34.98	2178.19	N.A.
1957-58	766.76	+ 4.74	+0.66	34.68	2210.88	1838
1958-59	768.42	+ 1.66	+0.13	34.29	2240.63	N.A.
1959-60	768.96	+ 0.54	+0.13	33.36	2305.09	N.A.
1960-61	778.91	+ 9.95	+1.30	33.16	2348.86	1924
1961-62	752.69	-26.22	-3.34	32.15	2341.20	1932
1962-63	802.66	+49.97	+8.64	32.81	2446.62	2009
1963-64	805.08	+ 2.42	+0.25	32.69	2462.58	2022
1964-65	801.12	- 3.96	-0.50	32.18	2489.45	2037
1965-66	802.33	+ 1.21	+0.12	31.45	2551.34	2064
1966-67	799.44	- 2.89	-0.37	30.49	2621.97	2091
1967-68	809.54	+10.10	+1.38	29.36	2757.44	2129
1968-69	873.87	+64.33	+7.90	30.63	2852.76	2154
1969-70	874.06	+ 0.19	+0.02	29.97	2916.09	2166
1970-71	874.93	+ 0.87	+0.11	29.84	2932.54	2172
1971-72	875.16	+ 0.23	+0.03	29.58	2958.36	2188
1972-73	873.70	- 1.46	-0.11	29.26	2986.48	2197
1973-74	874.68	+ 0.98	+0.11	29.16	2999.58	2202
1974-75	881.47	+ 6.79	+0.80	29.11	3028.00	2208
1975-76	876.00	- 5.47	-0.68	29.38	2981.28	2189
1976-77	854.37	-21.63	-2.51	29.13	2933.45	2201
1977-78	840.37	-14.00	-1.64	28.74	2923.80	2201
1978-79	799.24	-41.00	-4.38	27.70	2885.71	2204
1979-80	793.27	- 5.97	-0.75	27.79	2854.06	2195
1980-81	801.70	+ 8.43	+1.13	27.79	2884.84	2180
1981-82	806.87	+ 5.17	+0.62	27.77	2905.25	2190
1982-83	778.49	-28.38	-3.59	27.20	2862.07	2180
1983-84	740.09	-38.40	-4.88	25.86	2361.70	2180
1984-85	730.38	- 9.71	-1.31	25.40	2875.00	2184
1985-86	678.28	-52.1	-7.13	23.66	2866.55	2191

Source: Agricultural Statistics in Kerala, 1975.
Directorate of Economics and Statistics, Trivandrum, Kerala.
Economic Review, Annual series, State Planning Board, Trivandrum, Kerala.

Note : Columns 3, 4 and 5 are estimated.

Table - 1.5 Average Yield of Rice Crop in Kerala

(Kg. per Hectare)

Year	Rice	Yearly Change	Annual percentage change
1	2	3	4
1952-53	973	--	--
1953-54	986	+13	+ 1.34
1954-55	1072	+86	+ 8.72
1955-56	1164	+92	+ 8.58
1956-57	1164	--	--
1957-58	1207	+43	+ 3.69
1958-59	1242	+35	+ 2.84
1959-60	1350	+108	+ 8.70
1960-61	1371	+21	+ 1.56
1961-62	1334	-37	- 2.70
1962-63	1362	+28	+ 2.10
1963-64	1401	+39	+ 2.86
1964-65	1401	--	--
1965-66	1243	-158	+11.28
1966-67	1356	+113	+ 9.09
1967-68	1388	+32	+ 2.36
1968-69	1432	+44	+ 3.17
1969-70	1403	-29	- 2.03
1970-71	1483	+80	+ 5.70
1971-72	1544	+61	+ 4.11
1972-73	1575	+31	+ 2.01
1973-74	1437	-138	- 8.76
1974-75	1513	+76	+ 5.29
1975-76	1517	+ 4	+ 0.26
1976-77	1468	-49	- 3.23
1977-78	1540	+72	+ 4.90
1978-79	1592	+52	+ 3.38
1979-80	1638	+46	+ 2.89
1980-81	1587	-51	- 3.11
1981-82	1600	+13	+ 0.82
1982-83	1678	+78	+ 4.88
1983-84	1632	-46	- 2.74
1984-85	1720	+88	+ 5.39
1985-86	1729	+29	+ 1.69

Source: Ibid.

Note: Columns 3 and 4 are calculated.

Table - 1.6 Production of Rice in Kerala ('000 tonnes)

Year	Rice	Change over the previous year Absolute	Per cent
1	2	3	4
1952-53	722	--	--
1953-54	757	+ 37	+ 5.12
1954-55	818	+ 61	+ 8.05
1955-56	884	+ 66	+ 8.06
1956-57	887	+ 3	+ 0.33
1957-58	923	+ 36	+ 4.58
1958-59	954	+ 31	+ 3.46
1959-60	1038	+ 84	+ 8.80
1960-61	1068	+ 30	+ 2.89
1961-62	1004	- 64	- 5.99
1962-63	1093	+ 89	+ 8.86
1963-64	1128	+ 35	+ 3.20
1964-65	1121	- 7	- 0.62
1965-66	997	-124	-11.06
1966-67	1084	+ 87	+ 8.73
1967-68	1124	+ 40	+ 3.69
1968-69	1251	+127	+11.30
1969-70	1226	- 25	- 1.99
1970-71	1298	+ 72	+ 5.87
1971-72	1352	+ 54	+ 7.16
1972-73	1376	+ 24	+ 1.78
1973-74	1257	-119	- 8.68
1974-75	1334	+ 77	+ 6.13
1975-76	1329	- 5	- 0.38
1976-77	1254	- 75	- 5.67
1977-78	1295	+ 41	+ 3.27
1978-79	1273	- 22	- 1.70
1979-80	1230	- 43	- 3.38
1980-81	1272	+ 42	+ 3.72
1981-82	1339	+ 67	+ 5.27
1982-83	1306	- 33	- 2.77
1983-84	1208	- 98	- 7.50
1984-85	1256	+ 48	+ 3.97
1985-86	1173	- 83	- 6.61

Source and Note: Ibid.

Table - 1.7 Average Farm Price of Paddy and Average Agricultural Wages

Year	Price of paddy per Quintal	Change over previous year		Average Wage/Day	Change over previous year	
		Absolute	Per cent		Absolute	Per cent
1	2	3	4	5	6	7
1952-53	29.32	--	--	1.78	--	--
1953-54	29.75	+ 0.43	+ 1.47	N.A.	--	--
1954-55	28.36	- 1.39	- 4.61	N.A.	--	--
1955-56	30.02	+ 1.66	+ 5.85	1.48	- 0.30	-16.85
1956-57	36.95	+ 6.93	+23.08	N.A.	--	--
1957-58	34.49	- 2.46	- 6.66	N.A.	--	--
1958-59	36.55	+ 2.06	+ 5.64	N.A.	--	--
1959-60	39.98	+ 3.43	+ 9.38	N.A.	--	--
1960-61	40.51	+ 0.53	+ 1.33	1.85	+ 0.37	+25.00
1961-62	43.72	+ 3.21	+ 7.92	2.22	+ 0.37	+20.00
1962-63	41.02	- 2.70	- 6.18	2.42	+ 0.20	+ 9.01
1963-64	44.04	+ 3.02	+ 7.36	2.51	+ 0.09	+ 3.72
1964-65	67.78	+23.74	+53.90	2.84	+ 0.33	+13.15
1965-66	86.77	+18.99	+28.02	3.20	+ 0.36	+12.68
1966-67	101.76	+14.99	+17.28	3.71	+ 0.51	+15.94
1967-68	137.48	+35.72	+35.10	4.46	+ 0.75	+20.22
1968-69	108.98	-28.50	-26.15	4.73	+ 0.27	+ 6.05
1969-70	102.31	- 6.67	- 6.12	4.90	+ 0.17	+ 3.59
1970-71	93.53	- 8.78	- 8.78	5.09	+ 0.19	+ 3.88
1971-72	99.62	+ 6.09	+ 6.81	5.44	+ 0.35	+ 6.88
1972-73	119.19	+19.57	+19.64	5.78	+ 0.34	+ 5.88
1973-74	187.53	+68.34	+57.33	6.67	+ 0.89	+15.40
1974-75	245.92	+58.39	+31.14	8.05	+ 1.38	+20.69
1975-76	188.54	-52.38	-23.33	8.90	+ 0.85	+10.56
1976-77	147.74	-40.80	-21.64	8.48	- 0.42	- 4.72
1977-78	132.69	-15.05	-10.19	8.67	+ 0.19	+ 2.24
1978-79	127.76	- 4.93	- 3.72	8.99	+ 0.32	+ 3.69
1979-80	137.24	+ 9.48	+ 7.42	9.58	+ 0.59	+ 6.56
1980-81	156.84	+18.60	+13.55	11.13	+ 1.55	+16.18
1981-82	183.85	+28.01	+17.97	12.74	+ 1.61	+12.64
1982-83	212.00	+28.15	+15.31	13.24	+ 0.50	+ 3.92
1983-84	261.00	+49.00	+18.77	16.08	- 2.84	+21.45
1984-85	218.00	-43.00	-19.72	23.41	+ 7.33	+45.58
1985-86	246.00	+28.00	+11.38	25.96	+ 2.55	+10.89

Source: Ibid.
Statistics for Planning, 1977, 1980, 1983, 1986.
Directorate of Economics and Statistics, Trivandrum, Kerala.

Note : Columns 3, 4, 6 and 7 are estimated.

Chapter 2

CHANGES IN CROPPING PATTERN IN KERALA

2.1 Brief Review of Agricultural Situation in Kerala

2.2 Changes in Area under Paddy

2.3 Changes in Area under Coconut

2.4 Substitution of Coconut for Rice

2.5 Changes in Area under Rubber

2.6 Substitution of Rubber for Coconut

2.7 Growth Pattern of Area under Rice, Coconut and Rubber.

Chapter 2

CHANGES IN CROPPING PATTERN IN KERALA

This chapter examines shifts in cropping pattern in Kerala from 1960-'61 to 1985-'86. It appears that garden land crops (especially coconut) have been gaining at the expense of wet land crops (particularly paddy); and plantation crops (particularly rubber) have been gaining at the expense of garden land crops. Crop area data are inadequate in some respects, but the broad conclusion of a shift in cropping pattern holds even when the data inadequacies are accounted for. Also examined are the technical possibilities of substitution of coconut on paddy growing lands and rubber on coconut growing lands.

A brief review of agricultural situation in Kerala is described in 2.1. Changes in rice area are discussed in 2.2 and it is established that the area under rice has fallen from 1974-'75 onwards. 2.3 discusses changes in area under coconut and juxtaposes wth the changes in area under rice. Possibilities of substitution of coconut for rice is described in 2.4. 2.5 deals with changes in area under rubber and juxtaposes with the changes in area under coconut. 2.6 examines the possibilities of substitution of rubber for coconut. Growth pattern of area under rice, coconut and rubber and substitution of paddy lands in favour of coconut and coconut in favour of rubber are presented in 2.7.

2.1. Brief Review of Agricultural Situation in Kerala

Kerala has an area of 38,86,000 square Kilometres and a population of 272 lakhs[1]. Animal husbandry, Forestry and Fisheries jointly constitute the most important single sector in its economy. It contributes a share of 41.85 per cent to the state income. It provides employment to 41.1 per cent of the working population.[2]

The land man ratio in Kerala has been declining. It fell from 0.13 hectare of arable land in 1961 to 0.09 hectare

---

1. Kerala Economy, 1986 (Revised Estimate), Directorate of Economics and Statistics, Trivandrum, Kerala.

2. Census of India (1981).

of arable land in 1981. By the turn of the century, it is expected to fall to 0.07 hectare

Kerala's progress has been facinating and somewhat unusual. In education, health, land reforms etc. Kerala has made considerable progress in the past few decades.

Land reforms in Kerala brought about radical and comprehensive institutional changes and altered drastically the land holding pattern in the state. One of the main intentions of the Kerala Land Reforms Act was to put a ceiling on land holdings. This resulted in a drastic reduction in the number of large holdings registered. The tenancy reforms, granting of ownership right to Kudikidappukar etc. helped to increase the number of families owning or having interest on the land.

Out of 35 lakh operational holdings in Kerala nearly 31 lakh holdings (87 per cent) are marginal, ie. below 1 hectare in size. The average size of such holdings is 0.22 hectare. About 42 per cent of the total area falls under marginal holding. The small (between 1 and 2 hectares) and marginal (below 1 hectare) holdings together constitute 66 per cent of the area. Thus not only a large number of the holdings, but also a large chunk of the area fall under small and marginal holdings which has significant implications for productivity and income. With all its positive gains like distribution of land to the real cultivator, making a lot of landless people land owners, the fact remains that agricultural production has not gone up satisfactorily (See tables 2.1 and 2.2).

There has been some growth in agriculture, but it has not kept pace with the growth of the population over the last twenty five years. The net area sown rose from 19.24 lakh hectares in 1960-61 to 21.84 lakh hectares in 1984-85 (13.3%) and the gross cropped area rose from 23.49 lakh hectares in 1960-61 to 28.75 lakh hectares in 1984-85 (22%). This was mostly due to an increase in the cropping intensity from 1.22 to 1.32 over the period. While there was an increase in the stock of land put to non-agricultural uses during this period, the area under permanent pastures and other grazing lands, land under miscellaneous tree crops, cultivable waste, current fallow etc. fell substantially through this period (See table 2.3).

After 1960-61 area under most of the crops increased. Area under rice which had increased from 7.8 lakh hectares in

1960-61 to 8.8 lakh hectares in 1974-75 and then declined to 7.3 lakh hectares in 1984-85. The area under pulses declined from 0.44 lakh hectares in 1960-61 to 0.32 lakh hectares in 1984-85. The area under oilseeds (sesamum) increased from 0.12 lakh hectares to 0.14 lakh hectares in 1984-85. Among the annual crops, area under Tapioca increased from 2.4 lakh hectares in 1960-61 to 3.2 lakh hectares in 1974-75 and declined to 2.3 lakh hectares in 1984-85. Among perennial crops, area under coconut went up from 5 lakh hectares in 1960-61 to 7.5 lakh hectares in 1974-75 but declined to 6.9 lakh hectares in 1984-85. Area under pepper went up from 0.99 lakh hectares in 1960-61 to 1.18 lakh hectares in 1974-75 but fell down to 1.02 lakh hectares in 1984-85. The area under cashewnut went up progressively from 0.54 lakh hectares in 1960-61 to 1.42 lakh hectares in 1984-85. Plantation crops in general have registered substantial increase in area. The area under cardamom increased from 0.27 lakh hectares in 1960-61 to 0.61 lakh hectares in 1984-85. The area under tea has remained more or less the same, while the area under rubber increased from 1.2 lakh hectares in 1960-61 to 3.1 lakh hectares in 1984-85 and the area under

Table - 2.1 Comparative Figures on Percentage Distribution of Operational holdings in the State

	As per land Reforms Survey 1966-67			As per Agricultural Census 1976 - 77		
Size of Operational holdings	Percentage of Holdings Number	Distribution in terms of Area	Average size of Holding	Percentage of Holdings Number	Distribution in terms of Area	Percentage Size of Holding
Less than 1 hectare	81.80	31.10	0.27	87.10	42.40	0.22
1 ha. to 2 ha.	10.10	19.60	1.43	8.40	23.60	1.37
2 ha. to 4 ha.	5.60	21.20	2.78	3.40	18.70	2.70
4 ha. to 6 ha.	1.50	9.90	4.92			
6 ha. to 8 ha.	0.40	3.30	6.74	1.00	11.20	5.50
8 ha. to 10 ha.	0.20	2.50	9.02			
10 ha. and above	0.40	12.40	19.82	0.10	4.10	18.20
All sizes	100.00	100.00	0.73	100.00	100.00	0.49
Absolute values	24.79	18.28		35.01	17.19	

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

Note : Absolute values are given in lakh hectares.

Table - 2.2 Number, Area and Average size of Operational Holdings in 1970-71 and 1976-77

Sl. No.		Number of Holdings			Area of Operational Holdings			Average size of Holdings (ha.)	
	Size class (ha.)	1970-71	1976-77	Percentage variation	1970-71	1976-77	Percentage variation	1970-71	1976-77
1.	0.02 - 1.00	1880381	2866518	52.4	538655	678250	25.9	0.29	0.24
2.	1.00 - 2.00	267833	276917	3.4	365199	379930	4.0	1.55	1.37
3.	2.00 - 4.00	125781	112195	-10.8	338742	303139	-10.5	2.69	2.70
4.	4.00 -10.00	26880	33047	22.9	149506	181427	21.4	5.56	5.49
5.	10.00 and above	4266	3494	-18.1	200676	66612	-66.8	47.04	19.07
	Total	2305141	3292171	42.8	1592788	1609358	1.1	0.69	0.49

Source: Ibid.

Table - 2.3 Land use Pattern in Kerala

(Area in '000 ha.)

Sl. No.	Classification of Land	1960-61 Absolute	1960-61 Percent	1970-71 Absolute	1970-71 Percent	1984-85 Absolute	1984-85 Percent
1.	Total Geographical Area	3886	100.00	3886	100.00	3886	100.00
2.	Forests	1056	27.37	1055	27.35	1082	27.84
3.	Land put to Non-Agricultural uses	205	5.31	275	7.13	280	7.20
4.	Barren and uncultivable waste	151	3.91	72	1.87	86	2.21
5.	Permanent Pastures and other Grazing Land	45	1.17	28	0.73	4	0.11
6.	Land under Miscellaneous Tree Crops	204	5.29	132	3.42	51	1.31
7.	Cultivable waste Land	144	3.73	80	2.07	130	3.34
8.	Fallow Land other than current Fallow	62	1.61	23	0.60	27	0.70
9.	Current Fallow	67	1.74	24	0.62	42	1.07
10.	Net Area Sown	1924	49.87	2172	56.30	2184	56.22
11.	Area Sown More than once	425	11.02	761	19.73	690	17.76
12.	Total cropped Area	2349	60.89	2933	76.02	2875	73.98

Source: Directorate of Economics and Statistics, Trivandrum, Kerala.
(Percentages are calculated from the absolute figures)

coffee went up from 0.16 lakh hectares in 1960-61 to 0.64 lakh hectares in 1984-85.

Production of important crops has increased in varying degrees from 1960-61 onwards, spectacular increase in production was noticed only in some plantation crops. Annual production of rice in the state increased from 10.65 lakh tonnes in 1960-61 to 12.6 lakh tonnes in 1984-85, though the all time high level of production viz., 13.76 lakh tonnes was in 1972-73. The annual production of tapioca went up from 16.83 lakh tonnes in 1960-61 to 39.5 lakh tonnes in 1984-85. The most important cash crop of the common man in Kerala viz., coconut provides a dismal picture. The total production of coconut declined from 3220 million nuts in 1960-61 to 2602 million nuts in 1983-84 but increased to 3395 million nuts in 1984-85. The productivity of coconut declined steeply from 6130 nuts per hectare in 1960-61 to 4925 nuts per hectare in 1984-85. Production of pepper, marginally increased during this period although its productivity declined. The production of cardamom nearly trebled during this period while that of cashewnuts declined. Tremendous increases in production were noticed in plantation crops like Tea, Coffee and Rubber. The production of rubber in the State increased from 2.3 lakh tonnes in 1960-61 to 17.2 lakh tonnes in 1984-85 and Tea from 0.10 lakh tonnes to 0.48 lakh tonnes respectively.

Comparative statement of area, production and productivity of selected crops for the years 1960-61, 1974-75 and 1984-85 is furnished in Table 2.4.

Table - 2.4 Comparative statement showing Area, Production and Productivity of various crops for the years 1960-61, 1974-75 and 1984-85

Sl. No.	Items	Unit	1960-61	1974-75	Percentage change	1984-85	Percentage change
	Area						
1	2	3	4	5	6	7	8
1.	Net area sown	Lakh Ha.	19.24	22.08	14.76	21.84	- 1.1
2.	Gross Cropped Area	"	23.48	30.28	28.96	28.75	- 5.1
3.	Rice	"	7.78	8.81	13.24	7.30	-17.2
4.	Coconut	"	5.00	7.48	49.6	6.89	- 7.9
5.	Tapioca	"	2.42	3.17	30.99	2.33	-26.5
6.	Tea	"	0.37	0.38	2.70	0.35	- 7.9
7.	Coffee	"	0.16	0.37	31.25	0.64	72.97
8.	Rubber	"	1.22	2.02	65.57	3.10	53.46
9.	Cardamom	"	0.28	0.47	67.86	0.61	29.79
10.	Pepper	"	0.99	1.18	19.19	1.02	-13.66
11.	Cashewnut	"	0.54	1.05	94.44	1.42	35.24
12.	Banana & Plantains	"	0.44	0.47	6.82	0.50	6.38
13.	Arecanut	"	0.54	0.93	72.22	0.59	-36.66

(Contd....)

1	2	3	4	5	6	7	8
	Production						
1.	Rice	Lakh Tn.	10.68	13.34	24.91	12.56	- 5.9
2.	Coconut	Million nuts	32.20	37.19	15.50	33.95	-8. 8
3.	Tapioca	Lakh Tn.	16.56	56.25	239.67	39.53	-29.73
4.	Tea	"	0.40	0.49	22.5	0.48	- 2.15
5.	Coffee	"	0.07	0.15	114.29	0.47	213.33
6.	Rubber	"	0.23	1.22	430.43	1.72	40.98
7.	Cardamom	"	0.01	0.02	100.00	0.03	50.00
8.	Pepper	"	0.27	0.27	0.00	0.19	-29.73
9.	Cashewnut	"	0.83	1.18	42.17	0.76	-35.60
10.	Banana & Plantains	"	3.28	3.57	8.84	3.16	-11.49
11.	Arecanut	Million nuts	7737	13777	78.07	8589	-37.66

(Contd...)

1	2	3	4	5	6	7	8
	Productivity						
1.	Rice	Kg/ha.	1371	1513	10.36	1720	13.68
2.	Coconut	No. of nuts per ha.	6430	4971	-22.70	4925	- 9.93
3.	Tapioca	Kg/ha.	6949	17696	154.66	16982	- 4.04
4.	Tea	"	1073	1301	21.24	1382	6.23
5.	Coffee	"	442	431	- 2.5	732	69.84
6.	Rubber	"	187	601	221.39	555	- 7.66
7.	Cardamom	"	45	44	- 2.23	47	6.82
8.	Pepper	"	271	230	-15.13	190	-17.40
9.	Cashewnut	"	1558	1122	-27.99	533	-52.5
10.	Banana and Plantains	"	7381	7564	2.48	6373	-15.75
11.	Arecanut	No. of nuts per ha.	142601	148072	3.14	145357	-1.84

Source: Op. Cit., Agricultural Statistics in Kerala, 1975.
Statistics for Planning 1977, 1980, 1983, 1986.
Economic Review, 1985, 1986.
(Percentages are estimated from the given absolute figures)

It is evident from table 2.4 that only the productivity of rice has been increasing continuously from 1960-61 to 1984-85. The yield level of tea also has been increasing upto 1984-85, but the rate of increase was high only upto 1974-75. The yield levels of Tapioca, rubber, Banana and other plantains and arecanut also have been increasing upto 1974-75 but declined thereafter, but the yield levels in the case of coffee and cardamom have been increasing after 1974-75 also.

An overall trend of the shifting of land area, towards non-food crops from food crops is indicated in Table 2.5.

Table - 2.5 Classification of Crops according to Percentage Change in area, production and Yield

	1960-61 to 1974-75	1974-75 to 1984-85
+ A + P + Y	Rice, Tapioca, Tea, Rubber, Banana and other plantains, Arecanut	Coffee, Cardamom
+ A + P - Y	Coconut, Coffee, Cardamom, Pepper, Cardamom	Rubber
+ A - P - Y		Cashewnut, Banana and other plantains
- A - P + Y		Rice, Tea
- A - P - Y		Coconut, Tapioca, Pepper, Arecanut
Total No. of Crops	11	11

Source: Derived from Table 2.4.

Note: - = Negative, + = Positive, A = Area, P = Production, Y = Yield per hectare.

The classification of crops in Table 2.5 gives a clear picture of change in cropping pattern in the state. From 1960-61 to 1974-75 there has been positive change in area and production in all the 11 crops under consideration. But negative change is seen in yield in the case of five crops. Only coffee and Cardamom indicated positive percentage change in area, production and yield during 1974-75 to 1984-85. Rubber depicts a negative percentage change in yield and positive change in area and production. Cashewnut, banana and other plantains showed positive change in area and negative change in production and yield. While tea and rice showed positive change in yield and negative change in area and production, coconut, tapioca, pepper and arecanut indicated a decline in area, production and yield during the same period. That is area under coffee, Cardamom, rubber, cashewnut and banana and other plantains increased during 1960-61 to 1984-85. Area and production together increased in the case of coffee, cardamom and rubber, but yield decreased with regard to rubber during 1974-75 to 1984-85.

There has been a shift of land area towards coffee, cardamom, rubber, cashewnut and banana and other plantains. Positive change in yield of rice and tea has not been sufficient to offset the decline in area and hence decline in production also. Hence it is evident that there has been a shift of land area towards non-food crops from food crops during 1960-61 to 1984-85.

Taking into consideration the area under different crops, area under rice, coconut and rubber can be marked as the first, the second and the third. Again the area under rice and coconut was declining after 1974-75, but area under rubber was increasing very rapidly.

2.2. Changes in Area Under Paddy

The area under cultivation in the state can be classified into two broad categories: (1) area under wet land cultivation and (2) area under dry land cultivation. The former consists mainly of paddy while the latter includes such commercial crops as coconut, arecanut, tapioca, yam, cocoa, pepper and vegetables. Of these, paddy and coconut are the principal crops grown by the small farmers. However, of late, agricultural scene in Kerala has undergone a sea-change. Highly remunerative cash crops like coconut, arecanut and rubber are now being raised in the erstwhile paddy fields. Such shifts in the cropping pattern have already taken place in almost all the districts of the state. The Economic Review[3] of Kerala has also made mention of the trend. According to the Economic Review "There was a gradual expansion of area by

---

3. Kerala Economic Review, 1979.

the non-foodgrains sector. This expansion is mainly at the cost of the foodgrains sector".

Official sources of statistics on the area under rice give us only the total gross cropped area under rice in each year, not the net sown area (ie., the actual physical area under rice). The gross area may increase either due to an increase in multiple cropping or an increase in the physical (ie., net) area under the crops during a particular production cycle. From the regular official figures it is not possible to separate these two components and to measure the changes in the physical area. It is crucial to the enquiry, to know if there has been a fall in the net area under rice. Fortunately, some estimates of the net area under rice and the intensity of cultivation have been obtained for three time points.

The changes in gross cropped area and the relative area (ie., proportion to total area) of rice are focussed at first. Again identifying the various phases of change as well as the districts in which this change has been most marked are aimed at. Then the figures on net area sown and intensity of cultivation for three time points are presented and on the basis of the net area figures, the observed changes in the gross cropped area are interpreted.

In general, the gross area under rice has been declining in both absolute and relative terms. However, while the proportion of area under rice to total area started falling in the early sixties, the decline in absolute terms began only in the mid seventies (See Table 2.6 and Diagrams 2.1 & 2.2).

Among the districts, a large absolute decline in gross area over the period 1960-'61 to 1978-'79 is seen in Trivandrum in the south and Canannore and Kozhikode in the north. But after that, the decline in area was so steep that it led to absolute decline in gross area in all districts except Ernakulam (Table 2.7). All these districts differ from Ernakulam in that they show a continuous decline in area during the third phase from 1974-'75.

The relative area under rice, on the other hand, fell almost continuously throughout the period of study in the whole of Kerala, the major part of this fall occurring between 1960-61 and 1968-69 (Table 2.6). Of the districts Alleppey and Kottayam, however, show an almost continuous increase in relative area under rice upto 1977-78. Since then these districts also show a continuous and steep fall in relative area (Table 2.7).

Table - 2.6 Area Under Rice in Hectares and Proportion to Total Cropped Area: District-wise

('000)

Year	Trivandrum	Quilon	Alleppey	Kottayam	Ernakulam	Trichur	Palghat	Kozhikode	Canannore	All Kerala
1960-61	37417 (19.03)	46143 (17.95)	79389 (35.78)	39965 (12.86)	77894 (35.06)	102197 (51.92)	192108 (60.33)	108115 (30.24)	95698 (35.77)	778.91 (33.16)
1961-62	36411 (18.41)	44989 (17.46)	76125 (34.38)	38706 (12.34)	74150 (34.00)	93435 (49.41)	191204 (60.03)	105250 (29.43)	92434 (34.58)	752.69 (32.15)
1962-63	38531 (19.45)	49691 (18.33)	82302 (37.16)	40775 (12.73)	83584 (38.50)	108218 (53.04)	194439 (59.10)	111242 (30.21)	83895 (27.31)	802.66 (32.82)
1963-64	38789 (19.78)	49605 (17.91)	82320 (37.38)	40691 (12.60)	83560 (35.14)	108493 (53.60)	1[illegible]062 (60.10)	111042 (30.96)	95738 (30.68)	805.08 (32.71)
1964-65	38602 (19.57)	49469 (17.75)	81911 (37.27)	40775 (12.44)	83040 (35.04)	107586 (53.84)	194666 (58.44)	109844 (29.58)	95228 (30.04)	801.12 (32.18)
1965-66	38734 (18.79)	49637 (17.26)	81603 (36.71	40530 (12.11)	83460 (33.80)	108807 (52.20)	195121 (57.70)	110793 (28.67)	94244 (29.22)	802.33 (31.44)
1966-67	39036 (18.11)	50057 (16.84)	81087 (35.87)	39732 (11.32)	84172 (32.20)	108844 (50.85)	194826 (56.35)	108806 (28.76)	92878 (29.12)	799.44 (30.52)
1967-68	39583 (16.44)	50378 (15.10)	81708 (35.52)	41008 (11.56)	85987 (31.52)	108967 (49.53)	196968 (54.90)	111294 (26.91)	93651 (28.12)	809.54 (29.36)
1968-69	39962 (16.99)	51785 (14.99)	86713 (36.76)	49886 (13.33)	93994 (34.23)	114371 (49.60)	211352 (55.10)	125155 (29.12)	97653 (28.44)	873.87 (30.63)
1969-70	39489 (16.74)	51883 (14.73)	85240 (36.09)	50081 (13.44)	93691 (33.40)	113311 (47.93)	211326 (54.31)	130384 (29.26)	98653 (26.83)	874.06 (29.97)
1970-71	39496 (16.25)	51883 (15.20)	85162 (36.68)	50033 (13.45)	93691 (33.93)	115267 (46.90)	211419 (54.30)	129186 (27.73)	93692 (26.95)	874.93 (29.84)
1971-72	39496 (15.83)	51729 (14.52)	85162 (36.52)	50033 (13.63)	93691 (32.90	115267 (47.60)	211393 (53.34)	129683 (27.75)	98702 (27.52)	875.16 (29.58)
1972-73	39486 (15.36)	51155 (14.24)	91131 38.45)	50209 (13.34)	94046 (33.13)	110492 (45.32)	210890 (52.81)	128338 (27.08)	97957 (26.92)	873.70 (29.26)
1973-74	39765 (16.28)	51189 (13.78)	92039 (38.35)	50086 (13.25)	94338 (32.70)	109914 (44.70)	211755 (52.80)	127624 (26.68)	98065 (28.02)	874.68 (29.16)
1974-75	39926 (16.19)	51686 (13.69)	96459 (39.41)	49920 (13.17)	95561 (33.02)	108966 (44.23)	213653 (52.35)	127339 (26.42)	97961 (27.63)	881.46 (29.11)
1975-76	37447 (15.80)	53053 (15.36)	96316 40.68)	50826 (14.41)	108223 (35.94)	126426 (51.17)	201828 (52.36)	117437 (23.84)	84466 (22.04)	876.02 (29.38)
1976-77	37976 (15.71)	49657 (14.78)	88591 (39.13)	55851 (15.61)	108447 (36.63)	118065 (50.76)	199412 (53.29)	114916 (23.06	81459 (21.99)	854.37 29. 13
1977-78	34529 (15.22)	50383 (15.52)	90907 (41.10)	49326 (14.58)	107250 (34.23)	119768 (51.19)	199312 (52.20)	110376 (22.24)	78523 (20.26)	840.37 (28.74)
1978-79	33080 (14.67)	50815 (16.54)	75501 (36.12)	41158 (12.16)	105287 (32.97)	115787 (48.74)	199666 (51.89)	105118 (21.97)	72825 (18.91)	799.24 (27.70)
1979-80	32569 (15.07)	49895 (16.67)	80059 (37.38)	35421 (10.87)	106668 (33.33)	110634 (48.47)	203210 (51.13)	101459 (21.63)	73497 (19.06)	793.27 27.79)
1980-81	32583 (14.47)	50055 (17.01)	82466 (37.61)	35775 (10.91)	107934 (32.93)	110314 (47.62)	209033 (51.23)	100074 (21.74)	73465 (19.06)	801.70 27.80)
1981-82	30775 (13.42)	50406 (16.84)	88 606 (40.09)	38282 (11.48)	105987 (32.52)	115511 (48.33)	206799 (51.36)	97945 (20.85)	72560 (19.11)	806.90 (27.78)
1982-83	29391 (13.12)	49601 (17.18)	83862 (39.62)	38700 (11.82)	101155 (31.08)	107711 (47.16)	198860 (49.50)	97538 (20.90)	71672 (18.99)	778.49 (27.18)
1983-84	27079 (12.11)	47880 (16.27	79050 (35.75)	37717 (11.59)	91888 (28.13)	103391 (45.37)	192769 (48.37)	91370 19.70	68942 (18.30)	740.09 (25. 86)
1984-85	27020 (12.00)	50041 (17.36)	78571 (36.24	35620 (10.98)	94028 (28.48)	102540 (44.78)	191396 (47.28)	87858 (18.68)	63305 (16.62)	730.38 (25.39)
1985-86	26352 (11.93)	44149 (16.12)	61188 (28.11)	35533 (10.65)	89406 (25.95)	95215 (43.38)	182320 (45.73)	81862 (17.48)	62256 (16.02)	678.28 (23.65)

Notes: 1. Area in Idukki redistributed between Kottayam and Ernakulam, that of Malapuram between Palghat and Kozhikode, Wynad between Kozhikode and Canannore, Pathanamthitta among Quilon, Kottayam and Alleppey and that of Kasargode in Canannore according to the proportion derived from a three year average prior to the formation of the new district.
2. Figures in parentheses refer to proportion to Total cropped area.
3. Unpublished data for the latest period obtained from the Directorate of Economics and Statistics, Trivandrum, Kerala.

Source: Op. Cit., 1. Agricultural Statistics in Kerala, 1975. 2. Statistics for Planning 1977, 1980, 1983, 1986.

DIAGRAM 2.1

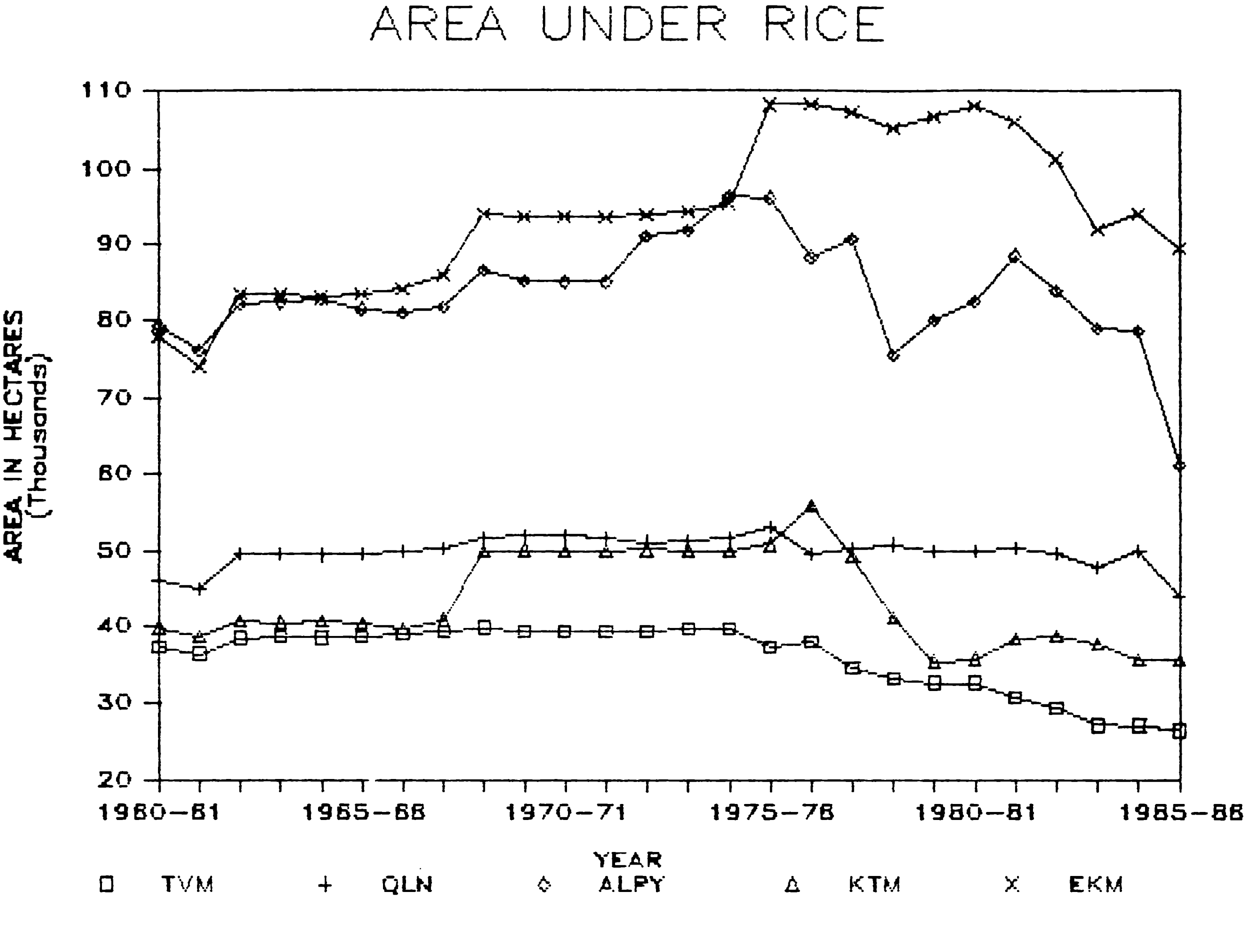

AREA UNDER RICE
110
100
90
80
70
60
50
40
30
20
AREA IN HECTARES (Thousands)
1960–61
1965–66
1970–71
1975–76
1980–81
1985–86
YEAR
TVM
QLN
ALPY
KTM
EKM

DIAGRAM 2.2

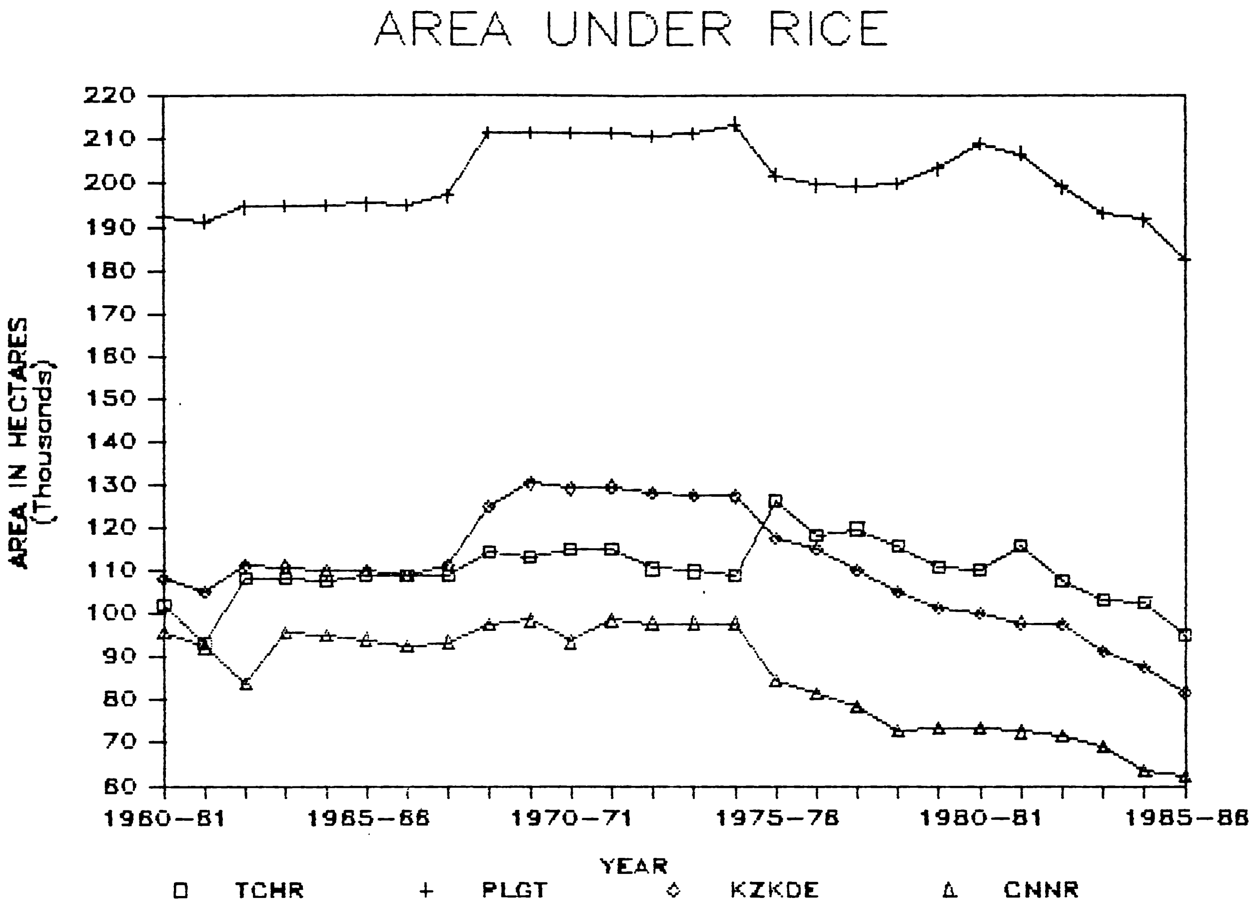

AREA UNDER RICE
AREA IN HECTARES (Thousands)
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
1960–61
1965–66
1970–71
1975–76
1980–81
1985–86
YEAR
TCHR
PLGT
KZKDE
CNNR

Table - 2.7 <u>Change in Gross and Relative Area under Rice 1960-'61 to 1985-'86</u>

Districts/State	Gross Area Percentage	Relative Area Percentage
Trivandrum	-29.57	- 7.10
Quilon	- 4.32	- 1.83
Alleppey	-22.93	- 7.67
Kottayam	-11.09	- 2.21
Ernakulam	+14.78	- 9.11
Trichur	- 6.77	- 8.54
Palghat	- 5.10	-14.60
Kozhikode	-24.28	-12.76
Canannore	-34.95	-19.75
Kerala	-12.92	- 9.51

Source: Derived from Table 2.6.

Table - 2.8 Net Area, Gross Cropped Area and Intensity of Cultivation under Rice ('000 hectares)

Type of Land	1969-70[1]		1975-76[2]		1976-77[3]	
	Net Area	Gross Area	Net Area	Gross Area	Net Area	Gross Area
Single cropped Land	181.7	181.7	193.3	193.3	156.6	156.6
Double Cropped Land	336.8	673.6	294.5	589.0	291.4	582.7
Triple Cropped Land	6.3	18.9	31.2	93.6	38.4	115.1
Total	524.8	874.2	519.0	875.9	486.4	854.4
Intensity of Cropping of Rice (Per cent)*	166.58		168.77		175.69	

Note: *Intensity of Cropping of rice $= \frac{\text{Gross area under rice}}{\text{Net area under rice}} \times 100$

Source: 1. K.N. Syamasundaran Nair, "What Ails Rice Production in High Rainfall Tropics - Kerala - A Case" presented to the Symposium on Rice Research and Development, Patambi, 21-23, Dec. 1977.

2. Season and Crop Reports, 1975-'76, Directorate of Economics and Statistics, Trivandrum, Kerala.

3. Ibid, 1976-77.

Interestingly, between 1960-61 and 68-69 when the proportion of area under rice declined significantly, the absolute gross area rose sharply. This implies that the area under some other crop/crops increased more rapidly than rice area. After 1974-75, both the absolute and relative rice area fell.

The data on net area under rice are for 1969-70, 1975-76 and 1976-77. The period in which the state-wise gross area under rice stagnated is from 1969-70 to 1974-75. In this period, the net area under rice actually fell, but the intensity of cultivation increased normally, causing little change in the gross area under rice (Table 2.8).

Between 1975-76 and 1976-77 (which fall within the third phase) there is a sharp fall in net area. As noted earlier, the gross area also fell. The fall in net area occurred mainly from single cropped lands (Table 2.8). Of course, we interpret this data with caution since it is not strictly possible to draw inferences from data relating to two consecutive years, and what is observed may be a phenomenon peculiar to those particular years.

The changes observed in gross area can be interpreted as follows. Between 1960-61 and 1968-69 there was a large increase in the gross cropped area. This was possibly because of the increase in the intensity of cultivation in this period, the actual increase in net area under rice, even during this period, could not have been very large except for some amount of reclamation of land from Kayal. Net area actually fell between 1968-69 and 1974-75. The increase in intensity of cultivation tapered off, perhaps because most of the land in which multiple cropping was possible had already been brought under cultivation. Gross area under rice, therefore, stagnated during this period. Between 1974-75 and 1985-86 the gross area under rice fell, though less sharply in some districts than in others. This fall could have been for two reasons:

1. fall in intensity of cultivation and/or
2. fall in actual net sown area

It appears unlikely that lands already under multiple crops, would be cropped less intensively, unless some other crop was being grown between two crops of paddy. Actually, the intensity of cropping of rice rose between 1975-76 and 1976-77 (Table 2.8) indicating that the lands in rice cultivation were now mainly the lands that were being more intensively cultivated. Though we do not have data for the subsequent years it is highly probable that the further decline in the gross area under rice has been mainly on account of fall in actual net area, due to diversion of paddy lands under single cropping.

It would be interesting to examine in which districts or regions this phenomenon of decline in net area under rice, has been occurring. Unfortunately district-wise data on net area under rice are available only for two consecutive years, 1975-76 and 1976-77. The information for earlier years is confined to the distribution of gross area under rice as between autumn, winter and summer crops. On comparing these latter estimates with the district-wise net area of rice in 1975-76, some interesting results are obtained as can be seen from Table 2.9.

Column (1), (3) and (5) in Table 2.9 give the area under rice in each district in the season in which this area was the highest in 1960-61, 1965-66 and 1969-70. This indicates the minimum net area under rice for each district in the respective years. It will be seen that this estimated minimum net area under rice in these years is significantly higher than the actual net area in 1976-77 in Canannore district. It is higher also in Palghat, Malapuram, Kozhikode and (to a much smaller extent) Trivandrum district. It will be recalled that Trivandrum, Canannore, Kozhikode followed by Palghat showed the sharpest fall in area (absolute and relative) from 1960-61.

Table - 2.9 <u>Net Area in Major Seasons, Loss in Net Area</u>

Districts/ State	1960-61 Major Seasons (1)	Minimum loss 1960-61 to 1975-76 (2) =(1) -(7)	1965-66 Major Seasons (3)	Minimum Loss 1965-66 to 1975-76 (4)=(3)-(7)	1969-70 Major Seasons (5)	Minimum Loss 1969-70 to 1975-76 (6)=(5)-(7)	1975-76 Net Area** (7)
Trivandrum	18889(A)	677	19769(W)	1557	20201(W)	1989	18212
Quilon	26049(W)	--	27479(W)	--	29340(W)	932	28408
Alleppey	40098(S)	--	42075(S)	--	41704(S)	--	62911
Kottayam / Idukki / Ernakulam	52795(W)	--	55397(W)	--	67073(W)	--	103729
Trichur	58481(W)	--	61076(W)	--	61499(W)	--	72637
Palghat* / Malapuram / Kozhikode	186859(A)	8386	181432(A)	2959	180125(A)	1652	178473
Canannore	67905(A)	13522	66421(A)	12038	65897(A)	11514	54383
Kerala	396132(A)	--	398012(A)	--	39374(A)	--	519064

Note: (A) Autumn, (W) Winter, (S) Summer.

* These districts are clubbed together to make the season-wise area comparable with net area in column (7) since Idukki and Malapuram were created only in 1972-73 and 1970-71 respectively.

**Dry land paddy given separately has been incorporated into these figures.

Source: Op.cit., <u>Agricultural Statistics in Kerala, 1975</u>.
<u>Season and Crop Report, 1975-76.</u>

This implies clearly that the net area under rice in the northern districts of Canannore, Kozhikode, Malapuram and Palghat has fallen between 1960-61 and 1974-75, the major part of this fall took place after 1965-66, particularly in the Canannore district. In the southern districts of Trivandrum and Quilon the fall in net area has been marked only since 1969-70. In the central districts, it is not possible to say anything definitely regarding this from the available data; though that does not exclude the possibility of some fall in net area even in these districts.

This lends support to our earlier interpretation of the changes in gross cropped area, that the increase in gross cropped area noticed in the first phase (1960-61 to 1968-69) was mainly due to increase in intensity of cultivation and not due to any increase in actual area, particularly in the northern districts.

A fall in net area under rice could mean that the following processes were occurring. Land previously under rice cultivation might now be left fallow, though one would expect this to be only a transitory phenomenon before the land is put to an alternative use. Alternatively, rice might be substituted by a more remunerative garden land crop, like coconut and coconut by a more lucrative plantation crop, like rubber. Some of the land could also have been converted into housesites, especially since the price of land for house sites has been rising sharply in recent years.

2.3. Changes in Area under Coconut

Looking at the absolute area under coconut, for all Kerala, we see that there has been continuous increase in area from 1960-61 to 1974-75 and then a decline upto 1980-81. From 1960-61 to 1974-75 the area under coconut increased by 49.41 per cent. The greater part of this increase (37 per cent) took place between 1960-61 and 1968-69 (Table 2.10 and Diagrams 2.3 & 2.4).

At a more disaggregate level, Canannore district more than doubled and Palghat district nearly doubled their area under coconut within the period 1960-61 to 1985-86 (Table 2.11). Kozhikode, Trichur, Ernakulam followed by Trivandrum and Quilon districts also showed a phenomenal increase in the area under coconut in the same period while Alleppey and Kottayam districts indicated decline.

It is observed that the major part of the increase in area took place in most districts between 1960-61 and 1968-69. The percentage increases in the absolute area under coconut (37 per cent) was much larger than the increase in the absolute area under rice (12.19 per cent) during this period. This is consistent with and explains our earlier observation that the sharp increase in the absolute area along with the fall in the relative area under rice during this period was due

Table - 2.10 <u>Area under Coconut (Hectares) and Proportion to Total Cropped Area</u>

('000)

Year	Trivandrum	Quilon	Alleppey	Kottayam	Ernakulam	Trichur	Palghat	Kozhikode	Canannore	All Kerala
1960-61	55039 (27.99)	64713 (25.17)	75829 (34.17)	58795 (18.92)	44172 (19.88)	35977 (18.30)	18488 (5.80)	99341 (27.79)	48414 (18.10)	500.76 (21.32)
1961-62	55326 (27.98)	64865 (25.17)	77064 (34.81)	58944 (18.80)	44890 (20.60)	37020 (19.60)	18765 (5.90)	99484 (27.81)	48472 (18.14)	504.82 (21.56)
1962-63	55815 (28.17)	70261 (25.32)	68425 (30.90)	63705 (19.89)	44951 (20.70)	34673 (17.00)	20335 (6.20)	114350 (31.06)	66744 (21.72)	539.26 (22.40)
1963-64	56864 (29.10)	70431 (25.43)	69059 (31.56)	64698 (20.03)	46405 (19.52)	35497 (17.53)	20929 (6.45)	113877 (31.75)	67239 (21.53)	544.99 (22.14)
1964-65	58711 (29.77)	73455 (26.35)	70784 (32.21)	67065 (20.43)	46966 (19.82)	36835 (17.75)	21589 (6.50)	113642 (30.61)	69944 (22.07)	558.99 (22.15)
1965-66	61150 (29.66)	74019 (25.74)	75599 (34.01)	71618 (21.40)	51740 (20.94)	37236 (17.85)	22903 (6.80)	118332 (30.79)	73716 (22.86)	586.31 (22.98)
1966-67	61762 (28.65)	77718 (26.15)	77592 (34.33)	70009 (19.95)	59132 (22.60)	40958 (19.13)	25650 (7.42)	12069 (30.80)	76071 (23.85)	609.58 (23.28)
1967-68	70401 (29.24)	80052 (23.99)	79675 (34.64)	70865 (19.98)	59273 (21.73)	41148 (18.70)	27658 (7.70)	131078 (31.69)	78571 (23.59)	638.72 (23.16)
1968-69	73885 (31.41)	85000 (24.60)	81557 (35.58)	78272 (20.92)	62784 (22.90)	48916 (21.21)	32911 (8.60)	132345 (30.80)	90393 (26.32)	686.06 (24.05)
1969-70	67137 (28.46)	91732 (26.06)	82463 (34.92)	75705 (20.30)	63758 (22.92)	50451 (21.34)	34063 (8.75)	138599 (31.10)	93931 (25.65)	707.84 (24.27)
1970-71	76515 (31.49)	92512 (27.11)	81962 (35.30)	74839 (20.11)	64687 (23.36)	54861 (22.32)	33775 (8.67)	146750 (31.50)	93235 (25.46)	719.14 (24.52)
1971-72	77326 (31.00)	104272 (29.26)	82139 (35.23)	71020 (19.11)	70352 (24.70)	54684 (22.37)	34211 (8.63)	148581 (31.79)	88575 (24.69)	730.26 (24.68)
1972-73	76194 (30.60)	106798 (29.73)	79941 (33.73)	74737 (19.86)	70880 (24.97)	56869 (23.33)	34552 (8.65)	154235 (32.54)	91223 (25.07)	745.43 (24.96)
1973-74	76956 (31.50)	106798 (28.75)	79941 (33.31)	71242 (18.84)	70880 (24.57)	56869 (23.13)	35724 (8.91)	155195 (32.44)	91223 (26.06)	744.83 (24.83)
1974-75	77270 (31.33)	107409 (28.46)	79963 (32.68)	71317 (18.82)	71059 (24.55)	57328 (23.30)	35979 (8.82)	155571 (32.28	92277 (26.03)	748.17 (24.71)
1975-76	74074 (31.21)	98073 (28.40)	72824 (30.76)	60577 (17.18)	59789 (19.85)	50699 (20.52)	28237 (7.33)	156474 (31.77)	92198 (24.06)	692.95 (23.24)
1976-77	79335 (32.83)	93465 (27.81)	64338 (28.42)	59560 (16.65)	65053 (21.97)	50030 (21.51)	29106 (7.78)	161483 (31.71)	92575 (24.49)	694.99 (23.69)
1977-78	75806 (33.42)	87563 (26.96)	59354 (26.84)	54294 (16.05)	68567 (21.88)	49641 (21.22)	29436 (7.71)	154562 (31.15)	94256 (24.32)	673.48 (23.03)
1978-79	72775 (32.27)	81381 (26.49)	61814 (29.57)	57009 (16.84)	72779 (22.79)	50690 (21.34)	29551 (7.68)	149087 (31.16)	85541 (22.21)	660.63 (22.89)
1979-80	73485 (33.33)	84488 (28.00)	62907 (29.44)	57644 (18.01)	67967 (21.18)	53549 (23.58)	31785 (8.06)	153723 (32.98)	77109 (20.10)	662.66 (23.23)
1980-81	73771 (32.46)	86765 (27.89)	63114 (28.90)	59424 (17.88)	69189 (21.04)	54030 (23.38)	32954 (8.09)	144143 (31.30)	72980 (19.06)	651.37 (22.56)
1981-82	73515 (32.03)	84544 (28.62)	62118 (27.93)	59437 (17.82)	71002 21.78)	57312 23.75)	32916 (8.19)	147994 (31.49)	78780 (20.68)	666.62 (22.96)
1982-83	73727 (33.48)	85178 (29.21)	62118 (29.25)	59562 (18.18)	71601 (22.15)	57312 (24.84)	33688 (8.46)	152129 (32.41)	80063 (21.05)	674.38 (23.55)
1983-84	73568 (33.18)	85018 (28.81)	65714 (29.86)	59175 (17.99)	70300 (21.41)	58929 (25.99)	33186 (8.27)	152709 (33.12)	83682 (22.28)	682.28 (23.83)
1984-85	76969 (34.22)	78927 (27.43)	61625 (28.44)	55697 (17.07)	63196 (19.09)	62438 (26.96)	35504 (8.91)	161438 (34.18)	71689 (18.99)	687.48 (23.90)
1985-86	73094 (33.49)	78769 (28.94)	66223 (30.41)	57826 (17.16)	68424 (19.83)	60366 (27.40)	36349 (9.05)	166485 (35.39)	97146 (25.06)	704.68 (24.56)

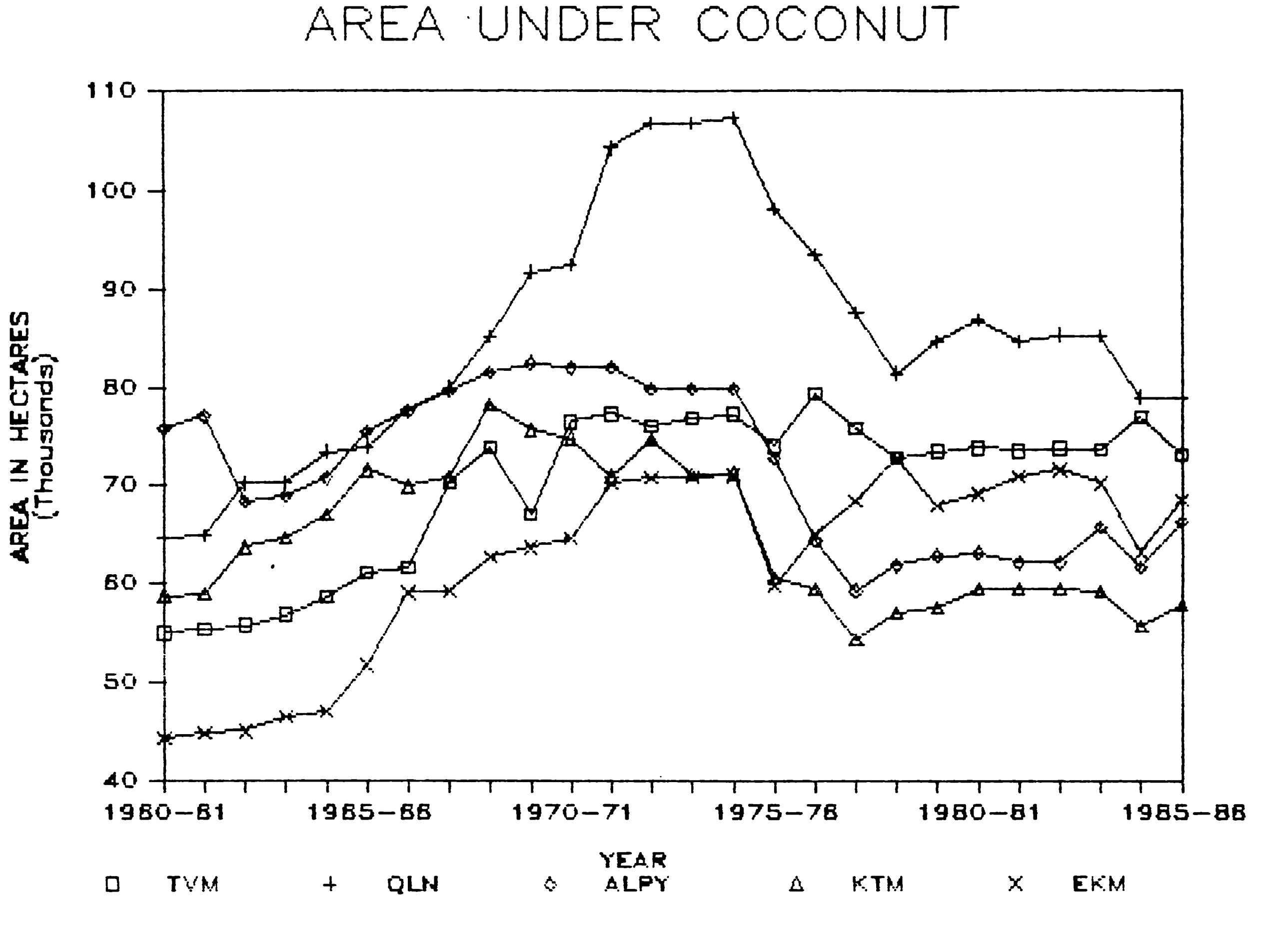
Notes: 1. Area in Idukki redistributed between Kottayam and Ernakulam, that of Malapuram between Palghat and Kozhikode, Wynad between Kozhikode and Canannore, Pathanamthitta among Quilon, Kottayam and Alleppey and that of Kasargode in Canannore according to the proportion derived from a three year average prior to the formation of the new district.

2. Figures in parentheses refer to proportion to Total cropped area.

3. Unpublished data for the latest period obtained from the Directorate of Economics and Statistics, Trivandrum, Kerala.

Source: <u>Op. Cit</u>: 1. <u>Agricultural Statistics in Kerala</u>, 1975.
2. <u>Statistics for Planning</u>, 1977, 1980, 1983, 1986.

DIAGRAM 2.3



AREA UNDER COCONUT
110
100
90
80
70
60
50
40
AREA IN HECTARES (Thousands)
1960-61
1965-66
1970-71
1975-76
1980-81
1985-86
YEAR
TVM
QLN
ALPY
KTM
EKM

DIAGRAM - 2.4

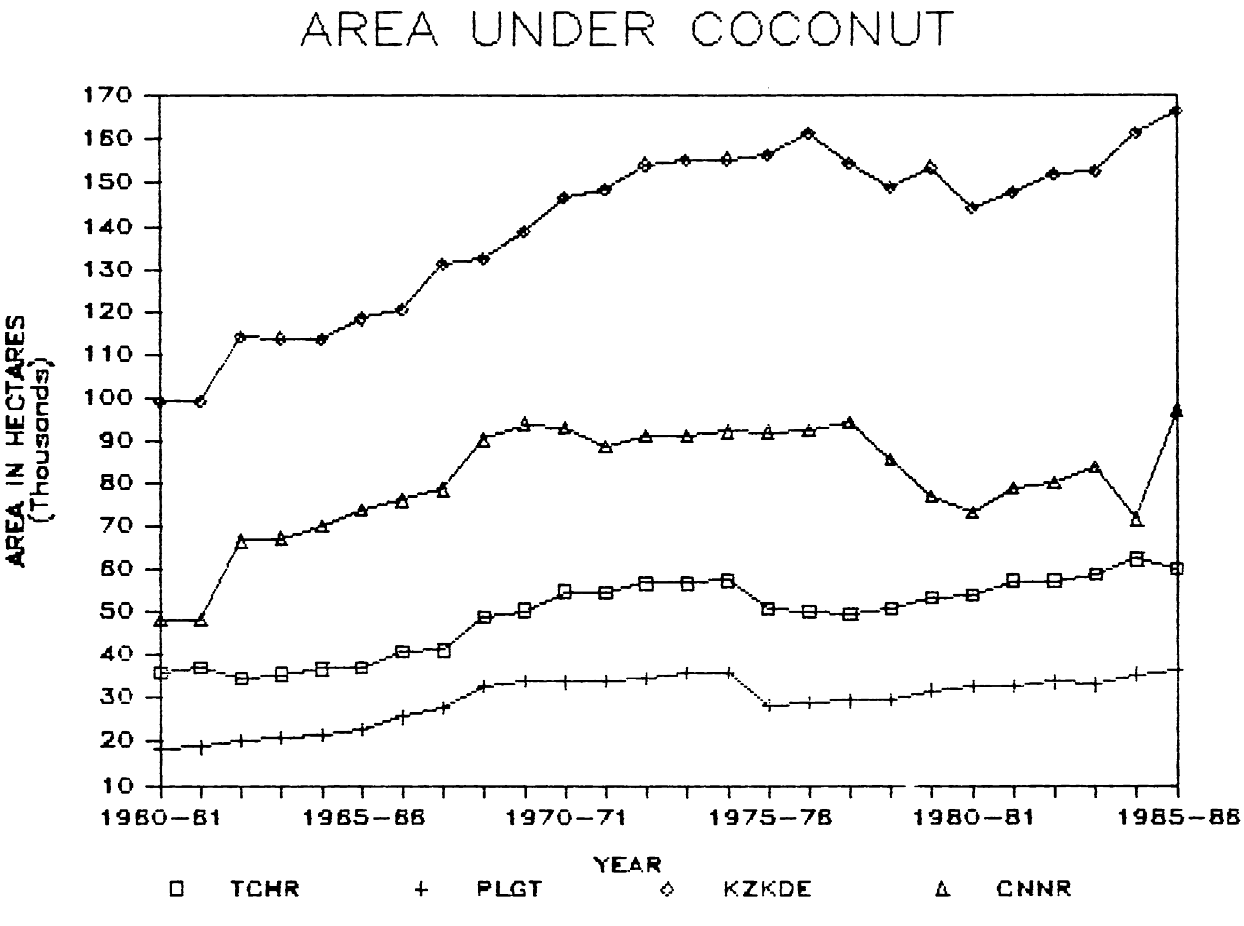

AREA UNDER COCONUT
AREA IN HECTARES (Thousands)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
1960-61
1965-66
1970-71
1975-76
1980-81
1985-86
YEAR
TCHR
PLGT
KZKDE
CNNR

Table - 2.11 Change in Gross and Relative Area under Coconut, 1960-61 to 1985-86

Districts/State	Gross Area Percentage	Relative Area Percentage
Trivandrum	+ 32.80	+ 5.50
Quilon	+ 21.72	+ 3.77
Alleppey	- 12.67	- 3.76
Kottayam	- 1.65	- 1.76
Ernakulam	+ 54.90	- 0.05
Trichur	+ 67.79	+ 9.10
Palghat	+ 96.61	+ 3.25
Kozhikode	+ 67.59	+ 7.60
Canannore	+100.66	+ 6.96
Kerala	+ 40.72	+ 3.24

Source: Derived from Table 2.10.

to the still sharper increase in area under some other crop/ crops, one of which was coconut.

The relative area under coconut increased steadily between 1960-61 and 1985-86, by 3.24 per cent for Kerala as a whole. Among the districts, Trichur shows the maximum increase in the relative area under coconut in the same period, followed by Kozhikode, Canannore, Trivandrum, Quilon and Palghat districts. Alleppey, Kottayam and Ernakulam (to a lesser extent) districts indicate decline in relative area during the same period (Table 2.11).

Juxtaposing the change noticed in the area under rice in 2.2; with the changes in the area under coconut, it is observed that, whereas rice was losing area both absolutely (net area) and relatively, coconut was gaining. District-wise, the northern most districts of Canannore and Kozhikode followed by Palghat and the southern most districts of Trivandrum and Quilon show this tendency to shift out of rice cultivation, these districts together with Ernakulam and Trichur show also large increase in area under coconut. But Alleppey and Kottayam districts depict decline in area under coconut.

2.4. Substitution of Coconut for Rice

The area under current fallows were falling consistently from 1960-61 to 1974-75 in all districts, then there was sudden increase in the land left fallow in 1975-76 and this has continued to increase thereafter in almost all districts upto 1984-85 (Table 2.12 and Diagrams 2.5 & 2.6).

Trivandrum district has shown the maximum increase in current fallows during recent years, increasing more than 421 per cent between 1974-75 and 1984-85. Other districts that showing remarkable growth in fallow land are Alleppey, Quilon, Trichur, Palghat, Kozhikode and Canannore. It is significant that Palghat, Trichur, Alleppey and Ernakulam are districts which had the largest proportion of their area under rice cultivation. Alleppey, though it did not register much of shift in the cropping pattern, as it was seen earlier, outstrips all other districts except one in its increase in current fallows. A possible reason for this could be that the wet lands cultivated in this region are not convertible into garden lands, being mainly 'Kayal' lands. Hence the only option available to farmers if they do not wish to cultivate rice is to leave it fallow (Table 2.13).

As observed in 2.2; land left fallow will not permanently be left as such. Current fallows can only be a transitory phenomenon before the land is put to alternative use. One such case is cultivation of a more remunerative crop, like coconut.

Table - 2.12 Current Fallow

(Hectares)

Year	Trivandrum	Quilon	Alleppey	Kottayam	Ernakulam	Trichur	Palghat	Kozhikode	Canannore	Keral
1960-61	2713	3709	5835	7041	6910	4624	9297	15425	11468	67022
1961-62	2239	3413	5935	6698	7112	4325	9572	15335	11737	66366
1962-63	2238	2218	3439	5986	3214	2455	7857	12733	3741	43881
1963-64	1856	1709	1924	4818	2646	1808	8600	10792	3956	38109
1964-65	1169	1869	639	3648	2178	1007	9341	8278	6605	34734
1965-66	1085	1570	790	2945	1820	1630	8760	8200	6420	33220
1966-67	597	1384	600	1815	2255	1860	7798	5044	5093	26446
1967-68	466	1384	494	1815	2255	1860	5044	5093	4922	23333
1968-69	281	480	344	3159	2883	1847	4197	5492	4471	23154
1969-70	253	425	458	3258	3204	1681	4281	5410	4272	23242
1970-71	275	398	568	3462	3229	1581	4430	5261	4431	23635
1971-72	263	434	528	3381	3189	1765	4564	4901	4350	23379
1972-73	239	399	594	4665	4773	1554	4224	4460	4756	25664
1973-74	231	488	561	5429	6230	1744	4418	4585	4266	27952
1974-75	224	484	530	4410	4794	1546	4327	4186	3888	24389
1975-76	1304	1313	1475	2852	5458	3583	8528	3983	7172	35668
1976-77	1172	1654	2013	2765	5046	4067	9640	4495	6557	37409
1977-78	2411	1834	5435	4576	4527	4501	10264	6564	5999	46111
1978-79	1261	1917	3617	4553	4113	4266	10213	6885	5221	42246
1979-80	1352	1859	2955	5913	4527	4954	10371	6341	5112	43384
1980-81	1301	1953	2067	4836	4353	4860	11049	8088	5174	43579
1981-82	1472	1891	2131	3837	4396	4561	10491	9561	6147	44487
1982-83	1449	1858	2302	4312	4422	4781	10605	8719	6007	44455
1983-84	1311	1567	2443	4000	4257	4660	10015	8246	6439	42938
1984-85	1166	1528	2048	3805	4114	4423	10124	8597	5953	41758

Notes: 1. Area in Idukki redistributed between Kottayam and Ernakulam, that of Malapuram between Palghat and Kozhikode, Wynad between Kozhikode and Canannore, Pathanamthitta among Quilon, Kottayam and Alleppey and that of Kasargode in Canannore according to the proportion derived from a three year average prior to the formation of the new district.

2. Figures in parentheses refer to proportion to Total cropped area.

3. Unpublished data for the latest period obtained from the Directorate of Economics and Statistics, Trivandrum, Kerala.

Source: Op.Cit.: 1. Agricultural Statistics in Kerala, 1975.

2. Statistics for Planning, 1977, 1980, 1983, 1986.

DIAGRAM- 2.5

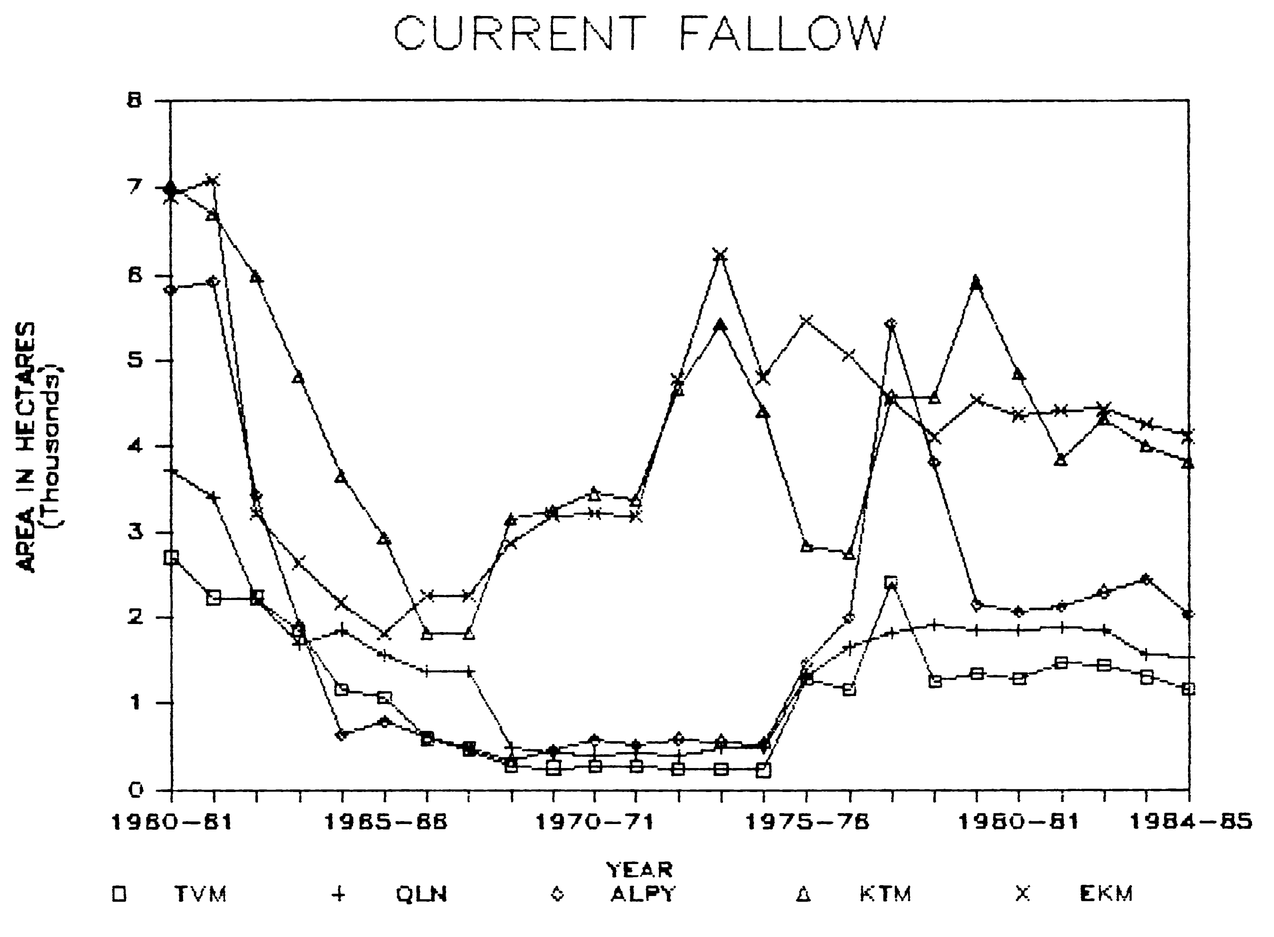

CURRENT FALLOW
AREA IN HECTARES (Thousands)
0
1
2
3
4
5
6
7
8
1960-61
1965-66
1970-71
1975-76
1980-81
1984-85
YEAR
TVM
QLN
ALPY
KTM
EKM

DIAGRAM 2.6

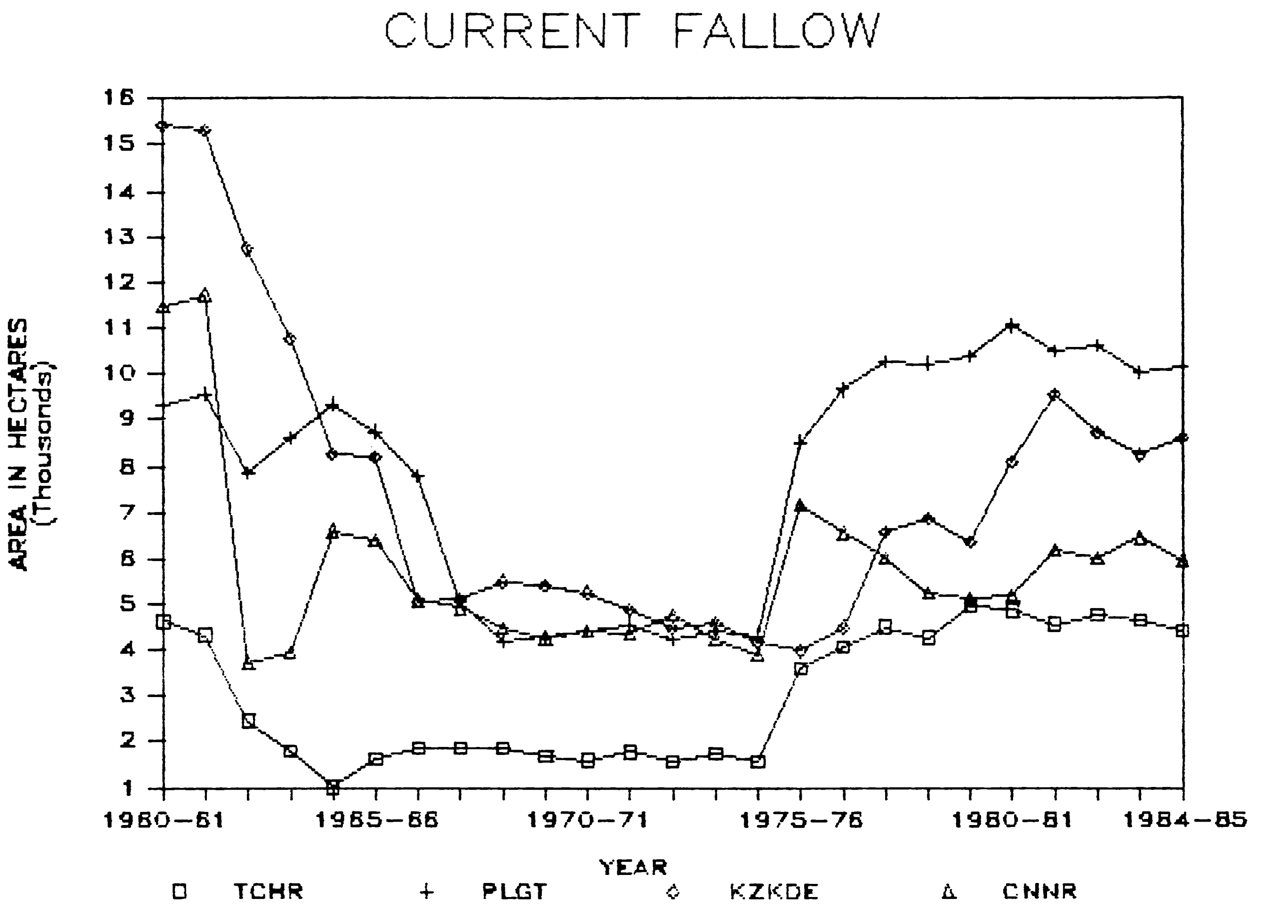

CURRENT FALLOW
AREA IN HECTARES (Thousands)
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
1960-61
1965-66
1970-71
1975-76
1980-81
1984-85
YEAR
TCHR
PLGT
KZKDE
CNNR

Table - 2.13 Percentage Change in Current Fallow; 1974-'75 to 1984-'85 and 1960-61 to 1974-75

Districts/State	1974-75 to 1984-85 Percentage Change	1960-61 to 1974-75 Percentage change
Trivandrum	421	-91.74
Quilon	216	-86.95
Alleppey	286	-90.92
Kottayam	- 13.72	-37.37
Ernakulam	- 14.18	-30.62
Trichur	186	-66.57
Palghat	134	-53.46
Kozhikode	105	-72.86
Canannore	53	-66.10
Kerala	71	-63.61

Source: Derived from Table 2.12.

There are two commonly observed ways in which paddy lands are converted into coconut gardens. Coconut saplings are planted on the bunds of the paddy fields. This also helps to strengthen the bunds. Gradually these bunds are widened and another row of coconut saplings are planted, and this goes on till the whole field is converted into a raised coconut garden. In the second method, the land is raised in mounds within the paddy fields, at regular distance from each other, and coconut saplings are planted on them. As these plants reach a certain stage in their growth, more such mounds are raised till the plot is converted into a coconut garden.

The advantage of these two methods is that, in the period before the coconut palms mature, paddy continue to be planted and harvested between the bunds or mounds so that during the gestation periods when no income is forthcoming from coconut, there is income from rice. The initial investment involved in this process is also limited.

In the earlier discussion, on the topographical features of Kerala and its impact on the cropping pattern, it was observed that rice was grown under varied topographical conditions in the flat landscape of the lowlands, in the valleys, and in the terraced slopes of the midlands. Coconut is a crop which prefers moist soil conditions, and can be grown in all these conditions as well. Hence, topographically it is possible for rice to be substituted by coconut in the lowlands and in the valleys and terraced slopes of the midlands. At the same time coconut can substitute, besides rice, other garden land crops, such as arecanut, pepper, cashewnut, tapioca, etc. on the slopes of the midlands.

The topographical possibilities reinforce the data analysed above; which indicate a trend towards substitution of paddy in favour of coconut on paddy lands. It was seen that the net area under rice has been falling from the early 1960s in some districts but more markedly in recent years. On the other hand coconut has been gaining rapidly throughout the period. Besides, the districts which showed the greatest tendency to shift away from rice experienced also the greatest increase in coconut area (eg. the northern district). In the one district, Alleppey, where substitution possibilities are limited, fallow land has sharply increased. These trends have important implications for the rice economy of Kerala.

Like Alleppey, Kottayam also did not show much of shift in the cropping pattern, as it was seen earlier and also outstrips all other districts in its increase in relative area under rubber.

2.5. Changes in Area under Rubber

Rubber is an important plantation crop and is extensively cultivated throughout the state. Kerala has a near monopoly for the cultivation of this crop. Now rubber cultivation has spread to other parts of India also. Since the return on rubber is very attractive compared to other crops,more and more area occupied by the other crops are being brought under rubber in recent years. Kottayam leads other districts in the cultivation of rubber while Quilon, Ernakulam and Canannore are the other major rubber growing districts in the state. (Table 2.14 and Diagrams 2.7 & 2.8).

Looking at the absolute area under rubber, for all Kerala, there has been a continuous increase in area from 1960-61 to 1985-86. In general, the gross area under rubber has been increasing in both absolute and relative terms (Table 2.14). The intensity of increase in gross and relative area under rubber has been higher after 1974-75, while both relative and gross area under rice has been declining in the same period (Table 2.6). It is clear that the area under rubber increased by 168.83 per cent over a period 1960-61 to 1985-86, only a smaller part of this increase (64.66 per cent) took place between 1960-61 and 1974-75.

At a more disaggregate level, the area under rubber increased more than five times in Palghat and Alleppey, four times in Trivandrum, three times in Canannore and Ernakulam and two times in Quilon, Kottayam and all Kerala. Kozhikode and Trichur districts showed only 74 and 52 per cent increase in area under rubber respectively (Table 2.15). Thus all the

Table - 2.14 Area Under Rubber in Hectares and Proportion to Total Cropped Area: 1960-61 to 1985-86 - District - wise.

('000)

Year	Trivandrum	Quilon	Alleppey	Kottayam	Ernakulam	Trichur	Palghat	Kozhikode	Canannore	All Kerala
1960-61	3175 (1.52)	21534 (8.56)	1960 (0.90	43136 (13.83)	15889 (7.21)	6260 (3.05)	5064 (1.57)	14927 (4.20)	10382 (3.73)	122.87 (5.24)
1961-62	4147 (2.02)	22769 (8.91)	2320 (0.90)	44764 (14.33)	17668 (8.26)	6867 (3.70)	5900 (1.88)	16340 (4.47)	12304 (4.49)	133.08 (5.68)
1962-63	4336 (2.02)	23035 (8.49)	2500 (1.36)	44959 (14.06)	18525 (8.37)	6897 (3.43)	6230 (1.82)	18898 (5.16)	12442 (3.91)	137.91 (5.64)
1963-64	4693 (2.55)	24755 (9.02)	2715 (1.36)	46670 (14.55)	19438 (7.98)	7387 (3.47)	4977 (1.54)	19833 5.42	12441 (3.85	142.91 (5.81)
1964-65	4844 (2.54)	24920 (8.96)	2737 (1.36)	46943 14.33)	19684 (8.44)	7564 (3.85)	7296 (2.10)	20190 (5.39)	12774 (4.10)	146.95 (5.91)
1965-66	4844 (2.43)	25672 (9.03)	2736 (1.35)	46958 (14.03)	21423 (8.50)	7624 (3.83)	7384 (2.10)	20159 (5.21)	12834 (4.04)	149.63 (5.88)
1966-67	5245 (2.31)	26487 (8.75)	2827 (1.34)	46619 (13.39)	22102 (8.40)	7680 (3.74)	7490 (2.02)	20294 (5.10)	12913 (4.08)	153.36 (5.84)
1967-68	5861 (2.48)	28069 (8.38)	3103 (1.30)	40877 (11.55)	25584 (9.52)	7853 (3.64)	7972 (2.23)	20909 (4.76)	13714 (4.20)	162.92 (5.91)
1968-69	6328 (2.55)	29320 (8.38)	3217 (1.27)	51411 (13.64)	25383 (9.09)	8076 (3.46)	8190 (2.08)	21591 (5.12)	14018 (4.08)	168.53 (5.92)
1969-70	6821 (2.97)	30653 (8.81)	3446 (1.27)	54281 (14.52)	26140 (9.25)	8214 (3.39)	8637 (2.31)	22239 (4.93)	14759 (4.08)	175.19 (6.00)
1970-71	7040 (2.88)	30888 (9.09)	3584 (1.72)	55444 (14.78)	26459 (9.39)	8402 (3.25)	8752 (2.23)	23612 (5.32)	15079 (4.10)	179.26 (6.10)
1971-72	7407 (2.81)	31543 (8.99)	3718 (1.72)	56412 (15.26)	26996 (9.47)	8962 (3.67)	16283 (3.87)	22032 (4.89)	15229 (4.18)	188.61 (6.39)
1972-73	7620 (3.21)	32163 (8.91)	3797 (1.69)	57981 (15.68)	27085 (9.41)	9762 (4.10)	18101 (4.32)	22934 (5.05	16160 (4.40)	195.60 (6.56)
1973-74	7640 (3.28)	32380 (8.63)	3788 (1.67)	61707 (16.76)	25613 (8.93)	8929 (3.63)	17788 (4.29)	22778 (5.02)	18981 (5.43)	199.60 (6.67)
1974-75	7732 (3.24)	32612 (8.75)	3815 (1.63)	62683 (16.98)	25898 (8.81)	8952 (3.66)	18242 (4.20)	23161 (5.01)	19223 (5.35)	202.32 (6.67)
1975-76	6307 (2.53)	33995 (9.86)	4029 (1.69)	62749 (18.16)	29316 (9.48)	7785 (3.24)	17042 (4.08)	23338 (5.01)	22125 (5.74)	206.69 (6.74)
1976-77	7907 (3.31)	33500 (10.12)	3847 (1.77)	64972 (18.16)	26491 (8.84)	8924 (3.86)	19511 (4.85)	24012 (5.22)	20559 (5.68)	209.72 (7.16)
1977-78	8031 (3.51)	34759 (10.76)	3865 (1.81)	65151 (19.29)	26819 (8.63)	8947 (3.85)	19681 (4.82)	24083 (5.19)	20935 (5.41)	212.27 (7.25)
1978-79	8153 (3.54)	34933 (11.40)	3875 (1.91)	65728 (19.70)	27316 (8.39)	8950 (3.78)	19936 (4.99)	24336 (5.21)	21188 (5.45)	214.42 (7.42)
1979-80	8246 (3.65)	34674 (11.67)	4030 (1.87)	65728 (20.50)	27594 (8.72)	8963 (3.93)	20108 (5.04)	24553 (5.35)	21538 (5.74)	215.47 (7.53)
1980-81	8735 (3.95)	38890 (13.27)	4273 (1.83)	74050 (22.42)	29965 (9.15)	9386 (3.90)	22653 (5.64)	25883 (5.65)	23934 (6.27)	237.77 (8.25)
1981-82	8735 (3.90)	38890 (13.13)	4273 (1.80)	74050 (22.36)	29965 (9.20)	9386 (3.75)	22653 (5.71)	25235 (5.32)	22582 (6.02)	237.77 (8.19)
1982-83	10158 (4.52)	38666 (13.40)	4814 (2.36)	77511 (23.03)	34544 (10.77)	9445 (3.93)	25464 (6.22)	27006 (5.76)	28654 (7.63)	256.28 (8.94)
1983-84	11574 (5.38)	44590 (15.25)	9784 (4.52)	85998 (26.21)	35916 (11.01)	10760 (4.85)	21773 (5.57)	27277 (5.84)	23528 (6.37)	271.20 (9.47)
1984-85	14891 (6.67)	48257 (16.57)	9629 (4.59)	96591 (29.57)	45261 (13.64)	11019 (4.78)	23840 (5.94)	30465 (6.37)	31622 (8.18)	311.98 (10.85)
1985-86	14721 (6.88)	58204 (21.25)	9939 (4.61)	102903 (30.47)	49573 (14.58)	9493 (4.11)	27010 (6.78)	25996 (5.57)	32475 (8.27)	330.32 (11.51)

Notes: 1. Area in Idukki redistributed between Kottayam and Ernakulam, that of Malapuram between Palghat and Kozhikode, Wynad between Kozhikode and Canannore, Pathanamthitta among Quilon, Kottayam and Alleppey and that of Kasargode in Canannore according to the proportion derived from a three year average prior to the formation of the new district.
2. Figures in parentheses refer to proportion to Total cropped area.
3. Unpublished data for the latest period obtained from the Directorate of Economics and Statistics, Trivandrum, Kerala.

Source: Op. cit.: 1. *Agricultural Statistics in Kerala*, 1975.
2. *Statistics for Planning*, 1977, 1980, 1983, 1986.

DIAGRAM. 2.7

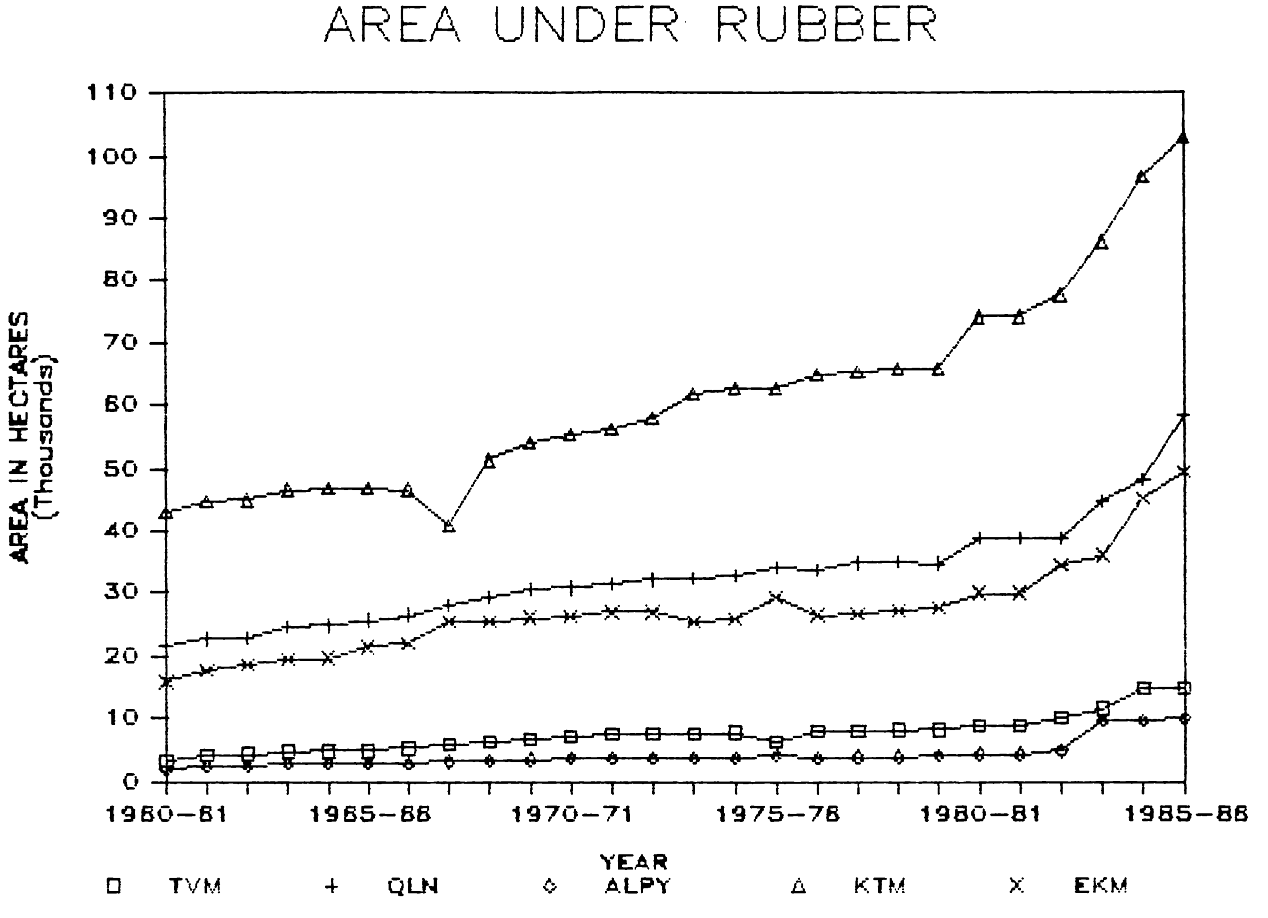
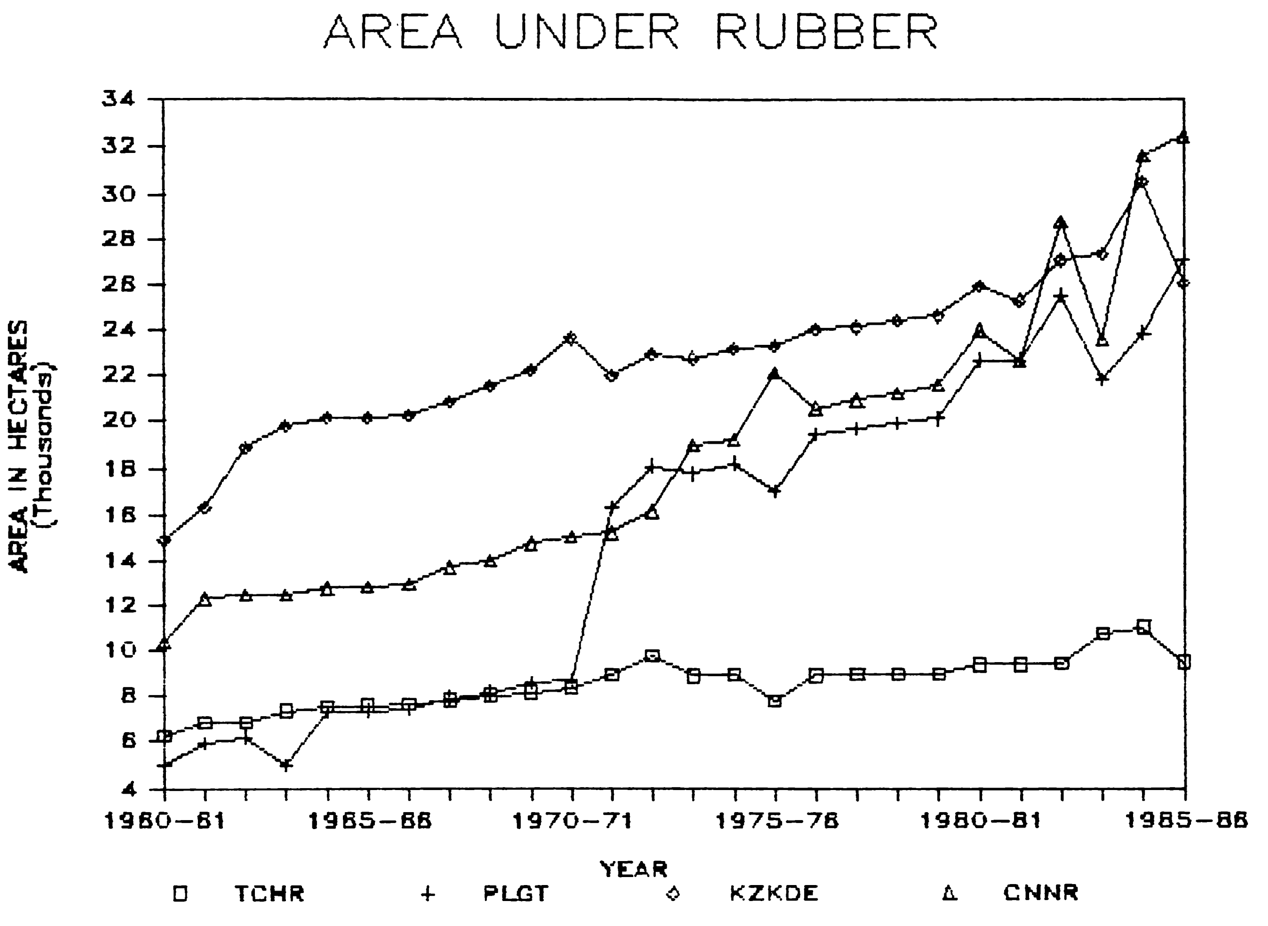

AREA UNDER RUBBER
110
100
90
80
70
60
50
40
30
20
10
0
AREA IN HECTARES
(Thousands)
1960—61
1965—66
1970—71
1975—76
1980—81
1985—86
YEAR
□ TVM
+ QLN
◇ ALPY
Δ KTM
X EKM

DIAGRAM - 2.8


AREA UNDER RUBBER
AREA IN HECTARES (Thousands)
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
1960–61
1965–66
1970–71
1975–76
1980–81
1985–86
YEAR
□ TCHR
+ PLGT
◇ KZKDE
Δ CNNR

districts and all Kerala showed a rapid increase in the area under rubber during 1960-61 to 1985-86. Alleppey and Kottayam indicated decline in the area under rice and coconut during the same period. Ernakulam also showed a slight decline in area under coconut.

It is observed that the major part of the increase in area under rubber took place in most districts between 1974-75 and 1985-86. This is consistent with and explains our earlier observation that the sharp decline in both absolute and relative area under rice during this period was due to the still sharper increase in area under some other crop/crops, one of which was rubber.

The relative area under rubber increased steadily between 1960-61 and 1985-86, by 6.27 per cent for Kerala as a whole. Among the districts, Kottayam showed the maximum increase in the relative area (16.64 per cent) under rubber in the same period, followed by Quilon, Ernakulam, Trivandrum, Palghat, Canannore, Alleppey, Kozhikode and Trichur districts (Table 2.15). This is in line with the earlier observation that among the districts, Trichur showed the maximum increase in the relative area under coconut and Alleppey, Kottayam and Ernakulam depicted a decline in relative area during the same period.

Table - 2.15 Change in Gross and Relative Area under Rubber, 1960-61 to 1985-86

Districts/State	Gross Area Percentage	Relative Area Percentage
Trivandrum	363.65	5.36
Quilon	170.29	12.69
Alleppey	407.09	3.71
Kottayam	138.55	16.64
Ernakulam	212.00	7.37
Trichur	51.65	1.06
Palghat	433.37	5.21
Kozhikode	74.15	1.37
Canannore	212.80	4.54
Kerala	168.83	6.27

Source: Derived from Table 2.14.

Juxtaposing the change noticed in the area under coconut in 2.4, with the changes in the area under rubber, it is observed that whereas coconut is losing area both absolutely and relatively after 1974-75, rubber is gaining. Kottayam, Ernakulam, Alleppey, Quilon and Palghat districts show the tendency to shift out of coconut cultivation. Again these districts together with Trivandrum and Canannore show the maximum increase in the relative area under rubber, Kozhikode and Trichur districts indicate not much increase in area under rubber.

2.6. Substitution of Rubber for Coconut

As noticed earlier the area under current fallows were falling consistently from 1960-61 to 1974-75 in all districts, then there was sudden increase in the land left fallow in 1975-76 and this has continued to increase thereafter in almost all districts upto 1984-85 (Table 2.12).

Trivandrum district has shown the maximum increase in current fallows during recent years, increasing more than 421 per cent between 1974-75 and 1984-85. Other districts that showed remarkable growth in fallows are Alleppey, Quilon, Trichur, Palghat, Kozhikode and Canannore. It is significant that Trivandrum, Kozhikode, Alleppey, Quilon and Canannore are the districts which had the largest proportion of their area under coconut cultivation. Kottayam, though it did not register increase in current fallows, as it was seen earlier, outstrips all districts in its increase in relative area under rubber. Hence the only option available to farmers if they do not wish to cultivate coconut is to increase the cultivation of rubber; since the return on rubber is very attractive compared to other crops.

As observed in 2.2, land left fallow will not permanently be left as such. Current fallows can only be a transitory phenomenon before the land is put to alternative use. One such use is cultivation of a more remunerative crop, like rubber.

In the earlier discussion, on the topographical features of Kerala and its impact on the cropping pattern, it was observed that rice was grown under varied topographical conditions in the flat landscape of the low lands, in the valleys, and in the terraced slopes of the midlands. Coconut is a crop which prefers moist soil conditions, and can be grown in all those conditions as well. Rubber usually grows in the tropical belt lying within 15° and 10° S of the equator and usually at an altitude of 300 meters above mean sea level. A warm and humid climate is required for the cultivation of rubber. The annual rainfall should be between 200 to 300 cm.

and should be well distributed. Stiff alluvial soil which is neither too steep nor swampy is suited for the cultivation of rubber. The midland enjoys an intense diversity of seasonal, annual and perennial crops, like rice, sugarcane, tapioca, banana, ginger, coconut, arecanut, pepper, cashewnut, rubber etc. Hence topographically it is possible for rice to be substituted by coconut in the low lands and in the valleys and terraced slopes of the midlands. At the same time coconut can substitute, besides rice, other crops, such as arecanut, pepper, cashewnut, tapioca, rubber etc. on the slopes of the midlands.

The topographical possibilities reinforce the data analysed above, which indicate a trend towards substitution of paddy in favour of coconut on paddy lands and coconut in favour of rubber on coconut gardens. It was seen that the net area under rice has been falling from the early 1960s in some districts, but more markedly in recent years. On the other hand, coconut has been gaining rapidly upto 1974-75 and then falling year after year upto 1981-82 and then increasing slightly upto 1985-86. But, rubber has been gaining rapidly upto 1974-75 and even more rapidly since then. Besides the districts which showed the greatest tendency to shift away from coconut experienced also greatest increase in rubber area (eg. Kottayam, Quilon, Ernakulam, Trivandrum, Palghat, etc.). These trends have important implications for the coconut economy of Kerala.

2.7. Growth Pattern of Area under Rice, Coconut and Rubber

In the main, area under three main crops are treated viz., rice, coconut and rubber. Growth rates are calculated in order to measure the average annual growth rate of area under the three crops.

On examination of growth rate presented in table 2.16 in the state as a whole, it is quite evident that the area under the three crops increased during the first and the second periods. While the growth rates of area under rice and coconut were negative, the growth rate of area under rubber is positive during the third period. Again the growth rate of area under rice is negative during the combined period also, but the growth rates of the area under the other two crops are positive. The decline in area under rice is more pronounced compared to the decline in area under coconut. The highest positive growth rate of area is seen in the case of rubber during the second, the third and the combined periods, but the highest growth rate of area is seen with regard to coconut during the first period. The same trend is seen in Kottayam district also, where the absolute area under rubber is the highest.

It is evident from table 2.16 that the growth rate of area under rice in all the districts and the state as a whole and coconut in five districts out of nine and the state as a whole indicate negative growth rates of area, whereas the area under rubber depicts very high positive growth rates. The decline in area under both rice and coconut is so high and it has resulted in negative growth rates of area under rice in five districts and all Kerala and coconut in three districts. The growth rates of area under rubber were high, and positive during the combined period also (Table 2.16).

One important conclusion emerging from the analysis is that the area under rice is on the decrease especially after 1974-75 while the area under coconut is on the increase upto 1974-75 and the area under rubber is on the increase especially after 1974-75. It depicts a trend towards substitution of paddy in favour of coconut upto 1974-75 and coconut in favour of rubber particularly after 1974-75.

Table - 2.16 Growth Rates of Area under Rice, Coconut and Rubber

(Per cent)

Period	Crop	Trivandrum	Quilon	Alleppey	Kottayam	Ernakulam	Trichur	Palghat	Kozhikode	Canannore	All Kerala
(I) 1960-61 to 1968-69	Rice	0.89*	1.34	0.88**	1.79***	2.02*	1.52**	0.81**	1.21**	0.50 n.s.	1.12**
	Coconut	3.63*	3.29*	1.22n.s.	3.31*	4.83*	3.12*	6.71*	3.29*	7.17*	3.81*
	Rubber	7.02*	3.63*	5.18*	0.08n.s.	5.73*	2.78*	5.93*	3.96*	2.72*	3.55*
(II) 1960-61 to 1974-75	Rice	0.49*	0.82*	1.07*	1.76*	1.69*	0.90*	1.24*	1.29*	0.63*	1.14*
	Coconut	2.97*	4.08*	0.97	1.50*	4.09*	4.29*	5.55*	3.44*	4.46*	3.28*
	Rubber	5.91	3.13*	4.41*	2.66*	3.67*	2.73*	9.48*	2.57*	3.53*	3.50*
(III) 1974-75 to 1985-86	Rice	-3.70*	-0.93*	-2.63*	-3.97*	-1.08***	-1.70*	-1.26*	-3.00*	-3.22*	-2.05*
	Coconut	-0.03n.s.	-2.13*	-1.11n.s.	-0.08n.s.	0.02n.s.	1.64*	1.44**	0.02n.s.	-1.23n.s.	-0.02n.s.
	Rubber	6.62*	4.37*	9.21*	4.42*	5.18*	1.94*	3.46*	1.85*	4.12*	4.28*
(IV) 1960-61 to 1985-86	Rice	-1.37*	0.02n.s.	-0.14n.s.	-0.39n.s.	1.05*	0.09n.s.	-0.03n.s.	0.02*	-1.62*	-0.24n.s.
	Coconut	1.23*	-0.07**	-0.93*	-0.07**	1.79*	2.19*	2.20*	1.76*	1.29*	1.03*
	Rubber	4.59*	2.97*	4.69*	3.12*	3.13*	1.60*	7.08*	1.88*	4.06*	3.30*

Note:

*1 per cent level of significance
**5 per cent level of significance
***10 per cent level of significance
n.s. not significant.

Chapter 3

TRENDS IN AREA, YIELD AND PRODUCTION

Chapter 3

TRENDS IN AREA, YIELD AND PRODUCTION

Rice is the most important crop in Kerala. It accounts for about 26 per cent of the gross cropped area, more than 99 per cent of the production of cereals and 91.1 per cent of the seasonal crops. It is the staple food of a population of 272 lakhs.[1] But the internal production of it meets only 42 per cent of the domestic requirements. It is estimated that by the turn of the century, the population of the State would grow to 33 million who would need 3.90 million tonnes of rice. This comes to three times the current internal production. If production does not increase adequately, there would be a yawning gap between availability and requirements. This would necessitate extreme dependence on outside supplies with all the attendant risks and uncertainties. This shows the gravity of Kerala's food problem and the need to find urgent solutions for increasing rice production through all possible means.

From 1960-61 to 1974-75 the area under rice increased at an annual compound growth rate of 1.14 per cent, yield went up from 1317 Kg/ha. to 1513 Kg/ha. indicating a low annual growth rate of about one per cent and production increased at

---

1. Kerala Economic Review, 1986, Page 3.

an annual compound growth rate of about 2 per cent. Between 1974-75 and 1985-86, the growth rate of area turned out to be negative (-2.05 per cent). In spite of a slight improvement in the growth rate of yield as compared to the previous period, because of the fall in the area, production remained more or less stagnant upto 1982-83, and then further declined as a result of greater decline in cropped area. The production of rice in 1985-86 was only 1.17 million tonnes as against the peak production of 1.37 million tonnes in 1972-73. This is somewhat different from the all India pattern where agricultural growth in the seventies was much faster than in the sixties (Table 3.1). It is sometimes argued that in Kerala probably the sixties was a period of accelerated growth and the seventies, especially after 1974-75 was a period of decelerated growth.

The decline in area was attributed to a number of factors such as the reversal of the rising trend in paddy price from 1974-75 and increased cost of production. Along with this trend in relative prices, yield increase is only marginal and the relative profitability of rice has become unfavourable. The poor performance of rice production in Kerala is also attributed to a number of constraints, such as, diverse agroclimatic conditions, acidic soils, uneven distribution of rainfall, soil erosion, multiple cropping, high incidence of pests and diseases and low level of fertiliser use.

Table - 3.1 Area, Production and Yield of Rice in All India and All Kerala

Year	Area (Million hectares)		Production (Million Tonnes)		Yield (Kg/ha.)	
	All India	All Kerala	All India	All Kerala	All India	All Kerala
1960-61	34.13	0.78	51.86	1.07	1520	1371
1970-71	37.59	0.87	63.34	1.30	1685	1483
1980-81	40.15	0.80	80.31	1.27	2000	1587
1983-84	41.24	0.74	90.05	1.21	2183	1632
1984-85	41.16	0.73	87.99	1.26	2138	1720
1985-86	40.91	0.68	96.22	1.17	2352	1729

Source: For All India- *Yojana*, Oct. 16-31, 1987, Page 7.
For All Kerala - Directorate of Economics & Statistics, Government of Kerala.

Most of the studies on rice in Kerala are based on data aggregated over seasons and over space, such aggregations might conceal some of the inherent trends in the disaggregated data by mutual adjustments of the positive and negative trends. In particular, the observed stability in production of rice in Kerala may not be uniformily spread over the three seasons and over the different spatial regions of the state. An analysis of area, production and productivity at the micro level with taluks as strata, would indicate that one cannot assume that the traditional paddy fields hold the same natural endowments for rice production or are homogenous in agro-ecological conditions. Even within a taluk there may be heterogeneity. However, the scope of analysis beyond the taluk strata is at the moment, restricted for want of data.

The main purpose of this chapter is to analyse the trends in area, yield and production of rice during the three seasons in the State as a whole. The analysis is done with reference to nine former districts for 26 years and 57 taluks for 12 years.

Paddy is grown during the three seasons, viz., autumn, winter and summer. The changes in area, yield and production during the three seasons and for the combined seasons are analysed. Though the most appropriate procedure to study spatial divergence might have been an analysis based on the agro-climatic zones, existing data base did not permit such an analysis.

Growth and stability of output are two important concerns of agricultural development policies in India. As pointed out by C.H.H. Rao (1975), S.R. Sen (1967) and others, measures adopted for achieving growth in agricultural production through extension of area under crops and intensive use of inputs, especially the HYV have often resulted in increasing the annual fluctuations in production. Though rice production in Kerala has not witnessed any major breakthrough as in the case of HYV wheat in the north, the changes in the production system over the period might have influenced annual fluctuations in area, yield and production. In this study annual variations in area, yield and production are measured using the co-efficien of variation for each period separately and for the combined period in order to identify the nature of changes in stability over periods and regions.

An attempt is made here to analyse the factors responsible for the changes in yield with particular reference to the role of HYV, irrigation facilities and fertiliser consumption. Since yield data for HYV and non-HYV according to irrigation facilities are available only for the third period, the analysis is confined to this period only.

3.1. State Level Analysis

Of the total area of 6,78,281 hectares under rice during 1985-86, 41.24 per cent is cultivated in autumn, 46.21 per cent in winter and 12.55 per cent in summer. The share of autumn rice was slightly less than half the total area under rice in the beginning of the sixties except for the year 1960-61. But this share gradually declined until the middle of the seventies. Further, the area under autumn was higher than the area under winter until 1974-75, but in a majority of years in the subsequent period area under winter rice exceeded the area under autumn. The area under summer accounts for 10 to 13 per cent of the total area under rice. Table 3.2 and Diagram 3.1 indicate the share of autumn, winter and summer rice in total area under rice in Kerala.

The average yield of rice increased from 1371 Kgs. per hectare in 1960-61 to 1729 Kgs. per hectare in 1985-86. The maximum yield during this period was 1729 Kgs. per hectare in 1985-86 and minimum was 1243 Kgs. per hectare in 1965-66.

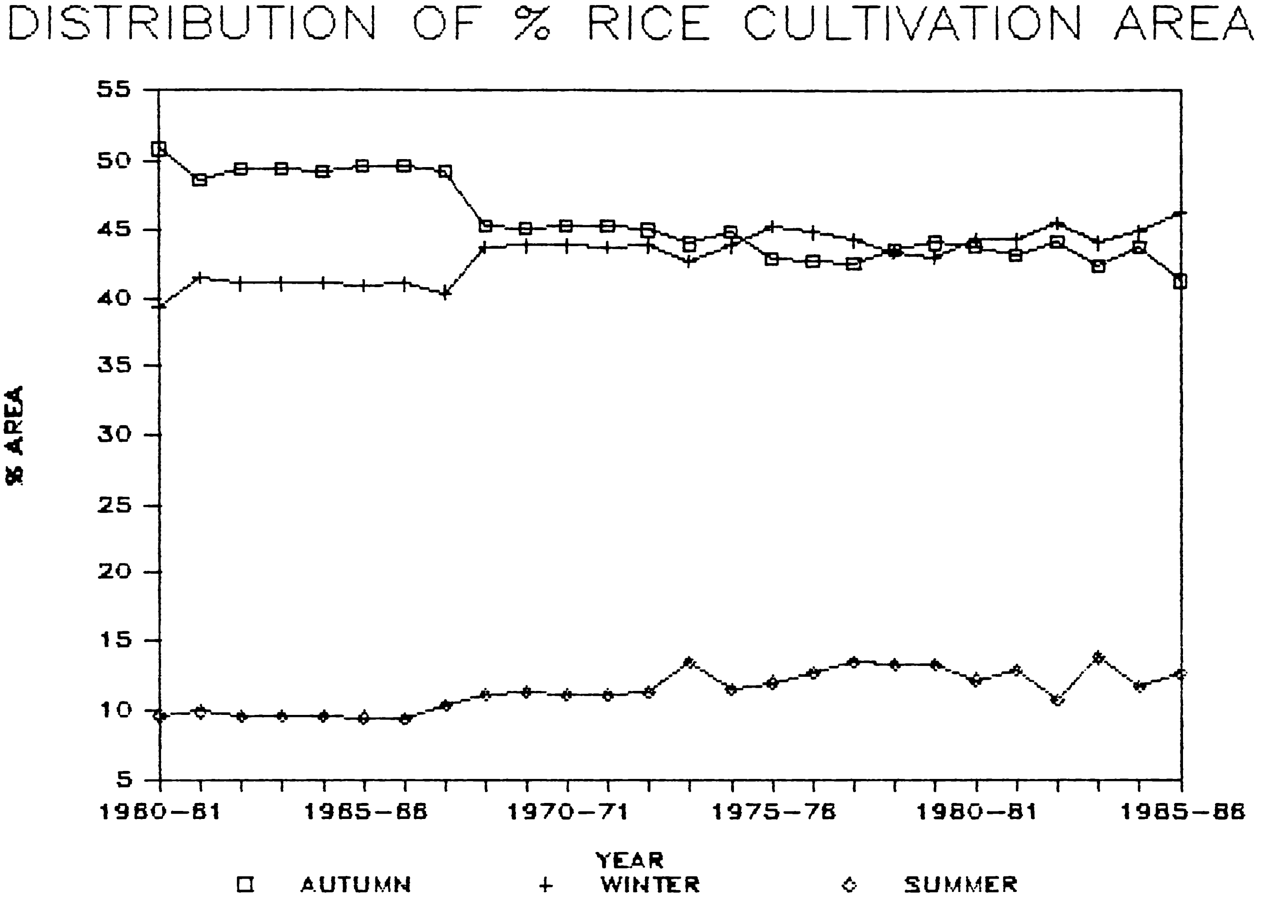
Seasonal variations in yield indicated a range between 1148 Kgs. per hectare in 1961-62 and 1723 Kgs. per hectare in 1984-85 for autumn, between 118 Kgs. per hectare in 1965-66 and 1681 Kgs. per hectare in 1985-86 for winter, and between 1122 Kgs. per hectare in 1965-66 and 2316 Kgs. per hectare in 1971-72 for summer. From 1960-61 to 1985-86, the

Table - 3.2 Share of Autumn, Winter and Summer Rice in the Total Area under Rice

Year	Percentage Area under			Total Area ('000 Hectares)
	Autumn	Winter	Summer	
1960-61	50.9	39.4	9.7	779
1961-62	48.6	41.5	9.9	753
1962-63	49.4	41.0	9.6	803
1963-64	49.4	41.0	9.6	805
1964-65	49.3	41.1	9.6	801
1965-66	49.6	40.9	9.5	802
1966-67	49.6	41.0	9.4	799
1967-68	49.3	40.4	10.3	810
1968-69	45.2	43.6	11.2	874
1969-70	45.0	43.7	11.3	874
1970-71	45.2	43.7	11.1	875
1971-72	45.2	43.6	11.2	875
1972-73	44.9	43.7	11.4	874
1973-74	43.9	42.6	13.5	875
1974-75	44.8	43.7	11.5	881
1975-76	42.8	45.2	12.0	876
1976-77	42.6	44.7	12.7	854
1977-78	43.4	44.1	12.5	840
1978-79	43.4	43.3	13.3	799
1979-80	43.9	42.8	13.3	793
1980-81	43.6	44.2	12.2	802
1981-82	43.0	44.1	12.0	807
1982-83	44.0	45.3	10.7	778
1983-84	44.3	43.9	11.8	740
1984-85	43.6	44.7	11.7	730
1985-86	41.2	46.2	12.6	678

Source: Compiled from the estimates of area under crops prepared by the Directorate of Economics and Statistics, Government of Kerala.

DIAGRAM 3.1



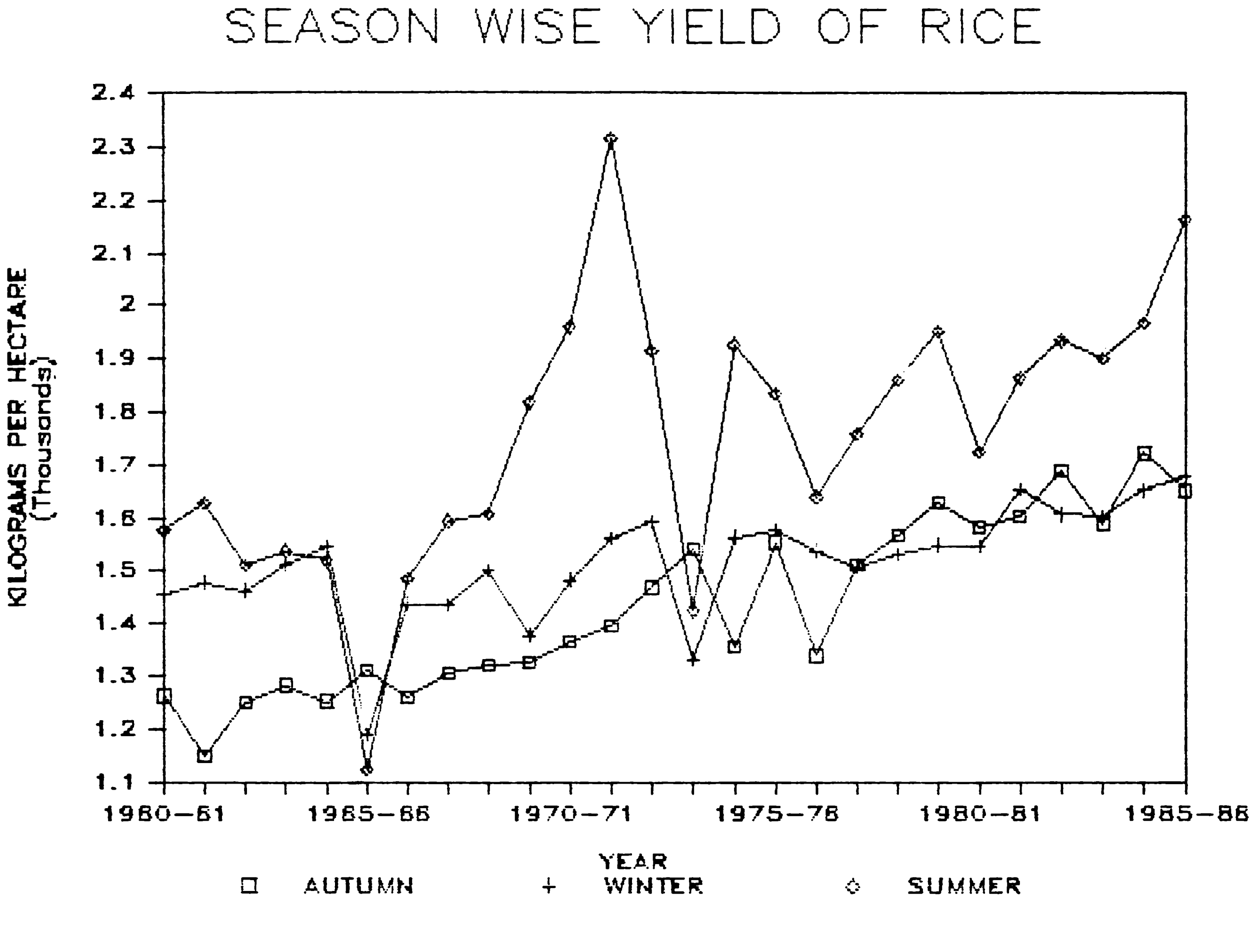
DISTRIBUTION OF % RICE CULTIVATION AREA
% AREA
55
50
45
40
35
30
25
20
15
10
5
1960–61
1965–66
1970–71
1975–76
1980–81
1985–86
YEAR
AUTUMN
WINTER
SUMMER

Table - 3.3 Season-wise yield of Rice in Kerala

Year	Autumn	Winter	Summer	Average
1960-61	1263	1458	1577	1371
1961-62	1148	1479	1630	1334
1962-63	1249	1464	1512	1362
1963-64	1282	1513	1540	1401
1964-65	1252	1548	1521	1401
1965-66	1311	1188	1122	1243
1966-67	1261	1439	1487	1356
1967-68	1305	1435	1596	1388
1968-69	1320	1502	1610	1432
1969-70	1324	1378	1819	1403
1970-71	1365	1484	1960	1484
1971-72	1397	1562	2316	1545
1972-73	1470	1594	1917	1575
1973-74	1542	1333	1424	1437
1974-75	1356	1565	1929	1513
1975-76	1555	1578	1836	1518
1976-77	1339	1540	1641	1468
1977-78	1511	1508	1759	1541
1978-79	1569	1533	1861	1587
1979-80	1630	1550	1952	1638
1980-81	1585	1549	1726	1587
1981-82	1604	1654	1864	1660
1982-83	1689	1606	1935	1678
1983-84	1588	1604	1901	1632
1984-85	1723	1652	1966	1720
1985-86	1652	1681	2162	1729

Source: Compiled from the estimates of yield of paddy prepared by the Directorate of Economics and Statistics, Government of Kerala.

DIAGRAM 3.2


SEASON WISE YIELD OF RICE
KILOGRAMS PER HECTARE
(Thousands)
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1960–61
1965–66
1970–71
1975–76
1980–81
1985–86
YEAR
AUTUMN
WINTER
SUMMER

highest yield per hectare was recorded for the summer crop in 23 years, for the autumn crop in two years and for the winter crop in one year. In terms of the ranking of yield levels during these 26 years, the combination SWA[2] of the highest yield during summer (S) followed by winter (W) and the least in autuman (A) was observed in 17 years. The frequency of other combinations were SAW in six years, ASW, AWS and WSA in one year each.

The annual average is greatly influenced by the performance of the summer crop. During the 26 years (considered here) summer yield was above the annual average yield in 24 years and only twice it was below the average. During the winter season, yield levels were above the annual average in 13 years and were below the annual average in 12 years and exactly the same in one year. Autumn yields were below the annual average in 21 years and were above the annual average in only five years (Table 3.3 and Diagram 3.2).

---

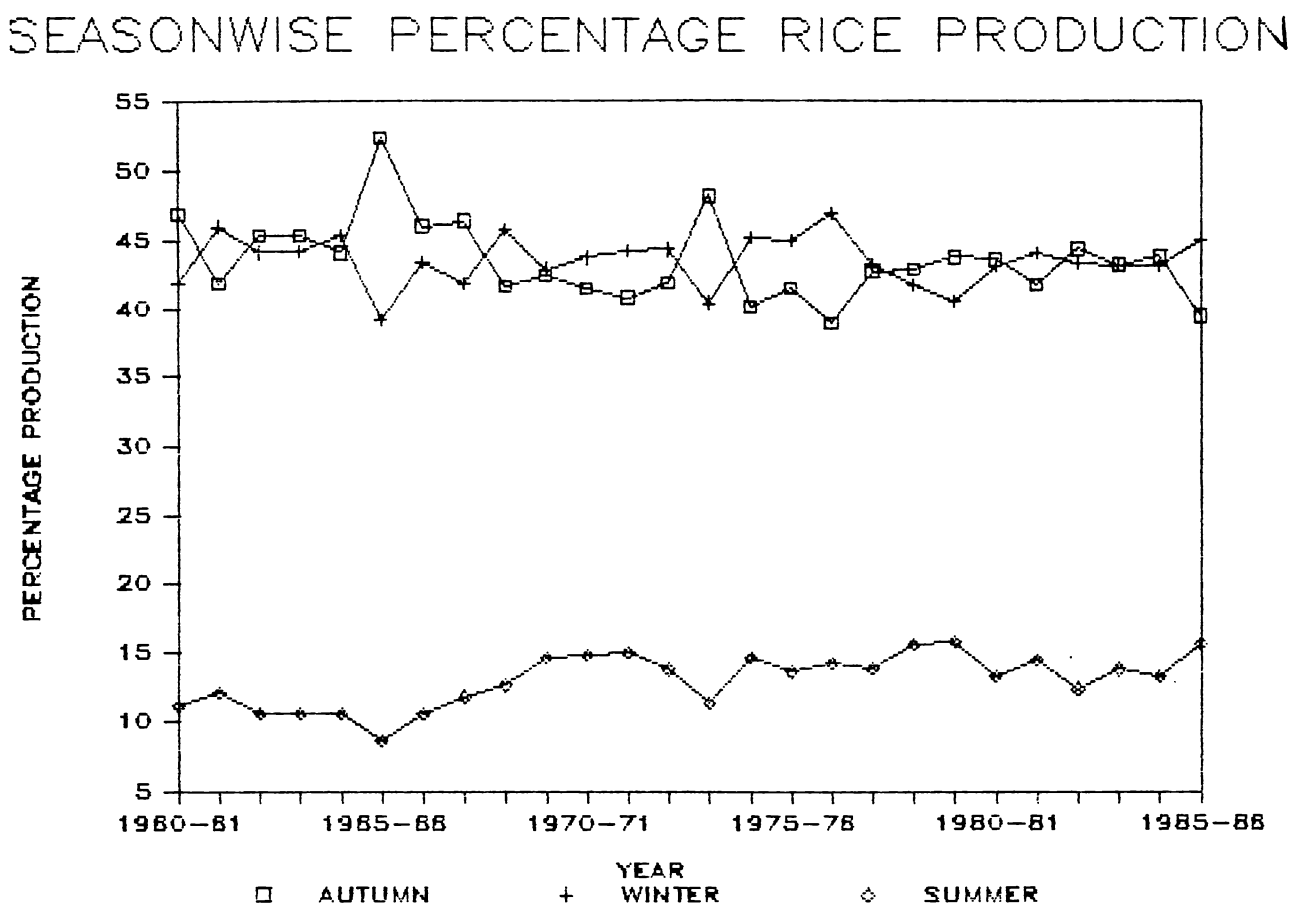
2. S = Summer, W = Winter, A = Autumn.

Table - 3.4 Shares of Autumn, Winter and Summer Production in the Total Production

Year	Share of Production During			Total production ('000 tonnes)
	Autumn	Winter (Per cent)	Summer	
1960-61	46.9	41.9	11.2	1068
1961-62	41.9	46.0	12.1	1004
1962-63	45.3	44.1	10.6	1093
1963-64	45.3	44.2	10.5	1128
1964-65	44.1	45.4	10.5	1121
1965-66	52.3	39.1	8.6	997
1966-67	46.0	43.4	10.6	1084
1967-68	46.4	41.8	11.8	1124
1968-69	41.7	45.7	12.6	1251
1969-70	42.5	42.9	14.6	1226
1970-71	41.5	43.7	14.8	1298
1971-72	40.8	44.2	15.0	1352
1972-73	41.9	44.3	13.8	1376
1973-74	48.2	40.4	11.4	1257
1974-75	40.1	45.2	14.7	1337
1975-76	41.4	45.0	13.6	1329
1976-77	38.9	46.9	14.2	1254
1977-78	42.6	43.2	13.9	1295
1978-79	42.8	41.6	15.6	1273
1979-80	43.7	40.5	15.8	1300
1980-81	43.5	43.1	13.3	1272
1981-82	41.6	44.0	14.4	1339
1982-83	44.3	43.3	12.4	1306
1983-84	43.1	43.1	13.8	1208
1984-85	43.7	43.0	13.3	1256
1985-86	39.4	44.9	15.7	1173

Source: Compiled from the estimates of Production of rice Prepared by the Directorate of Economics and Statistics, Government of Kerala.

DIAGRAM - 3.3


SEASONWISE PERCENTAGE RICE PRODUCTION
PERCENTAGE PRODUCTION
55
50
45
40
35
30
25
20
15
10
5
1960-61
1965-66
1970-71
1975-76
1980-81
1985-86
YEAR
AUTUMN
WINTER
SUMMER

During 1985-86, the total production of rice in Kerala was 11,73,051 tonnes. This consisted of 4,61,992 tonnes in autumn, 5,26,981 tonnes in winter and 1,84,078 tonnes in summer. The shares of autumn, winter and summer production in the total production were 39.38 per cent, 44.92 per cent and 15.70 per cent respectively. Between 1960-61 and 1985-86, the maximum production was 13,76,370 tonnes in 1972-73 and the minimum was 9,97,490 tonnes in 1965-66. The autumn production was maximum in 1973-74 and minimum in 1962-63, while the winter production was maximum in 1972-73 and minimum in 1965-66. The summer production was maximum in 1979-80 and minimum in 1965-66. The share of autumn production in the total production ranged between 38.9 per cent in 1976-77 and 52.3 per cent in 1965-66, winter production shares ranged between 39.1 per cent in 1965-66 and 46.9 per cent in 1976-77 and summer production shares ranged between 8.6 per cent in 1965-66 and 15.8 per cent in 1979-80 (Table 3.4 and Diagram 3.3).

3.2. <u>District Level Analysis</u>

From the analysis of district level data, it would be possible to obtain a broad picture regarding the trends in area, yield and output of rice. It would be better to examine how far the performance of rice differs among districts of the State and what are the factors that are responsible for such differences. Similarly, the performance of rice differs among the crop seasons, the examination of the causes for this would be interesting.

3.2.1. Trivandrum

Of the total area of 26,352 hectares under rice during 1985-86, 48.9 per cent was cultivated in autumn, 50 per cent in winter and 1.1 per cent in summer. For most of the years, ie., out of the 26 years the area under winter was higher than the area under autumn for 22 years and only for four years area under autumn was higher than the area under winter. The share of winter rice was slightly higher than half the total area under rice and slightly less than half the area under rice with regard to autumn rice in almost all the years. Area under summer rice was very meagre and accounts for only one to six per cent of the total area under rice except in the year 1976-77, which accounts for about 13 per cent of the total area under rice.

The average yield of rice increased from 1531 Kgs. per hectare during 1960-61 to 1787 Kgs. per hectare during 1985-86. The maximum yield during this period was 1787 Kgs. per hectare in 1985-86 and the minimum was 1300 Kgs. per hectare in 1966-67. Seasonal variations in yield showed a range between 1106 Kg. per hectare in 1964-65 and 2094 Kgs. per hectare in 1985-86 for autumn, between 1171 Kgs. per hectare in 1983-84 and 1676 Kgs. per hectare in 1960-61 for winter and between 758 Kgs. per hectare in 1968-69 and 1298 Kgs. per hectare in 1974-75 for summer. From 1960-61

1985-86, the highest yield per hectare was recorded for the winter crop in 17 years, for the autumn crop in nine years and for the summer crop yield level was very low compared to other two seasons. In terms of ranking of yield levels during these 26 years, the combination WAS of highest yield during winter (W) followed by autumn (A) and the least in summer (S) was observed in 11 years. The frequency of other combinations were AWS in eight years, WA in five years, AW in one year (since for six years data are not available for summer crop) and for one year yield for the summer and autumn crop was equal and highest yield come under winter crop.

The annual average was greatly influenced by the performance of the winter crop. During the 26 years considered here winter yield had been above the annual average yield in 18 years and was below the State average in eight years. During the autumn season, yield levels were above the annual average in 10 years and were below the annual average for 16 years. Summer yields were below the annual average in all the 20 years.

The total production of rice in Trivandrum was 47,106 tonnes consisting of 26,965 tonnes in autumn, 19,806 tonnes in winter and 335 tonnes in summer during 1985-86. The shares of autumn, winter and summer production in the total production were 57.2 per cent, 42.1 per cent and 0.7 per cent respectively. Between 1960-61 and 1985-86, the maximum production was 64,182 tonnes in 1971-72 and the minimum was 36,462 tonnes in 1983-84. 1971-72 and 1983-84 indicated maximum and minimum production respectively during the seasons autumn and winter, whereas the summer production was maximum in 1976-77 and minimum in 1966-67. The share of autumn production in the total production ranged between 39.3 per cent in 1964-65 and 57.2 per cent in 1985-86, winter production shares ranged between 42.1 per cent in 1985-86 and 60.7 per cent in 1964-65 and summer production shares ranged between 0.4 per cent in 1966-67 and 5.4 per cent in 1976-77.

3.2.2. Quilon

During 1985-86, out of the total area of 44,149 hectares, 45.7 per cent was cultivated in autumn, 53.0 per cent in winter and 1.3 per cent in summer. But, of the 26 years, the area under winter is higher than the area under autumn for 24 years and the area under autumn is higher than area under winter only for two years. The share of area under winter rice was higher than half of the total area under rice and less than half the area under rice with regard to autumn rice in almost all years. Area under summer rice accounted for 0.4 to 2.8 per cent of the total area under rice.

The maximum yield during 1960-61 to 1985-86 was 1744 Kgs. per hectare in 1985-86 and the minimum was 1261 Kgs. per hectare in 1965-66. Seasonal variations in yield showed a range between 839 Kgs. per hectare in 1964-65 and 1804 Kgs. per hectare in 1985-86 for autumn, between 1267 Kgs. per hectare in 1965-66 and 1825 Kgs. per hectare in 1968-69 for winter, and between 589 Kgs. per hectare in 1977-78 and 2101 Kgs. per hectare in 1985-86 for summer. From 1960-61 to 1985-86, the highest yield per hectare was recorded for the winter rice in 22 years, for the autumn and summer rice in two years each. In terms of ranking of yield levels during these 26 years, the combination WAS of highest yield during winter (W) followed by autumn (A) and the least in summer (S) is observed in 15 years. The frequency of Combinations are WSA in seven years, AWS in two years, SWA and SAW in one year each.

The annual average was greatly influenced by the performance of the winter crop. During the 26 years considered here winter yield was above the annual average yield in 23 years and was below annual average in three years. During the autumn and summer seasons, yield levels were above the annual average in four Years and were below annual average in 22 years each. Both summer and autumn yields were low compared to winter yield of rice.

During 1985-86, the total production was 77,021 tonnes consisting of 36,369 tonnes in autumn, 39,446 tonnes in winter and 1206 tonnes in summer. The shares of autumn, winter and summer production were 47.2 per cent, 51.2 per cent and 1.6 per cent respectively. Between 1960-61 and 1985-86, the maximum production was 85,846 tonnes in 1982-83 and the minimum 62,571 tonnes in 1965-66. The autumn production was maximum in 1982-83 and minimum in 1964-65, the winter production was maximum in 1968-69 and minimum in 1983-84 and the summer production was maximum in 1970-71 and minimum in 1983-84. The share of autumn production in the total production ranged between 27.4 per cent in 1964-65 and 51.7 per cent in 1983-84, winter production shares ranged between 48 per cent in 1983-84 and 70.3 per cent in 1964-65 and summer production shares ranged between 0.3 per cent in 1983-84 and 2.7 per cent in 1970-71.

3.2.3. Alleppey

During 1985-86, of the total area of 61,118 hectares, 24.7 per cent was cultivated in autumn, 29.6 per cent in winter and 45.7 per cent in summer. Of the 26 years, the area under summer was higher than the area under autumn and winter for 18 years, the area under autumn was higher than the area under winter and summer for six years and the area under winter was higher than area under autumn and summer for two years. The share of area under summer rice was slightly higher than half of the total area under rice in seven years, slightly lower than half of total area under rice in five years and lower than that in all the rest of the years. Area under autumn rice accounted for 24.7 to 44.6 per cent, winter rice 21.3 to 43.8 per cent and summer rice 26.6 per cent to 52.3 per cent of the total area under rice.

The average yield increased from 1516 Kgs. per hectare in 1960-61 to 2018 Kgs. per hectare in 1985-86. The maximum yield during 1960-61 to 1985-86 was 2018 Kgs. per hectare in 1985-86 and the minimum, 1135 Kgs. per hectare in 1965-66. Seasonal variation in yield showed a range between 868 Kgs. per hectare in 1968-69 and 1863 Kgs. per hectare in 1984-85 for autumn, between 925 Kgs. per hectare in 1973-74 and 1853 Kgs. per hectare in 1976-77 for winter and between 1114 Kgs. per hectare in 1965-66 and 2742 Kgs. per hectare in 1985-86 for summer. The highest yield per hectare was recorded for summer rice in 25 years, and for autumn rice in one year. In terms of ranking of yield levels during these 26 years, the combination of SWA is observed in 19 years. The other combinationsare SAW in six years and ASW in one year.

The annual average is greatly influenced by the performance of the summer crop. During the 26 years considered here summer yield was above the annual average yield in 25 years and was below annual average only in one year. During the autumn season, yield levels were below the annual average in 25 years and above the annual average only in one year, yield levels were below the annual average in 24 years and above the annual average only in two years during the winter season.

The total production during 1985-86 was 1,23,499 tonnes consisting of 15,164 tonnes in autumn, 31,724 tonnes in winter and 76,612 tonnes in summer. The shares of autumn, winter and summer production were 12.3 per cent, 25.7 per cent and 62 per cent respectively. Between 1960-61 and 1985-86, the maximum production was 1,73,162 tonnes in 1981-82 and the minimum, 92,600 tonnes in 1965-66. The autumn production was maximum in 1984-85 and minimum in 1985-86. The winter production was maximum in 1976-77 and minimum in 1966-67 and the summer production was maximum in 1971-72 and minimum in 1976-77. The share of autumn production in the total production ranged between 12.3 per cent in 1985-86 and 42.5 per cent in 1984-85, winter production shares ranged between 18.4 per cent in 1966-67 and 44.4 per cent in 1976-77 and summer production shares ranged between 31-6 per cent in 1976-77 and 65.4 per cent in 1971-72.

3.2.4. Kottayam

During 1985-86, of the total area of 35,533 hectares, 11,475 hectares were cultivated in autumn, 17,443 hectares in winter and 6615 hectares in summer, ie. 32.3 per cent in autumn, 49.1 per cent in winter and 18.6 per cent in summer. Of the 26 years, the area under winter was higher than the area under summer and autumn in 20 years, the area under autumn was higher than the area under winter and summer in six years. Area under autumn rice accounted for 13.5 to 42.3 per cent, winter rice 33.1 to 66.1 per cent and summer rice 17.3 to 41.4 per cent of the total area under rice.

The average yield increased from 1603 Kgs. per hectare in 1960-61 to 1854 Kgs. per hectare in 1985-86. The maximum yield during 1960-61 to 1985-86 was 2,422 Kgs. per hectare in 1982-83 and the minimum, 931 Kgs. per hectare in 1965-66. Seasonal variations in yield indicate a range between 1030 Kgs. per hectare in 1964-65 and 2231 Kgs. per hectare in 1982-83 for autumn, between 876 Kgs. per hectare in 1965-66 and 2189 Kgs. per hectare in 1982-83 for winter and between 916 Kgs. per hectare in 1965-66 and 3335 Kgs. per hectare in 1982-83 for summer. The highest yield per hectare was recorded for the summer rice in 20 years and for the autumn and winter rice in three years each. In terms of ranking of yield levels during these 26 years, the combination of SWA is observed in 14 years, SAW in six years, WSA in three years, AWS in two years and ASW in one year.

The annual average was greatly influenced by the performance of the summer crop. During the 26 years considered here summer yield was above the annual average yield in 21 years and below annual average in five years, winter yield was above the annual average yield in six years and below annual average in 20 years and summer yield was above the annual average yield only in three years and below annual average in 23 years.

The total production during 1985-86 was 66,476 tonnes consisting of 15,026 tonnes in autumn, 32,090 tonnes in winter and 19,360 tonnes in summer. The shares of autumn, winter and summer production were 22.6 per cent, 48.3 per cent, 29.1 per cent respectively. Between 1960-61 and 1985-86, the maximum production was 93,738 tonnes in 1982-83 and the minimum,37,741 tonnes in 1965-66. The autumn production was maximum in 1982-83 and minimum in 1961-62, the winter production was maximum in 1972-73 and minimum in 1965-66 and the summer production was maximum in 1971-72 and minimum in 1983-84. The share of autumn production in the total production ranged between 10.4 per cent in 1961-62 and 41.8 per cent in 1981-82, winter production shares ranged between 20.8 per cent in 1979-80 and 53 per cent in 1968-69 and summer production shares ranged between 18.5 per cent in 1983-84 and 44.8 per cent in 1971-72.

3.2.5. Ernakulam

Of the total area of 89,406 hectares, 36,760 hectares were cultivated in autumn, 37,727 hectares in winter and 14,919 hectares in summer in 1985-86. The shares of autumn, winter and summer area are 41.1 per cent, 42.2 per cent and 16.7 per cent respectively. Out of the 26 years, area under winter was higher than the area under autumn and summer in 15 years, the area under autumn was higher than winter and summer in 11 years. Area under autumn rice accounted for 39.4 to 50.3 per cent, winter rice 36.4 to 47.8 per cent and summer rice 6.4 to 18.34 per cent of the total area under rice.

The average yield increased from 1372 Kgs. per hectare in 1960-61 to 1698 Kgs. per hectare in 1985-86. The maximum yield during 1960-61 to 1985-86 was 1698 Kgs. per hectare in 1985-86 and minimum was 1166 Kgs. per hectare in 1969-70. Seasonal variation in yield indicate a range between 1054 Kgs. per hectare in 1966-67 and 1742 Kgs. per hectare in 1985-86 for autumn, between 1130 Kgs. per hectare in 1969-70 and 1760 Kgs. per hectare in 1974-75 and 1975-76 for winter and between 1148 Kgs. per hectare in 1973-74 and 1616 Kgs. per hectare in 1984-85 for summer. The highest yield per hectare was recorded for the winter rice in 10 years, followed by autumn in nine years and summer in seven years. In terms of ranking of yield levels during 26 years, the combination of AWS is observed in seven years, WSA in six years, SWA in five years, WAS in four years, ASW and SAW in two years each.

The annual average was greatly influenced by the performance of the winter crop. During the 26 years considered here winter yield was above the annual average yield in 19 years and was below annual average in seven years. Autumn and summer yields are above the annual average yield in 12 years and are below annual average in 14 years for autumn crop and 13 years for summer crop and summer yield and the annual average yield were exactly the same in one year.

The total production was 1,51,829 tonnes sharing among autumn, winter and summer, 64,029 tonnes 64,163 tonnes and 23,637 tonnes respectively in 1985-86. The shares of autumn, winter and summer production were 42.2 per cent, 42.3 per cent, 15.5 per cent respectively. Between 1960-61 and 1985-86, the maximum production was 1,60,550 tonnes in 1978-79 and the minimum was 93,383 tonnes in 1965-66. The autumn production was maximum in 1978-79 and minimum in 1961-62, the winter production was maximum in 1974-75 and 1975-76 and minimum in 1965-66 and summer production was maximum in 1979-80 and minimum in 1964-65. Of the 26 years, higher production of rice shared between autumn and winter in 13 years each. Summer production of rice was comparatively very low. The share of summer production in the total production ranged between 6.2 per cent in 1964-65 and 19.5 per cent in 1979-80.

3.2.6. Trichur

The shares of autumn, winter and summer area under rice were 34 per cent, 48 per cent, 18 per cent respectively during 1985-86. The total area was 95,215 hectares consisting of 32,362 hectares during autumn 45,671 hectares during winter and 17,182 hectares during summer. The area under winter was higher than the area under autumn and summer in all the 26 years. The area under winter was evidently higher than the other two crops, autumn and summer. The total area under rice reached its peak level in 1975-76, autumn crop in 1977-78, winter crop in 1970-71 and summer crop in 1981-82. Whereas the lowest total area under rice was in 1961-62, autumn area was also in the same year, winter area in 1985-86 and summer area in 1960-61. Area under autumn rice accounted for 27.6 to 37.1 per cent, winter rice for 43.8 to 63.2 per cent and summer rice for 8.2 to 19.2 per cent of the total area under rice.

The average yield of rice increased from 1234 Kgs. per hectare in 1960-61 to 1596 Kgs. per hectare in 1985-86. The maximum yield during this period was 1596 Kgs. per hectare in 1985-86 and the minimum was 1109 Kgs. per hectare in 1961-62. Seasonal variations in yield indicated a range between 995 Kgs. per hectare in 1965-66 and 1408 Kgs. per hectare in 1983-84 for autumn, between 1043 Kgs. per hectare in 1973-74 and 1893 Kgs. per hectare in 1967-68 for winter and between 1210 Kgs. per hectare in 1973-74 and 1989 Kgs. per hectare in 1985-86 for summer. During 1960-61 to 1985-86, the highest yield per hectare was recorded for the summer crop in 22 years, for the winter crop in two years and for the autumn crop in one year and the yield was exactly the same for winter and summer crop in one year. In terms of ranking the yield levels during the 26 years, the combination SWA was observed in 22 years, WSA in two years, ASW in one year and the yield level in one year exactly the same for winter and summer rice.

The annual average was greatly influenced by the performance of the summer crop. During the 26 years considered here summer yield was above the annual average yield in 25 years and was below the state average only in one year. During the winter season, yield levels were above the annual average in 16 years and were below the annual average in 10 years. Autumn yields were below the annual average in 25 years and was above only in one year.

Of the total production of rice 1,51,936 tonnes, 27.3 per cent production was from autumn crop, 50.2 per cent from winter crop and 22.5 per cent from summer crop during 1985-86. Between 1960-61 and 1985-86, the maximum production was 1,63,397 tonnes in 1970-71 and the minimum was 1,03,600 tonnes in 1961-62. The autumn production was maximum in 1983-84 and minimum in 1961-62, the winter production was maximum in 1972-73 and minimum in 1980-81 and the summer production was maximum in 1979-80 and minimum in 1960-61. The share of autumn production in the total production ranged between 24.1 per cent in 1972-73 and 35.1 per cent in 1982-83, between 42.3 per cent in 1980-81 and 58.3 per cent in 1972-73 and between 8.5 per cent in 1960-61 and 25 per cent in 1979-80.

3.2.7. Palghat

During 1985-86, the total area was 1,82,320 hectares, consisting of 94,432 hectares during autumn, 83,737 hectares during winter and 4151 hectares during summer. The shares of autumn, winter and summer area under rice were 51.8 per cent, 45.9 per cent, 2.3 per cent respectively. The area under autumn crop was higher than the area under winter and summer in all the 26 years. The total area reached its highest level in 1974-75, autumn crop in 1970-71, winter crop in 1980-81 and summer crop in 1976-77. The lowest area under rice was in 1985-86, autumn area in 1985-86, winter area in 1960-61 and summer area in repeatedly three years from 1964-65 to 1966-67. Area under autumn rice accounted for 48.8 per cent in 1980-81 to 62.7 per cent in 1960-61, winter rice for 35.9 per cent in 1960-61 to 47.9 per cent in 1980-81 and summer rice for 1.4 per cent in 1965-66 to 4.4 per cent in 1976-77 of the total area under rice.

The average yield of rice increased from 1593 Kgs. per hectare in 1960-61 to 1850 Kgs. per hectare in 1985-86. The maximum yield during this period was 2072 Kgs. per hectare in 1972-73 and the minimum was 1536 in 1962-63. Seasonal variations in yield indicate a range between 1338 Kgs. per hectare in 1961-62 and 2216 Kgs. per hectare in 1982-83 for autumn, between 1460 Kgs. per hectare in 1965-66 and 2063 Kgs. per hectare in 1971-72 for winter and between 811 Kgs. per hectare in 1968-69 and 2739 Kgs. per hectare in 1972-73 for summer. During 1960-61 to 1985-86, the highest yield per hectare was recorded for the winter in 11 years, followed by autumn in 10 years and summer in five years. In terms of ranking the yield levels during 26 years, the combination WAS was observed in 11 years, AWS in nine years, SWA in four years, SAW and ASW in one year each.

The annual average was influenced by both winter and autumn crop. During the 26 years considered here winter yield was above the annual average yield in 14 years followed by autumn in 11 years and summer in five years and below the annual average in 12, 15 and 21 years respectively during winter, autumn and summer.

The total production of rice was 3,37,374 tonnes consisting of 1,82,415 tonnes in autumn, 1,47,401 tonnes in winter and 7558 tonnes in summer during 1985-86. The shares of autumn, winter and summer production were 54.1 per cent, 43.7 per cent, 2.2 per cent respectively. Between 1960-61 and 1985-86, the maximum production was 4,49,240 tonnes in 1972-73 and minimum was 2,95,500 tonnes in 1961-62. During autumn, the maximum production was 2,43,138 tonnes in 1975-76 and minimum, 1,59,581 tonnes in 1961-62, during winter, the maximum production was 1,90,673 tonnes in 1981-82 and minimum, 1,10,639 tonnes in 1960-61 and during summer, the maximum was 15,733 tonnes in 1976-77 and minimum, 3077 tonnes in 1966-67. In terms of ranking of production during 26 years, the combination of AWS is observed in all years. That is, the production during autumn was higher in all the 26 years followed by production during winter and summer. Summer production shares ranged between 0.9 per cent in 1966-67 and 4.6 per cent in 1976-77.

3.2.8. Kozhikode

Of the total area of 81,862 hectares under rice during 1985-86, 30.1 per cent was cultivated in autumn, 597 per cent in winter and 10.2 per cent in summer. The share of autumn rice was higher than winter and summer rice for the first 10 years, then in last 16 years winter rice was leading and summer rice increased considerably from 1967-68 onwards, but less than winter and autumn rice. In terms of ranking of area during 26 years, the combination of AWS was observed in 10 years and WAS in 16 years. That is, the area under autumn crop was higher in 10 years and winter crop in 16 years. The share of the area under summer crop ranged between one per cent in 1965-66 and 10.4 per cent in 1978-79.

The average yield of rice increased from 1080 Kgs. per hectare in 1960-61 to 1447 Kgs. per hectare in 1985-86. The maximum yield during this period was 1447 Kgs. per hectare in 1985-86 and the minimum, 979 Kgs. per hectare in 1965-66.

Seasonal variations in yield indicate a range between 902 Kgs. per hectare in 1967-68 to 1223 Kgs. per hectare in

1985-86 for autumn, between 1006 Kgs. per hectare in 1965-66 and 1605 Kgs. per hectare in 1972-73 for winter and between 968 Kgs. per hectare in 1963-64 and 2602 Kgs. per hectare in 1972-73 for summer. During 1960-61 to 1985-86, the highest yield per hectare was recorded for the summer crop in 18 years, and for the winter crop in eight years. According to the ranking of the yield levels during these 26 years, the combination SWA was observed in 18 years and WSA in eight years. Autumn yield was the lowest in all the years.

The annual average was greatly influenced by the performance of the summer crop. During the 26 years considered here summer yield was above annual average yield in 24 years and it was below the annual average in two years. During winter, the yield was above annual average in all the 26 years. The summer yield was below annual average in all the 26 years considered here.

During 1985-86, the total production of rice was 1,18,467 tonnes consisting of 30,087 tonnes in autumn, 75,487 tonnes in winter and 12,893 tonnes in summer. The shares of autumn, winter and summer production in the total production were 25.4 per cent, 63.7 per cent and 10.9 per cent respectively. Between 1960-61 and 1985-86, the maximum production was 1,47,629 tonnes in 1973-74 and the minimum was 1,07,877 tonnes in 1965-66. The autumn production was maximum in 1962-63 and minimum in 1985-86, the winter production was maximum in 1972-73 and minimum in 1965-66 and the summer production is maximum in 1977-78 and minimum in 1964-65. Of the 26 years, the production during autumn was higher in the first eight years and then winter production was higher in the last 18 years. Summer production was the lowest compared to autumn and winter production. The share of autumn production in the total production ranged between 25.4 per cent in 1985-86 and 57.3 per cent in 1962-63, winter production shares ranged between 41.5 per cent in 1962-63 and 63.7 per cent in 1985-86 and summer production between one per cent in 1964-65 and 13 per cent in 1977-78.

3.2.9. Canannore

Of the total area of 62,256 hectares under rice during 1985-86, 51.2 per cent was cultivated in autumn, 40.6 per cent in winter and 8.2 per cent in summer. The area under autumn was higher than winter and summer in all the years under study. Again the share of autumn rice was higher than half the total area under rice in all the 26 years. The area under winter rice ranged between 27.9 per cent in 1960-61 and 40.6 per cent in 1985-86, autumn rice ranged between 51.2 per cent in 1985-86 and 71 per cent in 1960-61 and summer rice ranged between 1.2 per cent in 1960-61 and 10.4 per cent in 1981-82.

The average yield of rice increased from 1057 Kgs. per hectare in 1960-61 to 1605 Kgs. per hectare in 1985-86.

The maximum yield during this period was 1605 Kgs. per hectare in 1985-86 and the minimum, 1017 Kgs. per hectare in 1961-62.

Seasonal variations in yield indicate a range between 1018 Kgs. per hectare in 1961-62 and 1582 Kgs. per hectare in 1985-86 for autumn, between 941 Kgs. per hectare in 1965-66 and 1604 Kgs. per hectare in 1985-86 for winter and between 863 Kgs. per hectare in 1965-66 and 2091 Kgs. per hectare in 1977-78 for summer. During 1960-61 to 1985-86, the highest yield per hectare was recorded for the summer crop in 15 years, for the autumn crop in seven years and winter crop in four years. In terms of the ranking of yield levels during those 26 years, the combination SWA was observed in 11 years, AWS in six years, SAW in four years, WAS in three years ASW and WSA in one year each.

The annual average was greatly influenced by the performance of the summer crop. During the 26 years considered here summer yield was above the annual average yield in 16 years and it was below the average in 10 years. During the winter season, yield levels were above the annual average in 10 years and below the average in 16 years. During the autumn season, yield levels were above the annual average in 12 years and below the average in 14 years.

During 1985-86, the total production of rice was 99,936 tonnes consisting of 50,449 tonnes in autumn, 40,583 tonnes in winter and 8904 tonnes in summer. The shares of autumn, winter and summer production in the total production were 50.5 per cent, 40.6 per cent and 8.9 per cent respectively. Between 1960-61 and 1985-86, the maximum production was 1,36,311 tonnes in 1969-70 and minimum, 82,147 tonnes in 1984-85. The autumn production was maximum in 1969-70 and minimum in 1984-85, the winter production was maximum in 1981-82 and minimum in 1965-66 and the summer production was maximum in 1978-79 and minimum in 1965-66. The share of autumn production in the total production ranged between 45.6 per cent in 1981-82 and 69.8 per cent in 1969-70, winter production ranged between 23.3 per cent in 1965-66 and 42.3 per cent in 1981-82 and summer production ranged between 0.9 per cent in 1965-66 and 14.1 per cent in 1978-79. Autumn production was higher than winter and summer production in all the 26 years considered here.

Comparative Analysis

A comparative study of the season-wise area, yield and production of rice in the state and in the districts is attempted.

In general, area under winter crop was higher in six districts, viz., Trivandrum, Kottayam, Quilon, Ernakulam, Trichur and Kozhikode. Area under autumn rice was higher in Palghat and Canannore districts and only in one district, viz., Alleppey, Table - 3.5 Comparative Position of Season-wise Area under Rice in the state and in the districts

Districts/State	Number of years state and districts' area under Rice remained Higher under			Total
	Autumn	Winter	Summer	
Trivandrum	4	22	--	26
Quilon	1	25	--	26
Alleppey	6	2	18	26
Kottayam	6	20	--	26
Ernakulam	11	15	--	26
Trichur	--	26	--	26
Palghat	26	--	--	26
Kozhikode	10	16	--	26
Canannore	26	--	--	26
All Kerala	19	7	--	26
Total	109	133	18	260

Source: Compiled from the estimates of season-wise area under rice in the state and in the districts prepared by the Directorate of Economics and Statistics, Government of Kerala.

area under summer rice was higher and very meagre in all the other districts. Even though area under summer rice was very meagre except in Alleppey, it is increasing in all the districts excluding Quilon and Palghat (Table 3.5).

Table - 3.6 District-wise Analysis of Different Combinations of Autumn, Winter and Summer yield of Rice

Districts	WAS	WSA	AWS	ASW	SWA	SAW	WA	AW	WA/S	W/SA	Total
Trivandrum	11		8				5	1	1		26
Quilon	15	7	2		1	1					26
Alleppey				1	19	6					26
Kottayam		3	2	1	14	6					26
Ernakulam	4	6	7	2	5	2					26
Trichur		2		1	22					1	26
Palghat	11		9	1	4	1					26
Kozhikode		8			18						26
Canannore	3	1	6	1	11	4					26
Total	44	27	34	7	94	20	5	1	1	1	234

Summer yield was higher than winter and autumn in 114 years, out of the 234 years under consideration, ie., when we take 26 years for nine districts we get 234 years in total. Winter yield was higher in 77 years, autumn yield in 42 years and winter and summer yield was exactly the same in one year. Hence the average yield was greatly influenced by the yield under summer rice in Alleppey, Kottayam, Trichur, Kozhikode and Canannore, whereas the average yield was greatly influenced by winter crop in Trivandrum, Quilon, Palghat and Ernakulam followed by autumn and summer (Table 3.6).

Table - 3.7 Ranking of the Districts according to yield levels during 1960-61 to 1985-86

District	Number of years when rank is								
	1	2	3	4	5	6	7	8	9
Trivandrum		3	4	4	8	6		1	
Quilon		1	4	12	4	3	2		
Alleppey	2	6	9	6	3				
Kottayam	4	11	8	1			1		1
Ernakulam				1	6	8	9	2	
Trichur				1	3	6	8	6	2
Palghat	20	5	1						
Kozhikode							1	8	17
Canannore				1	2	3	5	9	6

The highest average yield was obtained from Palghat followed by Kottayam, Alleppey, Quilon, Trivandrum, Ernakulam, Trichur, Canannore and Kozhikode districts respectively. Of the 26 years considered here, in 20 years Palghat recorded the highest yield, it occupied the second place in five years and third place in one year. Among the years when Palghat slipped from the highest yield level, Kottayam occupied that place in four years and Alleppey in two years. The lowest yield levels were recorded in Kozhikode district. The number of years when each district occupied the different rankings based on yield levels is given in Table 3.7.

Table - 3.8 Yield Position of each district in relation to the State Average

District	Number of Years when District yield remained		Total
	Below State Average	Above State Average	
Trivandrum	16	10	26
Quilon	12	14	26
Alleppey	6	20	26
Kottayam	4	22	26
Ernakulam	25	1	26
Trichur	26	--	26
Palghat	--	26	26
Kozhikode	26	--	26
Canannore	26	--	26

Table 3.8 indicates that yield levels in Palghat were always above the State average and those in Trichur, Canannore and Kozhikode were always below the state average. The position of other districts indicate that in majority years, ie., Ernakulam in 25 years and Trivandrum in 16 years have yield levels below the state average and in Alleppey (22 years), Kottayam (20 years) and Quilon (14 years) have yield levels above the state average.

The yield levels were lower in Northern-districts of Kerala except Palghat. Yield concentration was seen in Palghat, Kottayam and Alleppey district.

Taking into consideration annual and seasonal productio with regard to the state and nine districts, maximum production was concentrated in 1972-73 in six cases, in 1971-72 in five cases, in 1982-83 in four cases, in 1979-80, 1976-77, 1981-82 and 1978-79 in three cases each, in 1973-74, 1970-71 and 1969-70 in two cases each and in 1968-69, 1984-85, 1974-75, 1983-84, 1975-76, 1962-63 and 1977-78 in one case each, altogether forming 40 cases. Whereas minimum production was observed more in 1965-66, ie., in 13 cases, in 1961-62 in seven cases, in 1983-84 in six cases, in 1964-65 and 1966-67 in three cases each in 1984-85, 1960-61 and 1985-86 in two cases each and in 1976-77 and 1980-81 in one case each, forming 40 cases in total.

Table - 3.9 Production position of the State and the Districts in Relation to Autumn, Winter and Summer

Districts/ State	Number of years State and Districts' Production remained higher in			Total
	Autumn	Winter	Summer	
Trivandrum	9	17	--	26
Quilon	1	25	--	26
Alleppey	--	--	26	26
Kottayam	7	18	1	26
Ernakulam	13	13	--	26
Trichur	--	26	--	26
Palghat	26	--	--	26
Kozhikode	8	18	--	26
Canannore	26	--	--	26
All Kerala	12	14	--	26
Total	102	131	27	260

Of the 260 years (10 x 26), winter production was higher than autumn and summer production in 131 years, autumn in 102 years and summer in 27 years. That is, winter production was higher than autumn and summer production in 26, 25, 18, 18, 17, 14 and 13 years in Trichur, Quilon, Kottayam, Kozhikode, Trivandrum, All Kerala and Ernakulam respectively. Autumn production was higher than winter and summer production in 26, 26, 13, 12, 9, 8, 7 and one year in Palghat, Canannore, Ernakulam, All Kerala, Trivandrum, Kozhikode, Kottayam and Quilon respectively. All the 26 years in Alleppey district and one year in Kottayam district showed higher production levels during summer than autumn and winter production levels (Table 3.9).

On the whole, Palghat ranked first with regard to area, production and yield of rice during the period 1960-61 to 1985-86. Palghat was exclusively different from all other districts in the case of rice crop. Of the districts, Kottayam, Alleppey, Quilon, and Trivandrum had high yield rates compared with other northern districts such as Ernakulam, Trichur, Canannore and Kozhikode. Palghat was an exceptional case in the state as a whole. Trichur, Kozhikode, Ernakulam and Canannore had high percentage area under rice, but yield rate was very low compared with other districts. Percentage production of rice was also moving more or less in the same

Table - 3.10 Ranking of Districts according to Area, Production and yield of Rice from 1960-61 to 1985-86

Sl. No.	Districts	Area		Production		Yield per ha.	
		Percentage to All Kerala	Rank No.	Percentage to All Kerala	Rank No.	Average	Rank No.
1.	Trivandrum	4.42	9	4.31	9	1472	5
2.	Quilon	6.14	7	6.12	7	1498	4
3.	Alleppey	10.27	6	11.12	3	1642	3
4.	Kottayam	5.29	8	5.85	8	1670	2
5.	Ernakulam	11.52	4	10.69	4	1382	6
6.	Trichur	13.52	2	11.92	2	1325	7
7.	Palghat	24.89	1	30.51	1	1835	1
8.	Kozhikode	13.40	3	10.41	5	1173	9
9.	Canannore	10.56	5	9.07	6	1289	8

DIAGRAM. 3.4

RICE PRODUCTION : 1960-61 TO 1985-86

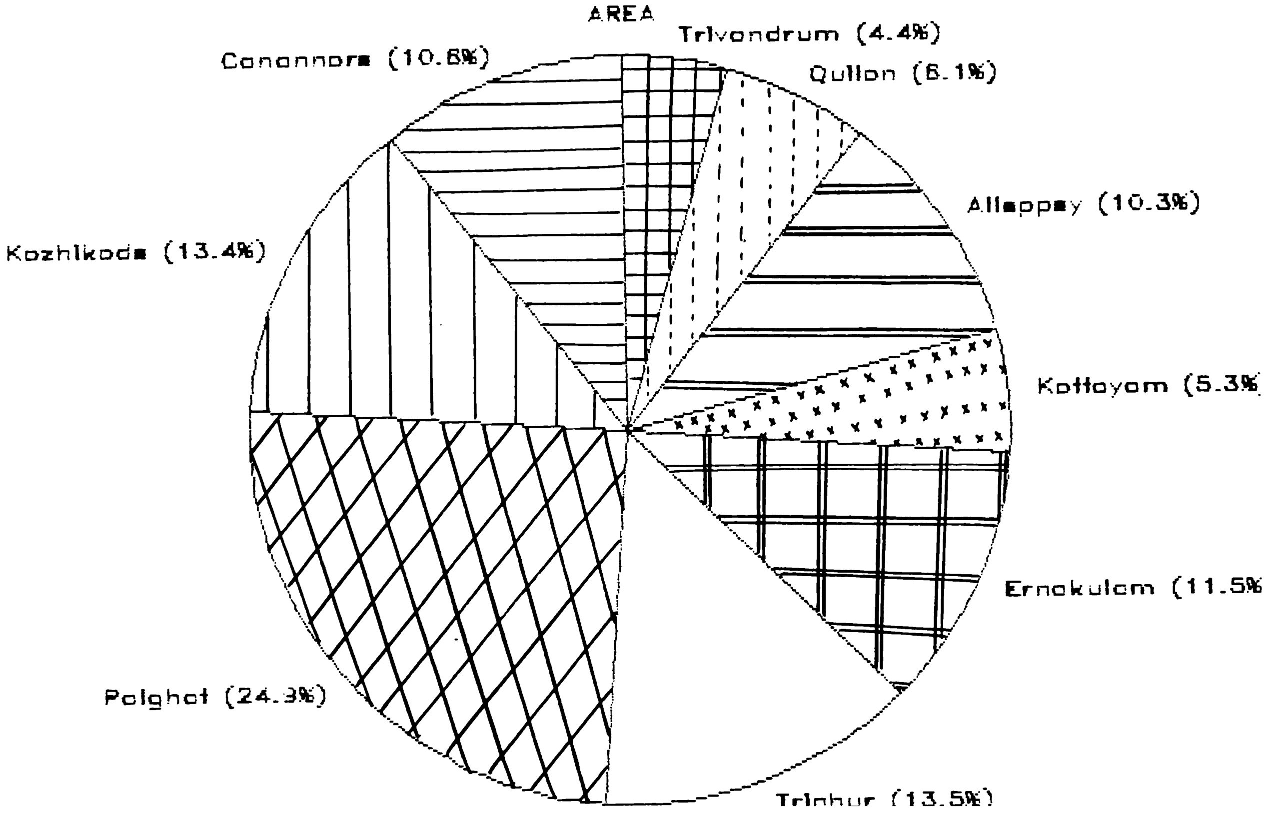


DIAGRAM 3.5

RICE PRODUCTION : 1960–61 TO 1985–86

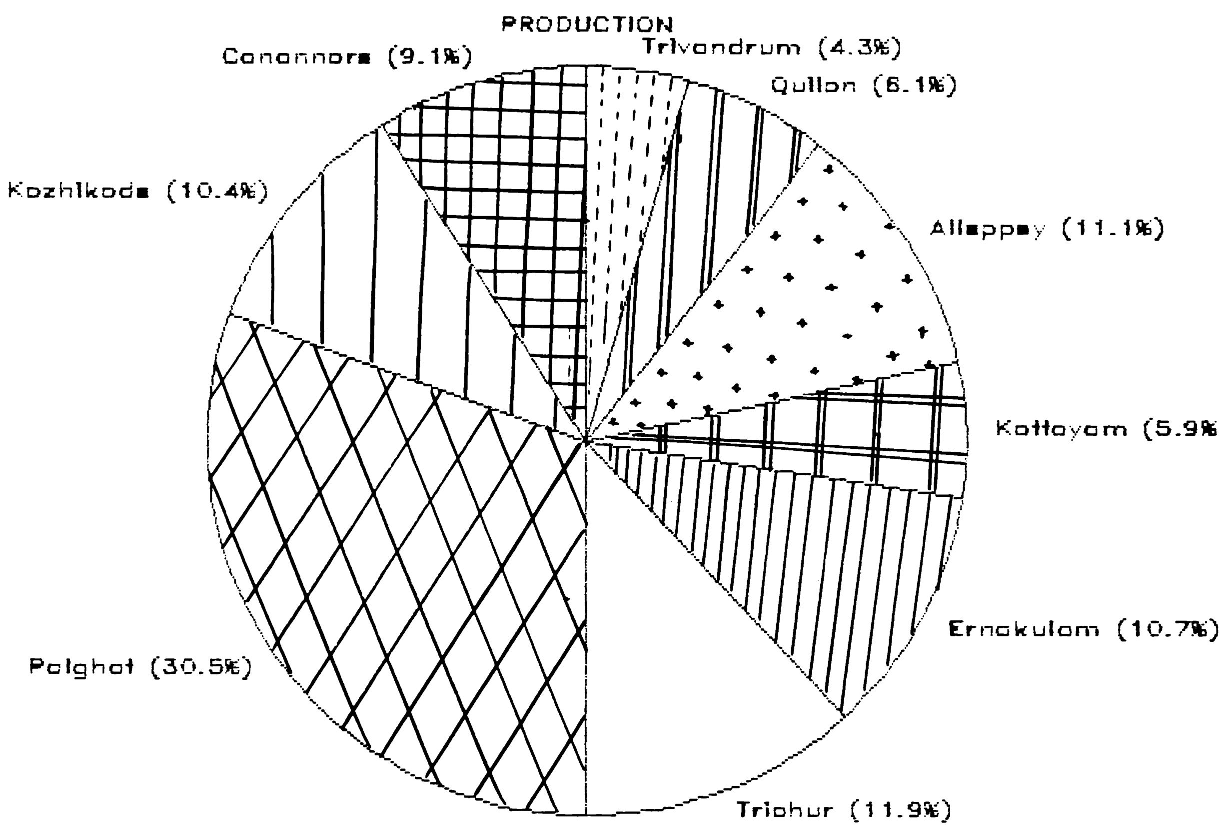
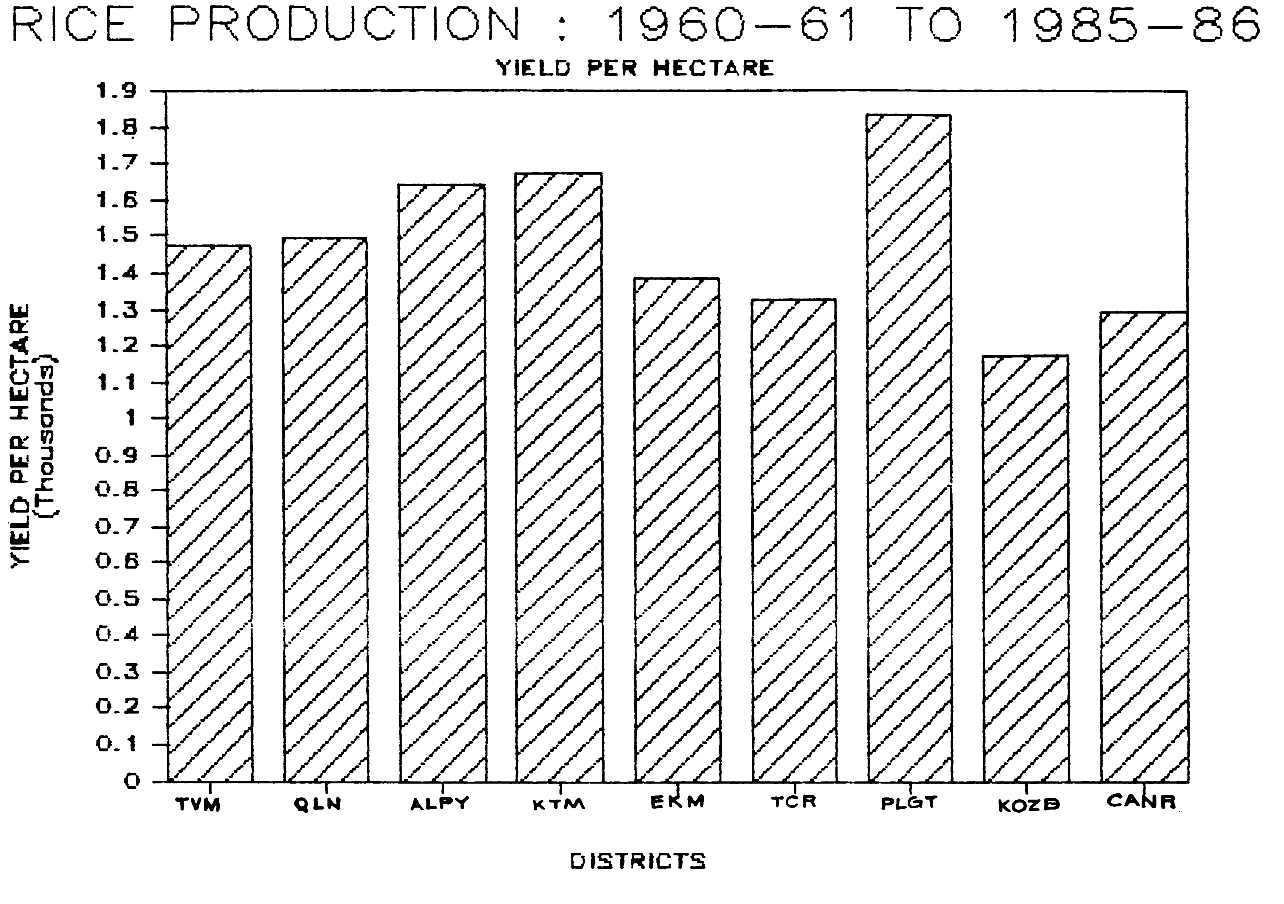


DIAGRAM 3.6


RICE PRODUCTION : 1960–61 TO 1985–86
YIELD PER HECTARE
YIELD PER HECTARE (Thousands)
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
TVM
QLN
ALPY
KTM
EKM
TCR
PLGT
KOZB
CANR
DISTRICTS

direction of land area under rice, except in the case of Alleppey (Table 3.10 and Diagrams 3.4, 3.5 and 3.6). Percentage share of production was high in the case of Alleppey due to high productivity per hectare. The relation between area and production was high, production and yield was very low and area and yield was very meagre.

Spearman's co-efficient of correlation or Rank correlation indicates the degree of correlation between area and production, production and yield and area and yield. The calculated values of co-efficient of correlation are 0.92, 0.34 and 0.13 respectively. This result shows the relationship between area and production is high, production and yield is very low and area and yield is very meagre. The same thing is evident in the percentages shown in table 3.10.

3.3. Growth Rates

The growth rates of area, yield and production of rice in general for the three periods separately and for the combined period are summarised for the state and district levels.

3.3.1. State Level

The annual growth rate of area under paddy from 1960-61 to 1985-86 was negative (-0.24) while the annual growth rate of area was positive for the first and the second periods (1.12 per cent and 1.14 per cent respectively). But it again turned out to be negative (-2.05) for the third period. The annual growth rate of area for the combined period was positive from 1960-61 to 1983-84 (0.15 per cent). But the decline in the absolute area was so steep and the growth rate upto 1985-86 was changed into negative (-0.24 per cent).

The average annual growth rate of yield for the combined period was 0.04 per cent. The growth rate of yield for the second period (0.99 per cent) was an improvement over the rate for the first period (0.29 per cent). Third period growth rate (1.35 per cent) was again an improvement over the rate for the second period.

The annual growth rate of production for the combined period was 0.79 per cent. The substantial drop in the growth rate of production for the third period (-0.71 per cent) over the first (1.44 per cent) and the second periods (2.14 per cent) influenced the low rate for the combined period. The positive growth rates of both area and yield for the first and the second periods contributed to a production growth rate above two per cent during this period. The increased growth rate of yield for the third period was offset by the negative growth rate of area (Table 3.11).

Table - 3.11 Growth Rates of Area, Yield and Production of Rice in All Kerala

Period	Area			Production			Yield		
	G.Rate	't' Stat	R^2	G.Rate	't' Stat	R^2	G.Rate	't' Stat	R^2
I	1.12	3.21**	0.60	1.44	1.84 n.s	0.33	0.29	0.54 n.s	0.96
II	1.14	7.52*	0.82	2.14	5.64*	0.73	0.99	3.29**	0.34
III	-2.05	-9.74*	0.90	-0.71	-2.60**	0.40	1.35	7.60*	0.85
Combined	-0.24	-1.42 n.s	0.07	0.79	4.24*	0.42	1.04	11.05*	0.84

Note: I Period: 1960-61 to 1968-69.
II Period: 1960-61 to 1974-75.
III Period: 1974-75 to 1985-86.
Combined Period: 1960-61 to 1985-86.

* Significant at 1 per cent Level.
** Significant at 5 per cent Level.
*** Significant at 10 per cent Level.

n.s. Not significant.

Table - 3.12 Seasonal Growth Rates of Area, Yield and Production in All Kerala

Period		Growth Rates During			
		Autumn	Winter	Summer	All Seasons
I	Area	0.40	1.64	2.29	1.12
	Yield	1.00	-0.41	-0.55	0.29
	Production	1.40	1.23	1.74	1.44
II	Area	0.10	1.78	2.72	1.14
	Yield	1.34	0.23	1.87	0.99
	Production	1.44	2.01	4.42	2.14
III	Area	-2.39	-1.74	-2.29	-2.05
	Yield	1.71	0.71	1.14	1.35
	Production	0.51	-1.01	-1.12	-0.71
Combined	Area	-0.93	0.20	0.94	-0.24
	Yield	1.39	0.58	1.21	1.04
	Production	0.45	0.78	2.16	0.79

Note: Same as in Table 3.11.

Among the seasons, the highest growth rate of area for the first, the second and the combined periods was during summer; but for the third period the highest negative growth rate occurred during autumn. In spite of the negative growth rate of area during all three seasons for the third period, the annual growth rate of area for the combined period was negative only during autumn. During winter and summer the positive growth rate of area for the first and the second periods was large enough to overcome the negative growth rates for the third period.

The average annual growth rate of yield for the combined period was 1.04 per cent. The growth rate of yield for the third period was an improvement over the rate for the first and the second periods. Among the seasons, the highest negative growth rate of yield for the first period was during summer, but for the second period the highest growth rate also occurred during summer. For the third period and the combined periods, the highest growth rate was during autumn.

While growth rates of production were positive during all seasons and the combined seasons for the first, the second and the combined periods, they were negative during all seasons and the combined seasons for the third period. The negative growth rates of production during all seasons for the third period were influenced by the dominant role played by the negative growth rates of area over the positive growth rates of yield (Table 3.12).

3.3.2. District Level

The growth rates of area, yield and production of rice in general and season-wise for the three periods separately and for the combined period are analysed for the districts.

3.3.2.1. Trivandrum District

The overall growth rate of area under rice for the combined period was -1.37 per cent being net outcome of a marginal growth rate (0.89 per cent) for the first period and 0.49 per cent for the second period and a large negative rate (-3.70 per cent) for the third period.

Table - 3.13 Growth rates of Area, Yield and Production in Trivandrum District

Period	Area			Production			Yield		
	G.Rate	't' Stat	R^2	G.Rate	't' Stat	R^2	G.Rate	't' Stat	R^2
I	0.89	4.82*	0.77	-0.20	-0.35 n.s	0.02	-1.14	-2.27**	0.42
II	0.49	4.87*	0.66	0.68	1.86***	0.22	0.17	0.46 n.s	0.02
III	-3.70	-16.95*	0.97	-2.71	-3.73*	0.58	1.12	1.64 n.s	0.22
Combined	-1.37	- 6.27*	0.62	-1.09	-4.35*	0.44	0.31	1.70 n.s	0.11

Note: Same as in Table 3.11.

The overall annual growth rate of yield for the combined period indicate a stagnant level with a growth rate of 0.31 per cent. The yield rate for the first period was -1.14 per cent, 0.17 per cent for the second period and 1.12 per cent for the third period.

The negative overall growth rate of area and the marginal growth rate of yield for the combined period had resulted in a negative growth rate of production (-1.09 per cent) while the growth rate of production for the first period remained negative (-0.20 per cent), the rate of production for the second period was positive (0.68 per cent), but by the third period the negative growth rate of area had induced a negative growth rate of production (-2.71 per cent) (Table 3.13).

The growth rates of area for the third and the combined periods were positive during all seasons for the first period and winter and summer for the second period. In spite of the negative growth rate of area during the second period autumn season, the positive growth rates during winter and summer could provide a positive growth rate of area for the combined seasons.

A major set back in yield levels occurred during winter when the growth rates turned out to be negative for all the four periods separately. The growth rates of yield for the first period are negative during all the three seasons and the combined season.

Table - 3.14 Season-wise Growth Rates of Area, Yield and Production in Trivandrum District

Period		Growth Rates During			
		Autumn	Winter	Summer	All Seasons
		(Per cent)			
I	Area	0.31	0.86	58.16	0.89
	Yield	-0.35	-1.66	- 3.13	-1.14
	Production	0.04	-0.81	55.01	-0.20
II	Area	-0.09	0.47	11.95	0.49
	Yield	0.62	-0.13	3.63	0.17
	Production	0.56	0.33	15.57	0.68
III	Area	-3.37	-3.93	-18.74	-3.70
	Yield	2.68	-0.79	0.35	1.12
	Production	-0.70	-4.71	- 1.39	-2.71
Combined	Area	-1.44	-1.60	- 1.75	-1.37
	Yield	1.10	-0.35	1.27	0.31
	Production	-0.33	-1.95	-17.47	-1.09

Note: Same as in Table 3.11.

While the growth rates of production for the first and the second periods remained positive during all seasons, except during winter for the first period, by the third and the combined periods, the negative growth rate of area had induced a negative growth rate of production for all seasons (Table 3.14).

3.3.2.2. Quilon District

The overall annual growth rate of production for the combined period was 0.75 per cent. Thanks to the relatively higher growth rate of yield for the third period, in spite of

Table - 3.15 Growth Rates of Area, Production and Yield of Rice in Quilon District

Period	Area			Production			Yield		
	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2
I	1.34	4.18*	0.71	1.36	1.38 n.s	0.21	-0.07	-0.07 n.s	0.001
II	0.82	4.97*	0.67	1.20	2.64**	0.37	0.35	0.72 n.s	0.04
III	-0.93	-3.44*	0.54	0.40	0.58 n.s	0.03	1.32	2.40**	0.36
Combined	0.02	0.18 n.s	0.00	0.75	3.90*	0.39	0.73	4.01*	0.40

Note: Same as in Table 3.11.

the negative growth rate of area, production growth rate in the third period was positive (0.40 per cent). The growth rate of production for the first period (1.36 per cent) was higher than the other three periods due to positive growth rate of area during the first period.

Growth rate was negative during the first period, but increased and was positive during the second period and substantially increased during the third period (1.32 per cent).

Growth rates of area and production were higher during the first period than the other three periods. Growth rates for the combined period remained positive with regard to area, production and yield (Table 3.15).

The growth rates of area were positive during all seasons for the first and the second periods and during autumn for the third and the combined periods. For the combined seasons, the growth rates remained positive for the first, the second and the combined periods and negative for the third period. While the growth rates of area remained low for most seasons and periods, the performance during summer indicated high positive growth rates for the first and the second periods and a high negative growth rate for the third period.

Table - 3.16 Season-wise Growth Rates of Area, Yield and Production in Quilon District

Period		Growth Rates During			
		Autumn	Winter	Summer	All Seasons
		(Per cent)			
I	Area	1.51	0.90	18.00	1.34
	Yield	1.33	-0.69	-3.77	-0.07
	Production	2.84	0.21	14.33	1.36
II	Area	0.58	0.72	8.66	0.82
	Yield	1.42	-0.01	-1.93	0.35
	Production	2.03	0.71	6.82	1.20
III	Area	0.26	-1.67	-10.81	-0.93
	Yield	3.06	-0.04	3.60	1.32
	Production	3.35	-1.70	- 7.28	0.40
Com-bined	Area	0.74	-0.63	- 0.06	0.02
	Yield	1.91	0.11	- 1.42	0.73
	Production	2.62	-0.52	- 1.46	0.75

Note: Same as in Table 3.11.

However, in autumn the growth rates for the three periods were positive, in winter, they were negative for the three periods and in summer, they were negative for the first and the second periods and positive for the third period. In spite of the negative growth rate of yield during winter and summer for the first and the second periods, the positive growth rate during autumn was sufficient to retain an overall positive growth rate for combined seasons for the second, the third and the combined periods.

During autumn, the rate of growth of production was 2.84 per cent for the first period, 2.03 per cent for the second period, 3.35 per cent for the third period and 2.62 per cent for the combined period. During winter, the first and the second period growth rates of production were less than one per cent and it became negative for the third and the combined periods. While the growth rates of production during summer were 14.33 per cent and 6.82 per cent for the first and the second periods respectively, it turned out to be a high negative rate (-7.28 per cent) for the third period (Table 3.16).

3.3.2.3. Alleppey District

The average annual growth rate of area under paddy for the combined period was -0.14 per cent. While area increased at a positive rate during the first (0.88 per cent) and the second periods (1.07 per cent), the third period witnessed a negative growth rate (-2.63 per cent). Combined period also showed a negative growth rate (-0.14 per cent).

Table - 3.17 Growth Rates of Area, Yield and Production of Rice in Alleppey District

Period	Area			Production			Yield		
	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2
I	0.88	2.61**	0.49	0.29	0.24 n.s	0.01	-1.67	-1.04 n.s	0.13
II	1.07	6.26*	0.77	1.92	3.20*	0.46	0.37	0.46 n.s	0.02
III	-2.63	-3.73*	0.58	-0.68	-0.91 n.s	0.08	1.95	4.04*	0.62
Combined	-0.14	-0.58 n.s	0.01	1.40	5.12*	0.52	1.38	5.34	0.54

Note: Same as in Table 3.11.

Production growth rate for the first, the second and the combined periods were positive, whereas for the third period it was negative (-0.68 per cent) while the yield rate during the first period was negative, all the other three periods indicated positive growth rate (Table 3.17).

Table - 3.18 Season-wise Growth Rates of Area, Yield and Production in Alleppey District

Period		Growth Rates During			
		Autumn	Winter	Summer	All seasons
		(Per cent)			
I	Area	0.20	1.42	0.47	0.88
	Yield	-2.79	-3.45	0.87	-1.67
	Production	-2.58	-0.83	1.39	0.29
II	Area	1.38	2.70	0.18	1.07
	Yield	0.14	-1.53	2.30	0.37
	Production	1.52	1.62	2.51	1.92
III	Area	1.49	-3.79	-2.84	-2.63
	Yield	0.84	1.43	1.38	1.95
	Production	-0.65	-2.35	-1.02	-0.68
Combined	Area	1.60	0.92	2.30	-0.14
	Yield	1.69	0.90	2.22	1.38
	Production	3.29	1.97	0.03	1.40

Note: Same as in Table 3.11.

Changes in the area during winter season dominated the changes for the first, the second and the third periods.

During autumn, the growth rate of yield for the first period was negative and for the second and the third periods were less than one per cent. However, the positive growth rate of yield during the third period winter influenced an overall positive growth rate of yield for the combined period. The growth rate of yield during summer was the highest for the second period.

The growth rates of production during autumn and winter were negative for the first and the third periods and positive for the second and the combined periods. During summer the growth rates of production were positive for the first, the second and the combined periods, and negative for the third period (Table 3.18).

3.3.2.4. Kottayam District

The annual growth rate of area under paddy for the combined period (0.39 per cent) was negative as a result of the dominant negative growth rate for the third period (-3.97 per cent) over the positive growth rate for the first (1.79 per cent) and the second periods (1.76 per cent).

Table - 3.19 Growth Rates of Area, Production and Yield of Rice in Kottayam District

Period	Area			Production			Yield		
	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2
I	1.79	2.07***	0.38	0.01 n.s.	0.01	0.00	2.07	-1.06 n.s	0.14
II	1.76	2.94**	0.42	3.67	2.68**	0.37	1.80	1.76 n.s	0.21
III	-3.97	-4.68*	0.69	-1.85	1.92***	0.27	2.09	2.74**	0.43
Combined	-0.39	-1.04 n.s	0.04	1.39	2.67**	0.23	1.77	4.99*	0.51

Note: Same as in Table 3.11.

In spite of a high growth rate of production for the second period (3.67 per cent), the negative growth rate of -1.85 per cent for the third period had a significant role in bringing down the overall growth rate to 1.39 per cent.

It is interesting to see that the annual growth rate of yield for the first period was negative (-2.07 per cent), but it was positive during the second period

(1.80 per cent). The third period showed further increase in growth rate (2.09 per cent). The annual growth rate of yield for the combined period was 1.77 per cent (Table 3.19).

Table - 3.20 Season-wise Growth Rates of Area, Yield and Production in Kottayam District

Period		Growth Rates During			
		Autumn	Winter	Summer	All Seasons
I	Area	4.56	1.99	0.07	1.79
	Yield	-0.29	-2.42	-2.64	-2.07
	Production	4.27	-0.42	-2.44	0.01
II	Area	2.85	3.29	1.45	1.76
	Yield	1.72	0.01	2.16	1.80
	Production	4.57	3.30	3.68	3.67
III	Area	1.41	-3.37	-10.59	-3.97
	Yield	3.15	2.41	2.64	2.09
	Production	4.56	-0.96	- 7.94	-1.85
Combined	Area	4.35	-1.15	- 3.44	-0.39
	Yield	2.17	1.42	2.49	1.77
	Production	6.52	0.27	- 0.92	1.39

Note: Same as in Table 3.11.

Even though the growth rates of area during winter and summer were positive for the first and the second periods, negative growth rates of area for the third period resulted in negative growth rates for the combined period.

While yield rates were negative during all the three seasons for the first period, they were positive during all the seasons for the second, the third and the combined periods.

The growth rates of production remained positive during all seasons for the second period with the highest rate of 4.57 per cent during autumn. However, for the third period the growth rate of production was positive only during autumn (4.56 per cent) with negative growth rates of -0.96 per cent during winter and -7.94 per cent during summer. The negative growth rates of area during these seasons accounted for the negative growth rate of production. The combined period had a positive growth rate during autumn (6.52 per cent) and winter (0.27 per cent) and a negative growth rate during summer (-0.92 per cent) (Table 3.20).

3.3.2.5. Ernakulam District

The annual growth rate of production for the combined period was 2.06 per cent. The positive growth rates of both area and yield for the second period and high growth rate of yield during the third period together contributed to a production growth rate above two per cent during this period.

Table - 3.21 Growth Rates of Area, Production and Yield of Rice in Ernakulam District

Period	Area			Production			Yield		
	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2
I	2.02	4.26*	0.72	1.64	1.46 n.s	0.23	-0.48	-0.57 n.s	0.04
II	1.69	8.13*	0.85	1.89	3.75*	0.54	0.16	0.36 n.s	0.01
III	-1.08	-2.12***	0.31	0.27	0.45 n.s	0.02	1.35	2.99**	0.47
Combined	1.05	5.50*	0.56	2.06	9.21*	0.78	1.02	5.93*	0.59

Note: Same as in Table 3.11.

The increased growth rate of yield for the third period was offset by the negative growth rate of area and result in very low growth rate of production (0.27 per cent) for the third period. For the first period growth rate of yield was negative (-0.48 per cent).

Negative growth rate of yield led to a lesser growth rate of production than the growth rate of area. Positive growth rates of yield and area resulted in increased growth rates of production for the second and the combined periods (Table 3.21).

Table - 3.22 Season-wise growth Rates of Area, Yield and Production in Ernakulam District

Period		Growth Rates During			
		Autumn	Winter	Summer	All seasons
I	Area	1.72	1.49	6.15	2.02
	Yield	-0.16	-0.76	-0.15	-0.48
	Production	1.60	0.72	6.00	1.64
II	Area	-0.09	1.27	6.31	1.69
	Yield	1.47	-0.09	-0.29	0.16
	Production	1.62	1.49	6.18	1.89
III	Area	-0.20	-0.10	1.86	-1.08
	Yield	0.97	-0.44	1.29	1.35
	Production	0.77	-0.53	3.15	0.27
Combined	Area	0.03	0.51	5.52	1.05
	Yield	1.87	0.69	0.56	1.02
	Production	1.92	1.21	6.05	2.06

Note: Same as in Table 3.11.

The growth rates of area during summer were positive for all the periods. The overall growth rate of area under summer paddy in the district was 5.52 per cent with a growth rate of 6.15 per cent for the first period, 6.31 per cent for the second period and 1.86 per cent for the third period. However, the growth performance of area under paddy during autumn and winter seasons was not encouraging.

The growth rates of yield during all the three seasons were negative for the first period. While the growth rate during the second period autumn was slightly over one per cent, the negative growth rates during winter and summer contributed towards the low annual rate. The growth rates of yield during all seasons of the third period ranged between 1.29 per cent in summer and -0.44 per cent in winter. The negative growth rates of yield for the first, the second and the third periods during winter and for the first and the second periods during summer resulted a very small growth rate for the combined period.

The highest growth rate of production was during summer for all the periods, this was contributed mainly by increase in the cropped area. However, during autumn, the growth rates of production were heavily influenced by the growth rates of area for all the periods. The growth rates of production during winter remained at a low level for both periods, mainly on account of the negative growth rates of yield for the first, the second and the third periods (Table 3.22).

3.3.2.6. Trichur District

The annual growth rate of area from 1960-61 to 1985-86 was very low (0.09 per cent), whereas yield rate was higher and both together formed still higher growth rate in production (0.72 per cent). Even though yield rate was positive during the third period, growth rate of production was offset by negative growth rate of area and resulted in negative growth rate of production (-0.09 per cent) comparatively high growth rate in area for the first period and positive growth rate of yield during the same period result in comparatively high growth rate of production during the first period (Table 3.23).

Table - 3.23 Growth Rates of Area, Production and Yield of Rice in Trichur District

Period	Area			Production			Yield		
	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2
I	1.52	3.04**	0.57	2.07	1.64 n.s	0.28	0.63	0.67 n.s	0.06
II	0.90	3.58*	0.52	1.50	2.27**	0.30	0.64	1.26 n.s	0.12
III	-1.70	-4.06*	0.62	-0.09	-0.29 n.s	0.01	1.63	3.64*	0.57
Combined	0.09	0.57 n.s	0.01	0.72	3.26*	0.31	0.64	3.47*	0.33

Note: Same as in Table 3.11.

Table - 3.24 Season-wise Growth Rates of Area, Yield and Production in Trichur District

Period		Growth Rates During			
		Autumn	Winter	Summer	All Seasons
I	Area	2.60	0.56	3.83	1.52
	Yield	0.15	2.70	-0.38	0.63
	Production	2.75	1.73	3.45	2.07
II	Area	0.42	0.21	4.91	0.90
	Yield	0.67	0.49	0.80	0.64
	Production	1.10	0.70	5.72	1.50
III	Area	-0.61	-2.17	0.65	-1.70
	Yield	1.41	1.39	1.73	1.63
	Production	0.80	-0.78	2.38	-0.08
Combined	Area	0.35	-1.08	3.98	0.09
	Yield	0.33	0.49	0.85	0.64
	Production	0.68	-0.48	4.83	0.72

Note: Same as in Table 3.11.

The growth rate of area during the second period summer was 4.91 per cent, but the autumn and winter rates for the same period had been fairly low. In the first period, the growth rates of area were positive during all the three seasons, but in the third period, the growth rate during summer was reduced to a nominal level, and the rates during autumn and winter had dropped to -0.61 per cent and -2.17 per cent respectively. The growth rates of area for the combined period was at a small positive level during autumn, negative for winter and 3.98 per cent for summer. Thus, in Trichur district, there was some increase in the area under summer paddy.

The growth rate of yield remained 0.15 per cent for autumn, 2.70 per cent for winter, -0.38 per cent for summer and below one per cent during all seasons for the second and the combined periods and below two per cent for the third period.

During autumn, the growth rate of production was the highest for the first period and the lowest for the combined period. During winter the growth rates of production were positive for the first and the second periods and negative for the third and the combined periods on account of the predominant negative growth rates of area over the small positive growth rate of yield. The growth rate of production during the second period summer was 5.72 per cent and 2.38 per cent for the third period. The high rate of increase in summer area in the district was mainly responsible for this accelerated rate of growth in spite of a nominal increase in the yield level (Table 3.24).

3.3.2.7. Palghat District

The annual growth rate of production for the combined period was 0.97 per cent. The substantial drop in the growth rate of production for the third period (-0.66 per cent) over the first (2.33 per cent) and the second periods (2.96 per cent) had influenced the low rate of growth for the combined period.

Table - 3.25 Growth Rates of Area, Production and Yield of Rice in Palghat District

Period	Area			Production			Yield		
	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2
I	0.81	2.85**	0.54	2.33	3.98*	0.69	1.50	2.97**	0.56
II	1.24	8.53*	0.86	2.96	6.94*	0.80	1.71	4.71*	0.65
III	1.26	6.42*	0.81	-0.66	-1.11 n.s	0.11	0.47	1.12 n.s	0.11
Combined	0.03	0.20 n.s	0.00	0.97	3.86*	0.38	0.93	6.43*	0.63

Note: Same as in Table 3.11.

Growth rate of area was higher during the third period compared with the other periods, whereas growth rate of production and yield decreased considerably during the same period (Table 3.25).

Table - 3.26 Season-wise Growth Rates of Area, Yield and Production in Palghat District

Period		Growth Rates During			
		Autumn	Winter	Summer	All Seasons
		(Per cent)			
I	Area	-0.37	2.33	5.99	0.81
	Yield	2.27	4.43	-3.03	1.50
	Production	1.89	2.89	2.96	2.33
II	Area	0.33	2.35	5.72	1.24
	Yield	1.76	-1.33	3.80	1.71
	Production	2.08	2.68	9.52	2.96
III	Area	-1.75	-0.60	-3.80	1.26
	Yield	1.19	-0.46	-0.34	0.47
	Production	-0.56	-1.06	-4.14	-0.66
Combined	Area	-0.91	1.10	3.20	0.03
	Yield	1.49	-0.93	1.56	0.93
	Production	0.59	1.36	4.76	0.97

Note: Same as in Table 3.11.

The area growth rate during summer ranges between 5.99 per cent for the first period and -3.80 per cent for the third period. The growth rates of area were positive during winter and summer, but negative during autumn for the first period. The growth rates were positive during all seasons for the second period and negative for the third period. Combined period growth rates were positive during winter and summer and negative during autumn.

The growth rates of yield for the first period ranged between 4.43 per cent during winter and -3.03 per cent during summer. The highest growth rate for the second period was during summer (3.80 per cent) and the lowest during winter (-1.33 per cent). The growth rates were negative during winter and summer; but positive during autumn. Winter yield rate was negative for the combined period.

During autumn, the negative growth rate of area for the first period had partially offset the moderate growth rate of production. However, the second period autumn growth rate of production increased to 2.08 per cent, mainly on account of the increased growth rate of yield and a small positive growth rate of area. The growth rate remained negative for the third period autumn due to negative growth rate of area. Winter growth rate ranged between 2.89 per cent for the first period and -1.06 per cent for the third period. During summer the growth rate was negative for the third period because of the negative growth rates of area and yield (Table 3.26).

3.3.2.8. Kozhikode District

The annual growth rate of production for the third period was negative (-0.61 per cent) due to considerable decline in the growth rate of area for the period (-3.00 per cent). Increase in the growth rate of yield (2.40 per cent) was offset by the decrease in the growth rate of area for the third period. The growth rate of area was negative (-0.67 per cent) for the combined period, whereas production and yield growth rates positive. Production and yield growth rates were negative for the first period (Table 3.27).

Table - 3.27 Growth Rates of Area, Production and Yield of Rice in Kozhikode District

Period	Area			Production			Yield		
	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2
I	1.21	2.33**	0.44	-0.17	-0.14 n.s	0.00	-1.51	-1.81 n.s	0.32
II	1.29	4.37*	0.61	1.57	2.87**	0.41	0.27	0.51 n.s	0.02
III	-3.00	-15.18*	0.96	-0.61	-1.70 n.s	0.22	2.40	5.85*	0.77
Combined	-0.87	3.62*	0.35	0.14	0.64 n.s	0.02	1.02	5.11*	0.52

Note: Same as in Table 3.11.

Table - 3.28 Season-wise Growth Rates of Area, Yield and Production in Kozhikode District

Period		Growth Rates During			
		Autumn	Winter	Summer	All Seasons
		(Per cent)			
I	Area	-0.33	2.95	12.85	1.21
	Yield	-1.08	-2.47	-2.41	-1.51
	Production	-1.39	0.48	10.41	-0.17
II	Area	-1.52	3.47	15.22	1.29
	Yield	0.04	0.11	2.79	0.27
	Production	-1.49	3.57	17.99	1.57
III	Area	-6.05	-1.87	1.65	-3.00
	Yield	2.19	2.43	0.89	2.40
	Production	3.86	-0.56	2.55	-0.61
Combined	Area	-3.71	0.96	10.08	-0.87
	Yield	0.59	0.70	0.65	1.02
	Production	-3.12	1.65	10.72	0.14

Note: Same as in Table 3.11.

Autumn growth rate of area was decreasing consistently period after period. The growth rate of area during winter was the highest for the second period but was negative for the third period. Summer growth rate of area increased to 15.22 per cent for the second period and decreased to 1.65 per cent for the third period and remained 10.08 per cent for the combined period.

The yield rates were negative for the first period during all seasons and positive for the second, third and combined periods.

The growth rates of production during autumn were negative for all the periods and positive during winter and summer for all the periods, on account of positive growth rates of area in almost all cases (Table 3.28).

3.3.2.9. Canannore District

The annual growth rate of area for the combined period was negative (-1.62 per cent). While the annual growth rate of area was positive for the first period (0.50 per cent) and for the second period (0.63 per cent) and it turned out to be negative for the third period (-3.22 per cent).

The average annual growth rate of yield for the combined period was 1.03 per cent. The yield growth rate for the first period (2.25 per cent) was higher than the yield growth rate for the second, the third and the combined periods.

Table - 3.29 Growth Rates of Area, Production and Yield of Rice in Canannore District

Period	Area			Production			Yield		
	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2	G.Rate	't'Stat	R^2
I	0.50	0.90 n.s	0.10	2.41	2.61**	0.49	2.25	2.98**	0.56
II	0.63	2.86**	0.41	1.94	3.74*	0.54	1.52	3.22*	0.46
III	-3.22	-8.42*	0.88	-2.35	-3.66**	0.57	0.82	1.64 n.s	0.21
Combined	-1.62	-6.83*	0.66	-0.63	-2.02***	0.15	1.03	5.93*	0.59

Note: Same as in Table 3.11.

The annual growth rate of production for the combined period was negative (-0.63 per cent). The substantial decline in production for the third period (-2.35 per cent) over the first (2.41 per cent) and the second periods (1.94 per cent) resulted in the negative growth rate for the combined period. The positive growth rate of yield was offset by the negative growth rate of area and resulted in negative growth rate of production for the combined period (Table 3.29).

Table - 3.30 Season-wise Growth Rates of Area, Yield and Production in Canannore District

Period		Growth Rates During			
		Autumn	Winter	Summer	All Seasons
I	Area	-0.07	0.22	6.43	0.50
	Yield	2.90	0.97	0.44	2.25
	Production	2.86	1.30	6.87	2.41
II	Area	-0.13	0.84	10.81	0.63
	Yield	1.39	1.44	3.00	1.52
	Production	1.26	2.26	13.81	1.94
III	Area	-5.67	-1.33	1.13	-3.22
	Yield	1.01	1.30	-0.35	0.82
	Production	-4.47	-0.02	0.78	-2.35
Combined	Area	-3.31	0.04	8.60	-1.62
	Yield	0.75	1.35	2.16	1.03
	Production	-2.56	1.38	10.76	-0.63

Note: Same as in Table 3.11.

The growth rate of area during autumn were negative for all periods and positive during winter and summer except for the third period during winter. The growth rate of area during summer was the highest (10.81 per cent) for the second period.

The yield rates of autumn, winter and summer remained positive for all periods except the negative growth rate during summer for the third period. It ranged between 3 per cent during summer for the second period and -0.35 per cent for the third period.

The growth rates of production remained negative for the third period and the combined periods during autumn and the third period during winter on account of negative growth rates of area during the same seasons (Table 3.30).

Comparative Performance

The growth rate of area, production and yield of rice for the state and each district is synthesised to obtain an integrated view of the performance among the districts in relation to the state.

Table - 3.31 Classification of the State and the Districts According to the Growth Rates

Growth Rates	Period I	Period II	Period III	Combined
+ A + Y + P	KERALA TCR, PLGT, CANR	KERALA TVM, QLN, ALP, KOT, EKM, TCR, PLGT, KOZD, CANR		QLN, EKM TCR, PLGT
- A + Y + P			QLN, EKM	KERALA ALP, KOT, KOZD
+ A - Y + P	QLN, ALP, KOT, EKM			
- A + Y - P			KERALA TVM, ALP KOT, TCR, PLGT, KOZD, CANR	TVM, CANR
+ A - Y - P	TVM, KOZD			
Total No. of Districts	9	9	9	9

Note: + Positive Growth Rate.
- Negative Growth Rate.
A - Area, Y - Yield
P - Production

TVM = Trivandrum
QLN = Quilon
ALP = Alleppey
KOT = Kottayam
EKM = Ernakulam.
TCR = Trichur
PLGT = Palghat.
KOZD = Kozhikode
CANR = Canannore.

When the districts and the state are classified according to positive and negative growth rates for the three periods individually and for the combined period Trichur, Palghat, Canannore and Kerala as a whole had positive growth rates of area, yield and production for the first period. Whereas, Quilon, Alleppey, Kottayam and Ernakulam had positive growth rates of area and production but negative growth rates of yield. Trivandrum and Kozhikode had positive growth rates of area and negative growth rates of yield and production for the same period.

All the nine districts and the state had positive growth rates of area, yield and production for the second period.

Quilon and Ernakulam have positive growth rates of yield and production but negative growth rates of area, Palghat had negative growth rate of production and positive growth rates of area and yield, all Kerala and the other six districts had negative growth rates of area and production and positive growth rates of yield during the third period.

For the combined period, Quilon, Ernakulam, Trichur and Palghat had positive growth rates of area, yield and production. Alleppey, Kottayam and Kozhikode districts and all Kerala had negative growth rates of area and positive growth rates of yield and production and Trivandrum and Canannore had negative growth rates of area and production and positive growth rates of yield (Table 3.31).

Season-wise Analysis

The growth rates during autumn, winter and summer seasons indicate a number of interesting tendencies.

In the first period yield rates were negative during winter and summer. The growth rate of area was maximum during summer in the second period, but for the third period, the maximum negative growth rate of area was more or less the same during autumn and summer. The maximum growth rate of yield for the second period was observed during summer, but by the third period, growth rate of yield during summer had fallen behind the autumn growth rate of yield. Thus both area and yield for the second period had the highest growth rates during summer resulting in the highest growth rate of production, but because of the reversal in both area and yield rates for the third period production growth rate was minimum during summer.

While the growth rates of production were positive for the first, the second and the combined periods, they were negative for the third period during all seasons an outcome of the dominant role played by the negative growth rates of area over the positive growth rates of yield.

In the first period, output growth rates were positive for all seasons and districts except for Kozhikode and Alleppey during autumn, Trivandrum, Alleppey and Kottayam during winter and Kottayam during summer. The negative growth rate of output in Kozhikode was influenced by both negative growth rates of yield and area, and Alleppey, Trivandrum and Kottayam by negative growth rates of yield over the positive growth rates of area.

The growth rates of production for the second period were positive for all seasons and districts except for Kozhikode during autumn. The negative growth rate of output in Kozhikode was the outcome of dominant negative growth rate of area over positive growth rate of yield.

During autumn, winter and summer for the third period, output growth rates were negative in Trivandrum, Alleppey, Palghat, Kozhikode and Canannore, Alleppey, Kottayam, Trichur and Canannore, Trivandrum, Quilon, Alleppey and Kottayam respectively, all because of dominant negative growth rates of area over the positive growth rates of yield. Thus all the observed third period negative growth rates of output levels during autumn, four out of eight negative growth rates of output levels during winter and four out of five negative growth rates of output levels during summer were mainly influenced by

Table - 3.32 Classification of Districts according to Growth Rates of Area, Yield and Production (Season-wise)

	Period I			Period II			Period III			Combined period		
	A	W	S	A	W	S	A	W	S	A	W	S
+A+Y+P	QLN TCR	TCR PLGT CANR	ALP CANR	QLN ALP KOT TCR PLGT	KOT TCR KOZD CANR	TVM ALP KOT TCR PLGT KOZD CANR	QLN KOT		EKM TCR KOZD	QLN ALP KOT EKM TCR	ALP EKM KOZD CANR	EKM TCR PLGT KOZD CANR
-A+Y+P	PLGT CANR			TVM EKM CANR			EKM TCR	KOZD		PLGT	KOT	ALP
-A+Y-P				KOZD			TVM ALP PLGT KOZD CANR	ALP KOT TCR CANR	TVM QLN ALP KOT	TVM KOZD CANR	QLN TCR	TVM KOT
-A-Y-P	KOZD							TVM QLN EKM PLGT	PLGT		TVM	QLN
+A-Y+P	TVM KOT EKM	QLN EKM KOZD	TVM QLN EKM TCR PLGT KOZD		TVM QLN ALP EKM PLGT	QLN EKM			CANR		PLGT	
+A-Y-P	ALP	TVM ALP KOT	KOT									
Total No. of Districts	9	9	9	9	9	9	9	9	9	9	9	9

Note: Same as in Table 3.31. A = Autumn. W = Winter. S = Summer.

the negative growth rates of area, but during winter for the same period output growth rates were negative in Trivandrum, Quilon, Ernakulam and Palghat and during summer in Palghat were influenced by both negative growth rates in area and yield.

Again during autumn, winter and summer for the combined period, output growth rates were negative in Trivandrum, Kozhikode and Canannore, Quilon and Trichur and Trivandrum and Kottayam respectively, all on account of negative growth rates in area over positive growth rates in yield. But negative output growth rates in Trivandrum during winter and Quilon during summer were influenced by both negative growth rates of area and yield (Table 3.32).

3.3.3. Taluk Level Analysis

An analysis of area, production and productivity at the micro level - with taluks as strata - indicates that all the traditional paddy fields do not hold the same natural endowments for rice production or are homogenous in agroecological conditions. Even within a taluk there is heterogeneity. However, the scope of analysis beyond the taluk strata is at the moment restricted due to paucity of data.

The analysis in this section is based on the data available for 57 taluks in the state.[3] The data on area, production and yield of rice for 57 taluks for the period 1974-75 to 1981-82 are taken from statistics for planning 1977, 1980 and 1983, while those for later period, ie., from 1982-83 to 1985-86 are taken from the official collection of the special section dealing with area, production and yield of crops of the Directorate of Economics and Statistics, Trivandrum, Kerala. The main objective of the present analysis is to see the trend in area, production and yield of rice at taluk level.

Taluks ranked according to percentages of area and production to all Kerala and average yield of rice are given in maps 3.1, 3.2 and 3.3 respectively.

---

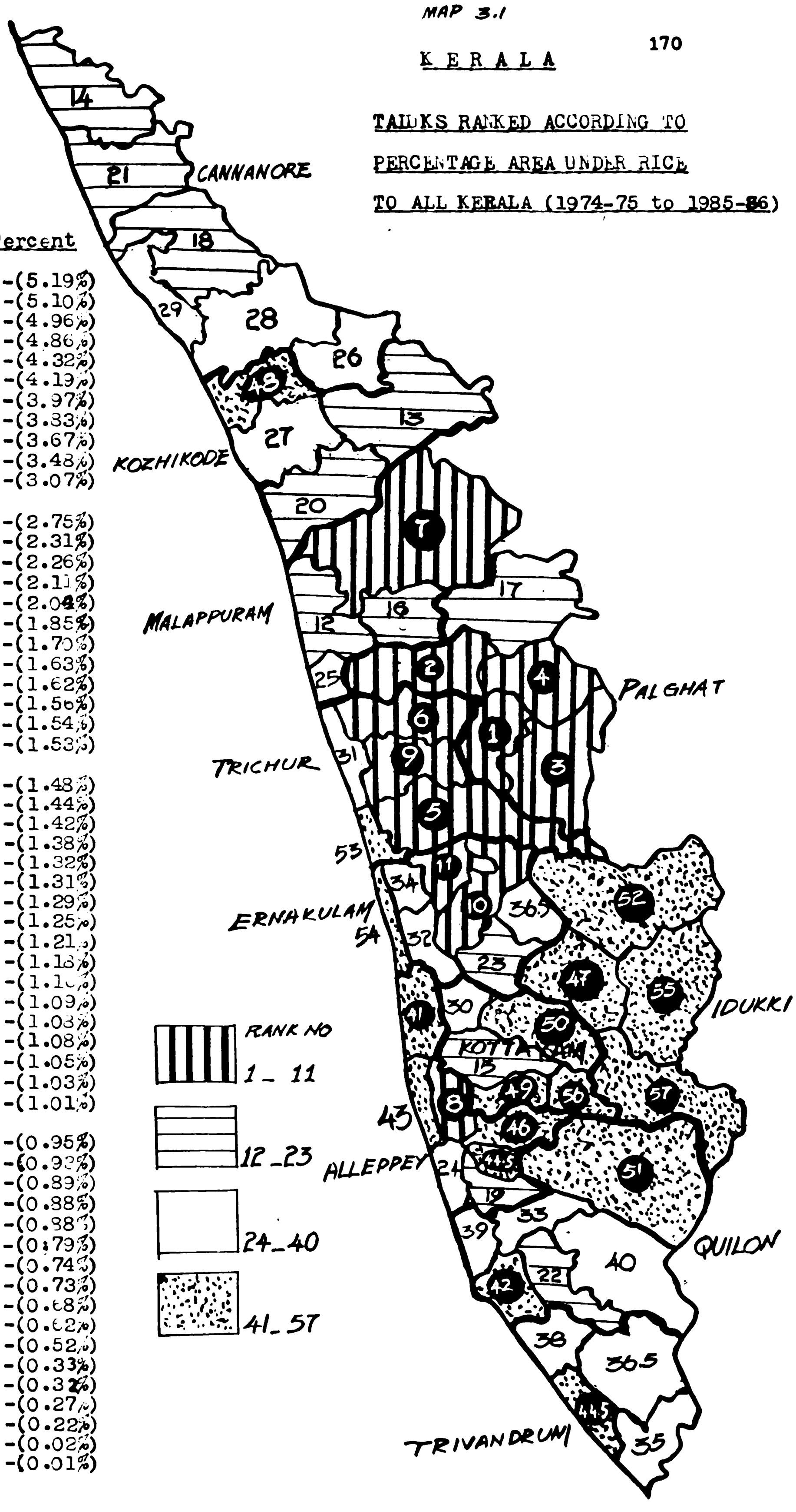
3. There are 61 taluks in the state, four of them are formed only very recently.

MAP 3.1

K E R A L A

TALUKS RANKED ACCORDING TO PERCENTAGE AREA UNDER RICE TO ALL KERALA (1974-75 to 1985-86)

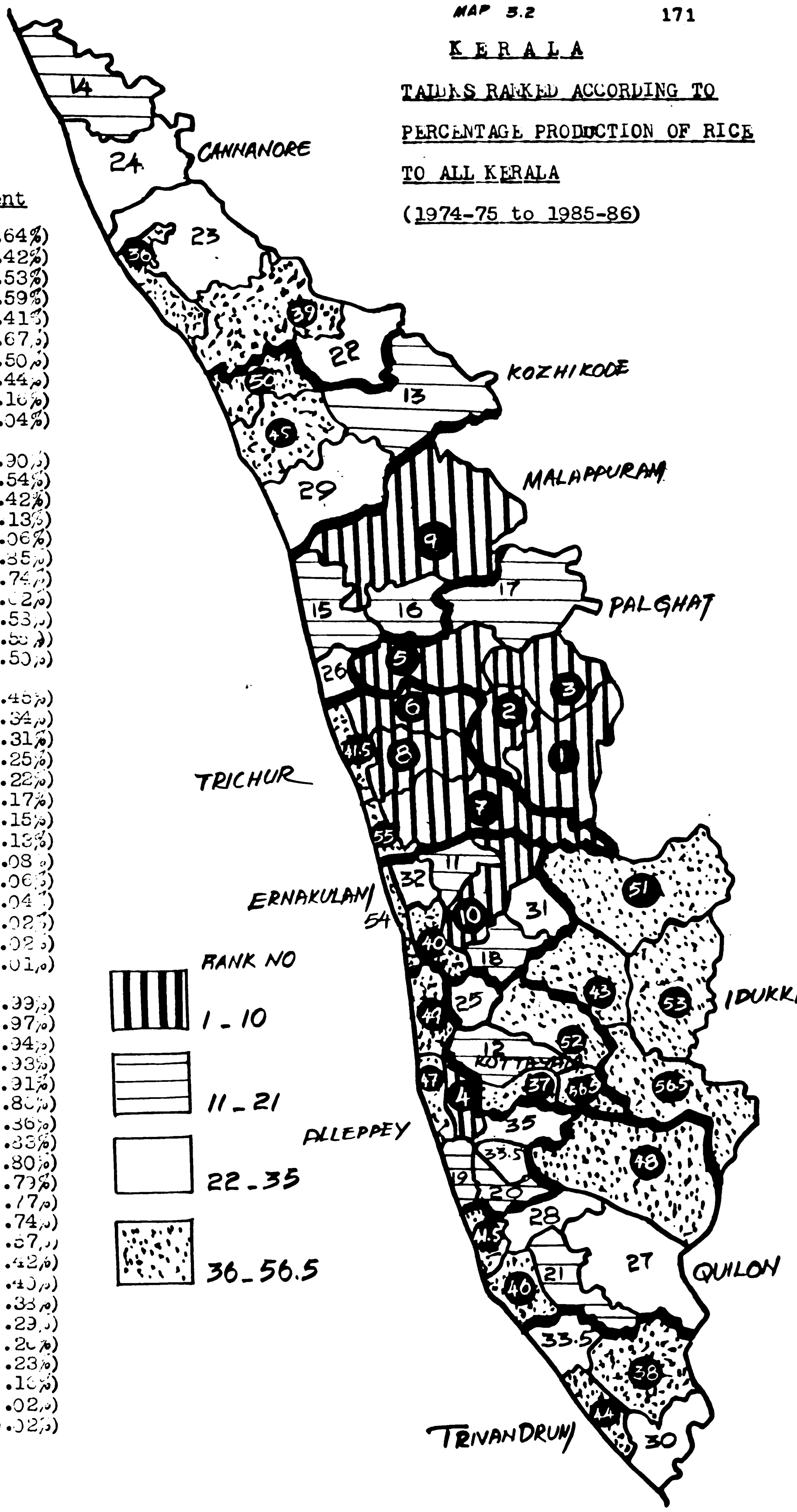
Name of Taluks	Percent
1. Alathur	-(5.19%)
2. Ottapalam	-(5.10%)
3. Chittur	-(4.96%)
4. Palghat	-(4.86%)
5. Mukundapuram	-(4.32%)
6. Thalapally	-(4.19%)
7. Ernad	-(3.97%)
8. Kuttanad	-(3.83%)
9. Trichur	-(3.67%)
10. Kunnathunad	-(3.48%)
11. Alwaye	-(3.07%)
12. Tirur	-(2.75%)
13. S.Wynad	-(2.31%)
14. Kasargode	-(2.26%)
15. Kottayam	-(2.11%)
16. Perinthalmanna	-(2.04%)
17. Mannarghat	-(1.85%)
18. Thaliparamba	-(1.70%)
19. Mavelikara	-(1.63%)
20. Kozhikode	-(1.62%)
21. Hosdurg	-(1.56%)
22. Kottarakara	-(1.54%)
23. Muvattupuzha	-(1.53%)
24. Karthikapally	-(1.48%)
25. Ponani	-(1.44%)
26. N.Wynad	-(1.42%)
27. Quilandy	-(1.38%)
28. Tellicherry	-(1.32%)
29. Cannanore	-(1.31%)
30. Vaikom	-(1.29%)
31. Chowghat	-(1.25%)
32. Kanayanoor	-(1.21%)
33. Kunnathur	-(1.18%)
34. Parur	-(1.10%)
35. Neyyattinkara	-(1.09%)
36.5 Nedumangad	-(1.08%)
36.5 Kothamangalam	-(1.08%)
38. Chirayinkil	-(1.05%)
39. Karunagapally	-(1.03%)
40. Pathanapuram	-(1.01%)
41. Sherthalai	-(0.95%)
42. Quilon	-(0.92%)
43. Ambalapuzha	-(0.89%)
44.5. Trivandrum	-(0.88%)
44.5. Chengannoor	-(0.88%)
46. Thiruvalla	-(0.79%)
47. Thodupuzha	-(0.74%)
48. Badagara	-(0.73%)
49. Changanacherry	-(0.68%)
50. Meenachil	-(0.62%)
51. Pathanamthitta	-(0.52%)
52. Devikulam	-(0.33%)
53. Kodugalloor	-(0.32%)
54. Cochin	-(0.27%)
55. Udumbanchola	-(0.22%)
56. Kanjirappally	-(0.02%)
57. Peermedu	-(0.01%)



KERALA

TALUKS RANKED ACCORDING TO PERCENTAGE PRODUCTION OF RICE TO ALL KERALA (1974-75 to 1985-86)

Name of Taluks	Percent
1.Chittur	-(7.64%)
2.Alathur	-(7.42%)
3.Palghat	-(6.53%)
4.Kuttanad	-(5.59%)
5.Ottapalam	-(4.41%)
6.Thalappally	-(3.67%)
7.Mukundapuram	-(3.50%)
8.Trichur	-(3.44%)
9.Ernad	-(3.16%)
10.Kunnathunad	-(3.04%)
11.Alwaye	-(2.90%)
12.Kottayam	-(2.54%)
13.S.Wynad	-(2.42%)
14.Kasargode	-(2.13%)
15.Tirur	-(2.06%)
16.Perinthalmanna	-(1.85%)
17.Mannarghat	-(1.74%)
18.Muvattupuzha	-(1.62%)
19.Karthikapally	-(1.53%)
20.Mavelikara	-(1.50%)
21.Kottarakara	-(1.50%)
22.N.Wynad	-(1.45%)
23.Thaliparamba	-(1.34%)
24.Hosdurg	-(1.31%)
25.Vaikom	-(1.25%)
26.Ponani	-(1.22%)
27.Pathnapuram	-(1.17%)
28.Kannathur	-(1.15%)
29.Kozhikode	-(1.13%)
30.Neyyattinkara	-(1.08%)
31.Kothamangalam	-(1.06%)
32.Parur	-(1.04%)
33.5 Chirayinkil	-(1.02%)
33.5 Chengannur	-(1.02%)
35.Thiruvalla	-(1.01%)
36.Cannanore	-(0.99%)
37.Changanacherry	-(0.97%)
38.Nedumangad	-(0.94%)
39.Tellicherry	-(0.93%)
40.Kanayannoor	-(0.91%)
41.5 Karunagapally	(0.86%)
41.5 Chowghat	-(0.86%)
43.Thodupuzha	-(0.83%)
44.Trivandrum	-(0.80%)
45.Quilandy	-(0.79%)
46.Quilon	-(0.77%)
47.Ambalapuzha	-(0.74%)
48.Pathanamthitta	-(0.57%)
49.Sherthalai	-(0.42%)
50.Badagara	-(0.40%)
51.Devikulam	-(0.38%)
52.Meenachil	-(0.29%)
53.Udumbanchola	-(0.26%)
54.Cochin	-(0.23%)
55.Kodungalloor	-(0.16%)
56.5 Kanjirapally	(0.02%)
56.5 Peermedu	-(0.02%)

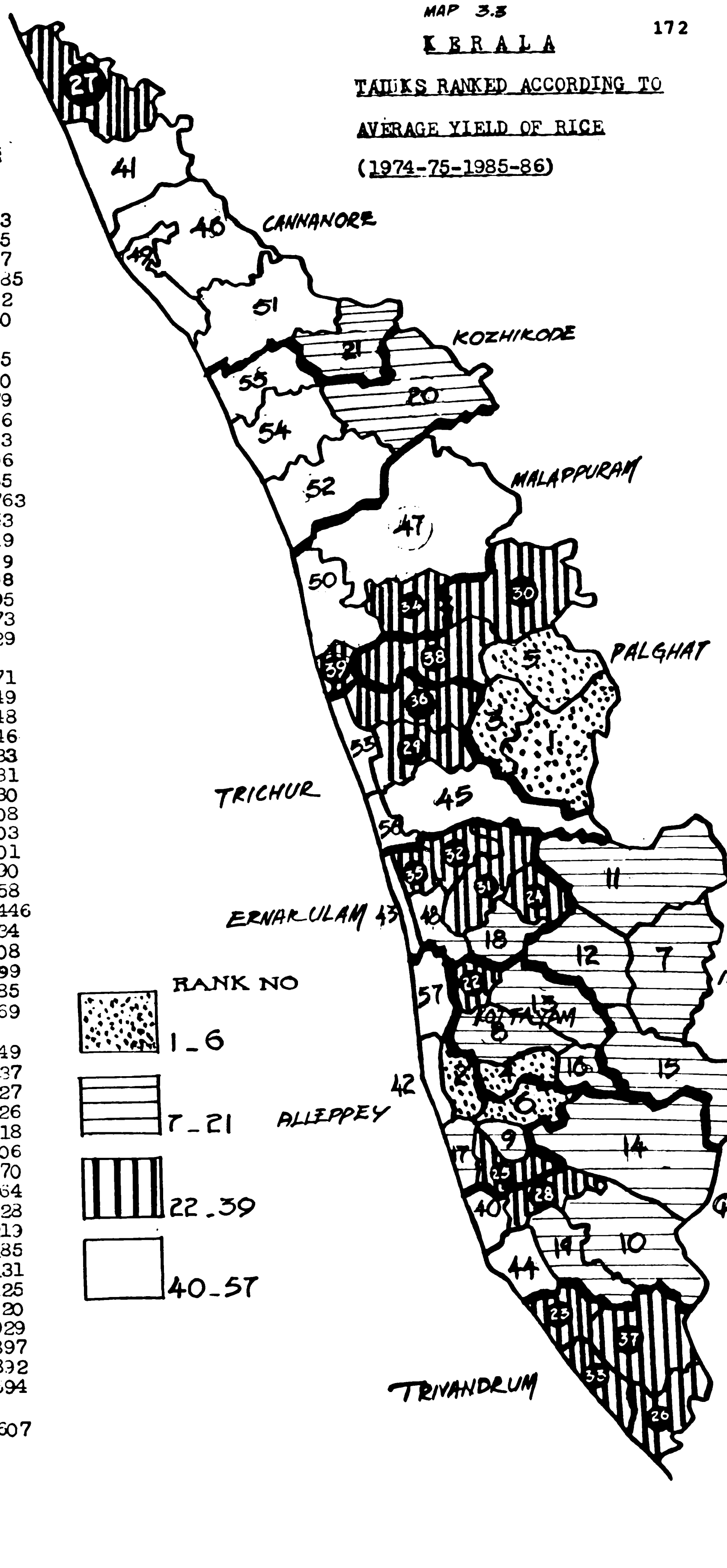


MAP 3.3

KERALA

TALUKS RANKED ACCORDING TO AVERAGE YIELD OF RICE (1974-75-1985-86)

Name of Taluks	Average yield
1.Chittur	-2463
2.Kuttanad	-2345
3.Alathur	-2287
4.Changanacherry	-2285
5.Palghat	-2152
6.Thiruvalla	-2060
7.Udumbanchola	-1995
8.Kottayam	-1930
9.Chenganoor	-1879
10.Pathanapuram	-1856
11.Devikulam	-1843
12.Thodupuzha	-1796
13 Meenachil	-1765
14.Pathanamthitta	-1763
15.Peerumedu	-1753
16.Kanjirapilly	-1749
17.Karthikapally	-1739
13 Muvattupuzha	-1708
19.Kottarakara	-1695
20.S.Wynad	-1673
21.N.Wynad	-1629
22.Vaikam	-1571
23.Chirayimkil	-1549
24.Kothamangalam	-1548
25.Mavelikara	-1546
26.Neyattinkara	-1533
27.Kasargode	-1531
28.Kunnathur	-1530
29.Trichur	-1508
30.Mannarghat	-1503
31.Kunnathunad	-1501
32.Alwaye	-1430
33.Trivandrum	-1458
34.Perunthalmanna	-1446
35.Parur	-1434
36.Thalapally	-1408
37.Nedumangad	-1399
38.Ottapalam	-1385
39.Ponani	-1369
40.Karunagapally	-1349
41.Hosdurg	-1337
42.Ambalapuzha	-1327
43.Cochin	-1326
44.Quilon	-1318
45 Mukundapuram	-1306
46.Thaliparamba	-1270
47.Ernad	-1264
48.Kanayanoor	-1223
49.Cannanore	-1219
50.Tirur	-1185
51.Tellicherry	-1131
52.Kozhikode	-1125
53.Chowghat	-1120
54.Quilandy	- 929
55.Badagara	- 897
56.Kodungallore	- 892
57.Sherthalai	- 694
State Average	-1607



Instead of presenting data on individual taluks, taluks were grouped together on certain criteria. The criteria adopted for grouping are: (i) Percentage of rice area of each taluk to total cropped area under rice in the state (ii) rate of growth of output (iii) area and yield and (iv) level of yield per hectare. The period for the study is taken as 1974-75 to 1985-86, the third period of analysis in the case of the State and the districts. Data availability limited the taluk level analysis for the period mentioned above. The third period which shows unprecedented decline of rice area is important.

3.3.3.1. Importance of Rice Crop in the Taluks

The district-wise distribution of taluks in relation to the percentage of all Kerala area under rice is presented in table 3.33. The data on area share of rice of taluks belong to a period from 1974-75 to 1985-86.

Among the 10 taluks having more than three per cent of the State's area under rice, four belong to Palghat, three to Trichur, two to Ernakulam and one to Kozhikode. Thus most of the districts belong to north Kerala. The next five taluks in importance, ie., which have two to three per cent of State's area under rice, four belong to the same region, ie., north Kerala. A large number of taluks of Trivandrum, Quilon, Alleppe Kottayam and Ernakulam have only less than two per cent of State's rice area each. Those districts belong to south Kerala, Table - 3.33 District-wise distribution of Taluks according to percentage of their area to total rice area in the state from 1974-75 to 1985-86.

District	Percentage of Rice Area of Taluks to Total Rice Area in the State				Total No. of Taluks
	Above 3 percent	Between 3 & 2 per cent	Between 2 & 1 per cent	Below 1 per cent	
Trivandrum			3	1	4
Quilon			4	2	6
Alleppey			2	5	7
Kottayam		1	1	6	8
Ernakulam	2		4	2	8
Trichur	3		1	1	5
Palghat	4	1	2		7
Kozhikode	1	2	2	1	6
Canannore		1	5		6
Total	10	5	24	18	57

where the area under rice is relatively less than the area under rice in north Kerala.

The district-wise distribution of taluks in relation to the percentage of all Kerala rice production is presented in table 3.34.

Table - 3.34 District-wise distribution of taluks according to percentage of their rice production to total Rice Production in the State as a whole

District	Percentage of Rice Production of Taluks to All Kerala Rice Production				
	Above 3 per cent	Between 3 & 2 per cent	Between 2 & 1 per cent	Below 1 per cent	Total No. of taluks
Trivandrum			2	2	4
Quilon			3	3	6
Alleppey	1		4	2	7
Kottayam		1	1	6	8
Ernakulam	1	1	3	3	8
Trichur	3			2	5
Palghat	4		3		7
Kozhikode	1	2	1	2	6
Canannore		1	3	2	6
Total	10	5	20	22	57

Of the 10 taluks each having more than three per cent of State's rice production, four taluks belong to Palghat, three to Trichur, one each to Alleppey, Ernakulam and Kozhikode districts. Of the five taluks having two to three per cent of State's rice production, two belong to Kozhikode and one each to Kottayam, Ernakulam and Canannore districts. Of the 42 taluks, 20 taluks have between one to two per cent of State's rice production and the rest 22 have below one per cent rice production of the state.

Of the 57 taluks, Chittoor, Alathur, and Palghat taluks of the Palghat district account for the first, second and third positions in rice production contributing 7.64, 7.42 and 6.53 per cent to the production of the State respectively. Kuttanad secured fourth position with regard to rice production with 5.59 per cent. Kuttanad belongs to Alleppey district. Of the different taluks, Alathur, Ottapalam, Chittur and Palghat taluks of the Palghat district respectively occupy first to fourth rank in the distribution of rice area in the State. Palghat district has the highest rice production, area and yield in the State.

3.3.3.2. Growth Rates of Area, Yield and Production of Rice

It is evident from the taluk level data that 13 taluks had negative growth rate of yield from 1974-75 to 1985-86. All the districts had positive growth rate of yield during the

Table - 3.35 <u>Distribution of Districts in the State according to Taluks having different Rate of Growth of Output, Area and Yield of Rice</u>

District	Number of Taluks having positive and negative Growth Rate of						Total No. of Taluks
	Area		Output		Yield		
	+	-	+	-	+	-	
Trivandrum		4		4	4		4
Quilon	1	5	3	3	3	3	6
Alleppey	1	6		7	4	3	7
Kottayam	1	7	3	5	7	1	8
Ernakulam	2	6	3	5	8		8
Trichur	2	3	2	3	4	1	5
Palghat		7	2	5	3	4	7
Kozhikode	1	5	2	4	6		6
Canannore	1	5	2	4	5	1	6
No.of taluks	9	48	17	40	44	13	57

Note: + = Positive

- = Negative

same period. The State was also showing the same trend as the districts. Again 17 taluks had positive growth rate of production, whereas only two districts had positive growth rates of production, Of the 17 taluks having positive growth rate of production, only six taluks belonged to those districts having positive growth rate of production, ie., all the other 11 taluks belonged to other districts. Nine taluks showed positive growth rate of area during the same period, but district level analysis indicates only negative growth rate of area during that period.

3.3.3.3. Comparative Performance

Table 3.36 presents an integrated view of the performance among the taluks. When the taluks were classified according to positive and negative growth rates for the period 1974-75 to 1985-86, 7 taluks are having positive growth rates of area, yield and production and those taluks are distributed among six districts out of nine districts. Pathanamthitta belong to Quilon, Kanjirappilly to Kottayam, Kunnathunadu and Alwaye to Ernakulam, Mukundapuram to Trichur, S. Wynad to Kozhikode and N.Wynad to Canannore.

Kodungallur was the only taluk having positive growth rate of area and production, but negative growth rate of yield. Kodungallur belongs to Trichur district and the same taluk occupied the lowest position when taluks were ranked according to yield of rice.

Table - 3.36 Classification of Taluks according to Growth Rates

Growth Rates	1974-75 to 1985-86	No. of Taluks
+A+Y+P	Pathanamthitta, Kanjirappilly, Kunnathunad, Alwaye, Mukundapuram, S. Wynad, N. Wynad	7
+A-Y+P	Kodungallur	1
+A-Y-P	Mavelikara	1
-A+Y+P	Kottarakara, Vaikom, Udumbanchola, Muvattupuzha, Alathur, Chittur, Ernad, Canannore	8
-A+Y-P	Neyyattinkara, Trivandrum, Nedumangad, Chirayinkil, Pathanapuram, Karthikapally, Chengannur, Thiruvalla, Kuttanad, Kottayam, Meenachil, Peermade, Devikulam, Thodupuzha, Kothamangalam, Cochin, Kanayanoor, Parur, Trichur, Thalapally, Chaughat, Ottapalam, Tirur, Kozhikode, Quilandy, Badagara, Tellicherry, Thaliparambu, Kasargode	29
-A-Y-P	Quilon, Kunnathur, Karunagapally, Ambalapuzha, Sherthalai, Changana-cherry, Palghat, Mannarghat, Perinthalmanna, Ponnani, Hosdurg.	11
Total No. of Taluks		57

Note: Same as in Table 3.35.
A = Area. Y = Yield. P = Production

Mavelikara showed positive growth rate of area, but negative growth rate of yield and production. This is an indication that Mavelikara belongs to taluks having very low yield of rice. Mavelikara belongs to Alleppey district.

Eight taluks had negative growth rate of area, but positive growth rate of yield and production. This is because yield rates are high enough to offset decline in area. This trend shows high rate of growth in yield and as a result of that growth rate of production increased. Of these eight taluks Kottarakara belongs to Quilon, Vaikom and Udumbanchola belong to Kottayam, Muvattupuzha to Ernakulam, Alathur and Chittur to Palghat, Ernad to Kozhikode and Canannore to Canannore district.

Twenty nine taluks had positive yield rate, but negative growth rate with reference to area and production. All the four taluks of Trivandrum come under this group. Five of the taluks in this group belong to Ernakulam district, four each to Alleppey, Kottayam and Kozhikode, three each to Trichur and Canannore districts, and one each to Quilon and Palghat districts.

Eleven Taluks had negative growth rates of area, yield and output. Four taluks belong to Palghat, three to Quilon, two to Alleppey and one each to Kottayam and Canannore districts

The general trend in the State during this period is positive growth rate of yield and negative growth rates of area and production. Six districts out of nine and 29 taluks out of 57 belonged to this group. Positive growth rates of yield were not sufficient to overcome the negative growth rates of area. Hence production growth rates remained negative in these above said taluks, districts and the state as a whole.

3.3.3.4. Relation between Growth of Output and Yield

Since growth of output in future would mainly depend upon the growth of yield, it would be relevant to examine how has growth in output of rice been related to the growth of its yield. The data presented in table 3.37 indicate that the rate of growth of rice output is very much low compared to the growth of its yield. It is because of the great decline in area which led to a greater negative growth rate in production compared to growth rate of yield. The growth rate of yield was not so high to offset the decline in the area under rice and resulted decline in production of rice.

It is clear from Table 3.37 that the rate of growth of output and yield was very poor in most of the taluks even though the growth of yield was higher compared to the growth of output of rice. The number of taluks showing negative rate of growth in both output and yield is 13 out of 40 taluks

Table - 3.37 Number of Taluks having different rate of growth of Output and yield between 1974-75 and 1985-86.

Growth Rate of yield	Growth Rate of Output					Total No.of Taluks
	Above 3 per cent	2 to 3 per cent	1 to 2 per cent	0-1 per cent	Negative	
Above 3 per cent	2					2
2 - 3 per cent	3	2	3	1		9
1 - 2 per cent				6	10	16
0 - 1 per cent					17	17
Negative					13	13
Total No. of Taluks	5	2	3	7	40	57

showing negative growth rate of either output or yield. That is taluks having exclusively negative growth rate of yield or output are 13 only.

The number of taluks having rate of growth of output and yield respectively above three per cent are five and two, between two and three per cent are two and nine, between one and two per cent are three and sixteen, between zero and one per cent are seven and 17 and negative growth rates are 40 and 13. Thus the number of taluks increases as the rate of growth of output and yield decline. In fact 46 out of 57 taluks had less than two per cent growth rate of output and yield. It is quite evident from the table that the correlation between rate of growth of output and yield is quite low. That is, the growth rates of yield were not sufficient to overcome the fast decline in area under rice. Hence what will be the impact of such a faster fall in area under rice on output? How much faster yield can grow to offset the faster fall in land area under rice?

3.3.3.5. Relation between Growth Rate of Output and Concentration of Crop

To know the level of growth of rice output in relation to concentration of rice crop among the taluks, relevant facts are presented in table 3.38. The table reveals that the total number of taluks under different ranges of output growth generally increases with the decline in the growth rate. The pattern with regard to individual category of growth rate and concentration of rice area differed widely.

Table - 3.38 Growth Rate of output in Relation to Concentration of crop

Percentage of GCA to Total GCA in the State under Rice	Number of taluks with different rate of growth of output					
	Above 3 per cent	2 - 3 per cent	1 - 2 per cent	0 - 1 per cent	Negative	No.of Taluks
Above 4 per cent	5	1				6
3 - 4 per cent		1	3	1		5
2 - 3 per cent				5		5
1 - 2 per cent				1	23	24
0 - 1 per cent					17	17
Total No. of Taluks	5	2	3	7	40	57

To have a clear picture, table 3.38 is shortened. The growth rate of rice output is taken to be high if it is more than three per cent, moderate if it is between one and three per cent and poor if it is less than one per cent. Similarly, the concentration of rice is taken to be high if the crop accounts for more than four per cent of GCA to total GCA in the state, medium if it accounts for two to four per cent, and low if it accounts for less than two per cent of GCA. The data with regard to these classes are present in Table 3.39.

Table - 3.39 Distribution of Taluks with different levels of output growth with reference to different levels of concentration of rice crop

No. of Taluks with different levels of concentrations of Rice crop	No. of Taluks with different levels of output growth			
	High	Moderate	Poor	Total No. of Taluks
High	5	1		6
Moderate		4	6	10
Low			41	41
Total No. of Taluks	5	5	47	57

It is clear from table 3.39 that the number of taluks increases with the decline in the concentration of rice crop. In the same way, the number of taluks declines with the increase in the level of output growth. This indicates broadly that the concentration of rice crop and the growth in its output are going together as there is some positive association between the two.

3.3.3.6. Relation between Rate of Growth and Yield Level

To assess the prospects of growth of yield, it is important to examine how growth rate of yield is related to the level of yield. One may guess that the growth of yield would depend, to a certain extent, on the level of yield at the base period. With change in the techniques of cultivation, one can expect that the rate of growth of yield would be faster in taluks that have lower yield. But if the traditional method of cultivation continues and if there is no improvement in the infra structure, the rate of growth of yield in taluks having lower yield level may continue to be slower.

The difference in the rate of yield among the taluks may arise due to variations in the extent of adoption of new technology and improvement in infrastructure and institution. With the existing pattern of production relation and the developmental efforts, it is not unlikely that the regional inequality would increase.

The relationship between the level of yield and the rate of growth of yield are presented in table 3.40.

Table - 3.40 Number of Taluks having different growth rate and level of yield between 1974-75 and 1985-86

Per Hectare Yield (Kgs.)	Rate of Growth of Yield (Percentage)				Total No. of Taluks
	Above 2	1 - 2	0 - 1	Negative	
Above 2000	1	2	1	2	6
1700 - 2000	2	8	2		12
1500 - 1700	3	3	4	3	13
1300 - 1500	1	1	6	6	14
Below 1300	4	2	4	2	12
Total No. of Taluks	11	16	17	13	57

The level of per hectare yield is divided into five categories and the level of growth rate is divided into four categories. The number of taluks coming under different category of yield and growth rate is presented in table 3.40.

The total number of taluks falling into different ranges of growth rate, by and large increased as the growth rate declined. Total number of taluks belonging to different levels of yield increased first but declined afterwards. Of the 57 taluks, 31 taluks had yield levels above state average and the rest had yield levels below average. Out of 57 taluks, only 11 taluks had more than two per cent growth rate of yield. Thus growth rate in yield was slower in most of the taluks having relatively lower level of yield. On the other hand, out of the 11 taluks having more than two per cent rate of growth of yield, one had 2060 Kgs. of yield, two between 1700-2000 Kgs., three between 1500-1700 Kgs., one between 1300-1500 Kgs. and four below 1300 Kgs. of yield.

Out of the 57 taluks, 11 taluks had more than two per cent growth rate of yield, 16 taluks between one and two per cent, 17 taluks between zero and one per cent and 13 negative growth rate of yield.

It is interesting to note that first the number of taluks increased as the growth rate of yield declined and then declined as the rate of growth of yield declined further. The inequality in the level of rice yield had increased. In fact, most of the taluks having negative growth rate of yield(eight out of 13 taluks) had less than 1500 Kgs. of yield. It is clear from the above analysis that if this pattern of growth continues in the taluks, it would not only slow down the general growth rate of rice output, but would also lead to regional inequality in the agricultural development.

Table - 3.41 Number of taluks in each district having different level of Yield between 1974-75 and 1985-86

Districts	No. of Taluks having per hectare Yield					Total No. of Taluks
	Above 2000	1700 - 2000	1500-1700	1300-1500	Below 1300	
Trivandrum			2	2		4
Quilon		2	2	2		6
Alleppey	2	2	1	1	1	7
Kottayam	1	6	1			8
Ernakulam		2	2	3	1	8
Trichur			1	2	2	5
Palghat	3		1	3		7
Kozhikode			1		5	6
Canannore			2	1	3	6
Total No. of Taluks	6	12	13	14	12	57

Having seen the change in the number of taluks from one class of yield to another, it would be important to know what is the spatial distribution of taluk with regard to their level of yield. Hence, data on number of taluks in each district having different level of yield during 1974-75 to 1985-86 are presented in table 3.41. Out of the six taluks having more than 2000 Kgs. of yield of rice, three belong to Palghat, two to Alleppey and one to Kottayam. This shows that high yield taluks are equally distributed between south and north Kerala. All the 12 taluks having yield between 1700-2000Kgs. per hectare belong to south Kerala. Out of the 13 taluks having yield between 1500-1700 Kgs. per hectare, eight belong to south Kerala and five to north Kerala. Out of the 14 taluks having yield between 1300-1500 Kgs. per hectare, eight belong to south Kerala and six to north Kerala. Of the 12 taluks having yield below 1300 Kgs. per hectare 10 belong to north Kerala and two to south Kerala. This indicate the fact that yield level of rice is higher in south Kerala compared to north Kerala.

Season-wise distribution of districts in the State according to taluks having different rate of growth of output, area and yield of rice is presented in table 3.42.

It is clear from table 3.42 that during winter season 11 taluks had positive growth rate of area while all the

Table - 3.42 Season-wise distribution of districts in the State according to Taluks having different rate of growth of output, Area and Yield of Rice From 1974-75 to 1985-86

Districts	Number of Taluks having positive and Negative Growth Rate of																		No. of Taluks
	Area						Yield						Output						
	Autumn		Winter		Summer		Autumn		Winter		Summer		Autumn		Winter		Summer		
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	
Trivandrum		4		4		4	4		1	3	2	2	2	2		4		4	4
Quilon	4	2		6	2	4	6		2	4	4	2	6		1	5	2	4	6
Alleppey	2	5		7		6*	6	1	5	2	6*		4	3	1	6	3*	3	7
Kottayam	3	4[1]	3	5	1	6[2]	7[1]		6	2	5	2[2]	3	4[1]	5	3	1	6[2]	8
Ernakulam	2	6	2	5[3]	4	3[3]	8		5	2[3]	7[3]		4	4	2	5[3]	6	1[3]	8
Trichur	1	4	1	4	4	1	4	1	3	2	5		2	3	2	3	4	1	5
Palghat	1	6	2	5	2	5	4	3	2	5	3	4	2	5	1	6	2	5	7
Kozhikode		6	1	5	6		6		5	1	3	3		6	2	4	1	5	6
Canannore		6	2	4	5	1	5	1	4	2	2	4		6	2	4	4	2	6
Total No. of Taluks	13	43	11	45	24	30	50	6	33	23	37	17	23	33	16	40	23	31	57

Note: * One of the taluks (Sherthalai) in Alleppey district has no summer crop. Hence only six numbers during that season instead of seven.

1. One of the taluks (Peermade) in Kottayam district has no autumn crop. Hence only seven numbers during that season instead of eight.

2. Again, one of the taluks (Kanjirappilly) in Kottayam district has no summer crop. So only seven numbers during that season instead of eight.

3. One of the taluks (Cochin) in Ernakulam district has no winter and summer crop and hence during those seasons only seven numbers instead of eight.

districts had negative growth rates. During autumn season six taluks had negative growth rates of yield, while all the districts had positive growth rates. Only one district had positive growth rate of output, whereas 16 taluks had positive growth rates of output during winter season. Taluk level study gives rather clear picture of the trends in area, yield and production of rice in the state.

3.4. Growth and Stability

This is an impression that the measures adopted for accelerated growth of agricultural production in India have often resulted in increasing annual fluctuations in production, especially after the introduction of high yielding varieties.[4] Since increased fluctuations in output levels lead to a number of problems in food management operations, often measures are initiated to reduce variability in output levels along with achieving sustained levels of growth. Here an attempt is made to analyse the performance of rice in Kerala in relation to growth and stability.

The growth rates of area under paddy declined during the third period over the first and the second for all the three seasons individually and for the combined seasons. However, between the first and the second periods, annual fluctuations in area declined during autumn and increased during winter, summer and combined seasons. But between the second and the

4. S.R. Sen (1967) and C.H.H. Rao (1975).

third periods, annual fluctuations increased during autumn and combined seasons and declined during winter and summer. Some of the important factors responsible for acreage adjustments include changes in the physical conditions (especially irrigation facilities) weather conditions and relative price changes. A change induced by weather condition is more of a short term nature than the changes induced by other factors, and therefore weather induced changes in cropping pattern have a tendency to increase fluctuations in area. The fact that growth rates of area remained negative during all seasons and that the fluctuations remained decreased over the second and the third periods during winter and summer and remained stable during autumn indicate that the reduction in area is the result of conscious decisions made at the farm level in favour of substituting other crops for paddy. This can be either because land diverted from paddy is brought under long duration crops (perennial crops) or because disadvantageous relative price situation prevailed over a long period.[5]

While area influenced negative growth rates for the third period, the growth rates of yield for the third period were consistently above the second period's rates for all the three seasons. However, the fluctuation of yield declined during winter, summer and combined seasons and increased during autumn indicating an overall reduction in variability of yield

---

5. P.S. George and Chandan Mukherjee (1986), Page 32.

during the third period. This is somewhat contradictory to the experience in the early phase of high yielding varieties when the yield increases associated with the new varieties induced higher levels of fluctuations over time. At the same time the recorded level of fluctuations of yield is consistent with the reduced level of fluctuations of area indicating that the land retained under paddy cultivation is suitable for this purpose and that there is no major in built technology bias towards inducing higher levels of fluctuations. Even if there existed some technology bias towards increased level of fluctuations, such tendencies might have been overcome either by physical conditions (especially land quality) or by measures adopted to safeguard crops from the vagaries of nature (Table 3.43).

In general, a situation of improved growth rate of yield associated with reduced variations would be most desirable. However, the performance of rice in Kerala during the third period do not provide such an encouraging outlook. The increased growth rate of yield for the third period was only a mild recovery from the near stagnant growth rate for the second period. The compound growth rates of yield (1.35 per cent for all seasons, 1.70 per cent during autumn, 0.71 per cent during winter and 1.14 per cent during summer) are well below the rates achieved in many other parts of India. Further, the increase in growth rate of yield was not sufficient to offset the decline in the growth rate of area, so that the outcome was a decline in the growth rate of output (Table 3.44).

The growth rates of output for the third period were below the rates for the second period during all the three seasons. Along with the fall in output level, there had been decline in the fluctuations of output levels. In Kerala, reductions in the fluctuations of both area and yield of rice had contributed towards a reduced level of variability in output of rice (Table 3.45).

The observed behaviour of changes in growth rates and fluctuations for the state was not uniformly consistent for all the districts. The emerging tendencies among the districts indicate a very scattered pattern. For example, while there was no instance of increased fluctuations at the State level in area, yield and output for all the three seasons during the third period, the fluctuations of area increased in Trivandrum, Quilon, Alleppey, Kottayam, Palghat, Kozhikode and Canannore districts during autumn, Trivandrum, Quilon, Kottayam, Trichur and Canannore districts during winter, Trivandrum, Quilon, Alleppey and Kottayam districts during summer. But the fluctuations of area increased in all the districts except Ernakulam and Palghat and the State as a whole during the combined seasons. Increased fluctuations of yield for the third

Table - 3.43 Changes in Growth Rates and Co-efficient of Variation.

(Area)

Season	Increase (+) Decrease (-) Growth Rate	Co-efficient of variation: Between I & II Period — Increase	Decrease	Stable	Between II & III Period — Increase	Decrease	Stable
	-	KOZD	KERALA QLN TCR	KOT TVM EKM CANR	TVM KOZD QLN CANR ALP KOT PLGT	TCR EKM	KERALA
Autumn							
	+	ALP PLGT					
	-	QLN EKM		TVM TCR	TVM QLN KOT TCR CANR	KERALA EKM PALGT KOZD	
Winter							
	+	KERALA ALP KOT PLGT KOZD CANR					
	-	PLGT	TVM QLN ALP		TVM QLN ALP KOT	KERALA EKM TCR PLGT KOZD CANR	
Summer							
	+	KERALA KOT EKM TCR CANR		KOZD			
	-	KOT EKM KOZD	QLN TCR	TVM	KERALA TVM QLN ALP KOT TCR KOZD CANR	EKM	
All seasons							
	+	KERALA ALP PLGT		CANR		PLGT	

Note: Same as in 3.31.

Table - 3.44 Changes in Growth Rates and Co-efficient of Variation

(Yield)

Season	Increase (+) Decrease (-) Growth Rate	Co-efficient of Variation: Between I & II Period			Between II & III Period		
		Increase	Decrease	Stable	Increase	Decrease	Stable
Autumn	-	PLGT CANR				EKM PLGT CANR	
	+	KERALA TVM ALP KOT EKM TCR KOZD	QLN		KERALA TVM QLN ALP KOT TCR KOZD		
Winter	-		TVM TCR PLGT		TVM	QLN EKM CANR	
	+	KERALA ALP EKM KOZD CANR	QLN KOT		ALP	KERALA KOT TCR PLGT KOZD	
Summer	-		EKM			ALP KOZD PLGT CANR	TVM
	+	KERALA TVM QLN ALP KOT TCR PLGT KOZD CANR			QLN	KERALA KOT EKM TCR	
All seasons	-	CANR				PLGT CANR	
	+	KERALA TVM KOT EKM TCR PLGT KOZD	QLN ALP		TVM QLN EKM TCR KOZD	KERALA ALP KOT	

Note: Same as in Table 3.31.

Table - 3.45 Changes in Growth Rates and Co-efficient of Variation

(Production)

Season	Increase (+) Decrease (-) Growth Rate	Co-efficient of Variation: Between I & II Period – Increase	Between I & II Period – Decrease	Between I & II Period – Stable	Between II & III Period – Increase	Between II & III Period – Decrease	Between II & III Period – Stable
Autumn	-	KOZD CANR	QLN TCR		TVM ALP KOT KOZD CANR	KERALA EKM TCR PLGT	
	+	KERALA TVM ALP KOT EKM PLGT			QLN		
Winter	-	TCR PLGT		TVM	TVM ALP	KERALA KOT EKM TCR PLGT KOZD CANR	QLN
	+	KERALA ALP KOT EKM KOZD CANR	QLN				
Summer	-		TVM	QLN	TVM QLN KOT	KERALA EKM TCR PLGT KOZD CANR	ALP
	+	KERALA ALP KOT EKM TCR PLGT KOZD CANR					
All seasons	-	TCR CANR			TVM CANR	KERALA QLN, KOZD ALP KOT EKM TCR PLGT	
	+	KERALA TVM QLN ALP KOT EKM PLGT KOZD					

Note: Same as in Table 3.31.

G 3914

period is observed during autumn in Trivandrum, Quilon, Alleppey, Kottayam, Trichur and Kozhikode, Trivandrum and Alleppey districts during winter, Quilon during summer and Trivandrum, Quilon, Ernakulam, Trichur and Kozhikode during the combined seasons. Fluctuations of output levels increased in Trivandrum, Quilon, Alleppey, Kottayam, Kozhikode and Canannore districts during autumn, Trivandrum and Alleppey during winter, Trivandrum, Quilon and Kottayam during summer and Trivandrum and Canannore during the combined seasons. Thus, in general fluctuations of area, yield and output indicate an increasing tendency in most of the southern districts and the northern most districts of Kerala. However, the opposite tendency in most of the northern districts and some of the southern districts (different districts for different seasons) had a dominant role so that for the state as a whole, the fluctuations of area, yield and output declined or remained stagnant except area during the combined seasons and yield during autumn (Tables 3.43 to 3.45).

3.5. Difference in Yield of Paddy

An attempt is made in this section to analyse the factors responsible for changes in yield with particular reference to the role of high yield varieties (HYV), irrigation facilities and fertiliser consumption in explaining yield levels. Since yield data for HYV and non-HYV according to irrigation facilities are available only for the third period viz., 1974-75 to 1985-86 the analysis is confined to this period only.

3.5.1. HYV Area

During 1985-86, 24.07 per cent of the cropped area under paddy during all seasons was covered under HYV. Among the districts, Kozhikode had the least coverage (10.20 per cent) and Kottayam the highest (65.49 per cent). The coverage of area under HYV during 1985-86 autumn, winter and summer were 51.31 per cent, 24.90 per cent and 23.79 per cent respectively. Between 1974-75 and 1985-86 the coverage of area under HYV during autumn declined in Alleppey (from 29.32 per cent to 17.02 per cent), Idukki (from 28.09 per cent to 26.46 per cent), Trichur (from 38.22 per cent to 32.16 per cent) and Palghat (from 84.86 per cent to 83.30 per cent) and it increased in all other districts. The highest increase being in Trivandrum (from 20.47 per cent to 66.35 per cent). The coverage of HYV area during winter declined in Trivandrum (from 59.34 to 32.37 per cent), Kottayam (from 48.76 to 48.15 per cent), Idukki(from 71.91 to 67.06 per cent), Ernakulam (from 30.46 to 21.54 per cent Malapuram (from 46.67 to 19.96 per cent), Kozhikode (from 53.30 to 21.61 per cent), Canannore (from 30.87 to 20.92 per cent) and all Kerala (from 30.41 to 24.90 per cent). During summer Alleppey, Trichur, Malappuram and Kozhikode districts had good coverage of HYV. However, in Trivandrum were about 20 per cent of summer area was under HYV during 1974-75, the proportion has declined to 1 per cent by 1985-86. A similar drop in the proportion of summer area under HYV occurred in Kottayam (from

Table - 3.46 Percentage of the total Area under HYV during Autumn, Winter & Summer and the proportion of total Cropped area under Paddy during all Seasons under HYV between 1974-75 and 1985-86.

Districts/ State	Autumn		Winter		Summer		All Seasons	
	1974-75	1985-86	1974-75	1985-86	1974-75	1985-86	1974-75	1985-86
Trivandrum	20.47	66.35	59.34	32.37	20.19	1.28	9.74	16.62
Quilon	84.38	84.50	14.21	15.48	1.41	0.02	7.84	28.38
Alleppey	29.32	17.02	12.56	15.85	58.12	67.13	27.21	39.90
Kottayam	14.89	28.87	48.76	48.15	36.35	22.98	28.61	65.49
Idukki	28.09	26.46	71.91	67.06	0.00	6.48	29.48	24.51
Ernakulam	50.74	68.60	30.46	21.54	18.80	9.86	20.37	22.64
Trichur	38.22	32.16	31.73	32.65	30.04	35.19	21.21	18.38
Palghat	84.86	83.30	12.15	15.10	2.98	1.39	17.84	19.57
Malappuram	38.08	47.91	46.67	19.95	15.25	32.13	20.63	11.34
Kozhikode	23.32	23.63	53.30	21.61	23.38	54.77	16.71	10.20
Canannore	52.96	76.67	33.87	20.92	13.17	2.41	13.43	15.59
All Kerala	46.25	51.31	30.41	24.90	23.34	23.79	19.01	24.07

Source: Same as in Table 3.2.

36.35 to 22.98 per cent), Ernakulam (from 18.80 to 9.86 per cent) and Canannore (from 13.17 to 2.41 per cent).

3.5.2. Growth Rates of Area under HYV and Non-HYV

The growth rates of area under HYV and non-HYV of paddy indicated that during the third period, there had been an overall decline in area under both HYV and non-HYV. While area under HYV declined by 1.55 per cent annually, area under non-HYV declined by 2.17 per cent. It may be recalled that the annual growth rate of total area under paddy declined during all the three seasons, the growth rate being -2.39 per cent during autumn, -1.74 per cent during winter and -2.29 per cent during summer. Moreover, the observed negative growth rates of area during the three seasons were not uniformly distributed between HYV and non-HYV. During autumn, HYV area had a negative growth rate of -0.06 per cent. Thus, during autumn, while area under paddy declined, simultaneously there had been a shift from non-HYV to HYV since the decline was more pronounced with regard to non-HYV. During winter, both HYV and non-HYV area declined, but the decline was more pronounced in the case of HYV. During summer, while HYV area declined at an annual rate of -3.88 per cent, non-HYV area increased at an annual rate of 0.13 per cent which indicates that while the overall area under paddy declined during summer simultaneously there was a shift from HYV area to non-HYV.

It is often argued that profitability of HYV depends on the acceptance of a package of practices whose viability depends on assured rainfall or irrigation facilities. Since autumn paddy is largely dependent on monsoon, it appears that farmers found it profitable to shift from traditional varieties to HYV. However, their experience with HYV during summer might have been discouraging and therefore they might have shifted back to non-HYV[6]. Considering some of the evidences available in the next section it could be visualised that the change might be due to unreliable irrigation facilities.

The slight decline in the growth rate (-0.06 per cent) of HYV compared to more pronounced decline in the growth rate (-3.16 per cent) of non-HYV during autumn was influenced by the increase in area under HYV in Trivandrum (3.01 per cent), Quilon (13.96 per cent) and Kottayam (8.60 per cent). Autumn HYV area in the other districts had a negative growth rate and non-HYV area had positive growth rate only in Trichur.

During winter, HYV area indicated a positive growth rate in Quilon (10.11 per cent), Kottayam (0.49 per cent), Idukki (0.36 per cent) and Palghat (7.46 per cent) and non-HYV area increased only in Malappuram. During summer there was no region where HYV area increased, but non-HYV area increased in Alleppey, Idukki, Ernakulam, Trichur, Palghat, Kozhikode and

---

6. Some of these non-HYV were improved local varieties.

Table - 3.47 <u>Growth Rates of Area under HYV and non-HYV (1974-75 to 1985-86)</u>

(Per cent)

Districts/State	Autumn		Winter		Summer		All Seasons	
	HYV	Non-HYV	HYV	Non-HYV	HYV	Non-HYV	HYV	Non-HYV
Trivandrum	3.01	-4.36	-9.86	-3.58	-25.26	-11.15	- 5.45	-4.05
Quilon	13.96	-6.33	10.11	-2.15	-23.82	-10.70	12.43	-3.72
Alleppey	-1.63	-1.27	-6.16	-2.56	- 4.42	6.98	- 3.59	-1.13
Kottayam	8.60	-7.58	0.49	-5.76	- 6.69	-15.63	0.65	-9.45
Idukki	-10.33	-1.86	0.36	-7.36	- 9.47	2.03	- 7.09	-5.13
Ernakulam	-1.03	-0.53	-6.81	-0.27	- 4.36	3.50	- 2.61	0.13
Trichur	-6.43	0.70	-6.14	-1.36	- 1.03	2.79	- 4.52	-0.89
Palghat	-0.52	-0.49	7.46	-1.30	-10.35	3.78	0.27	-0.92
Malappuram	-11.43	-3.52	-15.69	+1.09	- 3.13	- 1.14	-10.64	-1.33
Kozhikode	-7.67	-11.35	-10.99	-1.89	- 0.80	3.69	-6.22	-4.12
Canannore	-1.62	-6.54	-5.71	-0.70	-20.83	8.21	-4.74	-3.54
All Kerala	-0.06	-3.16	-2.19	-1.63	- 3.88	0.13	-1.55	-2.17

Canannore. Thus positive growth rate of summer paddy area in all the districts except Trivandrum, Quilon, Kottayam and Malappuram for the third period can be explained by the increased non-HYV area. For the combined seasons, positive growth rates were obtained for HYV in Quilon, Kottayam and Palghat and for non-HYV only in Ernakulam. It can also be noticed that Alleppey, Kozhikode, Canannore and All Kerala had consistently negative growth rates for both HYV and non-HYV areas during all seasons except non-HYV area during summer. Trivandrum showed positive growth rate only during autumn for HYV area and Malappuram for non-HYV area during winter.

3.5.3. Growth Rates of Yield for HYV and Non-HYV

The growth rate of yield for the third period during autumn, winter and summer and combined seasons were 1.71, 0.71, 1.14, and 1.35 per cent respectively. When growth rates of HYV and non-HYV were obtained separately, it was observed that at the State level, all the rates were positive. However, during autumn, the growth rates of yield of HYV (1.52 per cent) was lesser than growth rate of yield of non-HYV (2.48 per cent). This was just the opposite during winter when HYV and non-HYV growth rates of yield were 2.07 per cent and 1.72 per cent respectively. However, during summer the growth rate of HYV yield (1.61 per cent) was much below the rate for non-HYV yield (3.33 per cent). This was also true during all seasons when HYV and non-HYV growth rates of yield were 0.75 per cent and 1.58 per cent respectively. The observed fall in HYV area during winter, summer and all seasons can be explained, at least

Table - 3.48 Growth Rate of Yield for HYV and Non-HYV 1974-75 to 1985-86

(Per cent)

Districts/State	Autumn		Winter		Summer		All Seasons	
	HYV	Non-HYV	HYV	Non-HYV	HYV	Non-HYV	HYV	Non-HYV
Trivandrum	2.31	2.55	0.35	-0.91	-0.67	3.84	2.69	-0.33
Quilon	1.30	0.98	-0.22	-0.03	-0.39	1.31	2.17	0.82
Alleppey	0.58	0.82	2.28	2.80	1.55	1.59	1.55	4.13
Kottayam	-0.08	0.84	0.85	-3.13	-0.13	11.06	1.87	1.21
Idukki	0.46	3.17	2.65	1.46	1.29	0.37	3.16	1.79
Ernakulam	-0.79	3.41	1.89	0.05	-1.12	1.17	1.18	1.39
Trichur	-0.25	1.66	0.06	1.24	-0.42	4.39	1.87	1.75
Palghat	-0.97	1.66	-1.24	-0.27	-3.07	1.94	0.68	0.55
Malappuram	-1.77	0.99	-0.27	1.80	-1.66	6.38	0.66	1.52
Kozhikode	2.39	1.92	2.30	2.25	0.27	4.75	3.49	3.06
Cannanore	0.07	1.72	0.81	1.58	-2.06	-0.83	1.70	1.12
All Kerala	1.52	2.48	2.07	1.72	1.61	3.33	0.75	1.58

partially, by the relatively low increase in HYV yield.

The growth rates of yield were positive in all areas during autumn and summer for non-HYV, and during all seasons for HYV and non-HYV except in Trivandrum (all seasons) and in Canannore (summer) for non-HYV. For HYV, negative growth rates were observed in Trivandrum (summer), Quilon (winter and summer), Kottayam, Ernakulam and Trichur (autumn and summer), Palghat and Malappuram (all the three seasons) and Canannore (summer). During autumn, the growth rates of yield of HYV exceeded those of non-HYV only in Quilon and Kozhikode, but during winter this was true for Trivandrum, Kottayam, Idukki, Ernakulam, Kozhikode and all Kerala. During summer growth rates of yield of HYV exceeded non-HYV only in Idukki.

It is evident that yield of HYV of paddy has declined remarkably compared to non-HYV. It may be due to lack of irrigation facilities and insufficient availability of requisite inputs like fertilisers, insecticides, pesticides and paucity of training given to the farmers for the timely use of the same.

3.5.4. Association between yields of HYV and Non-HYV

An analysis of the association between changes in yields of HYV and non-HYV using data on annual changes in yield indicate that for the twelve years starting 1974-75, HYV yield during autumn increased in six years and declined in five years. During the six years of increased HYV yield, non-HYV yield increased for three years and decreased also for three years. At the same time during the five years of decreased HYV yield, non-HYV yield increased for three years and declined for the remaining two years. Thus during autumn the movement of HYV and non-HYV was consistent for five years and it was in the opposite direction for the remaining five years.

The movement of HYV and non-HYV in the districts indicate that during autumn, winter and summer yield movements were in the same direction for a majority of years in almost all districts. However, in Trivandrum and Canannore districts during autumn, HYV and non-HYV yield moved in opposite directions for most of the years. In Alleppey and Kozhikode when HYV yield increased during winter, for seven years, non-HYV yield increased for six years in Alleppey and eight years in Kozhikode. During summer HYV yield increased for seven years in Quilon and eight years in Ernakulam, whereas non-HYV yield increased in Quilon and Ernakulam only for five and four years respectively. The movement of HYV and non-HYV during autumn in Alleppey, Idukki and Ernakulam districts were inconsistent, ie., non-HYV yield increased for eight years, whereas HYV yield increased only for five years. In Trichur, Palghat and Kozhikode districts, dissimilarity in the yield movements were observed, during winter ie., HYV yield increased only for five years in the case of the first two districts and seven years with regard to Kozhikode, whereas non-HYV yield increased for eight years in Trichur and Kozhikode

Table - 3.49 <u>Annual Movement in HYV and Non-HYV Yield</u>

Districts/ State	Increase(+) or Decrease(-) in HYV yield	Increase or Decrease in Non-HYV yield					
		Autumn		Winter		Summer	
		+	-	+	-	+	-
Trivandrum	+	5	2	5	-	5	1
	-	-	4	1	5	-	5
Quilon	+	6	-	5	-	6	1
	-	-	5	1	5	-	4
Alleppey	+	5	-	6	1	6	-
	-	3	3	-	4	-	5
Kottayam	+	5	1	5	-	6	-
	-	-	5	-	6	-	5
Idukki	+	5	-	6	-	a	a
	-	3	3	-	5	a	a
Ernakulam	+	5	-	5	-	4	4
	-	3	3	1	5	-	3
Trichur	+	5	-	5	-	5	-
	-	-	6	3	3	2	4
Palghat	+	5	1	3	2	5	-
	-	-	5		6	1	5
Malappuram	+	6	-	6	-	5	-
	-	-	5	-	5	1	5
Kozhikode	+	6	-	7	-	6	-
	-	-	5	1	3	-	5
Canannore	+	5	2	5	1	6	-
	-	-	4	-	5	-	5
All Kerala	+	6	-	6	-	7	-
	-	-	5	-	5	-	4

Note: + Indicates an increase in yield and
- indicates a decline in yield. Figures in each cell indicate the number of years when corresponding movements occurred.

a Stands for incomplete data.

and only three years in Palghat. In Ernakulam and Trichur the yield movements were in the opposite direction during summer.

Thus it appears that on the whole yields of HYV and non-HYV moved in the same direction during all seasons, except some divergence in the movement pattern in a few districts. For eg.: The movement of HYV and non-HYV yield was dissimilar in Trivandrum, Alleppey, Idukki, Ernakulam and Canannore during autumn, Alleppey, Trichur, and Palghat during winter and Quilon, Ernakulam and Trichur during summer.

On the whole, as we have seen earlier yield of HYV of paddy has declined considerably compared to non-HYV of paddy. It may be due to paucity of irrigation facilities, inadequate availability of supporting inputs such as fertilisers, insecticides, pesticides and lack of information given to the farmers for the timely use of the same. Hence it would be worthwhile to look into the existing pattern of irrigation facilities and fertiliser consumption.

3.5.5. HYV Production

The overall growth rate of HYV production was -0.80 per cent against the non-HYV production growth rate of -0.58 per cent. The growth rate of HYV production was positive during autumn, but it was negative during winter and summer. At the same time the growth rate of non-HYV production was negative during autumn and winter, but it turned out to be positive during summer. It may be recalled that during autumn yield of HYV had positive growth rate. The positive growth rate of HYV yield during winter dominated over the negative growth rate of area, but during summer the negative growth rate of HYV area dominated over the positive growth rate of yield. However, for non-HYV, the positive growth rate of yield was not sufficient to offset the negative growth rate of area during autumn and winter. During summer, the growth rates of both non-HYV area and yield were positive.

The growth rate of production in Trivandrum was negative during autumn, winter, summer and all seasons for both HYV and non-HYV except during autumn for HYV. In Quilon and Kottayam the growth rates of HYV production were positive during all seasons except summer, but the rates for non-HYV production were negative during all seasons. In Alleppey positive growth rates were observed for non-HYV during all seasons except autumn.

In Ernakulam and Trichur, negative growth rates were observed for HYV production, but positive growth rates for non-HYV production during all seasons except summer. The other cases of negative growth rates for HYV production were in Idukki (autumn and summer), Palghat (summer), Malappuram and Canannore (autumn, winter and summer), Kozhikode (autumn and winter) and all Kerala (winter and summer).

Table - 3.50 Growth Rates of Production for HYV and Non-HYV

1974-75 to 1985-86

(Per cent)

Districts/ State	Autumn		Winter		Summer		All Seasons	
	HYV	Non-HYV	HYV	Non-HYV	HYV	Non-HYV	HYV	Non-HYV
Trivandrum	5.27	- 1.81	- 9.48	- 4.49	-25.96	- 7.31	- 2.73	- 4.38
Quilon	17.02	- 5.36	8.66	- 2.18	-19.45	- 9.39	14.62	- 2.91
Alleppey	- 1.04	- 0.46	- 4.14	0.24	- 2.32	9.30	- 2.04	3.09
Kottayam	10.29	- 6.36	5.40	- 8.88	- 5.64	- 4.56	2.52	- 8.24
Idukki	- 7.37	1.31	2.53	- 5.91	- 4.14	2.40	- 3.73	- 3.34
Ernakulam	- 0.25	2.89	- 0.15	- 0.22	- 6.72	5.70	- 1.43	1.51
Trichur	- 4.91	2.37	- 3.81	- 0.12	- 0.11	7.18	- 2.65	0.86
Palghat	0.27	1.17	3.89	- 1.58	-11.20	5.72	0.96	- 0.37
Malappuram	-11.43	- 2.54	-13.86	2.88	- 3.67	5.24	- 9.82	0.19
Kozhikode	- 3.54	- 9.42	- 6.06	0.36	0.15	8.44	- 2.74	- 1.06
Canannore	- 0.09	- 5.85	- 4.46	0.88	-19.97	7.40	- 3.08	- 2.46
All Kerala	1.46	- 1.28	- 7.50	- 0.36	- 2.23	1.86	- 0.80	- 0.58

Thus, the observed positive growth rate of production for paddy during autumn was influenced by a high rate of growth of yield for HYV. The negative growth rates of HYV production of paddy during winter and summer were influenced by the negative growth rates of area under paddy during the same seasons.

3.5.6. Irrigation

The importance of irrigation in agricultural development hardly needs emphasis. Programmes of agricultural development and irrigation received added emphasis in Kerala during the period of the successive five year plans. Even then only about one-third of the area under paddy in the State enjoys irrigation facilities. While the dependence on irrigation is very much limited during autumn on account of the extended monsoon season, about half the area under paddy during winter and three-fourth area during summer are irrigated. During autumn and winter, the percentage of HYV area under irrigation exceeded the percentage of non-HYV area under irrigation, but during summer the shares of irrigated area in HYV and non-HYV area remained more or less the same (Table 3.51).

Palghat district accounted for a large share of total irrigated HYV area in the State during autumn and winter. For non-HYV varieties, Ernakulam and Trichur had a higher percentage of irrigated area than Palghat. During summer, Alleppey and Trichur had large area under irrigated HYV, but for non-HYV, Ernakulam and Trichur had the highest share of irrigated area.[7]

---

7. P.S. George and Chandan Mukherjee, op.cit, Page 62.

Irrigation is one of the critical variables influencing agricultural growth, especially for growth induced by technologica change since Kerala has an extended monsoon season, most areas do not require extended irrigation during autumn and a part of winter It is during summer that the role of irrigation is crucial, and as pointed out earlier, farmers might have gone back to non-HYV varieties during summer because of inadequate irrigation facilities. This is also substantiated by field observations in many areas where the field channels had insufficient water during summer.[8]

Percentage distribution of area under irrigated paddy during summer was declining, whereas it was increasing during autumn and winter in the state as a whole. The same trend was observed in Quilon, Alleppey, Ernakulam, Kozhikode and Canannore districts and in other districts and proportion of irrigated area either remained the same or was increasing during summer (Table 3.52). This might be due to the decline in the yield level of HYV area during summer compared to non-HYV area.

---

8. K.N. Nair and D. Narayana have concluded that irrigation has contributed to increased yield only during autumn. Further there is some stabilisation of yield as a result of irrigation during autumn, doubtful stabilisation effect during winter and negligible stabilisation effect during summer. Thyagarajan and Nambiar have pointed out that when rainfall was not available during summer solar radiation was maximum and availability of irrigation facilities was poor and the consequence was that impact of irrigation on both yield and area expansion had been negligible.

Table - 3.51 Irrigated Area as a Percentage of Total Area under Paddy in Kerala

Season	Variety	Percentage of Irrigated Area 1979-80	1980-81	1981-82
Autumn	HYV	37	18	7
	Others	5	10	6
	Total	18	13	6
Winter	HYV	69	62	70
	Others	37	29	44
	Total	45	40	50
Summer	HYV	62	69	73
	Others	60	79	75
	Total	67	73	74
All Seasons	HYV	50	43	37
	Others	28	26	31
	Total	35	32	34

Source: Directorate of Economics and Statistics, Trivandrum, Kerala.

Table - 3.52 Percentage Distribution of Area under Paddy Irrigated/ Unirrigated

District	Season	1981-82 Irrigated	1981-82 Unirri-gated	1981-82 Total	1982-83 Irri-gated	1982-83 Unirri-gated	1982-83 Total	1983-84 Irri-gated	1983-84 Unirri-gated	1983-84 Total	1984-85 Irri-gated	1984-85 Unirri-gated	1984-85 Total
	Autumn	24.88	75.12	100	22.84	77.16	100	28.77	71.23	100	23.60	76.40	100
Trivandrum	Winter	29.87	70.13	100	41.38	58.62	100	34.20	68.80	100	33.52	66.48	100
	Summer	77.06	22.94	100	90.57	9.43	100	93.21	6.79	100	94.17	5.83	100
	Autumn	5.74	94.26	100	1.74	98.26	100	0.55	99.45	100	--	100	100
Quilon	Winter	15.15	84.85	100	19.96	80.04	100	26.28	73.72	100	22.18	77.82	100
	Summer	72.91	27.09	100	76.13	23.87	100	44.15	55.85	100	70.42	29.58	100
	Autumn	--	--	--	--	--	--	--	--	--	0.30	99.70	100
Alleppey	Winter	7.74	92.26	100	10.82	89.18	100	23.25	76.75	100	7.74	92.26	100
	Summer	37.12	67.88	100	41.65	58.35	100	25.87	74.13	100	13.45	86.55	100
	Autumn	0.15	99.85	100	2.45	97.55	100	0.05	99.95	100	0.93	99.07	100
Kottayam	Winter	33.47	66.53	100	22.65	77.35	100	48.91	51.09	100	62.16	37.84	100
	Summer	1.33	98.67	100	47.54	52.46	100	7.88	92.12	100	28.34	71.66	100
	Autumn	4.50	95.50	100	32.30	67.70	100	49.90	50.10	100	13.84	86.16	100
Idukki	Winter	46.48	53.52	100	71.79	28.21	100	67.00	33.00	100	52.61	47.39	100
	Summer	1.31	98.69	100	100.00	--	100	46.69	53.31	100	8.33	91.67	100
	Autumn	33.80	66.20	100	27.48	72.52	100	36.20	63.80	100	50.52	49.48	100
Ernakulam	Winter	72.11	27.89	100	79.25	20.75	100	73.37	26.63	100	94.54	5.46	100
	Summer	99.75	0.25	100	100.00	--	100	98.86	1.14	100	99.54	0.46	100
	Autumn	3.65	96.35	100	6.01	93.99	100	8.19	91.81	100	3.27	96.73	100
Trichur	Winter	70.15	29.85	100	62.85	37.15	100	80.98	19.02	100	79.71	20.29	100
	Summer	100.00	--	100	99.98	0.02	100	99.46	0.54	100	100.00	--	100
	Autumn	0.44	99.56	100	14.57	85.43	100	22.07	77.93	100	21.01	78.99	100
Palghat	Winter	75.83	24.17	100	79.04	20.96	100	85.04	14.96	100	82.70	17.30	100
	Summer	94.85	5.15	100	100.00	--	100	89.78	10.22	100	98.32	1.68	100
	Autumn	1.44	98.56	100	0.56	99.44	100	0.04	99.96	100	9.25	90.75	100
Malappuram	Winter	37.77	62.23	100	38.54	61.46	100	46.97	53.03	100	61.39	38.61	100
	Summer	96.23	3.77	100	98.45	1.55	100	57.35	42.65	100	96.69	3.31	100
	Autumn	0.13	99.87	100	--	--	--	--	--	--	0.01	99.99	100
Kozhikode	Winter	8.54	91.46	100	8.53	91.47	100	5.87	94.13	100	13.98	86.02	100
	Summer	93.29	6.71	100	94.02	5.98	100	88.55	11.45	100	86.30	13.70	100
	Autumn	1.14	98.86	100	0.26	99.74	100	3.19	96.81	100	0.84	99.16	100
Canannore	Winter	67.10	32.90	100	69.59	30.41	100	77.55	22.45	100	76.08	23.92	100
	Summer	99.32	0.68	100	96.33	3.67	100	97.77	2.23	100	93.76	6.24	100
	Autumn	6.26	93.74	100	9.38	90.62	100	12.69	87.21	100	14.43	85.57	100
All Kerala	Winter	49.63	50.37	100	58.17	41.83	100	58.49	41.51	100	65.10	34.90	100
	Summer	73.97	26.03	100	77.69	22.31	100	63.27	36.73	100	67.46	32.54	100

Source: Op.cit., Statistics for Planning 1986, Pages 55 - 56.

The impact of irrigation on the yield of crops was examined with the help of the data obtained from the crop cutting surveys of the Directorate of Economics and Statistics, Trivandrum. The district-wise details are given in table 3.53. It shows that on the average, the yield of irrigated paddy were nearly 20 per cent higher for virippu crop (autumn) and 10 per cent higher for mundakan crop (winter) as compared to unirrigated paddy, although considerable variations existed as between the various districts during 1973-74 to 1976-77. Development of irrigation did not provide significant contribution towards increased yield.

The proportion of area under HYV had a positive influence on yield during autumn and negative influence during winter and summer between 1984-85 and 1985-86 (Table 3.54). This is consistent with the result that during autumn the growth rate of HYV yield were much higher than the growth rates for non-HYV yield and that during winter and summer, the HYV yield had a smaller growth rate than the growth rate of non-HYV yield.

When all the seasons were combined, the proportion of area under HYV turned out to be insignificant variable in explaining yield levels although the co-efficient had a positive sign. Thus, for the annual data, proportion of HYV area was not a significant factor explaining yield changes in spite of its significance during the autumn and winter seasons. The proportion of irrigated area turned out to be insignificant for both annual

HYV and non-HYV yield.[9] This result further confirm the observation that irrigation facilities within the State were ineffective in raising rice yields. Significant negative co-efficient of HYV yield for summer indicated the ineffectiveness of HYV of paddy during summer.

It is clear that the yield level of HYV of paddy was declining and it was even negative during winter and summer during recent years. This indicates the ineffectiveness of HYV of paddy during summer (to a greater extent) and winter (to a lesser extent). This trend shows the paucity of irrigation facilities and the consequent limited consumption of fertilisers.

3.5.7. Fertiliser Consumption in Kerala

It is an undisputed fact that the HYV programme was successful due to assured irrigation and use of chemical fertilisers, besides the use of improved varieties of seeds. In the chemical fertilisers the use of Nitrogen, Phosphorus, and potash is prevalent in the State. In 1985-86 the index of fertiliser consumption rose to 1173 showing thereby an increase of 1073 per cent in the fertiliser consumed in the State compared to 1960-61. While in Uttar Pradesh in 1976-77 the index of fertiliser distributed rose to 2514 showing an increase of 2414 per cent in the fertiliser

9. P.S. George and Chandan Mukherjee, op. cit., Page 64.

Table - 3.53 Average Yield of Dry Paddy in Kg/ha. in Autumn and Winter (1973-74 to 1976-77).

District	Virippu (Autumn)			Mundakan (Winter)		
	Irrigated	Unirrigated	Percentage increase over unirrigated	Irrigated	Unirrigated	Percentage increase over unirrigated
Trivandrum	2264	2034	10.22	2347	2379	- 0.93
Quilon	2145	1961	9.38	2645	2560	3.32
Alleppey	2240	2040	9.80	2225	1908	16.61
Kottayam	2632	2201	19.58	2415	2206	9.47
Idukki	2794	2365	18.14	2631	2441	7.78
Ernakulam	2035	1941	4.84	2153	1979	8.79
Trichur	1878	1584	18.56	2004	1694	18.30
Palghat	3140	2578	21.80	2957	2385	23.98
Malappuram	2186	1795	21.78	2007	2157	- 6.96
Kozhikode	1167	1152	1.30	1513	1793	-15.62
Canannore	2046	1936	5.68	1982	1965	0.86
All Kerala	2322	1942	19.57	2334	2106	10.83

Source: Directorate of Economics and Statistics, Trivandrum, Kerala.

Table - 3.54 Average Yield of Paddy (HYV) in Kg/ha. in Autumn, Winter and Summer (1984-85 and 1985-86)

District	Autumn			Winter			Summer		
	Irri-gated	Unirri-gated	Percentage variation over un-irrigated	Irri-gated	Unirri-gated	Percentage variation over un-irrigated	Irri-gated	Unirri-gated	Percentage variation over un-irrigated
Trivandrum	3282	3301	- 0.58	2421	2515	- 3.88	1290	967	25.04
Quilon	2283	3017	-32.15	2805	2441	12.98	--	2410	--
Alleppey	1967	2454	-24.73	3407	3481	- 2.16	4297	4184	2.63
Kottayam	2387	2805	-17.51	2667	3232	-21.17	4055	4131	- 1.86
Idukki	3085	2787	9.66	2940	3482	-18.42	2510	3454	-37.61
Ernakulam	2672	2747	- 3.18	2732	2993	- 9.55	2560	1766	31.02
Trichur	2706	2145	20.73	2918	2460	16.70	3105	--	--
Palghat	3982	3431	13.84	3149	3115	1.08	2784	3044	9.34
Malappuram	2996	2398	19.96	2514	2729	- 8.55	3358	2420	27.93
Kozhikode	--	2233	--	3405	2581	24.20	2845	3497	-22.90
Canannore	4020	2643	34.25	2713	1998	26.34	2422	2058	15.03
All Kerala	3222	2956	8.26	2986	3097	- 3.70	3363	4140	-23.10

Source: Directorate of Economics and Statistics, Trivandrum, Kerala.

distributed in the State compared to 1960-61[10], in Kerala it increased to only 476 per cent during the same period ie., from 1960-61 to 1976-77 (Table 3.55). Such a phenomenal growth in the chemical fertilisers distributed in Uttar Pradesh shows its extent of effectiveness in increasing the productivity per hectare of land. In fact, the use of chemical fertiliser is an important component in vertical expansion of land utilisation programme. For application of scientific methods of cultivation and increasing cropping intensity the role of fertilisers is important. The application of chemical fertilisers to increase fertility of the soil is as important as the application of green manure and compost to preserve its fertility. The chemical fertilisers are useful only when assured irrigation facilities are available.

Table 3.55 presents the statistics on distribution of chemical fertilisers in the state for the period 1960-61 to 1985-86.

It is quite evident that prior to 1966-67 the use of chemical fertiliser was extremely limited (86 thousand tonnes only) in Uttar Pradesh. The use of Chemical fertilisers gained momentum during the green revolution. In the years 1970-71 and 1976-77 the chemical fertilisers were distributed to the extent of 411 and 729 thousand tonnes. It is beyond doubt that the

---

10. Som Nath Pandit, Critical Study of Agricultural Productivity in Uttar Pradesh 1951-75 (1983), concept Publishing Company, New Delhi, Page 74.

Table - 3.55 Fertiliser Consumption in Kerala

Tonnes)

Year	N	F_2O_5	K_2O	Total	Index base 1960-61
1960-61	5314	4703	2032	12049	100.00
1961-62	6264	8461	2248	16973	140.9
1962-63	8296	9033	7948	25277	209.8
1963-64	10148	9452	8853	28952	240.3
1964-65	12746	11210	10252	34208	283.9
1965-66	15251	12773	11305	39329	326.4
1966-67	21016	13373	11030	45419	376.9
1967-68	24000	15689	14853	54542	452.7
1968-69	28574	20442	21514	70330	583.7
1969-70	30120	20347	21543	72010	597.6
1970-71	26335	14183	16139	56655	470.2
1971-72	31257	15670	18044	64971	539.2
1972-73	31484	22314	20470	74268	616.4
1973-74	31691	22609	24546	78846	654.4
1974-75	32143	17187	18032	67362	550.1
1975-76	31654	14374	16643	62671	520.1
1976-77	33553	15696	20157	69406	576.0
1977-78	36995	19167	25394	81556	676.9
1978-79	45689	23382	30766	99837	828.6
1979-80	46341	25402	33872	105615	876.5
1980-81	41697	23402	32431	97530	809.4
1981-82	40612	23214	30935	94761	786.5
1982-83	45233	26555	38065	109853	911.7
1983-84	62480	31178	35819	129477	1074.6
1984-85	57657	32642	37346	127645	1059.4
1985-86	59263	34412	47655	141330	1172.9

Source: 1. Directorate of Agriculture, Trivandrum, Kerala.

Note: Column (6) is estimated from Column (5)

2. Agricultural Statistics in Kerala, 1975.

3. Economic Review, 1986.

use of chemical fertilisers has been increasing continuously in Uttar Pradesh[11], whereas in Kerala, the chemical fertilisers were consumed to the extent of 56 and 69 thousand tonnes only during the same period. In 1985-86 the chemical fertilisers were consumed only to the extent of 141 thousand tonnes in Kerala as a whole. It is evident that the impact of green revolution is meagre in Kerala.

It appears that the consumption rate of fertilisers is very low in Kerala compared to the other rice growing states in India. It shows that one of the causes of low productivity of rice in Kerala is paucity of fertiliser consumption in the State as a whole.

When we consider district-wise fertiliser consumption the percentage consumption of the same was higher in Kottayam, Palghat Quilon and Alleppey with 14.54 per cent, 14.07 per cent, 9.60 per cent and 9.33 per cent respectively during 1984-85 (Table 3.56). Consumption per hectare of gross cropped area was also higher in Kottayam, Alleppey, Palghat and Quilon with 77.88 Kilogram, 70.77 Kilogram, 53.73 Kilogram and 51.35 Kilogram respectively (Table 3.56) during the same year.

It is clear that where there is more consumption of fertilisers, the productivity rate of rice is also high.

Thus it is mainly due to paucity of irrigation facilities, the growth rate of area under paddy particularly HYV has been declining tremendously during recent years. And it is because of the considerable fall in area under paddy, production of paddy

11. <u>Ibid</u>.

Table - 3.56 <u>District-wise Consumption of Plant Nutrients Per Unit of Gross Cropped Area During 1984-85.</u>

Districts/ State	Total consumption (NPK) Tonnes)	Percentage to total	Gross Cropped Area (Hectares)	Percentage to Total	Consumption per hectare of Gross cropped area (Kg.)
Trivandrum	6248	4.89	223061	7.56	28.01
Quilon	12255	9.60	238665	8.09	51.35
Pathanamthitta	1577	1.24	107007	3.63	14.74
Alleppey	11912	9.33	168327	5.71	70.77
Kottayam	18555	14.54	238238	8.08	77.88
Idukki	4217	3.30	169289	5.74	24.91
Ernakulam	11378	8.91	257880	8.75	44.12
Trichur	10911	8.55	239895	8.14	45.48
Palghat	17960	14.07	334255	11.34	53.73
Malappuram	8840	6.93	249390	8.46	35.45
Kozhikode	8387	6.57	190039	6.44	44.13
Wynad	5248	4.11	152110	5.16	34.50
Canannore	10157	7.96	380552	12.90	26.69

Source: Directorate of Agriculture, Trivandrum, Kerala.

also has been decreasing. Inadequate irrigation facilities limit the use of available fertilisers. We may conclude that the combined effect of all the above said factors were principally responsible for low yield per hectare of paddy in Kerala.

Chapter 4

TRENDS IN INPUT AND OUTPUT PRICES

4.1 Movements in the Absolute and Relative Prices of Rice and Coconut

4.2 Trends in Wage Rate and Fertiliser Price

4.3 Growth Rates of Input and Output Prices

4.4 Period-wise Comparative Growth Rates of Input and Output Prices.

Chapter 4

TRENDS IN INPUT AND OUTPUT PRICES

Profitability of a crop depends, among other things, on the input and output prices. This chapter analyses the trends in the input and output prices during 1960-61 to 1985-86 to find out the changes in profitability of cultivation of the two competing crops, viz., rice and coconut.

Movements in the absolute and relative prices of rice and coconut are described in 4.1. 4.2 examines the trends in the two major input prices viz., wage rate and fertiliser price with reference to rice cultivation to identify the probable cause for diminishing profitability of rice cultivation. In order to give a clear picture of the output and input prices and to pinpoint the role of each factor in the declining trend of area under paddy, the growth rates of output and input prices are discussed in 4.3. A period-wise growth rates of the input and output prices are described in 4.4.

4.1. Movements in the Absolute and Relative Prices of Rice and Coconut

Our basic assumption here is that price is an important factor affecting the allocation of area under crops.

The three situations when price may not play this role are:

a) "In a mono-culture economy where the entire area sown belongs to only one crop".

b) "When several crops are sown alongside one another, provided area sown to each crop are so specific that they cannot be transferred to alternative uses" and

c) when two crops are close substitutes for each other at the level of consumption, because in such a case the "prices (of the crops) will tend to move in step and the less therefore, will be the provocation, from price to a shift of area between them".[1]

Kerala is not a mono-culture economy, hence the first possibility is not relevant to this study. Regarding the second, rice and coconut can be grown under similar agroclimatic conditions and that rice area can be converted to coconut gardens. As for the third possibility, rice and coconut are substitutable only to a very limited extent at the level of consumption as rice is a food crop and coconut a cash crop. Again, according to Dharm Narain, "The play of price on foodgrain area is likely to be more significant when foodgrains compete with other crops, rather than with rival foodgrains, for area".[2]

---

1. Dharm Narain, Page 7.

2. Ibid, Page 8.

4.1 examines first the movement of relative prices of rice to coconut and of coconut to rice to see if there is any correlation between them.

The price of paddy in Kerala shows a rising trend from 1960-61 to 1974-75. The price rose from Rs.41 per quintal in 1960-61 to Rs.246 per quintal in 1974-75. There was a slight dip in price between 1967-68 and 1970-71. The same trend is seen at the district level also for all districts. After 1974-75 the price of paddy fell sharply in all districts and the State in general upto 1978-79. There was a smooth increase in the price after 1978-79 (Table 4.1 and Diagrams 4.1 and 4.2). The major part of the increase in the price between 1960-61 and 1974-75 took place between 1960-61 and 1967-68, as can be seen from table 4.2.

Among the districts the northern districts of Canannore, Kozhikode and Palghat showed minimal percentage increase in the price of paddy for the whole period between 1960-61 and 1974-75. On the other hand, the peak prices of paddy in 1967-68, 1974-75 and 1983-84 were high in the southern districts in general compared to the northern districts. Canannore showed the least percentage increase in price and also the lowest absolute price in the peak year 1974-75 (Table 4.2).

This shows that the northern districts have a greater incentive to get out of rice cultivation since their price

Table - 4.1 Farm Harvest Price - Paddy Rs. Per Quintal

Year	Trivandrum	Quilon	Alleppey	Kottayam	Ernakulam	Trichur	Palghat	Kozhikode	Canannore	Kerala
1960-61	47	41	41	41	42	39	39	43	44	41
1961-62	51	46	45	42	44	41	42	41	46	44
1962-63	50	46	43	41	41	38	38	41	44	41
1963-64	51	49	44	41	44	41	45	42	46	44
1964-65	88	83	78	70	73	69	49	72	64	68
1965-66	97	87	94	86	90	89	83	90	75	87
1966-67	121	114	120	116	115	101	87	88	98	102
1967-68	161	156	153	139	153	133	120	118	129	137
1968-69	119	135	114	111	114	104	93	104	113	109
1969-70	119	128	108	103	111	97	90	94	98	102
1970-71	110	111	96	93	98	88	80	85	89	94
1971-72	120	117	104	107	107	99	91	93	91	100
1972-73	140	132	124	127	130	120	113	121	111	119
1973-74	228	198	185	187	208	190	180	190	161	187
1974-75	319	268	240	258	279	251	226	252	214	246
1975-76	225	205	184	189	196	182	165	187	168	189
1976-77	168	156	142	138	157	141	135	159	133	148
1977-78	150	139	125	122	137	125	126	136	121	133
1978-79	151	138	122	119	132	123	121	129	114	128
1979-80	168	143	129	126	141	128	129	139	127	137
1980-81	176	160	159	149	165	150	146	156	139	156
1981-82	197	194	185	192	195	175	171	187	159	184
1982-83	227	223	213	217	219	213	204	215	181	212
1983-84	299	253	252	265	268	257	233	267	253	261
1984-85	265	209	207	245	209	197	186	222	220	218
1985-86	309	238	244	236	252	217	233	247	241	246

Source: Op. cit., 1. Season and Crop Reports, Various years.

2. Unpublished data for latest period obtained from the Directorate of Economics and Statistics.

DIAGRAM 4.1

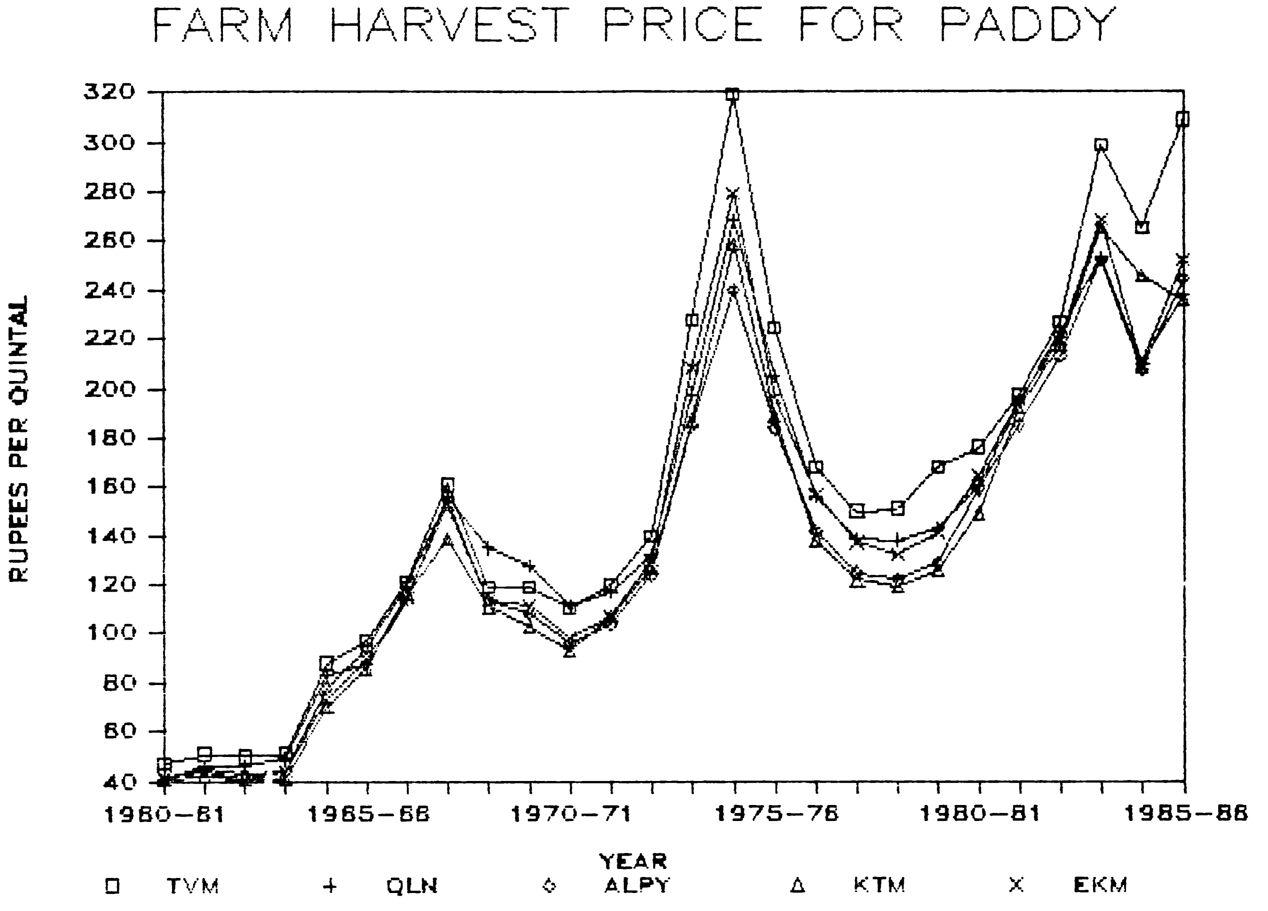

FARM HARVEST PRICE FOR PADDY
RUPEES PER QUINTAL
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
1960-61
1965-66
1970-71
1975-76
1980-81
1985-86
YEAR
TVM
QLN
ALPY
KTM
EKM

DIAGRAM 4.2

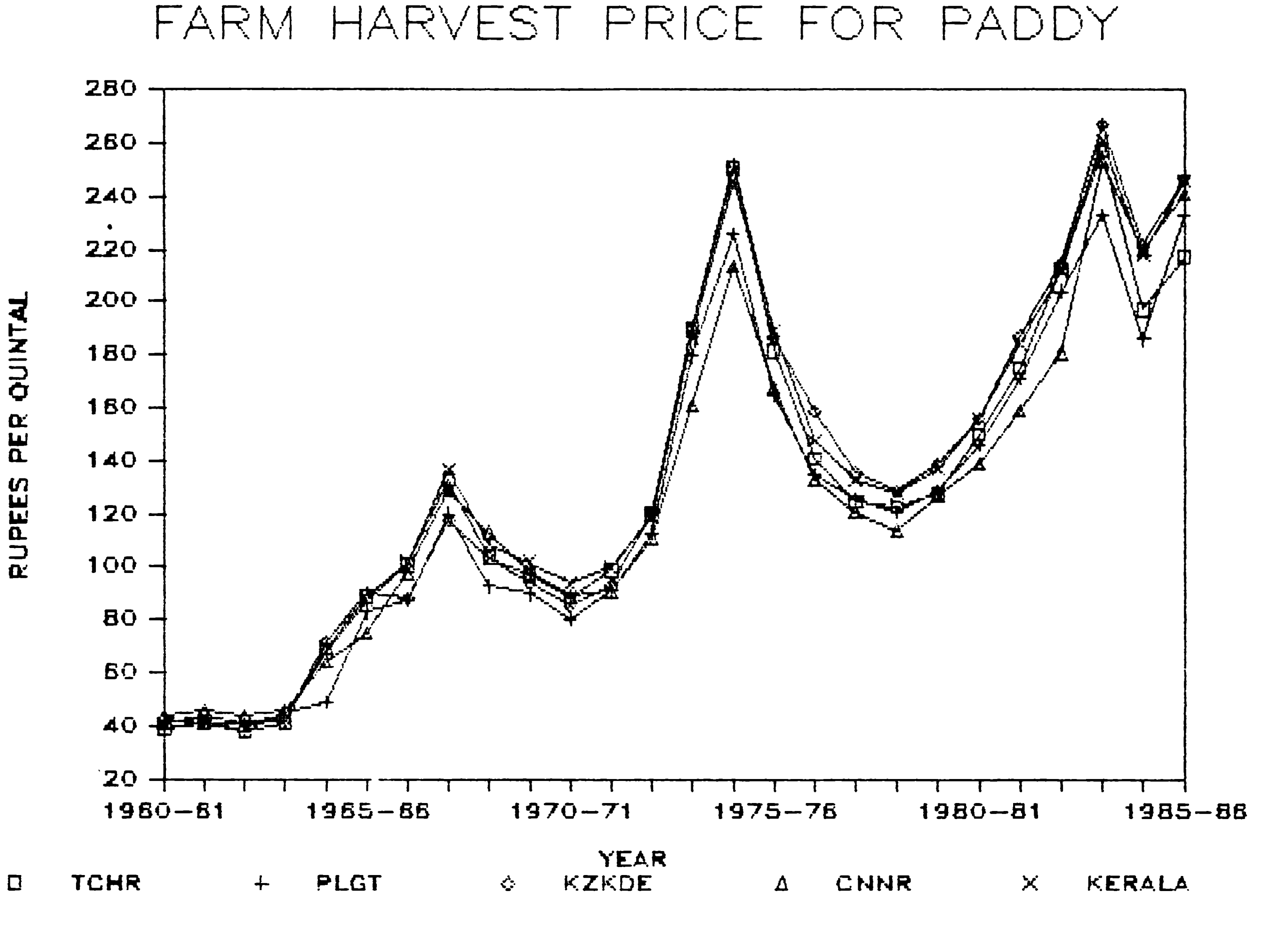

FARM HARVEST PRICE FOR PADDY
RUPEES PER QUINTAL
280
260
240
220
200
180
160
140
120
100
80
60
40
20
1960—61
1965—66
1970—71
1975—76
1980—81
1985—86
YEAR
□ TCHR
+ PLGT
◇ KZKDE
Δ CNNR
× KERALA

Table - 4.2 Percentage Changes and Absolute Prices(Rs./Qtl.) of Paddy - Farm Harvest Prices

District	Percentage change in Prices								Absolute Peak Prices		
	1960-61 to 1967-68	1967-68 to 1970-71	1960-61 to 1974-75	1974-75 to 1978-79	1974-75 to 1984-85	1978-79 to 1983-84	1960-61 to 1984-85	1960-61 to 1983-84	1967-68	1974-75	1983-
Trivandrum	242.55	-31.68	578.72	-52.66	-16.93	98.01	463.83	536.17	161	319	299
Quilon	280.49	-28.85	553.66	-48.51	-22.01	83.33	409.76	517.07	156	268	253
Alleppey	278.05	-38.06	485.37	-49.17	-13.75	106.56	404.88	514.63	155	240	252
Kottayam	239.02	-33.09	529.27	-53.88	- 5.04	122.69	497.56	546.34	139	258	265
Ernakulam	264.29	-35.95	564.29	-52.69	-25.09	103.03	397.62	538.10	153	279	268
Trichur	241.03	-33.83	543.59	-51.00	-21.52	108.94	405.13	558.97	133	251	25[illegible]
Palghat	207.69	-33.33	479.49	-46.46	-17.70	92.56	376.92	497.44	120	226	23[illegible]
Kozhikode	174.42	-27.97	486.05	-48.81	-11.90	106.98	416.28	520.93	118	252	26[illegible]
Canannore	193.18	-31.01	386.36	-46.78	+ 2.80	121.93	400.00	475.00	129	214	25[illegible]
Kerala	234.15	-31.39	500.00	-47.97	-11.38	103.91	431.71	536.59	137	246	26[illegible]

Note: Maximum percentage changes and greater absolute prices have been emphasised.

Source: Percentage changes in prices have been calculated from the absolute prices of paddy given in Table 4.1.

advantage in rice is the least. It is perhaps mainly in these districts that conversion of paddy lands to coconut gardens largely occurs.

The general trend in coconut prices shows continuous rise from 1960-61 to 1985-86, both at the all Kerala and at the district levels. It dipped slightly in 1968-69, 1971-72, 1975-76 and 1984-85 but then continued to rise thereafter (Table 4.3 and Diagrams 4.3 and 4.4).

The major part of this increase in prices occurred between 1960-61 and 1974-75, as is seen in table 4.4. Within this period the increase in prices was more prominent between 1960-61 and 1967-68 and from 1971-72 to 1974-75.

Among the districts, the northern districts of Canannore, Kozhikode and Palghat witnessed the maximum increase in coconut prices. This was followed by Ernakulam and Trichur in the various periods (Table 4.4).

In the northern districts, greater increase in coconut price together with the lower percentage increases and absolute price of rice (seen earlier) gave incentive to increase area under coconut cultivation at the expense of rice. These districts show movement of area away from rice.

As pointed out by Dharm Narain, "attempts to examine the effect of price on acreage changes under a particular crop

Table - 4.3 Price of Coconut, Rs. Per 1000 nuts

Year	Trivandrum	Quilon	Alleppey	Kottayam	Ernakulam	Trichur	Palghat	Kozhikode	Canannore	Kerala
1960-61	21.5	22.1	22.8	24.1	22.6	23.4	21.2	18.2	19.5	21.5
1961-62	21.0	20.3	23.2	23.7	23.5	21.6	--	19.7	18.9	21.4
1962-63	24.4	24.3	26.4	25.6	27.0	25.1	--	23.3	24.0	24.7
1963-64	23.8	23.7	25.3	26.3	25.7	25.6	--	21.7	22.6	24.0
1964-65	26.2	26.9	28.1	28.3	29.5	29.0	--	24.6	24.2	26.8
1965-66	39.1	39.5	39.1	40.3	43.0	42.8	--	37.5	34.7	39.2
1966-67	35.6	35.8	38.3	39.6	40.5	39.6	34.2	34.4	34.9	36.8
1967-68	40.1	45.1	46.2	47.4	49.3	48.4	45.1	45.6	42.1	45.4
1968-69	35.6	41.6	39.4	41.1	43.7	41.3	35.8	37.5	37.4	39.3
1969-70	44.5	47.8	50.0	52.8	56.1	52.2	51.6	49.4	48.4	49.8
1970-71	49.7	55.6	58.8	61.2	66.3	58.7	58.6	54.1	57.3	57.1
1971-72	38.2	42.4	44.6	45.3	48.1	40.9	40.2	38.5	42.1	42.1
1972-73	48.1	55.2	55.4	57.5	55.1	53.9	49.9	49.5	51.1	52.8
1973-74	83.2	87.6	90.8	94.8	99.5	91.8	87.3	86.2	90.6	89.0
1974-75	78.8	85.7	87.6	89.7	94.4	88.8	88.0	79.0	87.4	85.1
1975-76	61.8	66.6	66.7	68.2	75.4	70.1	71.8	63.9	62.0	67.4
1976-77	83.1	89.8	95.9	98.2	104.9	94.2	80.9	85.5	89.5	91.3
1977-78	90.7	96.3	99.0	103.7	111.6	107.3	99.6	91.7	95.6	101.4
1978-79	92.9	101.3	103.6	104.6	117.7	109.0	103.0	92.6	103.6	103.1
1979-80	104.1	121.4	119.3	117.1	129.2	122.2	110.4	104.7	112.3	115.6
1980-81	132.4	138.8	140.8	140.1	143.9	154.6	134.9	125.3	140.6	139.0
1981-82	105.0	115.8	119.1	114.4	119.6	126.5	103.1	106.2	110.7	113.4
1982-83	127.5	144.7	148.6	142.8	157.9	158.6	148.3	136.2	143.8	145.4
1983-84	225.3	256.4	243.4	242.8	264.5	257.5	252.5	234.1	234.40	245.6
1984-85	242.3	270.9	270.7	275.0	283.2	272.5	267.3	237.3	268.2	265.3
1985-86	133.0	152.6	153.6	148.0	163.7	162.4	146.4	129.9	130.8	146.7

Source: Same as in Table 4.1.

DIAGRAM 4.3

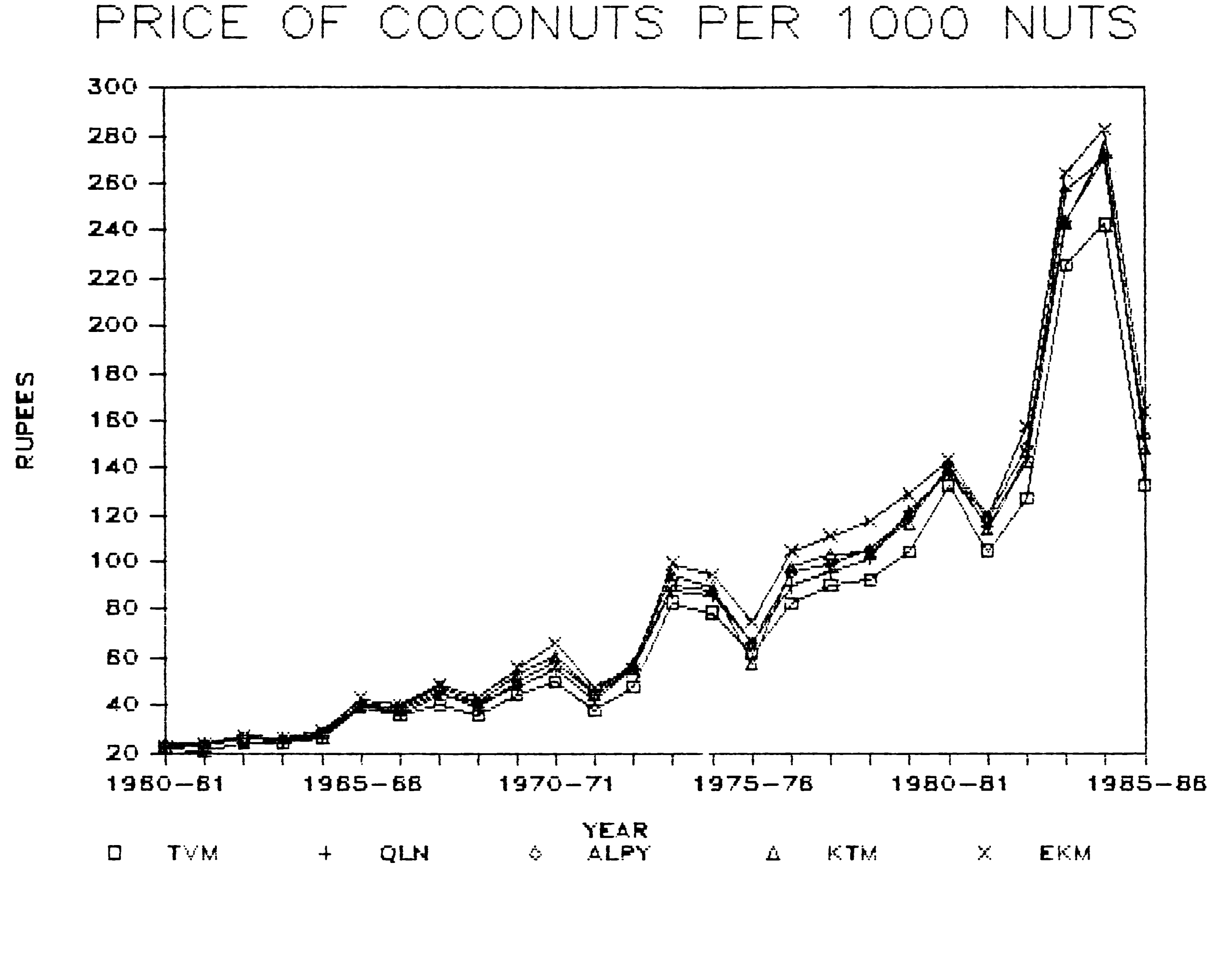

PRICE OF COCONUTS PER 1000 NUTS
RUPEES
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
1960-61
1965-66
1970-71
1975-76
1980-81
1985-86
YEAR
TVM
QLN
ALPY
KTM
EKM

DIAGRAM 4.4

PRICE OF COCONUTS PER 1000 NUTS

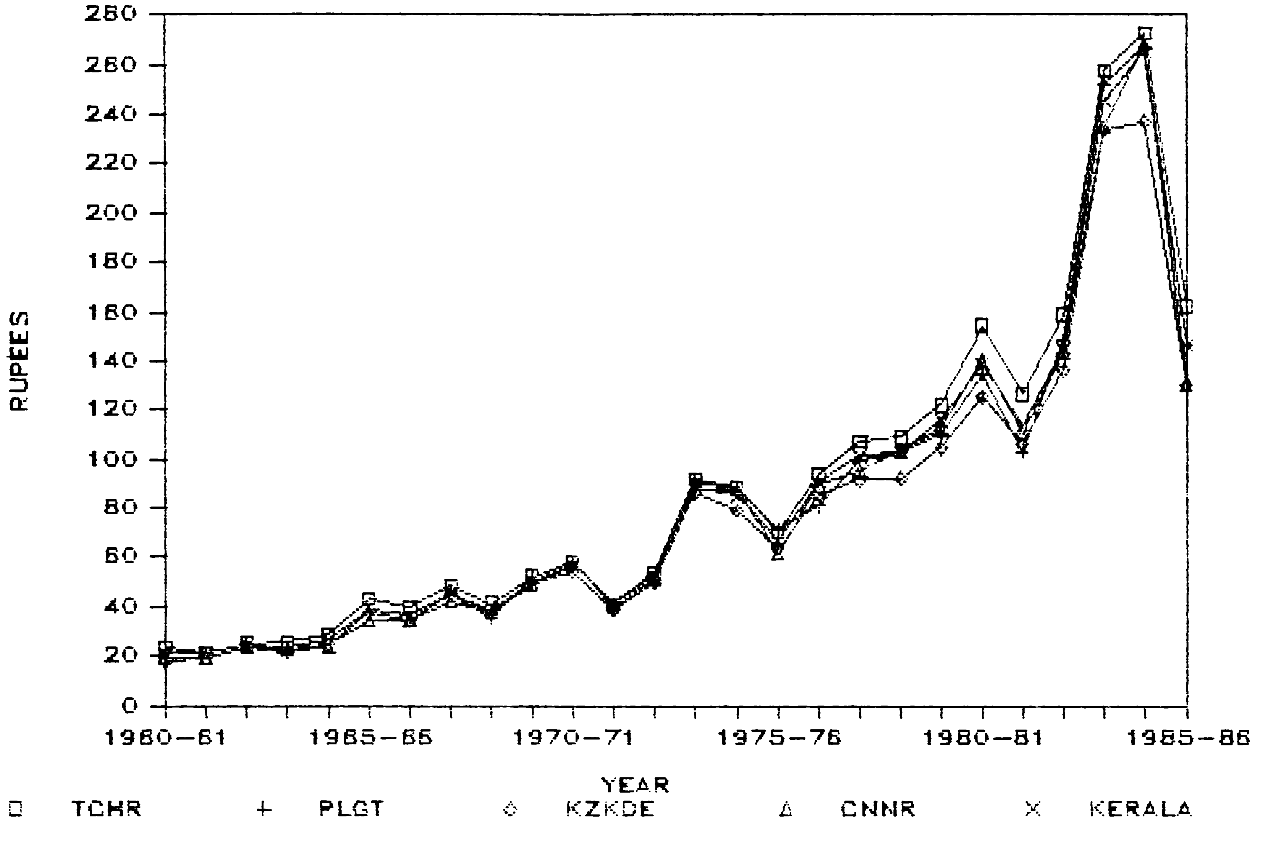


Table - 4.4 Percentage Changes in Farm Harvest Prices of Coconut

District	1960-61 to 1967-68	1971-72 to 1974-75	1968-69 to 1974-75	1960-61 to 1974-75	1960-61 to 1984-85	1974-75 to 1984-85
Trivandrum	87.04	106.20	121.35	267.32	1026.98	207.49
Quilon	104.35	102.29	117.51	288.44	1125.79	<u>216.10</u>
Alleppey	102.23	96.52	122.34	283.49	1087.28	209.02
Kottayam	96.35	97.92	118.25	271.72	1041.08	206.58
Ernakulam	118.51	96.11	116.02	317.85	1153.10	200.00
Trichur	106.88	116.83	115.01	279.20	1064.53	206.87
Palghat	113.19	<u>119.04</u>	<u>145.81</u>	315.83	1160.85	203.75
Kozhikode	<u>149.97</u>	104.96	110.67	333.19	1203.85	200.38
Canannore	115.78	107.77	133.69	<u>347.69</u>	<u>1275.38</u>	206.86
Kerala	111.32	102.35	116.54	296.51	1133.95	211.75

Note: Maximum percentage increases within each period have been emphasised.

Source: Percentage increases in prices have been calculated from the absolute prices of coconut given in Table 4.3.

with reference to the price of only that crop are inadequate. The significance of a price change when other prices remain constant is different from what it would be when other prices also change. Hence the need for correction: to convert crude prices into more meaningful ones".[3] Various 'correction factors' have been used for the purpose. The index of prices of goods and services used by the farmer, a general index of wholesale prices, an index of agricultural prices and prices of competing crops are some of them.

Thus besides absolute price movements the relative price movements of rice and coconut are looked into. It is seen that for all Kerala the relative price, price of rice/price of coconut, moved in favour of rice till 1967-68. Between 1967-68 and 1974-75 it fluctuated, but with a declining trend. After 1974-75 the relative price of rice to coconut fell sharply upto 1984-85, even though there was fluctuation after 1980-81 (Table 4.5 and Diagrams 4.5 and 4.6). Thus the relative price moved in favour of coconut after 1967-68.

A similar trend is seen in all the districts. In Kozhikode and Trichur though the rise in relative prices was in favour of rice in 1974-75 it went above the peak in 1967-68, but tapered off immediately after (Table 4.5).

---

3. Ibid, Page 11.

Table - 4.5 Relative Price of Paddy to Coconut

$\frac{PR}{PC} \times 100$

Year	Trivandrum	Quilon	Alleppey	Kottayam	Ernakulam	Trichur	Palghat	Kozhikode	Canannore	Kerala
1960-61	219	186	180	170	186	167	184	236	225	191
1961-62	243	226	194	177	187	190	--	208	244	206
1962-63	205	189	163	160	152	152	--	176	183	165
1963-64	214	207	174	156	171	160	--	194	203	183
1964-65	336	308	278	248	247	238	--	292	265	254
2965-66	248	320	240	213	209	208	--	240	216	222
1966-67	340	319	313	293	284	255	254	256	281	277
1967-68	401	346	336	293	310	275	266	259	306	302
1968-69	334	324	290	270	261	252	260	277	302	278
1969-70	268	268	216	195	198	186	174	190	237	205
1970-71	221	200	163	152	148	150	137	157	155	165
1971-72	314	276	223	241	222	242	227	241	216	238
1972-73	291	239	224	221	236	223	226	244	217	225
1973-74	274	226	204	197	209	207	206	220	178	210
1974-75	405	313	274	288	296	283	257	319	245	289
1975-76	364	308	276	277	260	260	230	293	271	280
1976-77	202	174	148	140	150	150	167	186	149	162
1977-78	165	144	126	118	123	117	126	148	127	131
1978-79	163	136	118	114	112	113	118	139	110	124
1979-80	161	118	108	108	109	105	117	133	113	119
1980-81	133	115	113	106	115	111	108	125	99	112
1981-82	187	168	155	168	163	138	166	176	145	162
1982-83	177	154	143	152	139	134	138	158	126	146
1983-84	133	99	104	109	101	100	92	114	108	106
1984-85	110	77	77	87	74	72	70	94	82	82
1985-86	232	156	159	159	154	134	159	190	184	168

Note: PR: Price of Rice. PC: Price of Coconut.

Source: Computed from Tables 4.1 and 4.3.

DIAGRAM 4.5

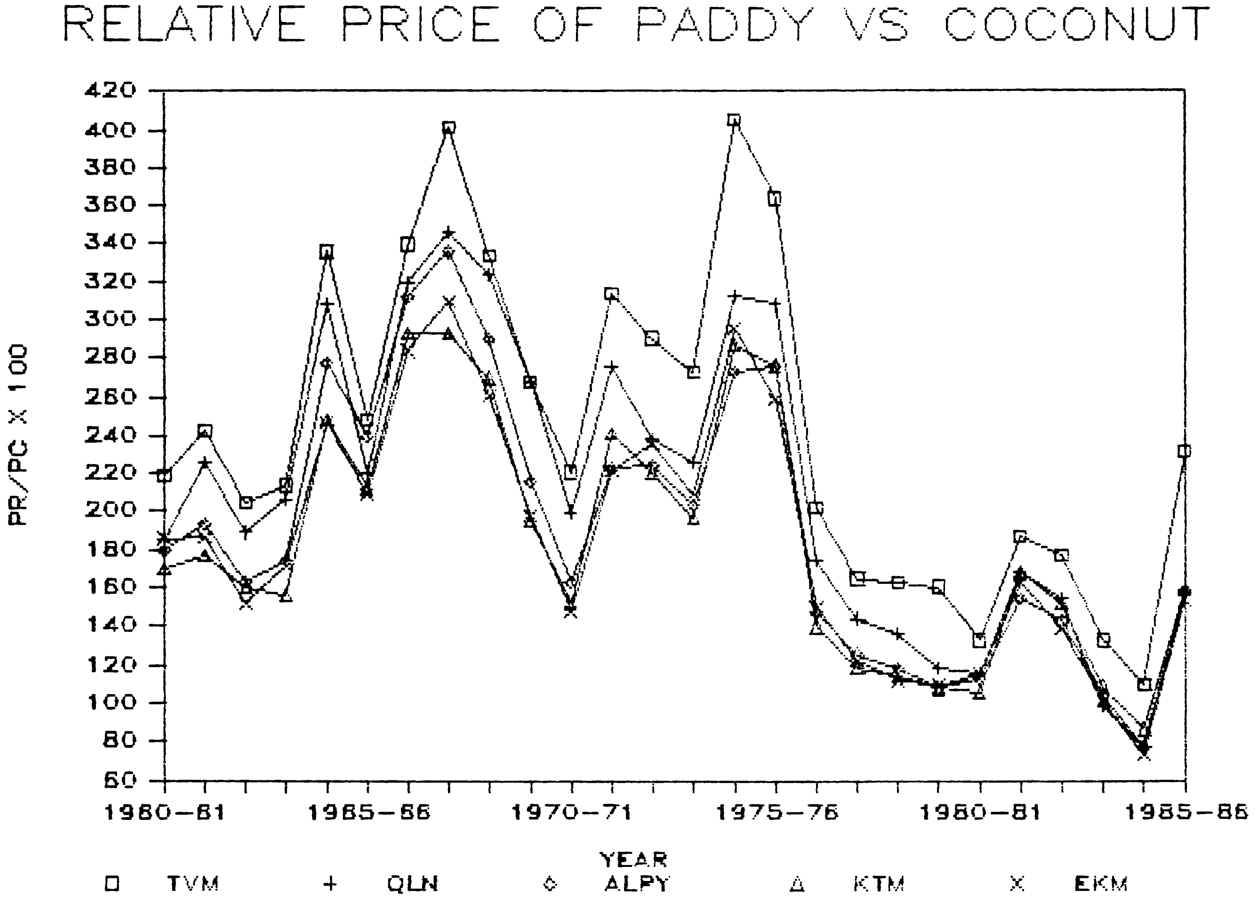

RELATIVE PRICE OF PADDY VS COCONUT
PR/PC X 100
420
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
1960-61
1965-66
1970-71
1975-76
1980-81
1985-86
YEAR
TVM
QLN
ALPY
KTM
EKM

DIAGRAM 4.6

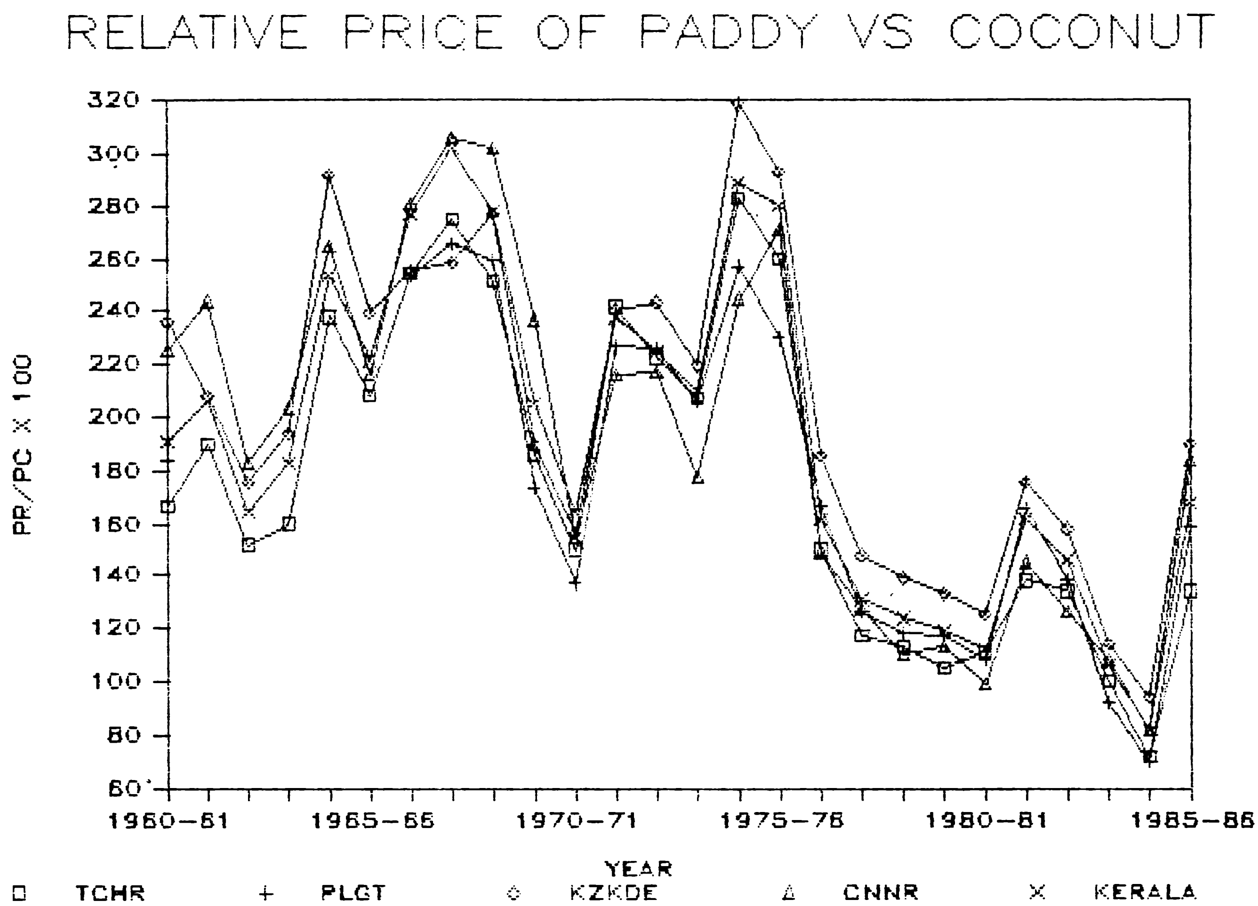

RELATIVE PRICE OF PADDY VS COCONUT
320
300
280
260
240
220
200
180
160
140
120
100
80
60
PR/PC X 100
1960—61
1965—66
1970—71
1975—76
1980—81
1985—86
YEAR
□ TCHR
+ PLGT
◇ KZKDE
△ CNNR
× KERALA

Table - 4.6 Relative Prices of Coconut to Paddy $\frac{PC}{PR}$ x 100

Year	Trivandrum	Quilon	Alleppey	Kottayam	Ernakulam	Trichur	Palghat	Kozhikode	Canannore	Kerala
1960-61	45.7	53.9	55.6	58.8	53.8	60.0	54.4	42.3	44.3	52.4
1961-62	41.2	44.1	51.6	56.4	53.4	52.7	--	48.0	41.1	48.6
1962-63	48.8	52.8	61.4	62.4	65.9	66.1	--	56.8	54.5	60.2
1963-64	46.7	48.4	53.7	64.1	58.4	62.4	--	51.7	49.1	54.5
1964-65	29.8	32.4	36.0	40.4	40.4	42.0	--	34.2	37.8	39.4
1965-66	40.3	45.4	41.6	46.9	47.8	48.1	--	41.7	46.3	45.1
1966-67	29.4	31.4	31.9	34.1	35.2	39.2	39.3	39.1	35.6	36.1
1967-68	24.9	28.9	29.8	34.1	32.2	36.4	37.3	38.6	32.6	33.1
1968-69	29.9	30.8	34.6	37.0	38.3	39.7	38.5	36.1	33.1	36.1
1969-70	37.4	37.3	46.3	51.3	50.5	53.8	57.3	52.6	49.4	48.8
1970-71	45.2	50.1	61.3	65.8	67.7	66.7	73.3	63.6	64.4	60.7
1971-72	31.8	36.2	42.9	42.3	45.0	41.3	44.2	41.4	46.3	42.1
1972-73	34.4	41.8	44.7	45.3	42.4	44.9	44.2	40.9	46.0	44.4
1973-74	36.5	42.0	49.1	50.7	47.8	48.3	48.5	45.4	56.3	47.6
1974-75	24.7	32.0	36.5	34.8	45.4	35.4	38.9	31.3	40.8	34.6
1975-76	27.5	32.5	36.3	36.1	27.0	38.5	43.5	34.2	36.9	35.7
1976-77	49.5	57.6	67.5	71.2	53.5	66.8	59.9	53.8	67.3	61.7
1977-78	60.5	69.3	79.2	85.0	71.1	85.8	79.0	67.4	79.0	76.2
1978-79	61.5	73.4	84.9	87.9	89.2	88.6	85.1	71.8	90.9	80.5
1979-80	62.0	84.9	92.5	93.0	91.6	95.5	85.6	75.3	88.4	84.4
1980-81	75.2	86.8	88.6	94.0	87.2	103.1	92.4	80.3	101.2	89.1
1981-82	53.3	59.7	64.4	59.6	61.3	72.3	60.3	56.8	69.6	61.6
1982-83	56.2	64.9	69.8	65.8	72.1	74.5	72.7	63.6	79.4	68.6
1983-84	75.4	101.3	91.8	91.6	98.7	100.2	108.4	87.8	92.6	94.1
1984-85	91.4	129.6	130.8	112.2	105.7	138.3	143.7	106.9	121.9	121.7
1985-86	43.0	61.1	63.0	62.7	65.0	74.8	62.8	52.6	54.3	59.6

Note: PC - Price of Coconut. PR - Price of Rice.

Source: Computed from Tables 4.1 and 4.3.

DIAGRAM 4.7

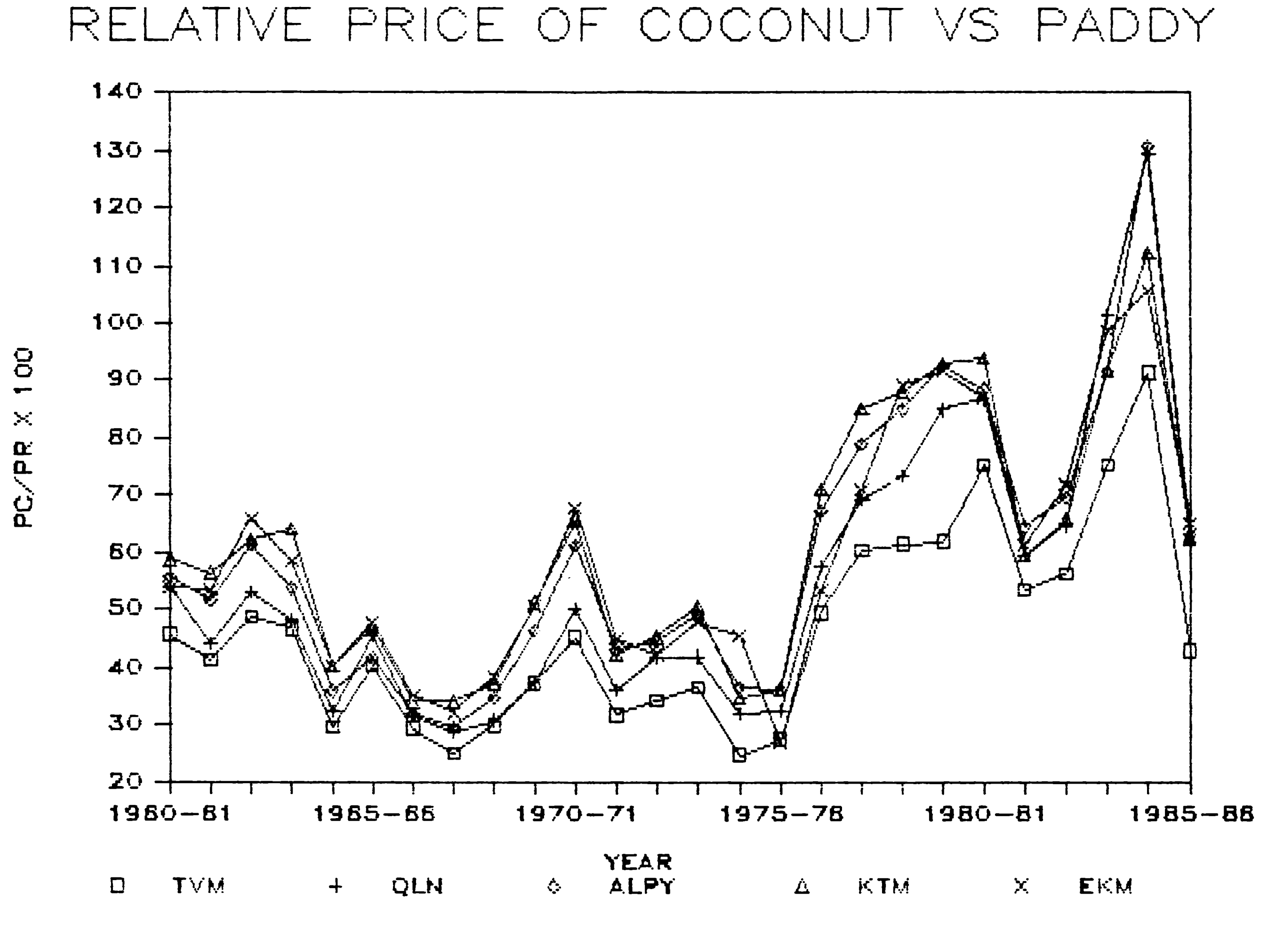
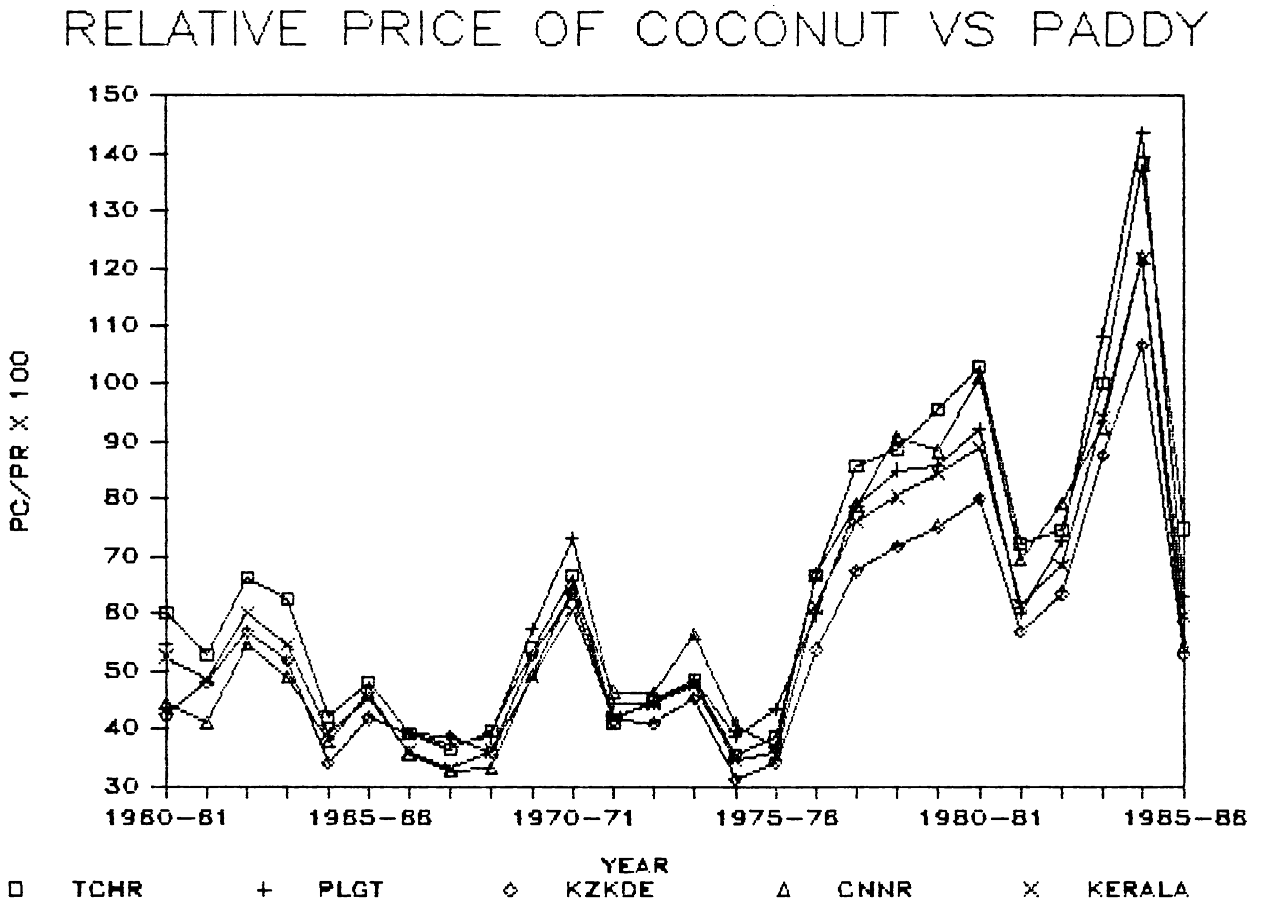

RELATIVE PRICE OF COCONUT VS PADDY
140
130
120
110
100
90
80
70
60
50
40
30
20
PC/PR X 100
1960-61
1965-66
1970-71
1975-76
1980-81
1985-86
YEAR
□ TVM
+ QLN
◇ ALPY
△ KTM
X EKM

DIAGRAM 4.8


RELATIVE PRICE OF COCONUT VS PADDY
PC/PR X 100
150
140
130
120
110
100
90
80
70
60
50
40
30
1960-61
1965-66
1970-71
1975-76
1980-81
1985-86
YEAR
TCHR
PLGT
KZKDE
CNNR
KERALA

This was expected to result in increases in rice area until 1967-68 as the relative price moved in favour of it, but then began to stagnate and started falling after 1974-75 as the relative price began to move in favour of coconut after 1967-68.

In the case of coconut, the price increased steadily almost throughout the period from 1960-61 to 1984-85. But the relative price of coconut fluctuated rather erratically. It was perhaps that rice is not the only substitute for coconut. Coconut can substitute other garden land crops also (Table 4.6 and Diagrams 4.7 and 4.8).

These absolute and relative price movements over the last 26 years could have some impact on the profitability of cultivation of these two crops. On the one hand, fluctuating prices and relative prices of rice and their plunge in the later year, (together with rising input prices) added to the insecurity of rice cultivation and to the consequent fall in area under rice. On the other hand, the consistent rise in coconut prices led to the buoyancy of coconut cultivation and the continued increase in area under coconut.

4.2 Trends in wage Rate and Fertiliser Price

There has been a phenominal increase in the money wage rates of agricultural workers. The wage rate of a male worker increased by 1197.3 per cent between 1960-61 and 1985-86. The money wage rates rose consistently from 1960-61 to 1985-86 in the districts also (Table 4.7 and Diagrams 4.9 and 4.10). The only district which showed some decline in wage rates after 1974-75 is Palghat.

The maximum increase in wage rates occurred in the northern - most districts of Canannore and Kozhikode and the southern - most district of Trivandrum (Table 4.8). The bulk of the change in wages occurred in the first phase, 1960-61 to 1967-68. In Kozhikode and Canannore the wage increase was concentrated in the later phases, ie. after 1968-69. This was perhaps owing to the fact that these northern districts had higher wage rates in the initial period itself (Table 4.9).

The money wage rates have been consistently high in Canannore. Kozhikode, Ernakulam and Trichur also have high wage rates compared to the rest of the State.

The exceptionally high wage rates even in the initial period, and the phenomenal increase in wage rates particularly in the latter phases made rice cultivation less attractive in Canannore than in other districts. Since wage cost constitutes around 45 to 75 per cent of total cost, and paddy is cultivated almost wholly by hired labour[4], any increase in wage rate, Ceteris Paribus adversely affect profitability of paddy cultivation.

---

4. Jeemol Unni (1981), Page 69.

Table - 4.7 Agricultural Wages - Paddy Farm Labourers (Men)

(Rupees)

Year	Trivandrum	Quilon	Alleppey	Kottayam	Ernakulam	Trichur	Palghat	Kozhikode	Canannore	Kerala
1960-61	1.59	1.80	1.78	1.71	--	1.97	1.45	2.05	2.48	1.85
1961-62	2.20	1.77	1.99	1.87	2.62	2.41	1.85	2.46	2.84	2.22
1962-63	2.41	2.02	2.28	1.78	2.89	2.87	2.28	2.36	2.92	2.42
1963-64	2.44	2.07	2.27	2.03	3.32	2.98	2.13	2.42	3.12	2.51
1964-65	2.69	2.55	2.79	2.37	3.69	3.21	2.52	2.85	3.21	2.84
1965-66	2.96	2.92	3.14	2.93	4.01	3.85	2.71	3.18	3.72	3.20
1966-67	3.68	3.25	3.90	3.27	4.29	5.09	2.36	3.53	4.30	3.71
1967-68	4.50	4.02	4.67	3.96	4.95	5.35	4.02	4.53	4.46	4.46
1968-69	4.71	4.35	4.72	4.32	5.00	5.45	4.26	4.33	5.51	4.73
1969-70	4.83	4.47	5.37	4.96	5.00	5.62	4.29	4.33	5.44	4.90
1970-71	4.75	4.47	5.43	5.04	5.83	5.95	4.05	4.39	6.23	5.09
1971-72	4.75	4.47	5.47	6.38	5.94	5.98	4.58	4.60	6.78	5.43
1972-73	5.10	4.72	5.97	6.75	6.92	7.26	5.05	4.86	6.93	5.78
1973-74	5.88	6.00	6.57	5.73	6.88	7.26	7.37	6.19	9.04	6.67
1974-75	6.96	7.25	7.70	7.54	8.71	8.08	8.39	7.81	11.10	8.05
1975-76	7.58	7.50	8.29	8.40	9.63	8.50	6.94	9.15	11.14	8.57
1976-77	7.96	7.73	7.90	7.38	9.69	8.50	6.18	9.06	11.38	8.44
1977-78	8.00	8.00	8.00	7.25	9.75	8.50	6.35	9.00	12.13	8.67
1978-79	8.00	8.46	8.05	7.25	9.79	8.88	6.75	9.71	12.96	8.99
1979-80	8.90	10.90	8.53	7.40	10.25	10.09	7.15	10.17	13.25	9.58
1980-81	11.04	11.96	11.68	8.31	10.73	12.46	8.08	11.40	14.08	11.13
1981-82	12.83	13.88	12.92	10.91	12.50	14.40	9.08	12.98	14.50	12.74
1982-83	13.92	14.50	14.38	13.08	13.25	14.25	9.79	13.00	14.50	13.24
1983-84	15.77	16.09	16.27	15.14	15.91	17.23	12.50	15.09	15.86	16.08
1984-85	23.79	21.17	21.00	19.23	26.88	25.75	15.69	23.08	33.25	23.41
1985-86	25.00	24.38	24.71	21.85	26.50	28.55	17.13	25.00	39.25	25.96

Source: Op. cit., 1. Season and Crop Reports, Various years.

2. Statistics for Planning 1980, 1983, 1986.

3. Unpublished data for the latest period obtained from the Directorate of Economics & Statistics.

DIAGRAM 4.9

WAGES OF PADDY FIELD LABOURERS – MEN

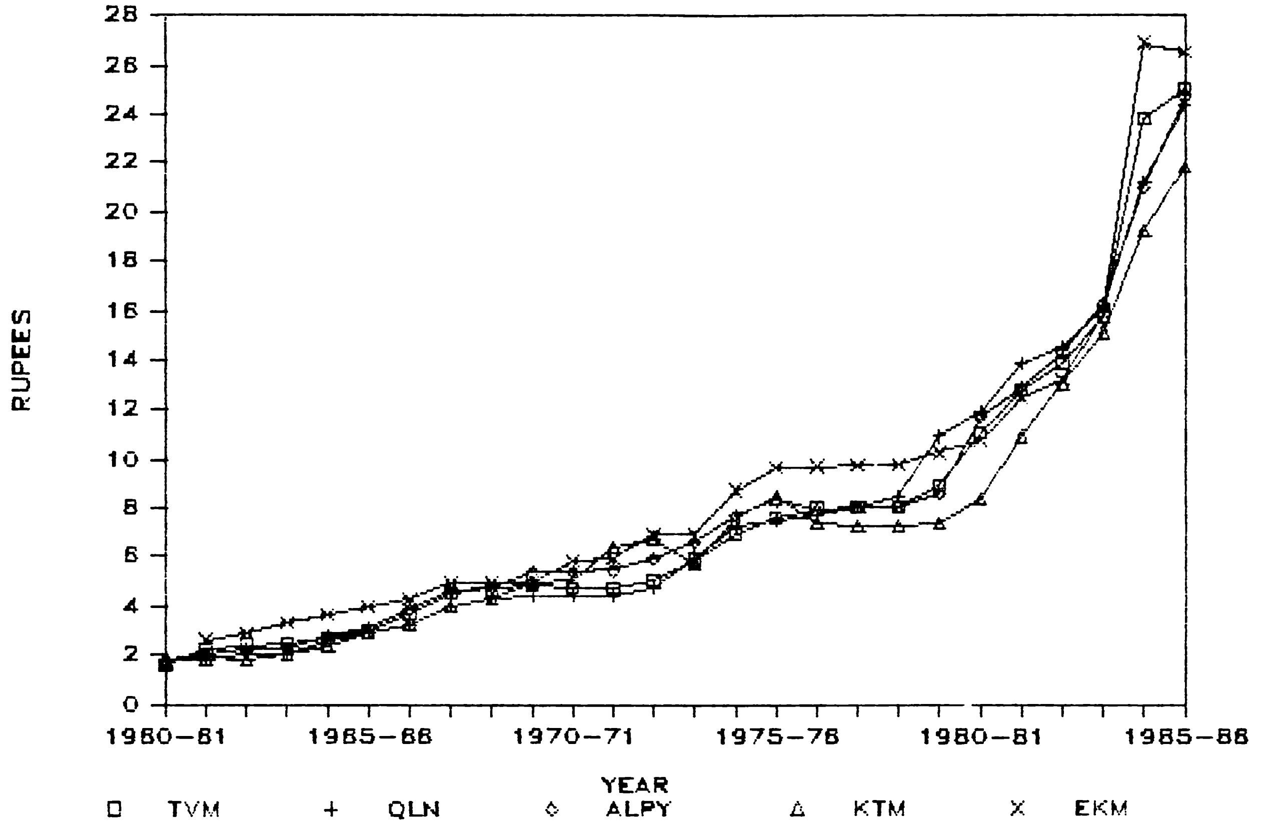
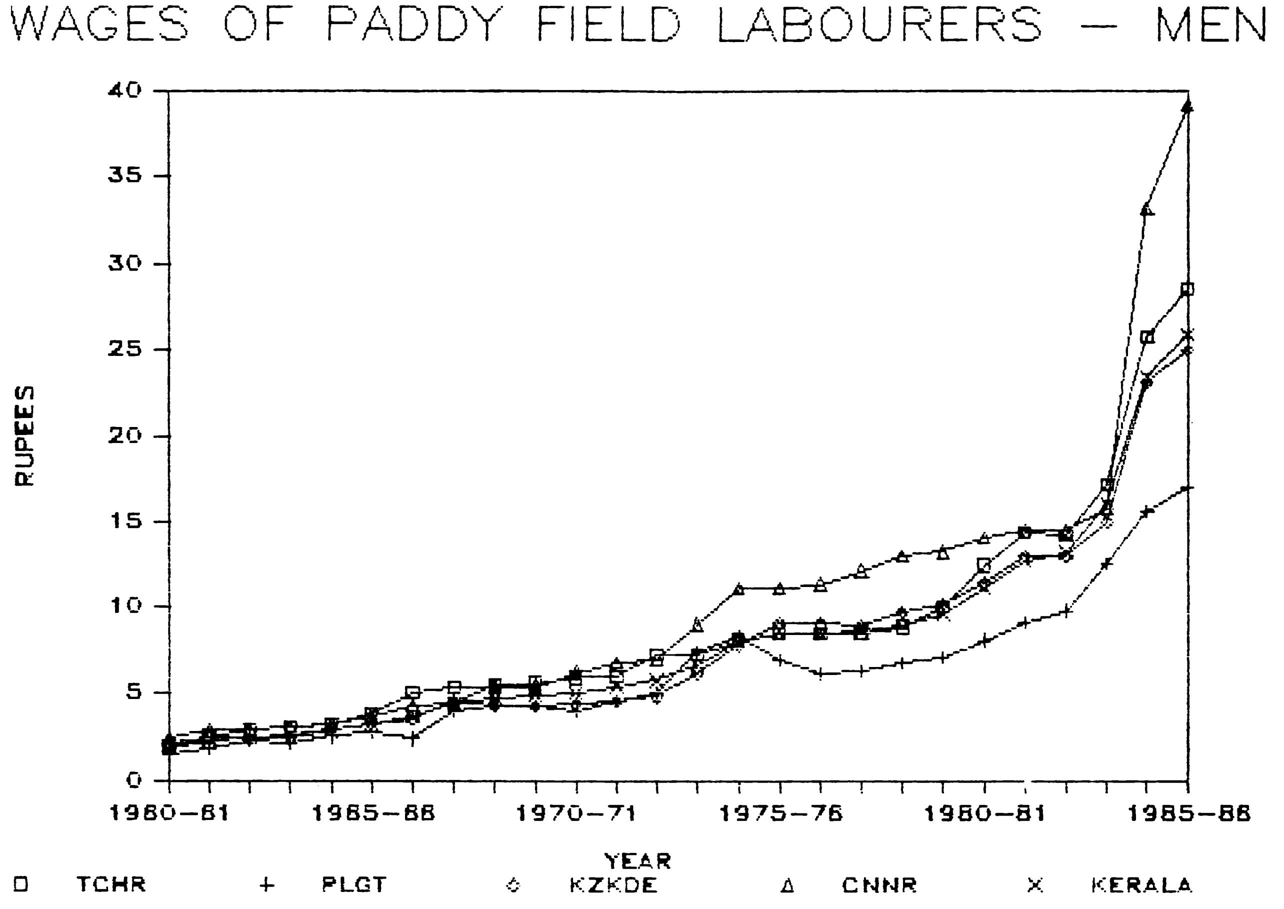


DIAGRAM 4.10



WAGES OF PADDY FIELD LABOURERS — MEN
RUPEES
40
35
30
25
20
15
10
5
0
1960–61
1965–66
1970–71
1975–76
1980–81
1985–86
YEAR
□ TCHR
+ PLGT
◇ KZKDE
Δ CNNR
× KERALA

Comparing the increase in wage rates with the increase in price of paddy in the period 1960-61 to 1974-75, it is seen that the wage rates increased more sharply in the northern districts whereas paddy prices increased more sharply in the southern districts. With the faster increase in wages and the slower increase in prices, the decline in profitability of rice cultivation has been much greater in the northern districts.

Next to labour cost, the fertiliser cost is seen to be the largest constituent of total cost in paddy cultivation. Whereas labour cost constitutes 45 to 75 per cent of total costs, fertiliser costs constitute 25 to 45 per cent of the total costs.[5] Hence the trend in fertiliser prices could have a significant influence on the costs of cultivation of paddy.

Fertiliser prices were almost uniform throughout the country except for minor regional differences, as can be seen from table 4.11. Hence we shall use the all-India Fertiliser prices to see the trend in fertiliser price.

The index numbers of the fertiliser prices, constructed from the all-India prices of fertilisers, show a slight fall in the initial period from 1960 to 1965. It then began to rise upto 1974, rising sharply between 1973 and 1974. There was a fall in prices after 1974 upto 1978-79. Then there was a sharp increase between 1979 and 1982 and remained constant upto 1984-85, as seen in tables 4.10 and 4.11 and Diagram 4.11.

---

5. Ibid, Page 71.

Table - 4.8 Percentage Changes in Wage Rates of Paddy Farm Labour

(Male)

District	1960-61 to 1968-69	1968-69 to 1974-75	1960-61 to 1974-75	1974-75 to 1985-86	1960-61 to 1985-86
Trivandrum	196.23	47.77	337.74	259.20	1472.33
Quilon	141.67	66.67	302.78	236.28	1254.44
Alleppey	165.17	63.14	332.58	220.91	1288.20
Kottayam	152.63	74.54	340.94	189.79	1177.78
Ernakulam	90.84	74.20	232.44	204.25	911.45
Trichur	171.57	51.03	310.15	253.34	1449.24
Palghat	193.79	96.95	478.62	104.17	1081.38
Kozhikode	111.22	80.35	346.34	220.10	1119.12
Canannore	122.18	101.45	347.58	253.60	1482.66
Kerala	155.68	70.19	335.14	222.48	1303.24

Note: 1. Initial year refers to 1961-62 since data for 1960-61 was not available.

2. This refers to the period 1960-61 to 1975-76. In Kozhikode there is a sharp increase in wage rate between 1974-75 and 1975-76 which continues unabated thereafter.

Source: Percentage changes in wage rates have been calculated from the Absolute Wage Rates given in Table 4.7.

Table - 4.9 Wage Rates of Paddy Farm Labour(Male)

(Rupees)

District	1960-61	1968-69	1974-75	1985-86
Trivandrum	1.59	4.71	6.96	25.00
Quilon	1.80	4.35	7.25	24.38
Alleppey	1.78	4.72	7.70	24.71
Kottayam	1.71	4.32	7.54	21.85
Ernakulam	2.62*	5.00	8.71	26.50
Trichur	1.97	5.35	8.08	28.55
Palghat	1.45	4.26	8.39	17.13
Kozhikode	2.05	4.33	7.81	25.00
Canannore	2.48	5.51	11.10	39.25
Kerala	1.85	4.73	8.05	25.96

Note: The time Series of Wage Rates from 1960-61 to 1985-86 is given in Table 4.7.

* This refers to 1961-62.

Source: Same as in Table 4.7.

Table - 4.10 <u>Fertiliser Price Index</u>

Year	Index
1961	100
1962	99
1963	96
1964	88
1965	90
1966	98
1967	123
1968	135
1969	138
1970	140
1971	137
1972	146
1973	170
1974	322
1975	302
1976	255
1977	227
1978	223
1979	220
1980	301
1981	362
1982	362
1983	334
1984	334
1985	334
1986	367

Source: <u>Fertiliser Statistics</u>, Fertiliser Association of India, New Delhi.

Note : Constructed from the All India Price of Fertilisers. This index of fertiliser prices has been calculated by weighting the prices of individual fertilisers (Urea, super-phosphate, and Muriate of Potash) by the proportion of nutrients N,P,K contained in them.

DIAGRAM 4.11

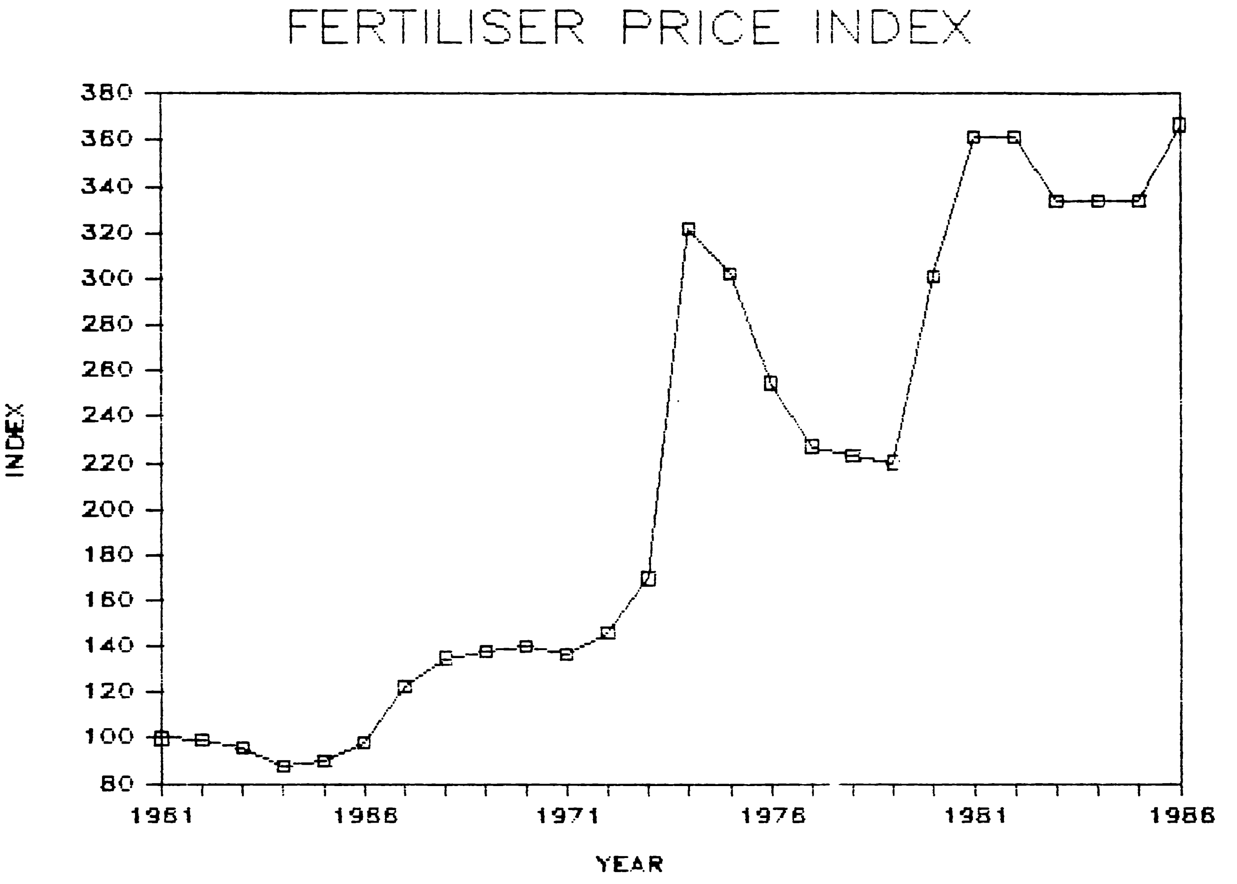

FERTILISER PRICE INDEX
INDEX
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
1961
1966
1971
1976
1981
1986
YEAR

Table - 4.11 Fertiliser Prices: All India and Kerala (Rs. /Metric Tonne)

Year	All India			All Kerala		
	Urea 46% N	Super Phos-phate 16% P_2O_5	MOP (Muriate of Potash) 60% K_2O	Urea 46% N	Super Phos-phate 16% P_2O_5	MOP (Muriate of Potash) 60% K_2O
1972	940.00	301.85	543.00	940.00	425.00	553.00
1973	1050.00	353.00	670.00	1050.00	492.00	683.00
1974	2000.00	759.00	1230.00	2000.00	762.00	1244.00
1975	1850.00	695.00	1180.00	1850.00	950.00	1192.00
1976	1750.00	344.00	910.00	1750.00	539.00	916.00
1977	1550.00	361.00	805.00	1550.00	576.00	809.00
1978	1500.00	361.00	805.00	1500.00	500.00	809.00
1979	1450.00	418.00	805.00	1450.00	566.00	809.00
1980	2000.00	516.00	1100.00	2000.00	754.00	1123.00
1981	2350.00	868.00	1300.00	2404.05	887.96	1327.00
1982	2350.00	868.00	1300.00	2404.05	887.96	1327.00
1983	2150.00	850.00	1200.00	2199.45	869.55	1226.00
1984	2150.00	850.00	1200.00	2199.45	869.55	1226.00
1985	2150.00	850.00	1200.00	2199.45	869.55	1226.00
1986	2350.00	950.00	1329.00	2404.05	971.85	1331.00

Source: 1. Fertilizer Statistics, Fertiliser Association of India.

2. Fertiliser Prices for Kerala were obtained from the Fertilisers and Chemicals Travancore Ltd., Marketing Division, Trivandrum. They are the Prices at which fertilisers are distributed all over Kerala.

3. Fertiliser Marketing News: Fertiliser Pricing and Subsidies Vol.17, Feb. 1986 No.2, Page 4. Table - 4. Changes in Fertiliser Prices since 1972.

Thus, apart from the sharp increase in price of rice in the first phase, a fall in fertiliser prices might also have contributed to making rice cultivation a profitable venture during 1960-61 to 1967-68 and to increase the area under rice cultivation. But after 1966 the price of fertilisers began to rise sharply adding to the already difficult situation created by the sharp increase in wage rates and fluctuating paddy prices.

Thus it is seen that the relative profitability of rice cultivation has been continuously decreasing consequent on increase in input prices such as labour and fertilisers and fluctuating paddy prices. It is likely that the profitability of paddy reduced further after 1974-75 because of the steep rise in the wage rates of agricultural labour and the comparatively low price of paddy.

4.3. Growth Rates of Input and Output Prices

As mentioned earlier, here we look into the growth rates of farm harvest price of paddy and coconut, wage rate and fertiliser price, expecting that it will give a more clear picture of the role of the above-said factors in the declining trend of rice area especially after 1974-75.

The growth rates of farm harvest price of paddy during the four periods under study are given in table 4.12.

Table - 4.12 Growth Rates of Farm Harvest Price of Paddy

(Per cent)

Districts/ State	1960-61 to 1968-69	1960-61 to 1974-75	1974-75 to 1985-86	1960-61 to 1985-86
Trivandrum	15.96*	11.44*	2.82	6.45*
Quilon	18.03*	11.59*	2.01	6.02*
Alleppey	17.69*	10.87*	3.28	6.04*
Kottayam	17.33*	11.61*	3.64	6.48*
Ernakulam	17.52*	11.85*	2.40	6.44*
Trichur	16.97*	11.59*	2.52	6.41*
Palghat	14.82*	11.07*	3.08	6.60*
Kozhikode	14.99*	11.04*	2.96	6.76*
Canannore	14.93*	9.86*	3.96	6.05*
All Kerala	16.37*	11.14*	3.08	6.50*

Note: * 1 per cent level of significance.

** 5 per cent level of significance.

*** 10 per cent level of significance.

It is evident from the table 4.12 that the growth rate of farm harvest price of rice declined after 1968-69 and even more steeply since 1974-75. This explains one of the causes for the decline in area under rice during the third period.

Table 4.13 looks at the growth rates of farm level price of coconut during four periods under study.

Table - 4.13 <u>Growth Rates of Farm Level Price of Coconut</u>

(Per cent)

Districts/ State	1960-61 to 1968-69	1960-61 to 1974-75	1974-75 to 1985-86	1960-61 to 1985-86
Trivandrum	8.68*	8.86*	9.56*	9.96*
Quilon	10.35*	9.79*	10.10*	9.42*
Alleppey	9.06*	9.40*	9.77*	9.16*
Kottayam	9.19*	9.51*	9.25*	8.96*
Ernakulam	10.31*	10.91*	9.21*	9.21*
Trichur	10.20*	9.38*	9.98*	9.39*
Palghat[1]	12.29*	10.29*	9.65*	9.39*
Kozhikode	11.23*	10.07*	9.40*	9.20*
Canannore	10.31*	10.53*	9.38*	9.55*
All Kerala	9.93*	9.66*	9.62	9.30*

Note: a) Same as in Table 4.12.

b) 1. Farm level price of Coconut is available only from 1966-67 onwards in Palghat district.

It is clear from table 4.13 that there is not much variation in growth rates of farm harvest price of coconut. Palghat, Kozhikode, Quilon, Ernakulam, Trichur and Canannore districts showed a comparatively higher growth rate of farm level price of coconut during the first period, ie., from 1960-61 to 1968-69 whereas Quilon, Alleppey, Kottayam and Ernakulam districts depicted a higher growth rate of farm price of paddy.

In the case of the growth rate of wage rate of paddy farm labour, the variations in growth rates are given in table 4.14.

Table - 4.14 Growth Rates of Wage Rate of Paddy Farm Labour

(Per cent)

Districts/ State	1960-61 to 1968-69	1960-61 to 1974-75	1974-75 to 1985-86	1960-61 to 1985-86
Trivandrum	12.55*	9.14*	11.73*	9.31*
Quilon	12.14*	9.72*	11.32*	9.92*
Alleppey	13.09*	10.36*	10.81*	9.19*
Kottayam	12.57*	11.41*	9.96*	9.12*
Ernakulam	9.60*	8.23*	9.53*	8.32*
Trichur	11.76*	9.52*	7.56*	8.97*
Palghat	11.58*	10.91*	8.15	8.37*
Kozhikode	9.84*	8.29*	9.62*	9.21*
Canannore	9.21*	10.00*	9.99*	9.69*
All Kerala	11.58*	9.71*	10.40*	9.20*

Note: Same as in Table 4.12.

Growth rates of wage rate are comparatively lower in general in northern districts during all the four periods under study. Growth rates of wage rates are highly significant just as in the case of farm price of coconut during all the four periods. Growth rates of farm level price of paddy were not significant during the third period, viz., 1974-75 to 1985-86.

As noted earlier fertiliser price remained more or less the same in the case of districts and the state as a whole except some minor regional variations. The growth rates of fertiliser price in Kerala are given in table 4.15.

Table - 4.15 Growth Rates of Fertiliser Price

(Per cent)

All Kerala	1960-61 to 1968-69	1960-61 to 1974-75	1974-75 to 1985-86	1960-61 to 1985-86
All Kerala	4.70**	7.78*	3.84**	6.36*

Note: Same as in Table 4.12.

The proportion of the growth rate of fertiliser price increased after 1968-69 and then it declined since 1974-75. The growth rates of fertiliser price are significant at 1 per cent probability level during the second and the combined periods, but only 5 per cent level of significance during the first and third periods.

Thus the decline in farm level price of paddy was very steep during the third period compared to all other variables, viz. farm level price of coconut, wage rate and fertiliser price. In other words, the growth rates of wage rate and farm level price of coconut are highly related to the very low growth rate of farm level price of paddy. That explains the rock bottom decline in the growth rate of area under paddy.

4.4. Period-wise Comparative Growth Rates of Input and Output Prices

A period-wise comparative growth rates of the input and output prices will give a more clear idea of the variations in the growth rates of area under paddy during the four periods under study. This section of the study is aimed at that.

4.4.1. Growth Rates of Paddy Farm Price, Coconut Farm Price, Wage Rate and Fertiliser Price from 1960-61 to 1968-69 in Districts and the State as a whole.

During the first period, the growth rates of farm level price of paddy was the highest compared to the growth rates of farm price of coconut, wage rate and fertiliser price.

As a result of a high rate of growth of farm price of paddy and low rate of growth of other variables, the first period makes a high growth rate of area under paddy related to the other periods.

Table - 4.16 Growth Rates of Paddy Farm Price, Coconut Farm Price, Wage Rate and Fertiliser Price from 1960-61 to 1968-69 in Districts and the State as a whole.

(Per cent)

Districts/ State	Paddy farm price	Coconut farm price	Wage rate	Fertiliser Price
Trivandrum	15.96*	8.68*	12.55*	4.70**
Quilon	18.03*	10.35*	12.14*	4.70**
Alleppey	17.69*	9.06*	13.09*	4.70**
Kottayam	17.33*	9.19*	12.57*	4.70**
Ernakulam	17.52*	10.31*	9.60*	4.70**
Trichur	16.97*	10.21*	11.76*	4.70**
Palghat	14.82*	12.29*	11.58*	4.70**
Kozhikode	14.99*	11.23*	9.21*	4.70**
Canannore	14.93*	10.31*	9.58*	4.70**
All Kerala	16.37*	9.93*	11.58*	4.70**

Note: Same as in Table 4.12.

4.4.2. Growth Rates of Farm Level Price of Paddy and Coconut, Wage Rate and Fertiliser price from 1960-61 to 1974-75 in districts and the State as a whole

During the second period also, the growth rates of farm level price of paddy remained higher compared to the growth rates of other variables (See Table 4.17).

Table - 4.17 Growth Rates of Farm Level Price of Paddy and Coconut, Wage Rate and Fertiliser Price from 1960-61 to 1974-75 in districts and the State as a whole.

(Per cent)

Districts/ State	Paddy Farm Price	Coconut Farm Price	Wage Rate	Fertiliser Price
Trivandrum	11.44*	8.86*	9.14*	7.78*
Quilon	11.59*	9.79*	9.72*	7.78*
Alleppey	10.87*	9.40*	10.36*	7.78*
Kottayam	11.61*	9.51*	11.41*	7.78*
Ernakulam	11.85*	10.94*	8.23*	7.78*
Trichur	11.59*	9.38*	9.52*	7.78*
Palghat	11.07*	10.29*	10.91*	7.78*
Kozhikode	11.04*	10.07*	8.29*	7.78*
Canannore	9.86*	10.53*	10.00*	7.78*
All Kerala	11.14*	9.66*	9.71*	7.78*

Note: Same as in Table 4.12.

The growth rates of fertiliser price increased at a higher rate after 1968-69, whereas the growth rates of farm level price of coconut and wage rate remained more or less the same during the second period also. But there was decline in the farm level price of paddy during this period, viz., 1960-61 to 1974-75. That could be the reason for the stagnant level of the growth rate of area and production of paddy during the second period.

4.4.3. Growth Rates of Farm Price of Paddy and Coconut, Wage Rate and Fertiliser price from 1974-75 to 1985-86 in districts and the State as a whole

The third period indicates a very low level of the growth rates of farm level price of paddy related to the other two periods. But the proportion of the growth rates of farm level price of coconut and wage rate remained more or less the same. But the growth rates of fertiliser price declined sharply from 1974-75 to 1985-86. These trends in the growth rates of input and output prices indicate the reason for the decline in area under paddy.

Table - 4.18 Growth Rates of Farm Price of Paddy and Coconut, Wage Rate and Fertiliser Price from 1974-75 to 1985-86 in Districts and the State as a whole.

(Per cent)

Districts/ State	Farm Price of Paddy	Farm Price of coconut	Wage Rate	Fertiliser Price
Trivandrum	2.82	9.56*	11.73*	3.84**
Quilon	2.01	10.10*	11.32*	3.84**
Alleppey	3.28	9.77*	10.81*	3.84**
Kottayam	3.64	9.25*	9.99*	3.84**
Ernakulam	2.40	9.21*	9.53*	3.84**
Trichur	2.52	9.98*	7.56*	3.84**
Palghat	3.08	9.65*	8.15*	3.84**
Kozhikode	2.96	9.40*	9.62*	3.84**
Canannore	3.96	9.38*	9.99*	3.84**
All Kerala	3.08	9.62*	10.40*	3.84**

Note: Same as in Table 4.12.

4.4.4. Growth Rates of Farm Price of Paddy and Coconut, Wage Rate and Fertiliser Price from 1974-75 to 1985-86 in Taluks and All Kerala

The growth rate of farm level price of paddy declined to the rock bottom level ie., from 16.37 per cent from 1960-61 to 1968-69 to 11.14 per cent from 1960-61 to 1974-75 to 3.08 per cent from 1974-75 to 1985-86 in all Kerala. The same trend with regional variations can be seen in the case of Taluk level study. Maximum growth rate of farm level price of paddy is seen in Quilandy with 5.32 per cent growth rate and the lowest 1.03 per cent in Chittoor taluk, taking only 20 taluks under consideration. From this it is evident that how meagre is the growth rate of farm level price of paddy from 1974-75 to 1985-86. But the growth rate of the farm price of coconut remained in between 11.43 per cent in Hosdurg taluk and 6.34 per cent in Devikulam taluk in the same period. Again the growth rate of wage rate remained high in Mukundapuram taluk with 12.73 per cent and low in Chittoor with 6.64 per cent during the same period.

Thus, as it was seen earlier steep fall in farm price of paddy, higher proportion of growth rate of farm price of coconut, and wage rate seem to be the reasons for the very steep decline in land area under paddy crop (Table 4.19).

Table - 4.19 Growth Rates of Farm Price of Paddy and Coconut, Wage Rate, and Fertiliser Price from 1974-75 to 1985-86 in Taluks and All Kerala

(Per cent)

Taluks/ All Kerala	Farm Price of Paddy	Farm Price of Coconut	Wage rate	Fertiliser Price
Trivandrum	3.54	9.83*	11.26*	3.84**
Neyyatinkara	2.01	9.83*	11.32*	3.84**
Kottarakara	2.12	10.59*	11.44*	3.84**
Pathanamthitta	1.67	10.43*	11.23*	3.84**
Karthikapally	2.91	9.70*	10.20*	3.84**
Chenganoor	2.58	10.83*	11.00*	3.84**
Vaikom	2.32	9.06*	10.35*	3.84**
Devikulam	1.29	6.34*	9.69*	3.84**
Kanayanoor	1.95	9.52*	8.84*	3.84**
Kunnathunad	2.77	10.40*	10.17*	3.84**
Mukundapuram	2.15	10.64*	12.73*	3.84**
Trichur	2.20	9.84*	10.83*	3.84**
Chittoor	1.03	10.34*	6.64*	3.84**
Palghat	2.66	8.81*	9.46*	3.84**
Ponnani	2.04	10.69*	12.48*	3.84**
Ernad	2.13	8.56*	10.19*	3.84**
Kozhikode	3.30	9.06*	9.41*	3.84**
Quilandy	5.32	8.91*	9.90*	3.84**
Tellicherry	2.33	10.31*	10.18*	3.84**
Hosdurg	3.75	11.43*	9.37*	3.84**
All Kerala	3.08	9.62*	10.40*	3.84**

Note: Same as in Table 4.12.

4.4.5. Growth Rates of Farm Price of Paddy and Coconut, Wage Rate and Fertiliser Price from 1960-61 to 1985-86 in Districts and All Kerala.

When the entire period is taken ie., from 1960-61 to 1985-86, the growth rates of farm price of paddy and fertiliser price remained more or less in the same proportion. But the growth rates of wage rate and farm price of coconut moved in the same old proportion. That is, the growth rates of wage rate and farm level price of coconut were higher than the growth rates of farm level price of paddy and fertiliser price. Hence, comparative low growth rate of paddy farm price and higher growth rate of farm price of coconut and wage rate resulted in continuous and steep fall in area under paddy especially after 1974-75 (Table 4.20).

Table - 4.20 Growth Rates from 1960-61 to 1985-86 in Districts and All Kerala

(Per cent)

Districts/State	Farm Price of paddy	Farm Price of Coconut	Wage Rate	Fertiliser Price
Trivandrum	6.45*	9.96*	9.31*	6.36*
Quilon	6.02*	9.42*	9.92*	6.36*
Alleppey	6.04*	9.16*	9.19*	6.36*
Kottayam	6.48*	8.96*	9.12*	6.36*
Ernakulam	6.44*	9.21*	8.32*	6.36*
Trichur	6.41*	9.39*	8.97*	6.36*
Palghat	6.60*	9.39*	8.37*	6.36*
Kozhikode	6.76*	9.24*	9.21*	6.36*
Canannore	6.05*	9.55*	9.69*	6.36*
All Kerala	6.50*	9.30*	9.20*	6.36*

Note: Same as in Table 4.12.

Chapter 5

ESTIMATES OF AREA, PRODUCTION AND YIELD RESPONSE

5.1 The Statistical Data

5.2 Estimates of Total Supply Response for the I Period for the State

5.3 Estimates of Total Supply Response for the I Period for the State and Districts

5.4 Estimates of Total Supply Response for the II Period for the State

5.5 Estimates of Total Supply Response for the II Period for the State and Districts

5.6 Estimates of Total Supply Response for the III Period for the State

5.7 Estimates of Total Supply Response for the III Period for the State, Nine Districts and 20 Taluks

5.8 Estimates of Total Supply Response for the Combined Period for the State

5.9 Estimates of Total Supply Response for the Combined Period for the State and Districts.

5.10 Comparison of the Pattern of Area, Production and Yield Response of the Four Periods under Study in the State as a whole

5.11 A Comparative Analysis of the Estimates of the Four Periods in the State and Districts under Study

5.12 Application of Regressors other than V_4, V_5, V_6 and V_7

5.13 Impact of Each Regressor on Area, Production and Yield of Paddy

5.14 Statistical Annexure.

Chapter 5

ESTIMATES OF AREA, PRODUCTION AND YIELD RESPONSE

The estimates of area, production and yield responses for paddy crop are presented in this chapter. Ordinary least squares (OLS) estimates of the parameters have been obtained separately for the area, production and yield of paddy for the nine districts and the State as a whole for the first (1960-61 to 1968-69), second (1960-61 to 1974-75), third (1974-75 to 1985-86), and combined (1960-61 to 1985-86) periods under study. Taking into consideration the data availability, analysis for the third period is carried out for 20 taluks also. Mainly four independent variables such as farm level price of coconut, farm level price of paddy, wage rate of paddy farm labour and fertiliser price index have been included in the analysis.

5.1. The Statistical Data

In this section, the nature and type of the data used for multiple regression analysis are examined for providing estimates of supply response. Time series data have been used for ten variables. They are as follows:

V_1 - Acreage under paddy in hectares

V_2 - Total production of paddy in tonnes

V_3 - Yield per hectare of paddy

V_4 - Farm level price of coconut

V_5 - Farm level price of paddy

V_6 - Wage rate of paddy farm labour

V_7 - Fertiliser price

V_8 - Area under coconut in hectares

V_9 - Area under rubber in hectares

V_{10} - Time trend

A brief description of the procedure followed may be in order. First, the sources of the data used for the analysis are noted. Then the different time periods to be covered are mentioned. This is followed by a description of the minor adjustments introduced in the time series data in order to make the series continuous and comparable over time. Then the analytical model used in the study is discussed.

5.1.1. Sources of Data

The data for the study are mainly collected from the following official publications, viz.:

1. Agricultural Statistics in Kerala (1975)

2. Kerala Economic Review (Annual Series, 1959 to 1986).
3. Statistics for Planning (1977, 1980, 1983, 1986)
4. Agricultural Statistics 1985-86.
5. Fertiliser Statistics in India (Annual Series upto 1985-86).

Taluk level price and wage data have been obtained from the Price Section, Directorate of Economics and Statistics, Trivandrum, Kerala.

5.1.2. Specification of Periods

The study covers a period of 26 years from 1960-61 to 1985-86. For analytical convenience, the following three sub periods are specified.

1. 1960-61 to 1968-69 (9 years)
2. 1960-61 to 1974-75 (15 years)
3. 1974-75 to 1985-86 (12 years)

Further, some of the independent variables are considered with a time lag of one year. This type of analysis is restricted for the State only, since area, production and yield are more responsive to current year regressors than to previous year regressors. On the other hand, only current year independent and dependent variables are used in district level and taluk level analysis.

5.1.3. Adjustments Made in Time Series Data

Data on wage rates were available only for 20 centres representing 20 taluks. These 20 taluks in turn represent 10 districts implying a representation of two taluks in each district. Hence the data collected from those 20 centres with regard to agricultural labour cost were taken as representative data for the 20 taluks. And the averages of the two centres in each district were taken as the wage level representing that district. The details of centres, taluks and districts are given in table 5.1.

Moreover, since the relevant data were available only for 20 taluks; only 20 taluks were taken for analysis at a disaggregated level.

Data on wage for the year 1960-61 for Ernakulam district and farm level price of coconut from 1961-62 to 1965-66 for Palghat district were not available and hence the State average was taken for those years for the purpose of making the time series data continuous and comparable over time.

Fertiliser prices are almost uniform throughout the country except for minor regional difference. Hence all India Fertiliser Index was used in all kinds of analysis.

Since area under coconut and area under rubber were not available for taluks, the taluk level analysis was restric using the other sets of data only.

Table - 5.1 Names of Centres, Taluks and Districts

Sl.No.	Name of Centres	Name of Taluks	Name of Districts
1.	Keezhoor	Neyyattinkara	Trivandrum
2.	Chenchery	Trivandrum	
3.	Perumkulam	Kottarakkara	Quilon
4.	Elanthur	Pathanamthitta	
5.	Karuvatta	Karthikappally	Alleppey
6.	Kodukulanji	Chengannoor	
7.	Poozhikode	Vaikom	Kottayam
8.	Marayoor	Devikulam	
9.	Cheranallur	Kanayannur	Ernakulam
10.	Kizhakkamblam	Kunnathunad	
11.	Alur	Mukundapuram	Trichur
12.	Puthur	Trichur	
13.	Elapally	Palghat	Palghat
14.	Koduvayoor	Chittoor	
15.	Cothellur	Ponani	Malapuram
16.	Nilampur	Ernad	
17.	Koduvally	Kozhikode	Kozhikode
18.	Perambra	Quilandy	
19.	Panoor	Tellicherry	Canannore
20.	Thrikaripur	Hosdurg	

Note: From November 1983 onwards there were certain changes in centres, taluks and districts. The table is formed accordingly. Formerly they have taken Chengamanadu instead of Perumkulam and Kodakara changed into Alur. Again at present the centre Elanthur is included in Kozhencherry taluk in Pathanamthitta district and Thrikaripur in Hosdurg taluk is included in Kasaragode district.

Source: Price Section, Directorate of Economics and Statistics.

5.1.4. Analytical Model Used in the Study

Six common equations were tried out for area, total production and yield per hectare to see the significance of each of the variables and the combined effect of all. Since the present study is purported to assess impact of input and output prices on area, output and yield per hectare of paddy, input and output prices together were taken into consideration.

The specified model is as follows:

$$V_1 = a + b_4v_4 + b_5v_5 + b_6v_6 + b_7v_7 \quad (1)$$

To assess the impact of input prices on area, total output and yield per hectare, the model specified is as follows:

$$V_1 = a + b_6v_6 + b_7v_7 \quad (2)$$

The model used to evaluate the impact of output prices is as follows:

$$V_1 = a + b_4v_4 + b_5v_5 \quad (3)$$

As a next step, considering one input price variable and one output price variable, viz., the farm level price of paddy and wage rate of paddy farm labour, the following model was used.

$$V_1 = a + b_5v_5 + b_6v_6 \quad (4)$$

Again, the same important variables were used to know the significance of farm level price of paddy and wage rate of paddy farm labour separately.

$$V_1 = a + b_5v_5 \qquad (5)$$

$$V_1 = a + b_6v_6 \qquad (6)$$

For the State as a whole, some more specifications were tried out. They are the following:

$$V_1 = a + b_4v_4 + b_5v_5 + b_6v_6 \qquad (7)$$

$$V_1 = a + b_4v_4 + b_5v_5 + b_7v_7 \qquad (8)$$

$$V_1 = a + b_4v_4 + b_6v_6 + b_7v_7 \qquad (9)$$

$$V_1 = a + b_5v_5 + b_6v_6 + b_7v_7 \qquad (10)$$

$$V_1 = a + b_4v_4 + b_6v_6 \qquad (11)$$

$$V_1 = a + b_4v_4 + b_7v_7 \qquad (12)$$

$$V_1 = a + b_5v_5 + b_7v_7 \qquad (13)$$

$$V_1 = a + b_4v_4 \qquad (14)$$

$$V_1 = a + b_7v_7 \qquad (15)$$

All the above equations were tried out in the case of V_2 and V_3 also.

Out of the above 15 equations, eight include each explanatory variable, viz., V_4, V_5, V_6, V_7. So altogether 24 results for each regressor as the same estimates are repeated with regard to total production of paddy (V_2) and yield per hectare of paddy (V_3) also.

Again, in the case of previous year estimates taking current year dependent and previous year regressors, the same number of equations were estimated. They are as follows:

$$V_1 = a + b_4v_{4-1} + b_5v_{5-1} + b_6v_{6-1} + b_7v_{7-1} \quad \text{(b)}$$

$$V_1 = a + b_4v_{4-1} + b_5v_{5-1} + b_6v_{6-1} \quad \text{(c)}$$

$$V_1 = a + b_4v_{4-1} + b_5v_{5-1} + b_7v_{7-1} \quad \text{(d)}$$

$$V_1 = a + b_4v_{4-1} + b_6v_{6-1} + b_7v_{7-1} \quad \text{(e)}$$

$$V_1 = a + b_5v_{5-1} + b_6v_{6-1} + b_7v_{7-1} \quad \text{(f)}$$

$$V_1 = a + b_4v_{4-1} + b_5v_{5-1} \quad \text{(g)}$$

$$V_1 = a + b_4v_{4-1} + b_6v_{6-1} \quad \text{(h)}$$

$$V_1 = a + b_4v_{4-1} + b_7v_{7-1} \quad \text{(i)}$$

$$V_1 = a + b_5v_{5-1} + b_6v_{6-1} \quad \text{(j)}$$

$$V_1 = a + b_5v_{5-1} + b_7v_{7-1} \quad \text{(k)}$$

$$V_1 = a + b_6v_{6-1} + b_7v_{7-1} \quad \text{(l)}$$

$$V_1 = a + b_4v_{4-1} \quad \text{(m)}$$

$$V_1 = a + b_5v_{5-1} \quad \text{(n)}$$

$$V_1 = a + b_6v_{6-1} \quad \text{(o)}$$

$$V_1 = a + b_7v_{7-1} \quad \text{(p)}$$

The results are presented in the tables in each section according to the significance of the regression co-efficients at 1 per cent, 5 per cent and 10 per cent probability levels. The major thrust of the analysis in this chapter is centred around the following questions:

1. Which of the dependent variables (area, production, yield) was more responsive to independent variables, viz., farm level price of coconut, farm level price of paddy, wage rate of paddy farm labour and fertiliser price index?

2. Which of the estimates, current year and previous year, had greater number of significant responses?

3. Which was the most important supply shifter in the case of both estimates, current year and previous year?

4. Differentiate the period in which there was concentration of area, production and yield response.

5.2. Estimates of Total Supply Response for the Period 1960-61 to 1968-69 for the State

Of the 24 results, 16 are significant for the variable V_6 for current year estimates for the first nine years, 1960-61 to 1968-69. But only four regression co-efficients were found to be significant for the same regressor V_6 at 10 or lower percentage probability level when the one year lag was taken for the explanatory variables (Table 5.5). Next in importance with reference to current year estimates was V_4 (farm level price of coconut) whereas in the case of previous year estimates two variables V_5 and V_7 had the same significant responses. Again, next in importance was V_5 with regard to current year estimates and the last was V_7, but in previous year estimates the last one was V_4 (Table 5.5).

Estimates of the Number of Significant Regression Co-efficients

Table - 5.2 Area as Dependent Variable

Regressors	t - 1	t
V_4	1	0
V_5	1	3
V_6	2	7
V_7	0	0

Table - 5.3 Production as Dependent Variable

Regressors	t - 1	t
V_4	0	2
V_5	1	2
V_6	2	6
V_7	1	0

There were some variations in yield responses when compared to area and production responses. That is, the total number of significant yield responses were lower than area and production responses. The responses of yield to wage rate were lower than the responses of farm level price of coconut for the current year estimates and it was zero in the case of previous year estimates (Table 5.4), whereas it was the highest in the case of both area and production for both estimates, current year and previous year (Table 5.2 and 5.3).

Estimates of the Number of Significant Regression Co-efficients

Table - 5.4 Yield as Dependent Variable

Regressors	t - 1	t
V_4	0	5
V_5	1	1
V_6	0	3
V_7	2	0

Table - 5.5
Total Number of Significant Regression Co-efficients Taking Area, Production & Yield as Dependent variables

Regressors	t - 1	t
V_4	1	7
V_5	3	6
V_6	4	16
V_7	3	0

From the estimates, it is seen that the acreage responses are higher than both production and yield responses. Again, curren year area, production and yield responses to previous year regresso are lower than current year response to current year regressors.

Altogether there are 29 significant responses in the case of current year estimates and only 11 significant responses with regard to previous year estimates.

Table - 5.6 Ranking of the Regressors in the Order of their Impact on Area, Production and Yield of Paddy

Rank No.	t - 1	Rank No.	t
1	V_6	1	V_6
2.5	V_5	2	V_4
2.5	V_7	3	V_5
4	V_4	4	V_7

Current year wage level and dependent variables were significantly correlated for 16 cases out of 24 and in previous year wage and current year dependent variables were significantly related only for four out of 24 cases. Hence the wage rate of paddy farm labour was the important supply shifter in both cases, current year and previous year estimates. Again, dependent variables were more responsive to current year regressors than previous year regressors. The OLS estimates of paddy area, production and yield responses for the State as a whole during 1960-61 to 1968-69 are presented in tables A, B, C, D, E and F

(Statistical Annexure).

5.3. Estimates of Total Supply Response for the Period 1960-61 to 1968-69 for the State and Districts

Of the 30 relationships estimated for the period 1960-61 to 1968-69 for the State as a whole and nine former districts, 24 relations had good fit to the data, as the co-efficient of determination (ie. R^2's) were statistically significant for them. The range of R^2's obtained for this period was wide, varying from 0.24 to 0.96. There were only six values which were less than 0.50. So the model is quite consistent in explaining variations in acreage, total output, and yield per hectare of paddy.

Out of the 30 relationships, 28 showed positive correlation between wage and dependent variables, whereas 24 in the case of farm level price of coconut, 20 with reference to farm level price of paddy and 16 with regard to fertiliser price were negatively correlated to dependent variables.

In general, of the 10 estimates with reference to acreage response, only four got significantly non-zero supply elasticities, since calculated values of 'F' ratios are greater than their table values. That is, only in the case of Alleppey, Kottayam and Palghat districts and the State as a whole, the estimated values were greater than table values. Alleppey, Kottayam, Ernakulam, Palghat and the State as a whole showed significant acreage response when wage was taken as independe variable. Only two districts, Alleppey and Kottayam had significant response in relation to farm level price of paddy The regressor V_4, V_5, V_6 and V_7 indicated above 75 per cent of the total variation in acreage in six districts and the St as a whole. Five cases showed above 80 per cent of variation in acreage out of the seven cases and one among them showed 9 per cent variation in acreage, ie., in Kottayam district the ratio was significant at five per cent probability level. It could be because of relatively high level of significance of co-efficient of wage of paddy farm labour.

Most of the estimates of production and yield elas cities for this period are not statistically significant. in Kottayam the estimated value of 'F' ratio is greater t table value in the case of both production and yield res In all the other cases, only in Alleppey district 'F' ra significant at 10 per cent probability level with refer yield response. This is perhaps due to a low growth r yield in the first period. Detailed results of the re are given in Tables G, H and I (Statistical Annexure)

Wage rate is the important supply shifter d first period in acreage response. Of the 10 relati in table G, five of them are statistically signifi among the other variables only farm level price of significant in the two districts of Alleppey and all the other variables in all cases are non-sig significant acreage response when wage was taken as independent variable. Only two districts, Alleppey and Kottayam had significant response in relation to farm level price of paddy. The regressor V_4, V_5, V_6 and V_7 indicated above 75 per cent of the total variation in acreage in six districts and the State as a whole. Five cases showed above 80 per cent of variation in acreage out of the seven cases and one among them showed 92 per cent variation in acreage, ie., in Kottayam district the 'F' ratio was significant at five per cent probability level. It could be because of relatively high level of significance of the co-efficient of wage of paddy farm labour.

Most of the estimates of production and yield elasticities for this period are not statistically significant. Only in Kottayam the estimated value of 'F' ratio is greater than table value in the case of both production and yield responses. In all the other cases, only in Alleppey district 'F' ratio is significant at 10 per cent probability level with reference to yield response. This is perhaps due to a low growth rate of yield in the first period. Detailed results of the regressors are given in Tables G, H and I (Statistical Annexure).

Wage rate is the important supply shifter during the first period in acreage response. Of the 10 relationships shown in table G, five of them are statistically significant, whereas among the other variables only farm level price of paddy is significant in the two districts of Alleppey and Kottayam and all the other variables in all cases are non-significant. Wage rate is significant in the case of production response for Kottayam district and Kerala as a whole (Table H), but farm level price of coconut is significantly related to yield in Alleppey and Kottayam districts and the State as a whole. Fertiliser price is significantly correlated to yield in four districts, viz. Quilon, Kottayam, Ernakulam and Canannore (Table I).

5.4. Estimates of Total Supply Response for the Second Period, 1960-61 to 1974-75 in All Kerala

The results of the analysis of this section are presented in Tables 5.7 to 5.11 according to the significance of the regression co-efficients at 10 or lower percentage probability levels.

Estimates of the Number of Significant Regression Co-efficients

Table - 5.7 Area as Dependent Variable

Regressors	t - 1	t
V_4	2	4
V_5	2	5
V_6	8	8
V_7	2	1

Table - 5.8 Production as Dependent Variable

Regressors	t - 1	t
V_4	2	2
V_5	3	5
V_6	8	8
V_7	1	2

Table - 5.9 Yield as Dependent Variable

Regressors	t - 1	t
V_4	2	4
V_5	5	5
V_6	7	8
V_7	1	1

Table - 5.10
Total Number of Significant Regression Co-efficients taking Area, Production and Yield as Dependent Variables.

Regressors	t - 1	t
V_4	6	10
V_5	10	15
V_6	23	24
V_7	4	4

Of the 24 results all are significantly correlated to wage rate in the case of current year regressors and current year dependent variables and 23 results are correlated significantly with regard to previous year regressors and current year dependent variables. Hence wage rate of paddy farm labour can be considered as the most important supply shifter during the second period also. Next in importance is farm price of paddy with both current year and lagged explanatory variables, since 15 results in the case of current year estimates and 10 results with regard to previous year estimates are statistically significant.

Table - 5.11 Ranking of Regressors in the Order of their Impact on Area, Production and Yield of Paddy

Rank No.	t - 1	t
1	V_6	V_6
2	V_5	V_5
3	V_4	V_4
4	V_7	V_7

In the case of lagged year estimates (significant) yield responses are higher than area and production responses and not much different in the case of significant responses of area, production and yield in the case of current year estimates. But the total number of significant responses with reference to current year calculations are 53 and 43 with reference to previous year calculations. Hence one year lag in the case of regressors produce only lesser number of significant responses of area, production and yield.

The estimates of paddy area, production and yield responses for the State as a whole for the period 1960-61 to 1974-75 are presented in tables J,K,L,M,N and O (Statistical Annexure).

5.5. Estimates of Total Supply Response for the Period 1960-61 to 1974-75 for the State and Districts

Of the 30 relationships consisting of 10 each in acreage, production and yield response, 29 show positive correlation with wage rate, only one indicates negative relationship with yield. But in the case of farm level price of coconut two indicate negative acreage response and nine each with regard to production and yield. All relationships with regard to farm level price of paddy are negatively correlated except one yield response in Canannore district, whereas in the case of fertiliser price, nine in acreage, three each in production and yield responses are negatively correlated (Tables P, Q & R). Twentyfour relationships have good fit to the date, as the co-efficient of determination (ie. R^2's) are statistically significant for them. The range of R^2's obtained for this period, is wide, varying from 0.31 to 0.91. Out of 30 values, only six are less than 0.50.

Wage rate is significantly and positively correlated with acreage for nine relationships out of ten, ie., one is positively correlated but not significant. The significance of co-efficients in Kottayam, Ernakulam and Palghat districts and the State as a whole is higher than other districts. The co-efficient of farm level price of paddy is significant above five per cent level in three cases and fertiliser price in two cases, but farm level price of coconut is non-significant in all cases. Regressors in Canannore district explain only 40 per cent variation in acreage, whereas in eight cases they depict above 70 per cent variation in acreage and five out of eight indicate above 80 per cent variation. Explanatory variables show only 67 per cent variation in acreage in Trichur district (Table P).

There is strong relationship between wage rate and production in the districts of Alleppey, Kottayam, Trichur Palghat and the State as a whole. Wage and production are positively correlated in all cases and significant in eight cases. Only in Canannore district farm level price of coconut and production of paddy is positively correlated. Farm level price of paddy and production is negatively correlated in all cases and only in Trichur, Palghat and Canannore districts fertiliser price and production are negatively correlated. 'F' ratio is significant in nine cases out of ten with regard to production response (Table Q).

There is significant relationship between wage and yield in Alleppey, Kottayam, Trichur, Palghat and the State as a whole. But only in Canannore district wage rate and yield are negatively correlated and farm level price of coconut and paddy and yield are positively correlated. Only in Kozhikode and the State as a whole fertiliser price and yield are positively correlated. 'F' ratio is significant only in six cases out of ten in the case of yield response (Table R).

The explanatory variables V_4, V_5, V_6 and V_7 explain above 70 per cent of the total variation in acreage in seven districts and the State as a whole. Five cases indicate above 80 per cent of the variation in acreage out of the eight cases and one among them depicts 91 per cent in acreage, ie., in the State as a whole. It may be because of a high level of significance of the relationship between wage rate of paddy farm labour and acreage and farm price of paddy and acreage. The relationship between wage rate of paddy farm labour and acreage are positively correlated whereas the relationship between farm level price of paddy and acreage are negatively correlated. Forty per cent variation in acreage is found in Canannore district and that may be due to the non-significant relation among the four regressors and acreage.

Out of ten relationships of production response, nine denote above 50 per cent variation and out of nine, five indicate above 70 per cent variation in production and only one district shows 45 per cent variation in production, ie., Trivandrum district. That may be due to the greater impact of some other factor like technology. Only wage and production are positively and significantly correlated, and other variables, V_4 and V_5 are non-significant and negatively correlated but the regressor V_7 is positively correlated.

Rather very low relationship is seen between yield and regressors compared to acreage and production since only six cases explain above 50 per cent variation in yield and only in two cases above 75 per cent variation. This is because of the greater impact of other factors in the case of yield, such as HYV seeds, fertilisers, irrigation etc. rather than the application of the present four regressors.

Wage rate is found as the most important supply shifter in acreage, production and yield response equations. Of the 30 relationships, 22 are found significant in the case of wage rate of paddy farm labour. The co-efficient of farm level price of coconut is significant in three cases each, in production and yield response. The regression co-efficient of farm level price of paddy are significant in three cases in acreage and yield response, and in four cases in production response. Farm level price of paddy is the second most important supply shifter during the second period. Fertiliser price and the dependent variables are significantly correlated in two cases each. In general, wage rate of paddy farm labour is the first important supply shifter, the second being farm level price of paddy and the third farm level price of coconut and the fourth fertiliser price. But when we consider the case of acreage response only, the order is wage rate, farm level price of paddy, fertiliser price and farm level price of coconut.

Detailed results of the regressions are given in Tables P, Q and R in the Statistical Annexure.

5.6. Estimates of Total Supply Response for the Period 1974-75 to 1985-86 in All Kerala

As pointed out earlier there are 24 results for each independent variable. Dividing it by three, the result is eight each for area, production and yield. In that way the results are given in tables 5.12 to 5.16 in this section according to the significance of regression co-efficients at 10 per cent or lower probability level.

Estimates of the Number of Significant Regression Co-efficients

Table - 5.12 Area as Dependent Variable

Regressors	t - 1	t
V_4	4	4
V_5	0	0
V_6	8	8
V_7	0	1

Table - 5.13 Production as Dependent Variable

Regressors	t - 1	t
V_4	4	2
V_5	0	0
V_6	8	6
V_7	3	0

Table - 5.14 Yield as Dependent Variable

Regressors	t - 1	t
V_4	4	2
V_5	2	0
V_6	4	8
V_7	0	6

Table - 5.15 Total Number of Significant Co-efficients Taking Area, Production and Yield as Dependent Variables

Regressors	t - 1	t
V_4	12	8
V_5	2	0
V_6	20	22
V_7	3	7

Of the 24 results 22 are significant for the variable V_6 taking independent and dependent variables for the current year, ie., for the period 1974-75 to 1985-86. But only 20 regression co-efficients are significant for the same variable V_6 at 10 per cent or lower probability level when one year lag for the independent variables and current year for the dependent variables are taken. Taking into consideration significant response, next in importance with regard to the estimates, current year and lagged year is V_4 ie., farm level price of coconut. Third in importance in both cases is fertiliser price and the last one is farm price of paddy. As was seen earlier in the fourth chapter the same order was followed in the case of growth rate of the same variables during the third period ie., wage rate, farm price of coconut, fertiliser price and then farm price of paddy (Table 5.15).

Table - 5.16 Ranking of Regressors in the Order of their Impact on Area, Production and Yield of Paddy

Rank No.	t - 1	t
1	V_6	V_6
2	V_4	V_4
3	V_7	V_7
4	V_5	V_5

In general the number of significant responses of both current year and previous year estimates are the same during this period. Thirty seven responses out of 96 are statistically significant (Table 5.15).

Wage again is the best supply shifter during this period also. Next in importance is farm level price of coconut, then fertiliser price and the last, farm price of paddy in both estimates, current year and previous year (Table 5.15 and 5.16).

Detailed results of the regressions are given in tables S, T, U, V, W and X in the Statistical Annexure.

5.7. Estimates of Total Supply Response for the Period 1974-75 to 1985-86 for the State, Nine Districts and 20 Taluks

Of the 30 relationships estimated for the period in the case of acreage response, all the 30 relations have good fit to the data, as the co-efficient of determination (ie. R^2's) are statistically significant for them. The range of R^2's obtained for this period is wide, varying from 0.52 to 0.97. There are only eight values which come between 0.52 to 0.70 and all the other values are above 0.70. Thus the model is quite consistent in explaining variations in acreage under paddy (Tables Y and B1).

Twenty eight relationships out of 30 indicate negative response of acreage to wage, 22 to farm level price of coconut and 20 to fertiliser price. Out of 30 relationships, 23 indicate positive correlation between farm level price of paddy and acreage. It is evident from the analysis that it is high rate of wage, fertiliser price and farm price of coconut and very low level of farm price of paddy which led to the steep decline in acreage under paddy during third period under study.

Even though wage rate and acreage were positively correlated during the first and second periods under study, the trend got reversed during the third period. The correlation turned out to be negative. The four independent variables seem to explain 52 per cent to 97 per cent variation in acreage under study. Taking into consideration the regression results, nine cases indicate above 80 per cent, 13 cases 70 to 80 per cent and eight cases 52 to 70 per cent variation in acreage by the four regressors. Ten estimates are having very high value of 'F' ratio and only four are non-significant. Hence the conclusion regarding acreage response are sufficiently supported by facts (Tables Y and B1).

In the case of production response, 23 relationships out of 30 have good fit to the data, as the co-efficient of determination are statistically significant. The range of R^2's obtained for the period is 0.13 to 0.94. Seven values are below 0.50, 11 above 0.70 and 12 in between 0.50 to 0.70. Hence the model is quite consistent in explaining variations in production of paddy, but not so consistent as the model explaining acreage under paddy (Tables Z and C1).

Of the 30 relationships 21 show negative relationship between wage rate and production. That is, only Trivandrum and Ernakulam districts and Kottarakkara, Pathanamthitta, Kanayannoor, Kunnathunad, Mukundapuram, Trichur and Ernad Taluks indicate positive relationships between wage rate and production of paddy. Of the 30 relationships, 23 show negative response of production with farm level price of coconut, 20 positive response of production with farm level price of paddy and 17 positive response of production with fertiliser price. It is high wage rate of paddy farm labour and farm level price of coconut which resulted in fall in production of paddy during the period under study.

The range of R^2's obtained for this period is wide with reference to yield response, ie., it varies from 0.16 to 0.99. There are only five values which explain variation above 80 per cent in yield, 14 values show variation in yield between 50 and 80 per cent and nine indicate below 50 per cent variation in yield. The four explanatory variables taken together explain 99 per cent variation in yield in Alleppey district. Thus the model is quite consistent in explaining variations in yield of paddy.

Of the 30 relationships, 25 show positive response of yield with wage rate, 18 negative response of yield with farm level price of coconut, 16 positive response of yield with farm level price of paddy and 18 positive response of yield with fertiliser price (Tables A1 and D1).

Even though wage rate and acreage and wage rate and production are negatively correlated in most cases, yield and wage rate are positively correlated in 25 cases out of 30.

Detailed results of the regression are given in tables Y, Z, A1, B1, C1 and D1 in the Statistical Annexure.

5.8. Estimates of Total supply Response for the Period 1960-61 to 1985-86 in All Kerala

Of the 24 results 16 are significant for the variables V_6 and V_7 during current period 1960-61 to 1985-86. But only ten regression co-efficients are significant for the regressor V_6 at 10 or lower probability level when one year lag is taken for the independent variables. Next in importance during current year and previous year estimates is V_5 ie., farm price of paddy. In the case of previous year estimates V_6 and V_4 have the same number of significant regression results (Table 5.20).

Estimates of the Number of Significant Regression Co-efficients

Table - 5.17 Area as Dependent Variable

Regressors	t - 1	t
V_4	6	4
V_5	6	5
V_6	4	7
V_7	3	2

Table - 5.18 Production as Dependent Variable

Regressors	t - 1	t
V_4	0	1
V_5	4	4
V_6	2	1
V_7	4	6

Table - 5.19 Yield as Dependent Variable

Regressors	t - 1	t
V_4	4	4
V_5	1	1
V_6	4	8
V_7	8	8

Table - 5.20

Total Number of Significant Regression Co-efficients taking area, Production and Yield as Dependent Variables

Regressors	t - 1	t
V_4	10	9
V_5	11	10
V_6	10	16
V_7	15	16

V_7 indicate 15 results which are statistically significant during the combined period taking one year lag for all the four independent variables. This result depicts mainly the major role of fertiliser price in the responses of yield; since eight responses out of 15 come under yield response. The regressors V_6 and V_7 have equal number of significant regression results in the case of current year estimates (Tables 5.19 and 5.20).

Only during the combined period V_7 ranked first in both estimates current year and previous year. This major difference is because of more number of significant yield response related to fertiliser price rather than acreage and production response. Significant production response to wage rate is only one and it is very low compared to yield and acreage response. Fifty one and 46 significant regression co-efficients are there in the case of current year and lagged year estimates respectively. Hence the number of significant regression co-efficients are greater in current year estimates rather than lagged year estimates (Tables 5.17 to 5.20).

Detailed results of regression are noted in tables E1, F1, G1, H1, I1 and J1 in the Statistical Annexure.

5.9. Estimates of Total Supply Response for the Period 1960-61 to 1985-86 for the State and Districts

Of the 30 relationships estimated for the period 1960-61 to 1985-86 for the State as a whole and nine districts, 17 relations have good fit to the data, as the R^2 values are statistically significant for them. The range of R^2 obtained for this period is wide, varying from 0.13 to 0.88. Since the State's R^2 value is 0.54 the model is consistent in explaining variations in acreage under paddy. Again, it is highly consistent in explaining variations in yield since it explains 80 per cent of the variation in the State as a whole, but with regard to production it explains only 39 per cent of the variation (Tables K1, L1 and M1).

There is negative correlation between wage rate and acreage in all cases. Farm level price of coconut and acreage are negatively correlated in six relationships and five in the case of fertiliser price and acreage. Of the 10 relationships, nine depict positive correlation between farm price of paddy and acreage (Table K1).

A look at the value of 'F' ratio reveals that the variations are significantly different if we take 10 per cent or lower probability levels in eight relationships. Five relationships show above 57 per cent of the variations in acreage and among them two indicate above 80 per cent variation. The relationships between wage rate and acreage is strong since they are significantly and negatively correlated in seven cases out of 10. Farm level price of paddy is positively and significantly correlated to acreage in six cases out of 10. The position of farm level price of coconut and fertiliser price

- G 3914 -

are third and fourth in their relation to that of acreage. In Kottayam and Trichur districts no variable is significantly correlated to acreage (Table K1).

The case of production response to the four regressors taken is different from acreage response. Seven values of 'F' ratios are statistically significant in the case of production as a result of the impact of the four regressors taken in our analysis is dependable. Only in four estimates the values show above 50 per cent variation in production. Total production and farm level price of coconut are negatively correlated in nine relationships out of 10. Seven estimates in the case of farm level price of paddy and fertiliser price and six estimates with regard to wage rate show positive correlation with production response. Fertiliser price has more significant relation to that of production (Table L1).

Nine values of regression co-efficients of wage rate are positively correlated to yield and of the nine values seven are statistically significant. Eight relationships between farm level price of paddy and yield are negatively correlated. Five relationships between coconut price and yield and eight relationships between fertiliser price and yield are positively correlated

It is interesting to note all the values of 'F' ratios are highly significant in the case of yield response, which indicate that the conclusions derived from the analysis are more definite and sure. Seven relationships between wage rate and yield and six relationships between fertiliser price and yield are highly significant (Table M1).

Table - 5.21 Ranking of Regressors in the Order of their Significant Impact on Area, Production and Yield of Paddy

Regressors	No. of Significant R Co-efficients	Rank No.
V_6	15	1
V_7	13	2
V_5	10	3
V_4	6	4

If we take total number of significant regression co-efficients, wage rate of paddy farm labour has the highest number of significant co-efficients. Hence wage rate of paddy farm labour can be considered as the important supply shifter. V_7, V_5 and V_4 are ranked second, third and fourth supply shifter respectively.

Detailed regression results are presented in tables K1, L1 and M1 in the Statistical Annexure.

5.10. Comparison of the Pattern of Area, Production and Yield Response of the Four periods under Study in the State as a Whole

It may be worthwhile to carry out a comparative analysis of the pattern of Area, Production and Yield response as revealed by the models used in the study.

Total Number of Significant Regression Co-efficients

Table - 5.22 Area as Dependent Variable

Regressors	t - 1	t
V_4	13	12
V_5	9	13
V_6	22	30
V_7	5	4

Table - 5.23 Production as Dependent Variable

Regressors	t - 1	t
V_4	6	7
V_5	8	11
V_6	20	21
V_7	9	8

There are 96 estimates having 32 each with regard to area, production and yield for each regressor in lagged year and current year estimates.

Table - 5.24 Yield as Dependent Variable

Regressors	t - 1	t
V_4	10	15
V_5	9	7
V_6	15	27
V_7	11	15

Table - 5.25
Total Number of Significant Regression Co-efficients Adding together all Significant Regression Co-efficients Coming under Area, Production & Yield as Dependent Variables

Regressors	t - 1	t
V_4	29	34
V_5	26	31
V_6	57	78
V_7	25	27

Of the 32 estimates, V_6 has 30 significant regression co-efficients taking area as dependent variable, 27 in relation to yield response and 21 with regard to production response with reference to current year estimates. Wage rate of paddy farm labour is the single and strong supply shifter in both models current year and lagged year. Next in importance is farm level price of paddy in both production and acreage response, whereas in yield response fertiliser price and farm price of coconut are equally sharing the significance as regressors which effected in significant yield response with regard to current year estimates. Again, fertiliser price is next important supply shifter in the case of production response and farm level price of coconut with reference to acreage response. Fertiliser price in the case of acreage response, farm level price of coconut with regard to production response and farm level price of paddy with reference to yield response in current year estimates are next important supply shifter (Tables 5.16 to 5.18).

In lagged year estimates too, wage rate of paddy farm labour is the most important supply shifter in the three cases of responses and the least important supply shifter is fertiliser price in the case of acreage response, farm level price of coconut with regard to production response and farm level price of paddy with reference to yield response.

Of the 96 relationships, the regressor V_6 has 78 and 57 significant regression co-efficients with regard to current year and previous year estimates respectively. Farm level price of coconut with its 34 and 29 significant regression co-efficients ranked second in importance in the case of current and lagged year estimates respectively. The third important regressor V_5 has 31 and 26 significant regression co-efficients during current and lagged year estimates respectively. The last in the order of importance V_7 in both estimates have 27 and 25 significant regression co-efficients respectively. Thus the order of the supply shifters according to the total number of significant regression co-efficients with reference to both estimates is wage rate, farm price of coconut, farm price of paddy and fertiliser price (Table 5.19).

5.11. A Comparative Analysis of the Estimates of the Four Periods in the State and Districts under Study

On the whole among the independent variables wage rate is the most important regressor responsible for variations in acreage. There is positive correlation between wage rate and acreage for the first two periods, then it changes its direction. In other words, during the third and the combined periods, the relation between wage rate and acreage is negative. It shows the important role of wage rate in the declining trend of acreage under paddy. The same finding is evident in the fourth chapter that, it is high wage rate which led to the seemingly great decline in rice area in general.

If the case of production response was taken both farm level price of paddy and wage rate are equally responsible for change in production during the second period, while farm price of paddy is negatively correlated, and wage rate is positively correlated with output. There is a positive correlation between fertiliser price and production, but the correlation between farm level price of coconut and production during the third period is negative but not significant. The responsiveness of production to wage rate was negative during the third and the combined periods. The unprecedented fall in area during the third period was so strong that it affected production during the same period and it resulted in very low rate of growth during the combined period also. The responsiveness of productic to fertiliser price is positive during the second, third and combined periods in the State as a whole.

The responsiveness of yield to wage rate is positively and significantly correlated in all the four periods in the State as a whole. In the first period farm level price of paddy and fertiliser price are negatively correlated, but coconut price is positively correlated in the State as a whole. The responsiveness of yield to farm level price of coconut and paddy are negatively correlated at five per cent level of significance and fertiliser price is positively correlated but not significant during the second period. Farm level price of paddy is negatively correlated and farm level price of coconut and fertiliser price are positivel correlated with yield during the third and the combined periods. There is significant and positive relations between fertiliser price and yield in the State as a whole during the third and the combined periods.

5.12. Application of Regressors other than V_4, V_5, V_6 and V_7

It would be worthwhile if regressors other than V_4, V_5, V_6 and V_7 are applied in order to test the impact of the same on Area, production and yield in the State as a whole.

5.12.1. Impact of Yield on Area under Paddy

In order to find out the response of acreage more clearly, yield per hectare are also included in the set of former explanatory variables and the following model is tried:

$$V_1 = a + b_3v_3 + b_4v_4 + b_5v_5 + b_6v_6 + V_7v_7$$

Consequent on the addition of yield also in the equation, the R^2 value has changed from 0.84 to 0.92 during the first period. There is no variation during the second period. The values of R^2 have increased from 0.86 and 0.54 to 0.95 and 0.66 respectively during the third and the combined periods. Hence it is evident that yield is active in acreage response during the first, the third and the combined periods under study.

5.12.2. Impact of Area under Coconut and Rubber on Area under Paddy

Again, when area under coconut and rubber were added deleting coconut price and adding yield to that of the former equation, the equation transforms as:

$$V_1 = a + b_3v_3 + b_5v_5 + b_6v_6 + b_7v_7 + b_8v_8 + b_9v_9$$

And the values of R^2 changed from 0.84, 0.91, 0.86 and 0.54 to 0.98, 0.93, 0.93 and 0.90 during first, second, third and combined periods respectively. This explains the impact of area under coconut, rubber and yield of paddy per hectare on acreage under paddy.

When area under rubber was taken with the four former variables ($V_1 = a + b_4v_4 + b_5v_5 + b_6v_6 + b7\ v_7 + b_9v_9$) there is not much change in R^2 value. There is a decline in the value of R^2 from 0.84 to 0.79 during the first period due to the high multicollinearity with the wage rates (V_6). There is an increase in the value of R^2 from 0.86 and 0.54 to 0.90 and 0.74 during the third and the combined periods respectively.

Similarly, when coconut area was also taken as an independent variable deleting coconut price ($V_1 = a + b_5v_5 + b_6v_6 + b_7v_7 + b_8v_8 + b_9v_9$) the R^2 value increased from 0.86, 0.91, 0.86 and 0.54 to 0.96, 0.93, 0.91 and 0.90 during first, second, third and combined periods respectively. Hence it is clear that coconut area has a great impact on paddy area than rubber area.

Again, when area under rubber and coconut are the only regressors ($V_1 = a + b_8v_8 + b_9v_9$) both the variables together explain 75, 92, 91 and 87 per cent variation in acreage under paddy during the first, second, third and combined periods respectively.

So also, when yield of paddy was also added to that of area under coconut and rubber and consider as regressors ($a + b_3v_3 + b_8v_8 + b_9v_9$) there is some variation in R^2 values to 0.80, 0.93, 0.92, 0.88 from 0.75, 0.92, 0.91 and 0.87 during firs second, third and combined periods respectively.

5.12.3. Impact of Time Trend on Area under Paddy

The equation tried out in this case is:

$$V_1 = a + b_4v_4+b_5v_5 + b_6v_6 + b_7v_7 + b_{10}v_{10}$$

The R^2 values without time trend are 0.84, 0.91, 0.86 and 0.54 and with time trend as 0.83, 0.91, 0.95, 0.68 during the four periods respectively under study. No variation is noticed during the second period due to the non-significance of technological change during the second period in all Kerala. First period marked a decline in R^2 value as a result of the existence of multicollinearity with the time trend. Third and combined periods denote the impact of time trend on acreage.

5.12.4. Impact of Production and Yield on Area under Paddy

Production and yield together explain 99.99 per cent variation in area when the model was modified as: $V_1 = a+b_2v_2 + b_3v_3$. Again, production alone was taken as regressor, the value of R^2 was 0.74 and yield alone as regressor, 0.21 during the first period. During the second period R^2 value varies to 0.86 and 0.57 when regressors production and yield are used respectively. But the change during the third period was just the reverse that is, 0.59 and 0.79 in the case of production and yield respectively. This shows that growth rate of yield has increased during the third period compared to the first and the second periods but growth rate of production became negative during the third period.

5.12.5. Impact of Yield on Production of Paddy

There is a change in the value of R^2 with reference to production response when yield also was included as an independent variable. The equation tried out is:

$$V_2 = a + b_3v_3 + b_4v_4 + b_5v_5 + b_6v_6 + b_7v_7$$

R^2 values have changed into 0.97, 0.98, 0.64 and 0.80 from 0.77, 0.93, 0.57 and 0.39 during the four periods in that order. This shows that yield has more impact on production than on acreage. It is also clear that it is because of increased yield rate, the trend of decline in production is not so steep as the fall in area.

5.12.6. Impact of Area and Yield on Production

With regard to production response when area, yield and the four former variables were taken ($V_2 = a + b_1v_1 + b_3v_3 + b_4v_4 + b_5v_5 + b_6v_6 + b_7v_7$) the values of R^2 increased from 0.84 to 0.997, 0.91 to 0.999, 0.58 to 0.999 and 0.91 to 0.999 during the first to the fourth periods respectively under study.

When area and yield alone are tried but, the values of R^2's are the same. Again, taking area and yield separately, the R^2 values are 0.74, 0.86, 0.59 and 0.22 respectively during first to fourth periods in the case of area as regressor and 0.72, 0.90, 0.16, and 0.48 respectively with regard to yield as regressor. This decline in the value of R^2 during the third period with regard to area as regressor and its impact on production is a proof of steep decline in area during third period and the least impact of the same on production.

5.12.7. Impact of Time Trend on Production

The equation in this case is:

$$V_2 = a + b_4v_4 + b_5v_5 + b_6v_6 + b_7v_7 + b_{10}v_{10}$$

The regression co-efficient of determination has varied from 0.77, 0.93, 0.57 and 0.39 to 0.74, 0.93, 0.60 and 0.68 during first, second, third and combined periods respectively. The value of R^2 declined during first period showing the existence of high multicollinearity with wage rate. No significance is attached to time trend during second period in the case of both area and production response.

5.12.8. Impact of Time Trend on Yield

The equation in this case is:

$$V_3 = a + b_4v_4 + b_5v_5 + b_6v_6 + b_7v_7 + b_{10}v_{10}$$

The co-efficient of determination has changed from 0.75, 0.82, 0.81 and 0.80 to 0.72, 0.82, 0.88 and 0.87. There is a repetition of the same trend of acreage and production response in this case also. That is, during the first period there is a decline from 0.75 to 0.72, as a result of the high multicollinearity with the wage rate. Again there is no change during the second period. The third period indicate a change from 0.81 to 0.88 and the combined period also depict a change from 0.80 to 0.87. Hence it may be concluded that there is more impact of technology during the third period compared to the first and the second periods.

5.12.9. Impact of Area and Production on Yield

With reference to yield response, when area, production and the four former regressors are considered as explanatory variables ($V_3 = a + b_1v_1 + b_2v_2 + b_4v_4 + b_5v_5 + b_6v_6 + b_7v_7$) the values of R^2 increased to 0.999 during all periods under study.

When tried out in the case of area and production alone ($V_3 = a + b_1v_1 + b_2v_2$) the values of R^2's are the same. Again, the R^2 values, when worked out with each regressor separately, are 0.21, 0.57, 0.79 and 0.10 in the case of area as regressor and 0.72, 0.90, 0.16 and 0.48 respectively taking production as regressor during the first, second, third and combined periods indicating highest impact of area on yield during the third period and lowest impact during the combined period. But in the case of impact of production on yield, the highest impact is seen during the second period and the lowest during the third period, since the third period depicts a decline in production and the second period increase in production. Even though area under paddy declined during the third period, yield level increased during the same period.

Impact of Each Regressor on Area, Production and Yield of Paddy

On the whole the second period indicates the highest acreage and production responses and the combined period the highest yield response when each regressor was taken (V_4, V_5, V_6, V_7, V_8, V_9) separately and calculate regression co-efficients, R^2 values and values of 'F' ratio. That is, R^2 values are the highest during second period in the case of area and production responses and with regard to yield response R^2 values are the highest during the combined period.

Values of 'F' ratio and regression co-efficients are also highly significant except the cases of farm level price of paddy and fertiliser price with regard to production response since in these cases they are more significant during the combined period than during the second period, even though R^2 values are high during the second period.

Table - 5.26 Highest Acreage Response with Single Regressor During the Second Period

Rank No.	Regressor	R^2
1	V_8	0.91
2	V_9	0.83
3	V_6	0.76
4	V_4	0.57
5	V_5	0.44
6	V_7	0.41

Among the acreage response with single regressor the variable area under coconut leads with 91 per cent variation. Area under rubber with 83 per cent, wage rate with 76 per cent, farm level price of coconut with 57 per cent, farm price of paddy with 44 per cent and fertiliser price with 41 per cent ranked second, third, fourth, fifth and sixth in the order of significance in the case of acreage response respectively, taking into consideration the values of R^2 of each explanatory variable.

Table - 5.27 <u>Highest Production Response During the Second Period with Single Regressor</u>

Rank No.	Regressor	R^2
1	V_6	0.70
2	V_4	0.44
3.5	V_5	0.36
3.5	V_7	0.36

Table 5.27 shows the highest production response with single regressor variable. Wage rate indicates the highest variation (70 per cent), next farm level price of coconut (44 per cent), then farm level price of paddy and fertiliser price (36 per cent each) during the second period.

Table - 5.28 Highest Yield Response During Combined Period with Single Regressor

Rank No.	Regressor	R^2
1	V_6	0.73
2	V_7	0.69
3	V_4	0.63
4	V_5	0.54

As shown in table 5.28 the impact on yield of wage rate is 73 per cent, fertiliser price 69 per cent, farm level price of coconut 63 per cent and farm level price of paddy 54 per cent during the combined period.

On the whole, area and production responses are the highest during the second period and yield responses during the combined period. This is due to the increase in area and production upto the second period and rather higher increase in yield after second period compared to area and production. The values of 'F' ratios are highly significant during the second period with regard to acreage and production responses, except in three cases in the case of production responses. With reference to yield response, the values of 'F' ratios are highly significant during the combined period with an exception of two cases.

When the four main regressors - farm level price of coconut, farm level price of paddy, wage rate of paddy farm labour and fertiliser price - were considered, wage rate of paddy farm labour ranks first in the case of supply shifters in all estimations in general.

Current year estimates give greater number of significant responses than lagged year estimates when the calculations related to the State as a whole are taken into consideration.

Area under paddy is more responsive to independent variables compared to production and yield response, since the percentage variation in acreage under paddy is greater than production and yield of paddy.

The analysis reveals that the impact of coconut area on area under paddy is grater than the impact of area under rubber.

The impact of time trend on acreage, production and yield is greater during the third and the combined periods rather than during the first and the second periods.

Growth rate of yield has increased during the third period compared to the first and second periods but growth rates of production and area have declined during the third period.

Yield has more impact on production than on area except during the third period. It is because of the increased growth rate in yield, the trend of decline in production is not so steep as the decline in area.

As a result of steep decline in area during the third period, its impact on production is the lowest during the same period and hence the rate of growth of production also declined.

In the case of impact of production on yield, the highest impact is during the second period and the lowest during the third period since the third period depicts a decline in production and the second period increase in production. Even though area under paddy declined during the third period, yield level has increased during the same period.

Statistical Annexure

Table A Regression Results for Rice Area Response for the State as a Whole
Lagged Year Estimates - I Period

E.No.	a	V_{4-1}	V_{5-1}	V_{6-1}	V_{7-1}	R^2	F ratio
b	654,162.18**	-156.49	-915.37	81,700.78	251.72	0.81	3.23
c	678,699.40*	-187.41	-707.93	80,388.67	--	0.81	5.61***
d	762,893.79*	- 78.22	900.69	--	27.90	0.61	2.06
e	718,687.06*	-284.89	--	63,293.63	-106.93	0.79	4.97
f	625,183.25*	--	-1311.40	79,254.21	416.65	0.80	5.31
g	765,461.64*	- 81.85	920.74	--	--	0.61	3.86
h	712,466.47*	-283.74	--	61,499.74***	--	0.79	9.26**
i	691,679.95*	181.61	--	--	576.33	0.57	3.26
j	660,949.58*	--	-1065.80	75,839.87	--	0.79	9.27**
k	746,540.02*	--	672.12	--	115.00	0.60	3.81
l	715,688.55	--	--	33,909.50	- 79.39	0.73	6.60***
m	727,582.84*	261.08***	--	--	--	0.53	6.80***
n	755,240.05*	--	717.74***	--	--	0.60	9.11**
o	711.024.19	--	--	32,664.22	--	0.72	15.80**
p	666,318.79*	--	--	--	1346.42	0.46	5.10

Note: E.No. = Equation number
a = Constant
V_{4-1} = Farm Level Price of Coconut during t-1
V_{5-1} = Farm Level Price of Paddy during t-1
V_{6-1} = Wage Rate of Paddy Farm Labour during t-1
V_{7-1} = Fertiliser Price Index during t-1
* = 1 per cent Level of Significance
** = 5 per cent Level of Significance
*** = 10 per cent Level of Significance

Lagged year Estimates = Estimation of regressions taking current year with regard to Dependent Variables and one year lag or previous year in the case of Independent variables.

Table B Regression Results for Rice Area Response for the State as a Whole

Current Year Estimates - I Period

E.No.	a	V_4	V_5	V_6	V_7	R^2	F Ratio
1.	680,296.00*	164.99	-1686.96	69,779.18**	-177.69	0.84	5.31***
2.	666,690.11*	191.65	-1770.32***	67,357.51**	--	0.84	8.70**
3.	642.814.31*	394.03	- 941.75	--	1007.63	0.43	1.26
4.	783,194.09*	-272.61	--	59,393.14***	-746.3	0.70	3.95
5.	709,985.08*	--	-1280.06***	72,747.33**	-346.75	0.83	8.07**
6.	733,615.24*	256.01	- 135.82	--	--	0.34	1.56
7.	740,679.88*	-247.52	--	44,751.08***	--	0.66	5.79
8.	707,633.91*	112.17	--	--	562.43	0.39	1.88
9.	689,670.44*	--	1320.69**	68,268.86**	--	0.82	13.60**
10.	714,119.01*	--	171.43	--	706.51	0.36	1.65
11.	760,861.49*	--	--	34,289.89	-599.97	0.61	4.65***
12.	739,343.74*	204.78	--	--	--	0.34	3.62
13.	765,668.16*	--	497.22	--	--	0.31	3.09
14.	727,738.49*	--	--	24,194.47**	--	0.58	9. 61**
15.	697,839.08*	--	--	--	977.34	0.35	3.69

Note: E.No. a, *, **, *** are same as in Table A.

V_4 = Farm price of coconut during t

V_5 = Farm price of paddy during t

V_6 = Wage rate of paddy farm labour during t

V_7 = Fertiliser price index during t

Current year estimates = Estimation of regressions taking current year dependent and independent variables.

Table C <u>Regression Results for Rice Production Response for the State as a Whole Lagged Year Estimates - I Period</u>

E.No.	a	V_{4-1}	V_{5-1}	V_{6-1}	4_{7-1}	R^2	F Ratio
b	278,410.08	747.27	-7470.18***	218,983.69	4722.14	0.83	3.58
c	738,720.60**	167.08	-3578.73	194,369.32	--	0.61	2.06
d	569,858.28	757.04	-2602.57	--	4122.23	0.58	1.83
e	804,987.85**	-300.61	--	68,765.79	1795.20	0.57	1.73
f	416,794.37	--	-5578.99	230,666.88	3934.54	0.78	4.71
g	948,499.21*	422.33	359.17	--	--	0.41	1.73
h	909,418.33*	-319.88	--	98,881.50	--	0.52	2.68
i	775,645.80*	206.23	--	--	2537.53	0.57	2.72
j	754,544.72*	--	-3259.70	19,424.49	--	0.60	3.82
k	769,999.45***	--	193.97	--	3056.60	0.50	2.50
l	801,823.92*	--	--	37,760.49	1824.26	0.61	2.06
m	933,722.98*	556.10	--	--	--	0.41	4.11
n	100,1243.40*	--	1406.69	--	--	0.39	3.85
o	907,848.73**	---	--	66,373.55***	--	0.51	6.12***
p	746,847.39*	--	--	--	3411.99***	0.50	5.95***

Note: Same as in Table A.

Table D <u>Regression Results for Rice Production Response for the State as a Whole</u>

<u>Current Year Estimates - I Period</u>

E.No.	a	V_4	V_5	V_6	V_7	R^2	F Ratio
1	10001003.08*	-1067.99	-988.05	172,293.13***	-316.85	0.77	3.44
2	976741.01*	-1020.44	-1136.69	167,974.81**	--	0.77	5.70***
3	908456.31**	- 502.45	851.96	--	2609.84	0.33	0.81
4	1066269.95*	-1324.27**	--	166,210.08**	-649.89	0.77	5.47***
5	808831.91*	--	-3621.88***	153,080.92***	777.46	0.68	3.55
6	1143637.57*	- 859.94	2939.39	--	--	0.22	0.84
7	102434831*	-1302.42**	--	153,459.69**	--	0.76	9.52**
8	849816.84*	- 247.47	--	--	3012.59	0.32	1.41
9	854380.05*	--	-3530.77***	163,122.23**	--	0.67	6.15***
10	817530.87**	--	- 567.54	--	2993.82	0.30	1.31
11	952785.00*	--	--	42,266.69	60.99	0.36	1.71
12	1019666.43*	248.60	--	--	--	0.09	0.69
13	1035969.68*	--	812.96	--	--	0.15	1.20
14	956151.95*	--	--	46,292.86	--	0.36	3.99
15	871426.13*	--	--	--	2097.22	0.29	3.79

Note: Same as in Table B

Table E Regression Results for Rice Yield Response for the State as a Whole

Lagged Estimates - I Period

E.No.	a	V_{4-1}	V_{5-1}	V_{6-1}	V_{7-1}	R^2	F Ratio
b	602.29***	1.20	-7.85***	136.68	5.38***	0.84	3.90
c	1127.19***	0.54	-3.42	108.64	--	0.30	0.56
d	784.80***	1.34	-4.81	--	5.00***	0.65	2.53
e	1156.14*	0.10	--	-21.15	2.30	0.29	0.55
f	826.02***	--	-4.80	155.52	4.11	0.61	2.45
g	1244.45*	0.69	1.22	--	--	0.18	2.58
h	1290.14*	0.08	--	17.49	--	0.14	0.42
i	1165.17*	-0.05	--	--	2.08	0.28	0.98
j	1178.72*	--	-2.38	121.85	--	0.24	0.80
k	1064.15**	--	-0.91	--	3.52	0.36	1.43
l	1157.24*	--	--	-10.43	2.29	0.29	1.01
m	1294.43*	0.23	--	--	--	0.14	0.95
n	1330.21*	--	0.49	--	--	0.09	0.59
o	1290.52*	--	--	25.54	--	0.14	0.99
p	1172.42*	--	--	--	1.85	0.28	2.33

Note: Same as in Table A.

Table F <u>Regression Results for Rice Yield Response for the State as a Whole</u>

<u>Current Year Estimates - I Period</u>

E.No.	a	V_4	V_5	V_6	V_7	R^2	F Ratio
1	1467.44^{*}	-1.62^{***}	1.78	92.44	-0.18	0.75	3.03
2	1453.75^{*}	-1.59^{**}	1.69	90.00^{***}	--	0.75	5.02^{***}
3	1417.79^{*}	-1.32	2.76	--	1.39	0.50	1.68
4	1359.15^{*}	-1.16^{**}	--	103.37^{***}	0.42	0.70	3.86
5	1175.80^{*}	--	-2.22	63.28	1.48	0.33	0.82
6	1543.17^{*}	-1.51^{***}	3.88^{***}	--	--	0.44	2.38
7	1383.06^{*}	-1.17^{**}	--	111.60^{**}	--	0.69	6.79^{**}
8	1227.65^{*}	-0.49	--	--	2.70	0.36	1.71
9	1262.62^{*}	--	-2.05	82.42	--	0.27	1.11
10	1179.39^{*}	--	-0.96	--	2.40	0.21	0.78
11	1264.11^{*}	--	--	-3.47	1.04	0.10	0.33
12	1379.73^{*}	-0.05	--	--	--	0.006	0.04
13	1354.37^{*}	--	0.15	--	--	0.009	0.07
14	1321.66^{*}	--	--	14.07	--	0.07	0.51
15	1270.49^{*}	--	--	--	0.88	0.10	0.76

Note: Same as in Table B.

Table G Regression Results for Rice Area Response for the State and Districts Between 1960-61 and 1968-69 (I Period)

Districts/State	Constant Term	Current Farm Price of coconut	Current Farm Price of paddy	Wage Rate (Current)	Fertiliser Price (Current)	R^2	F Ratio
Area Increasing Districts/State							
All Kerala	680296.00*	164.99	-1686.96	69779.18**	-177.69	0.84	5.31***
Trivandrum	37180.58*	3.99	- 7.78	1316.75	- 28.87	0.76	3.10
Quilon	48877.61*	- 3.15	- 30.91	4955.56	- 91.64	0.77	3.28
Alleppey	78640.37*	9.09	- 140.31***	7468.40**	-107.08	0.83	4.81***
Kottayam	33784.06*	-19.93	- 133.63***	8711.12*	8.00	0.92	11.61**
Ernakulam	50663.03**	20.57	- 179.06	6522.14***	151.62	0.80	4.00
Trichur	94107.41*	77.32	- 237.37	6618.79	-167.13	0.68	2.13
Palghat	173215.29*	- 5.47	- 145.85	7034.25***	147.45	0.81	4.24***
Kozhikode	97482.89*	-41.52	- 66.19	10438.20	- 14.84	0.46	0.85
Area Stagnant District							
Canannore	108991.83*	-82.33	271.84	3226.86	-217.93	0.39	0.65

Note: *, **, *** denote 1 per cent, 5 per cent and 10 per cent Level of Significance.

Table H Regression Results for Rice Production Response for the State and Districts 1960-61 to 1968-69 (I Period)

Districts/State	Constant Term	Current Farm Price of Coconut	Current Farm Price of Paddy	Current Wage Rate	Current Fertiliser Price	R^2	F Ratio
Production Increasing Districts							
Palghat	416363.04***	-611.99	2013.17	27587.15	-1019.45	0.62	1.64
Canannore	142679.03**	-130.05	475.69	16187.24	- 814.14	0.70	2.33
Production Stagnant							
All Kerala	1001003.08*	-1067.97	-988.05	172293.13**	- 316.85	0.77	3.44
Trivandrum	50620.92*	- 6.41	- 43.95	787.88	71.51	0.24	0.31
Quilon	39539.73**	- 44.16	-161.87	9505.16	291.03	0.79	3.83
Alleppey	118072.97**	- 272.82***	143.12	11113.92	358.63	0.78	3.63
Kottayam	43662.08**	- 227.04**	-197.68	19832.26**	467.17**	0.95	18.94*
Ernakulam	43182.86	- 60.46	-243.99	9281.74	646.08***	0.68	2.17
Trichur	147862.11***	- 22.27	-102.38	19774.71	-609.39	0.45	0.83
Kozhikode	111629.74**	- 62.15	-628.77	28655.04	-150.27	0.39	0.65

Note: Same as in Table G.

Table I Regression Results for Rice Yield Response for the State and Districts 1960-61 to 1968-69 (I Period)

Districts/State	Constant Term	Current farm Price of coconut	Current Farm Price of Paddy	Current Wage Rate	Current Fertiliser Price	R^2	F Ratio
Yield Increasing							
Trivandrum	1367.23*	0.32	-0.78	-33.75	2.99	0.54	1.16
Palghat	2329.69**	-3.07	11.62	78.63	-6.60	0.51	1.04
Canannore	1510.29*	-1.15	5.09	136.90	-8.12***	0.74	2.82
Yield Stagnant							
All Kerala	1467.44*	-1.62***	1.78	92.44	-0.18	0.75	3.03
Quilon	819.78**	-0.78	-2.30	37.67	8.66**	0.76	3.22
Alleppey	1501.80*	-3.51**	4.29	-0.51	6.37	0.82	4.53***
Kottayam	1336.32*	-4.79**	0.29	148.64	11.21**	0.96	24.63*
Ernakulam	1044.79*	-1.04	-0.04	5.17	5.30***	0.72	2.57
Trichur	1519.79**	-1.01	1.59	108.92	-3.87	0.33	0.48
Kozhikode	1158.65*	-0.11	-4.81	143.85	-1.33	0.59	1.45

Note: Same as in Table I.

Table J Regression Results for Rice Area Response for the State as a Whole

Lagged estimates - II Period

E.No.	a	V_{4-1}	V_{5-1}	V_{6-1}	V_{7-1}	R^2	F Ratio
b	731978.00*	-25.22	48.08	34952.47*	-220.63	0.89	18.47*
c	727890.21*	-92.72	-13.15	36829.44*		0.88	24.07*
d	764235.28*	180.03	603.24		-421.73	0.67	6.76*
e	731684.45*	-21.11		35490.46*	-214.27	0.89	27.28*
f	732817.59*		26.44	33905.15*	-257.53	0.89	27.13*
g	759500.88*	66.52	540.10			0.62	8.96*
h	727940.10*	-94.44		36692.09*		0.88	39.70*
i	767332.23*	290.95**			-371.97	0.61	8.72*
j	728927.59*		-225.32	31948.19*		0.86	33.34*
k	765433.88*		964.54**		-130.25	0.61	8.78*
l	732562.19*			34325.71*	-250.19***	0.89	44.72*
m	762814.85*	179.21*				0.57	16.16*
n	762428.63*		805.28*			0.61	18.49*
o	730617.95*			26376.61*		0.85	67.35*
p	775152.51*				450.90**	0.39	7.53*

Note: Same as in Table A.

Table K Regression Results for Rice Area Response for the State as a Whole

Current Year Estimates - II Period

E.No.	a	V_4	V_5	V_6	V_7	R^2	F Ratio
1	724040.45*	54.42	-759.90*	42509.74*	-135.65	0.91	25.41*
2	722037.36*	15.66	- 818.52*	43712.84*		0.91	35.29*
3	763585.78*	306.22**	- 94.88		-382.58	0.62	5.95**
4	740338.80*	28.93		30578.51*	-351.50	0.82	16.36*
5	723126.16*		-745.14*	45126.66*	- 51.97	0.91	35.57*
6	760957.41*	212.15***	-213.22			0.58	8.32*
7	738135.63*	-91.37		31413.67*		0.78	21.55*
8	764446.33*	290.30**			-406.84	0.62	9.66*
9	722193.27*		-792.85*	44670.59*		0.91	57.37*
10	775547.42*		343.43		148.39	0.45	4.85**
11	739678.37*			32106.93*	-304.89	0.82	26.57*
12	762650.68*	158.76*				0.57	17.25*
13	779808.76*		514.47*			0.44	10.10*
14	740728.43*			21433.03		0.76	40.64
15	774409.85*				395.37**	0.41	9.12*

Note: Same as in Table B.

Table L Regression Results for Rice Production Response for the State as a Whole

Lagged Estimates - II Period

E.No.	a	V_{4-1}	V_{5-1}	V_{6-1}	V_{7-1}	R^2	F Ratio
b	886449.98*	147.88	-1663.24	108727.41*	-292.07	0.85	12.44*
c	881038.51*	58.52	-1744.29	111212.18*		0.84	18.06*
d	986793.40*	786.37	63.70		-917.65	0.60	4.95*
e	896605.55*	5.72		90115.45*	-511.99	0.81	13.83*
f	881527.06*		-1536.37	114868.34*	- 75.69	0.84	17.98*
g	976491.79*	539.37	- 73.67			0.57	7.30*
h	887658.71*	-169.50		92986.63*		0.80	21.63*
i	987120.44*	798.09**			-912.40	0.60	8.17*
j	880383.72*		-1610.37***	114293.16*		0.84	29.59*
k	765433.88*		964.54**		-130.25	0.61	8.78*
l	896367.80*			90430.94*	-502.26	0.81	22.82*
m	976039.78*	524.00*				0.57	15.91*
n	1000232.14*		2076.55*	74473.10*		0.47	10.58*
o	892464.73*					0.79	44.14*
p	1008571.82*				1344.76**	0.40	7.96*

Note: Same as in Table A.

Table M Regression Results for Rice Production Response for the State as a Whole

Current Year Estimates - II Period

E.No.	a	V_4	V_5	V_6	V_7	R^2	F Ratio
1	861276.80*	-398.49***	-2606.25*	157769.23*	594.47	0.93	35.66*
2	870055.37*	-228.63	-2349.36*	152496.66*		0.92	44.47*
3	1008043.99*	536.03	- 138.12		-321.99	0.44	2.91
4	917175.49*	-485.90		116848.52*	-145.85	0.80	14.64*
5	867972.19*		-2714.37*	138605.44*	- 10.99	0.91	36.63*
6	1005831.91*	456.87	- 237.72			0.44	4.70**
7	916261.32*	-535.82**		117195.05*		0.80	23.88*
8	1009296.66*	-512.86			-357.29	0.44	4.75**
9	867778.69*		-2724.26*	138510.84*		0.91	59.94*
10	1028982.81*		629.14		607.47	0.38	3.65
11	928267.87*			91177.73*	-928.69***	0.76	19.16*
12	1007719.67*	397.34*				0.44	10.12*
13	1046427.99*		1329.36**			0.36	7.24*
14	931466.30*			58665.60*		0.70	29.68*
15	1026898.84*				1059.93**	0.37	7.45*

Note: Same as in Table B.

Table N Regression Results for Rice Yield Response for the State as a Whole

Lagged Estimates - II Period

E.No.	a	V_{4-1}	V_{5-1}	V_{6-1}	V_{7-1}	R^2	F Ratio
b	1235.91*	0.20	-2.01***	71.36**	-0.01	0.70	5.15**
c	1235.68*	0.20	-2.01***	71.46		0.70	7.63*
d	1301.76*	0.62	-0.87		-0.42	0.47	2.99***
e	1248.15*	0.03		48.91	-0.28	0.57	4.45
f	1229.09*		-1.83***	79.86*	0.29	0.68	7.18*
g	1297.02*	0.51***	-0.94			0.46	4.70**
h	1243.31*	-0.06		50.47***		0.57	7.19*
i	1297.28*	0.46			-0.49	0.44	4.40**
j	1233.43*		-1.55***	82.04*		0.67	11.34*
k	1305.91*		0.38		0.59	0.31	2.51
l	1246.77*			50.75**	-0.22	0.57	7.34*
m	1291.28*	0.31**				0.43	8.97*
n	1319.47*		1.10***			0.27	4.49**
o	1245.06*			43.74*		0.56	15.51*
p	1309.74*				0.82**	0.31	5.27**

Note: Same as in Table A.

Table O Regression Results for Rice Yield Response for the State as a Whole

Current Year Estimates - II Period

E.No.	a	V_4	V_5	V_6	V_7	R^2	F Ratio
1	1219.02*	-0.55**	-1.85**	115.49*	0.93	0.82	11.56*
2	1232.69*	-0.29	-1.45***	107.28*		0.77	12.01*
3	1326.46*	0.13	-0.04		0.25	0.25	1.23
4	1258.60*	-0.62***		86.51*	0.40	0.68	7.64*
5	1228.34*		-1.99**	88.82*	0.08	0.72	9.21*
6	1328.21*	0.19	0.04			0.54	7.11*
7	1261.12*	-0.48**		85.56*		0.66	11.84*
8	1326.81*	0.12			0.24	0.25	2.00
9	1229.80*		-1.92**	89.54*		0.71	15.01*
10	1331.52*		0.15		0.48	0.24	1.92
11	1272.67*			53.95**	-0.59	0.54	7.11*
12	1327.89*	0.20***				0.25	4.24**
13	1345.28*		0.70***			0.21	3.55**
14	1274.71*			33.23*		0.48	12.19*
15	1331.03*				0.58***	0.24	4.12**

Note: Same as in Table B.

Table P **Regression Results for Rice Area Response for the State and Districts 1960-61 to 1974-75(II Period)**

Area Increasing Districts/State	Constant Term	Current Farm Price of Coconut	Current Farm Price of Paddy	Current Wage Rate	Current Fertiliser Price	R^2	F Ratio
All Kerala	724040.45*	54.42	-759.90*	42509.74*	-135.65	0.91	25.41*
Trivandrum	36843 .31*	2.55	- 0.86	695.08**	- 10.64	0.75	7.47*
Quilon	46210.46*	4.69	- 15.10	2143.90***	- 30.68**	0.76	7.86*
Alleppey	73119.53*	-6.52	- 18.68	2231.32***	46.89	0.85	14.00*
Kottayam	37353.15*	-1.42	- 20.83	3614.36*	- 34.31	0.80	10.12*
Ernakulam	70725.77*	15.14	- 58.77	4180.28*	- 27.87	0.82	11.78*
Trichur	99743.46*	19.68	- 46.89	3999.93**	- 92.17***	0.67	5.18**
Palghat	184322.31*	8.93	-233.86**	12293.15*	- 61.76	0.89	20.53*
Kozhikode	93577.88*	28.85	-275.46**	10775.56**	- 37.84	0.72	6.55*
Canannore	91277.78*	6.40	- 17.55	1753.23	- 41.27	0.40	1.68

Note: Same as in Table G.

Table Q **Regression Results for Rice Production Response for the State and Districts 1960-61 to 1974-75 (II Period)**

Production Increasing	Constant Term	Current Farm Price of Coconut	Current Farm Price of Paddy	Current Wage Rate	Current Fertiliser Price	R^2	F Ratio
All Kerala	861276.80*	-398.49***	-2606.25*	157769.23*	594.47	0.93	35.66*
Trivandrum	50696.02*	- 25.96	- 45.79	3430.42**	57.27	0.45	2.07
Quilon	59985.01*	- 21.39	- 79.02	6163.49	49.94	0.53	2.85***
Alleppey	91214.70*	- 89.47	- 230.33***	15993.52*	210.43	0.77	8.22*
Kottayam	39934.69*	- 73.57***	- 248.49**	13903.90*	218.58***	0.83	12.06*
Ernakulam	79348.06*	- 30.02	- 117.60	9903.40**	98.08	0.72	6.45*
Trichur	118082.96*	- 0.54	- 71.41	13611.15*	-221.92	0.63	4.25**
Palghat	296051.63*	- 93.87	- 607.42	55527.03*	-360.26	0.71	6.05*
Kozhikode	91900.28*	- 14.49	- 612.86*	15951.47**	262.65**	0.63	4.30**
Canannore	103781.88*	98.41***	- 3.94	352.12	-201.09	0.60	3.72**

Note: Same as in Table G.

Table R Regression Results for Rice Yield Response for the State and Districts 1960-61 to 1974-75(II Period)

Yield Increasing	Constant Term	Current Farm Price of Coconut	Current Farm Price of Paddy	Current Wage Rate	Current Fertiliser Price	R^2	F Ratio
All Kerala	1219.02*	-0.55**	-1.85**	115.49*	0.93	0.81	11.56*
Kottayam	1130.88*	-1.61**	-5.22**	181.56*	6.49*	0.78	8.93*
Palghat	1615.23*	-0.48	-0.89	160.92**	-1.31	0.53	2.77***
Canannore	1113.86*	0.94***	0.56	- 15.44	-1.80	0.57	3.30***
Yield Stagnant							
Trivandrum	1382.39*	-0.75	-1.14	60.18	1.87	0.33	1.24
Quilon	1311.60*	-0.58	-1.17	61.88	1.92	0.31	1.13
Alleppey	1278.66*	-0.95	-2.60	154.46**	1.70	0.52	2.76***
Ernakulam	1161.43*	-0.56	-0.52	48.29	1.58	0.33	1.22
Trichur	1187.20*	-0.22	-0.04	77.33**	-1.02	0.43	1.89
Kozhikode	1002.44*	-0.37	-2.74***	35.09	2.60*	0.52	2.74***

Note: Same as in Table G.

Table S Regression Results of Rice Area Response for the State as a Whole

Lagged Estimates - III Period

E.No.	a	V_{4-1}	V_{5-1}	V_{6-1}	V_{7-1}	R^2	F Ratio
b	873650.14*	-34.20	333.79	-9339.39***	45.57	0.88	12.97*
c	881487.11*	-34.27	355.32	-9172.34***		0.88	19.57*
d	860978.98	-97.56*	366.49		- 9.39	0.81	11.52*
e	893981.44*	-23.16		-9836.53***	153.26	0.84	14.38*
f	883265.73*		287.14	-13411.46*	47.03	0.86	17.06*
g	859281.14*	-97.78*	362.08			0.81	19.44*
h	930281.74*	-20.61		- 9300.92***		0.83	21.96*
i	882674.69*	-89.10			106.24	0.77	14.78*
j	891373.32*		309.26	-13247.51*		0.86	28.53*
k	921707.13*		-114.35		-393.53	0.12	0.64
l	898786.42*			-12675.61*	143.62	0.84	22.90*
m	908699.99*	-84.77*				0.76	31.66*
n	859609.57*		-334.12			0.06	0.63
o	932540.59*			-11875.10*		0.82	46.72*
p	915922.28*				-394.43	0.12	1.35

Note: Same as in Table A

Table T Regression Results for Rice Area Response for the State as a whole

1974-75 to 1985-86 Current Year Estimates(III Period)

E.No.	a	V_4	V_5	V_6	V_7	R^2	F Ratio
1	915880.64*	-20.88	332.02	-8215.65*	-151.70	0.86	11.16*
2	889734.15*	-21.70	271.56	-8769.01*		0.85	15.61*
3	971068.17*	-60.26***	140.66		-390.50	0.62	4.38**
4	909771.67*	-25.84		-9995.57*	29.62	0.75	8.08*
5	913552.25*		305.10	-9545.93*	-163.68	0.84	14.39*
6	906484.49*	-70.27**	-70.58			0.54	5.38**
7	922844.82*	-18.30		-7730.80*		0.83	21.22*
8	976902.70*	-57.28**			-335.45	0.61	7.17**
9	885153.78*		238.50	-10201.53*		0.83	22.21*
10	998525.79*		-99.95		-600.95	0.37	2.66
11	930665.68*			-8669.85*	- 67.60	0.81	19.31*
12	896675.57*	-73.06**				0.54	11.85*
13	897072.71*		-524.49			0.17	2.07
14	915443.06*			-9071.01		0.81	42.25*
15	995050.99*				-651.76**	0.37	5.81**

Note: Same as in Table B.

Table U Regression Results for Rice Production Response for the State as a Whole

Lagged Estimates - III Period

E.No.	a	V_{4-1}	V_{5-1}	V_{6-1}	V_{7-1}	R^2	F Ratio
b	1289077.68*	34.42	-153.32	-14191.32**	445.78***	0.71	4.36**
c	1365738.91*	33.75	57.29	-12557.20***		0.57	3.59***
d	1269823.69*	-61.86**	-103.63		362.27	0.49	2.53
e	1279738.67*	29.35		-13962.96**	396.31***	0.70	6.29**
f	1279399.87*		-106.37	-10092.90*	444.32	0.69	5.94**
g	1335338.28*	-53.21***	66.55			0.39	2.90
h	1373606.90*	35.95		-12577.93***		0.57	6.02**
i	1263688.74*	-64.25**			329.57	0.48	4.17**
j	1356002.85*		102.65	- 8543.91**		0.55	5.53**
k	1308329.27*		-408.52		150.40	0.09	0.46
l	1273650.16*			-10365.50*	408.53***	0.68	9.76*
m	1344421.23*	-50.82**				0.39	6.32**
n	1335516.99*		312.30			0.07	0.80
o	1369667.30*			- 8088.37**		0.55	11.98*
p	1287663.04*				-31.46	0.001	0.01

Note: Same as in Table A.

Table V <u>Regression Results for Rice Production Response for the State as a Whole</u>

<u>Current Year Estimates - III Period</u>

E.No.	a	V_4	V_5	V_6	V_7	R^2	F Ratio
1.	1278385.92*	-13.96	57.92	-6999.40***	325.34	0.57	2.31
2.	1334461.21*	-12.20	187.61	-5812.63		0.50	2.68
3.	1325403.48*	-47.52	-105.11		121.90	0.32	1.24
4.	1281535.32*	-13.42		-6869.54***	343.05	0.57	3.50***
5.	1276828.89*		39.92	-7888.98**	317.33	0.56	3.34***
6.	1345564.35*	-44.39	-39.17			0.31	1.99
7.	1357337.48*	- 9.85		5095.33		0.48	4.17**
8.	1321043.49*	-49.74***			80.76	0.31	2.04
9.	1331886.29*		169.04	-6617.94**		0.49	4.34**
10.	1347053.01*		-294.82		-44.04	0.10	0.48
11.	1279068.12*			-7774.35*	329.90	0.55	5.61**
12.	1340287.18*	-45.94***				0.31	4.41**
13.	1339618.35*		-325.93			0.09	1.04
14.	1353353.47*			-5816.70**		0.47	9.02*
15.	1336803.14*				-193.92	0.05	0.49

Note: Same as in Table B.

Table W Regression Results for Rice Yield Response for the State as a Whole

Lagged Estimates - III Period

E.No.	a	V_{4-1}	V_{5-1}	V_{6-1}	V_{7-1}	R^2	F Ratio
b	1455.64*	0.11	-0.77***	2.16	0.42	0.81	7.58**
c	1528.66*	0.11	-0.57	3.72		0.77	8.74*
d	1458.58*	0.12*	-0.78***		0.44	0.81	11.41*
e	1408.89*	0.08		3.31	0.18	0.71	6.50**
f	1425.40*		-0.62	14.97*	0.42	0.73	7.17**
g	1537.66*	0.13*	-0.57			0.76	14.28*
h	1450.80*	0.09		3.92		0.70	10.49*
i	1412.69*	0.10*			0.19	0.70	10.74*
j	1497.81*	-0.42	16.43*			0.68	9.72*
k	1382.49*		-0.17		0.86	0.25	1.49
l	1391.84*			13.38**	0.21	0.66	8.66*
m	1459.91	0.11*				0.69	22.60*
n	1537.22*		0.37			0.04	0.41
o	1441.47*			14.56*		0.64	18.13*
p	1373.76*				0.78	0.24	3.20

Note: Same as in Table A.

Table X Regression Results for Rice Yield Response for the State as a Whole

Current Year Estimates - III Period

E.No.	a	V_4	V_5	V_6	V_7	R^2	F. Ratio
1.	1372.27*	0.02	-0.55	8.96***	0.66***	0.81	7.40**
2.	1485.20*	0.02	-0.29	11.35**		0.71	6.46**
3.	1312.12*	0.06	-0.34		0.92**	0.66	5.14**
4.	1342.22*	0.01		7.72***	0.49	0.75	8.16*
5.	1374.29*		-0.53	10.11*	0.67***	0.80	10.71*
6.	1463.53*	0.08***	0.15			0.44	3.51***
7.	1449.66*	0.02		10.23**		0.69	10.04*
8.	1297.84*	0.05			0.78**	0.64	7.86*
9.	1489.76*		-0.26	12.77*		0.70	10.31*
10.	1284.33*		-0.10		1.13**	0.53	4.98**
11.	1344.59*			8.59**	0.50	0.75	13.47*
12.	1483.89*	0.09**				0.43	7.63**
13.	1474.84*		0.70			0.16	1.87
14.	1456.92*			11.55*		0.68	21.47*
15.	1280.83*				1.08**	0.52	10.97*

Note: Same as in Table B.

Table Y Regression Results for Rice Area Response for the State and Districts 1974-75 to 1985-86 (III Period)

Districts/State	Constant Term	Current Farm Price of Coconut	Current farm Price of paddy	Current Wage Rate	Current Fertiliser price	R^2	F Ratio
Area Declining Districts/State							
All Kerala	915880.64*	- 20.88	332.02	-8215.65*	-151.70	0.86	11.16*
Trivandrum	41454.82*	- 2.67	23.75	-470.43**	- 17.10	0.86	10.35*
Quilon	51719.68*	0.97	1.18	-431.99**	6.62	0.65	3.29***
Alleppey	89528.24*	- 9.91	-12.51***	-174.64***	43.71	0.97	60.56*
Kottayam	68307.86*	- 4.70	79.38***	-277.19	-104.65**	0.77	5.70**
Ernakulam	120870.14*	- 1.51	-99.39*	-497.99**	30.15***	0.94	25.54*
Trichur	136876.48*	- 2.11	-30.74	-614.38	-28.71	0.75	5.33**
Palghat	197455.80*	- 1.68	116.19	-3305.05**	58.66	0.72	4.50**
Kozhikode	130242.22*	- 5.16	67.15***	-1374.30	-58.05***	0.91	17.95*
Canannore	87286.91*	- 7.93***	133.30**	- 765.94**	-38.42	0.79	6.49**

Note: Same as in Table G.

Table Z <u>Regression Results for Rice Production Response for the State and Districts</u>

1974-75 to 1985-86 (III Period)

District/State	Constant Term	Current price of coconut	Current Farm Price of Paddy	Current Wage rate	Current Fertiliser Prices	R^2	F Ratio
Production Stagnant <u>Districts</u>							
Quilon	65523.43*	-2.76	-28.29	-64.78	76.08	0.29	0.71
Alleppey	138342.20*	-2.04	4.43	-333.96***	67.31	0.92	20.52*
Ernakulam	166437.23*	-6.49	-177.45*	970.70***	52.82	0.69	3.97***
Trichur	147689.36*	-2.76	29.96	-17.56	8.96	0.13	0.26
Palghat	358264.85*	10.64	-17.52	-8036.83***	325.15	0.50	1.77
Kozhikode	145827.46*	-0.15	-66.12	-78.18	-19.16	0.53	1.96
Production Declining <u>Districts/ State</u>							
<u>All Kerala</u>	1278385.92*	-13.96	57.92	-6999.40***	325.34	0.57	2.31
Trivandrum	60292.76*	- 8.80**	45.75	79.74	-40.82	0.72	4.39**
Kottayam	92592.57*	- 4.35	165.68**	-624.53	-109.68	0.58	2.41
Canannore	110069.86*	-15.16*	196.79**	-669.60***	-30.38	0.82	8.02*

Note: Same as in Table G.

Table A1 Regression Results for Rice Yield Response for the State and Districts

1974-75 to 1985-86 (III Period)

Districts/State	Constant Term	Current Farm Price of Coconut	Current Farm Price of Paddy	Current Wage Rate	Current Fertiliser Price	R^2	F Ratio
Yield Increasing							
All Kerala	1372.27*	0.02	-0.55	8.96***	0.66***	0.81	7.40**
Quilon	1256.99*	-0.10	-0.58	13.90	1.28	0.64	3.09***
Alleppey	753.36	-1.92	34.60*	304.14*	-19.97	0.99	2671.82*
Kottayam	1149.84**	0.12	0.54	-3.20	1.64	0.45	1.41
Ernakulam	1355.48*	-0.05	-0.33	18.83*	0.09	0.75	5.39**
Trichur	1029.92*	-0.09	0.69	9.27***	0.34	0.78	6.36**
Kozhikode	1078.54*	0.05	-1.25**	18.14*	0.42	0.84	9.19*
Yield Stagnant							
Trivandrum	1461.59*	-0.18**	0.31	28.68*	-0.58	0.78	6.39**
Palghat	1815.87*	0.07	-1.14	-9.36	1.03	0.38	1.08
Canannore	1270.70*	-0.07	0.56	6.29	-0.04	0.43	1.32

Note: Same as in Table G.

Table B1 Regression Results for Rice Area Response for the Taluks

1974-75 to 1985-86 (III Period)

Taluks	Constant Term	Current Farm Price of Coconut	Current Farm Price of paddy	Current Wage Rate	Current Fertiliser price	R^2	F Ratio
Area Stagnant Taluks							
Pathanamthitta	5044.50*	0.42	-6.65**	14.86	- 1.08	0.64	3.12***
Vaikom	14096.25*	0.59	8.23	49.74	-16.99**	0.62	2.89
Kunnathunad	24802.28*	2.61	-78.90*	- 5.94	48.90**	0.77	5.87**
Mukundapuram	38742.10*	3.06	-78.30*	-284.11	30.57	0.73	4.70**
Chittoor	32963.12*	-0.05	39.55**	-231.64	8.59	0.52	1.92
Area Declining Taluks							
Neyyatinkara	9915.19*	-1.25	16.03**	-294.32	0.41	0.79	6.78**
Trivandrum	11083.55*	-1.54*	7.71**	- 44.98	-11.32**	0.90	15.43*
Kottarakara	11795.63*	-0.12	10.83**	-104.51**	- 0.46	0.76	5.50**
Karthikapally	11808.59*	-0.57	23.98**	-289.96**	- 0.33	0.73	4.76**
Chenganoor	7812.97*	0.41	1.15	-204.00*	3.11	0.83	8.68*
Devikulam	4905.43**	-0.93	11.19	- 50.72	-7.95	0.68	3.67***
Kanayanoor	12335.16*	-2.02	17.10	- 33.37	-8.58	0.62	2.81
Trichur	33579.12*	-1.99***	0.27	- 46.22	-2.29	0.68	3.77***
Palghat	33908.54*	-1.20	31.94**	-557.73**	19.65***	0.77	5.73**
Ponnani	13179.29**	-0.55	36.65**	-137.91	-20.09	0.62	2.81
Ernad	42558.81*	0.58	-14.94***	-369.16*	-14.68**	0.95	35.24*
Kozhikode	18461.86*	-2.87***	39.15**	-365.89**	-17.52	0.82	8.11*
Quilandy	15710.93*	-2.40	27.16	-269.97	-10.36	0.61	2.76
Tellicherry	14638.49*	-0.53**	2.81	-106.69*	- 6.87**	0.96	40.34*
Hosdurg	16316.47*	-2.74**	40.59**	- 87.04	-18.55	0.75	5.19**

Note: Same as in Table G.

Table C1 Regression Results for Rice Production Response for Taluks

1974-75 to 1985-86 (III Period)

Taluks	Constant Term	Current Farm Price of Coconut	Current Farm Price of Paddy	Current Wage rate	Current fertiliser Price	R^2	F Ratio
Production Increasing							
Pathanamthitta	7632.59*	0.56	- 11.26**	73.51	0.70	0.76	5.43**
Mukundapuram	45146.88*	4.25	- 75.83	354.59	6.89	0.51	1.83
Production Stagnant							
Kottarakara	17387.57*	-2.38	- 26.23	250.95	27.77	0.59	2.51
Vaikom	10812.75***	3.64	10.45	-282.73	5.28	0.31	0.80
Kanayanoor	12595.83**	-1.30	20.35	25.91	-11.13	0.27	0.68
Kunnathunad	31983.86*	-1.38	-109.33*	814.19***	77.50**	0.82	8.00*
Trichur	41999.66*	-2.67	58.38**	173.21	-22.99	0.48	1.60
Chittoor	71154.36**	4.68	110.08	-1086.52	43.05	0.23	0.51
Ernad	52924.53	0.22	-126.76*	129.60	23.41	0.75	5.24**
Production Declining							
Neyyattinkara	18457.72*	-3.77**	25.15**	- 47.62	-17.90	0.78	6.39**
Trivandrum	16196.43*	-2.32**	14.76***	- 31.33	-20.68***	0.76	5.69**
Karthikapally	25470.56*	2.21	31.51***	-393.09**	-30.84***	0.71	4.35**
Chenganoor	11468.39*	-0.36	1.44	-263.23**	16.68***	0.68	3.65***
Devikulam	8628.90***	-2.00	12.36	- 22.67	-9.06	0.52	1.92
Palghat	86328.68*	4.07	-63.95	-2813.29**	95.03***	0.74	4.88**
Ponnani	18086.89***	-1.38	52.27***	-173.69	-26.19	0.51	1.82
Kozhikode	23603.17*	-4.15	47.43***	-154.71	-39.20	0.66	3.44***
Quilandy	8666 .10	-2.19	30.48	-258.79	6.68	0.44	1.40
Tellicherry	15525.20*	-1.63*	- 2.40	- 58.61***	-0.12	0.85	10.23*
Hosdurg	19344.24*	-8.29*	61.37*	-239.61***	4.41	0.94	25.37*

Note: Same as in Table G.

Table D1 Regression Results for Rice Yield Response for Taluks

1974-75 to 1985-86(III Period)

Taluks	Constant Term	Current Farm Price of Coconut	Current Farm Price of Paddy	Current Wage rate	Current Fertiliser Prices	R^2	F Ratio
Yield Increasing							
Kottarakara	1460.74*	-0.19***	-3.40**	35.79**	2.32	0.80	7.13**
Pathanamthitta	1492.34*	-0.05	0.03	12.40	0.57	0.47	1.56
Kanayanoor	919.92*	0.14	0.33	7.52	-0.21	0.65	3.31***
Mukundapuram	1140.45*	-0.01	0.56	24.49**	-0.86	0.71	4.34**
Trichur	1212.92*	0.02	2.09**	8.76	-0.73	0.66	3.42***
Quilandy	428.51***	-0.03	0.50	5.08	1.27	0.58	2.46
Yield Stagnant							
Neyyatinkara	1891.69*	-0.27**	0.29	51.99**	-2.19***	0.63	2.93
Trivandrum	1506.01*	0.008	0.26	8.05	-0.76	0.20	0.45
Karthikapally	2184.99*	0.26	-0.40	9.07	-2.80	0.46	1.51
Chenganoor	1437.38*	-0.24	-0.04	27.42	1.41	0.54	2.02
Vaikom	541.01	0.46**	-0.32	-35.19	2.90	0.61	2.70
Devikulam	1876.96**	-0.21	-3.15	32.59	1.92	0.22	0.50
Kunnathunad	1281.01*	-0.19	0.36	27.46	0.34	0.33	0.86
Chittoor	2181.81*	0.12	0.36	-13.41	0.61	0.16	0.33
Palghat	2513.07*	0.17	-3.32***	-43.45***	1.29	0.67	3.53***
Ponnani	1431.82*	-0.07	0.53	6.17	-0.53	0.16	0.33
Ernad	1376.96*	-0.19	-4.04*	33.45**	1.31	0.80	7.17**
Kozhikode	1329.01*	-0.12	0.64	24.13	-1.67	0.22	0.50
Tellicherry	1063.47*	-0.12***	-0.39	9.20**	0.45	0.54	2.01
Hosdurg	2377.68	2.63	-11.05	183.33	-16.23	0.63	2.97***

Note: Same as in Table G.

Table E1 <u>Regression Results of Rice Area Response for the State as a Whole</u>

<u>Lagged Estimates - Combined Period</u>

E.No.	a	V_{4-1}	V_{5-1}	V_{6-1}	V_{7-1}	R^2	F Ratio
b	811624.56*	-84.54***	688.33**	-3283.79	35.03	0.63	8.39*
c	812683.49*	-84.99***	720.66*	-2978.61		0.63	11.71*
d	810455.78*	-106.20*	684.76**		11.05	0.62	11.47*
e	826824.83*	-71.56		-2862.65	334.81**	0.49	6.73*
f	820840.09*		636.84**	-13422.92*	51.58	0.56	8.91*
g	810849.11*	-105.67*	695.76*			0.62	18.03*
h	855155.33*	-69.00		2330.04		0.38	6.62*
i	825736.51*	-90.51*			312.53**	0.49	10.40*
j	822475.33*		684.15*	-13052.12*		0.56	13.92*
k	844179.82*		-308.99		-334.83	0.12	1.48
l	833742.64*			-11571.91*	329.77**	0.44	8.71*
m	857907.53*	-51.30*				0.37	13.66*
n	836071.42*		-152.71			0.03	0.76
o	861418.69*			- 6148.16*		0.33	11.37*
p	849234.51*				161.80	0.09	2.24

Note: Same as in Table A.

Table F1 Regression Result for Rice Area Response for the State as a Whole

1960-61 to 1985-86 - Current Year Estimates (Combined Period)

E.No.	a	V_4	V_5	V_6	V_7	R^2	F Ratio
1.	807408.40*	-23.46	559.67***	-9283.24*	123.21	0.54	6.22*
2.	811861.32*	-19.85	675.68*	-8934.43*		0.53	8.37*
3.	818790.65*	-75.64*	407.96		19.03	0.33	3.61**
4.	819273.32*	-17.71		-8231.69**	363.36**	0.45	6.09*
5.	809864.50*		535.56***	-10801.46*	91.89	0.53	8.17*
6.	819432.85*	-74.75*	427.37***			0.33	5.65*
7.	853478.22*	6.01		- 5427.03		0.26	5.31*
8.	826743.69*	-66.87**			208.50	0.28	4.50*
9.	813027.74*		628.47*	-10349.68*		0.52	12.53*
10.	840676.73*		159.97		-226.06	0.07	0.92
11.	820757.67*			- 9424.92*	331.56**	0.44	9.21*
12.	847996.82*	-39.70**				0.23	7.09*
13.	835285.06*		-152.47			0.04	0.88
14.	854058.32*			- 4873.81*		0.31	11.01*
15.	842961.88*				-134.16	0.07	1.70

Note: Same as in Table B.

Table G1 Regression Results for Rice Production Response for the State as a Whole

Lagged Estimates - Combined Period

E.No.	a	V_{4-1}	V_{5-1}	V_{6-1}	V_{7-1}	R^2	F Ratio
b	1070341.01*	-88.80	637.29	865.60	672.30	0.40	3.29**
c	1090662.70*	-97.43	1257.75**	6722.10		0.33	3.40**
d	1070649.10*	-83.09	638.23		678.63	0.40	4.60*
e	1084414.28*	-76.78		1255.51	949.86**	0.37	4.06**
f	1080021.28*		583.21	-9784.84	689.68	0.38	4.25**
g	1094802.51*	-50.75	1313.93**			0.32	5.19*
h	1164787.93*	-69.54		15987.19		0.13	1.70
i	1084891.60*	-68.47			959.63*	0.37	6.37*
j	1101888.29*		1215.90**	-4826.39**		0.30	4.81*
k	1097035.13*		344.07		408.009	0.32	5.14*
l	1091837.24*			-8089.71	944.45**	0.35	6.00*
m	1183671.66*	51.93				0.10	2.46
n	1106915.82*		906.45*			0.29	9.22*
o	1171099.63*			7443.54**		0.12	3.21**
p	1102667.33*				600.80*	0.31	10.30*

Note: Same as in Table A.

Table H1 Regression Results for Rice Production Response for the State as a Whole

Current Year Estimates - Combined Period

E.No.	a	V_4	V_5	V_6	V_7	R^2	F Ratio
1.	1063888.47*	-24.85	430.55	-6087.42	793.05***	0.39	3.31**
2.	1092550.13*	- 1.65	1177.27**	-3842.24		0.29	3.05**
3.	1071352.09*	-59.07	331.07		724.74	0.36	4.21**
4.	1073015.99*	-20.43		-5278.46	977.80*	0.37	4.38*
5.	1066490.45*		405.01	-7695.95	759.87***	0.38	4.54*
6.	1095806.26*	-25.26	1070.48**			0.28	4.58*
7.	1165061.37*	43.41		2268.88		0.14	1.83
8.	1077806.27*	-51.96			878.50*	0.36	6.40*
9.	1092647.34*		1173.33**	-3960.19		0.29	4.79*
10.	1088443.91*		137.41		533.33	0.33	5.61*
11.	1074728.32*			-6654.96	941.12*	0.37	6.79*
12.	1167352.99*	62.52***				0.13	3.71**
13.	1101163.86*		874.51*			0.28	9.20*
14.	1169249.61*			6263.00**		0.12	3.37**
15.	1090406.76*				612.27*	0.33	11.64*

Note: Same as in Table B.

Table I1 Regression Results for Rice Yield Response for the State as a Whole

Lagged Estimates - Combined Period

E.No.	a	V_{4-1}	V_{5-1}	V_{6-1}	V_{7-1}	R^2	F Ratio
b	1314.28*	0.05	-0.45	9.47	0.68**	0.80	20.06*
c	1334.83*	0.04	0.18	15.39		0.75	21.17*
d	1317.65*	0.11*	-0.44		0.75**	0.79	26.74*
e	1304.41*	0.01		9.20	0.49***	0.79	26.42*
f	1308.94*		-0.42	15.35*	0.67**	0.80	27.42*
g	1344.31*	0.15*	0.31			0.73	29.60*
h	1345.47*	0.04		16.73		0.75	32.79*
i	1307.90*	0.10*			0.56**	0.78	39.69*
j	1330.19*		0.20	20.17*		0.75	32.81*
k	1282.26*		-0.04		1.11*	0.70	25.25*
l	1300.49*			14.13*	0.49**	0.79	40.85*
m	1365.23*	0.17				0.72	59.31*
n	1309.19*		1.49*			0.53	26.04*
o	1341.46*			22.16*		0.75	67.42*
p	1281.57*				1.09*	0.70	52.77*

Note: Same as in Table A.

Table J1 <u>Regression Results for Rice Yield Response for the State as a Whole</u>

<u>Current Year Estimates - Combined Period</u>

E.No.	a	V_4	V_5	V_6	V_7	R^2	F Ratio
1.	1314.01*	0.008	-0.50	11.84**	0.71**	0.80	20.40*
2.	1339.74*	0.03	0.17	13.86**		0.74	21.08*
3.	1299.49*	0.08***	-0.31		0.84**	0.74	20.52*
4.	1303.39*	0.003		10.90**	0.50**	0.78	26.50*
5.	1313.08*		-0.49	12.42*	0.72**	0.79	28.43*
6.	1327.99*	0.11	0.55			0.66	22.22*
7.	1350.15*	0.04		14.73*		0.74	32.66*
8.	1293.49*	0.07***			0.70*	0.73	31.41*
9.	1337.99*		0.24	15.98*		0.74	32.31*
10.	1277.64*		-0.06		1.09*	0.69	26.03*
11.	1303.07*			11.16*	0.50**	0.78	41.55*
12.	1365.03*	0.16*				0.63	40.87*
13.	1303.62*		1.45*			0.54	28.32*
14.	1353.64*			18.07*		0.73	65.68*
15.	1276.78*				1.05*	0.69	54.27*

Note: Same as in Table B.

Table K1 Regression Results for Rice Area Response for the State and Districts

1960-61 to 1985-86 (Combined Period)

Area Increasing District	Constant Term	Current Farm Price of Coconut	Current Farm Price of Paddy	Current Wage Rate	Current Fertiliser Price	R^2	F Ratio
Ernakulam	80081.44*	0.32	- 33.62	-524.30	107.33*	0.48	4.94*
Area Stagnant Districts/State							
All Kerala	807408.40*	-23.46	559.67***	-9283.24*	123.21	0.54	6.23*
Quilon	48360.63*	0.88	22.23***	-407.36**	3.35	0.38	3.24**
Alleppey	77876.08*	1.59	81.51**	-1906.26*	39.21	0.57	6.98*
Kottayam	44539.59*	-4.75	72.32	-139.81	-29.91	0.26	1.83
Trichur	107309.83*	-1.03	22.23	-766.97	34.66	0.21	1.41
Palghat	194951.91*	-6.00	126.81	-2558.70***	61.26	0.35	2.81***
Area Declining Districts							
Trivandrum	40231.78*	-2.89**	30.48*	- 552.20*	-12.64	0.88	39.23*
Kozhikode	116897.76*	-4.88	99.38***	-1806.62*	-14.33	0.67	10.65*
Canannore	96673.41*	-9.37**	132.77**	- 867.19	-50.18***	0.80	20.44*

Note: Same as in Table G.

Table L1 Regression Results for Rice Production Response for the State and Districts

1960-61 to 1985-86 (Combined Period)

Production Increasing	Constant Term	Current Farm Price of Coconut	Current Farm Price of Paddy	Current Wage Rate	Current Fertiliser Price	R^2	F Ratio
All Kerala	1063888.26*	-24.85	430.55	-6087.42	793.05***	0.39	3.31**
Quilon	64444.95*	- 3.35	0.12	14.40	61.33**	0.48	4.95*
Alleppey	107669.82*	11.75	-15.50	-1752.35	160.32**	0.52	5.63*
Kottayam	58508.63*	- 7.40	84.79	571.67	17.70	0.19	1.20
Ernakulam	95350.25*	- 3.44	-109.43	1045.90	210.10*	0.68	11.26*
Trichur	134438.41*	- 2.64	74.05	485.20	- 2.76	0.18	1.19
Palghat	314232.54*	- 3.49	197.57	-5665.63	339.84***	0.36	2.91**
Production Stagnant							
Kozhikode	123195.90*	- 0.80	-52.37	-812.33	85.01	0.13	0.80
Production Declining							
Trivandrum	58075.39*	- 9.50*	43.41**	- 22.21	- 22.97	0.68	11.01*
Canannore	108288.53*	-16.09**	227.93**	-929.79***	- 16.22	0.50	5.24*

Note: Same as in Table G.

Table M1 Regression Results for Rice Yield Response for the State and Districts

1960-61 to 1985-86 (Combined Period)

Yield Increasing	Constant Term	Current Farm Price of Coconut	Current Farm Price of Paddy	Current Wage Rate	Current Fertiliser Price	R^2	F Ratio
All Kerala	1314.01*	0.008	-0.50	11.84**	0.71**	0.80	20.40*
Quilon	1338.56*	-1.11***	-0.65	14.54***	1.09**	0.62	8.49*
Alleppey	1391.31*	0.08	-1.73***	22.45***	1.09***	0.71	12.82*
Kottayam	1277.70*	0.05	-1.09	19.27	1.70***	0.57	7.07*
Ernakulam	1204.80*	-0.05	-0.61	19.89*	0.64***	0.74	15.13*
Trichur	1246.35*	-0.02	0.48	15.44**	-1.16	0.49	5.11*
Palghat	1611.98*	0.04	-0.14	-4.89	1.10	0.47	4.71*
Kozhikode	1044.18*	0.04	-1.51*	15.99*	0.83**	0.77	17.26*
Canannore	1088.36*	-0.06	1.01	4.60	0.36	0.57	7.08*
Yield Stagnant							
Trivandrum	1441.31*	-0.18*	-0.02	28.22*	-0.21	0.56	6.80*

Note: Same as in Table G.

Chapter 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

6.2 Recommendations

Chapter 6

CONCLUSIONS AND RECOMMENDATIONS

Unlike the performance during the previous year, production of most of the crops registered a decline during 1985-86. However, it is gratifying to note that productivity of crops like cereals and pulses improved, though only marginally. A striking feature was the general decline in area under almost all major crops during 1985-86. The largest fall in area was under rice (52098 hectares) followed by arecanut (2311 hectares), tapioca (1776 hectares) and groundnut (1723 hectares), while the area under rubber increased by 9700 hectares (3.13%) and ginger by 1037 hectares (7.13%). Area under coconut, pepper and cardamom remained stable. Very significant increase in production was seen in the case of pepper (68%). Production of rubber also increased by 7.33 per cent, while the increase in production of crops like cashewnut and turmeric had been only marginal. The largest decline in production was noticed in coffee (45.74%), followed by arecanut (41.40%), banana and other plantains (23.64%), groundnut (12.01%), coconut (8.8%), rice (6.6%), tapioca (6.25%) and tea (5.72%) in that order.[1]

---

1. _Kerala Economic Review_ (1986) Page 3.

6.1. Conclusions

Rice is the most extensively cultivated crop in the world, particularly concentrated in Asia and the Far East. Asian countries together make up for as much as 91.80 per cent of the world production of rice in 1986.

Of the countries in Asia, India occupied the first place in area, China in production and Japan in productivity during the year 1986. India and China together contributed to about 56.74 per cent of the total area under rice in Asia and 61.16 per cent of the total production in 1986. India, China, Indonesia, Thailand, Burma, Philipines, Japan and Pakistan together contributed 81.63 per cent of the total rice area and 84.65 per cent of the production in 1986.

In India though Uttar Pradesh occupied first place in area, productivity per hectare was the highest in the Punjab. Andhra Pradesh came first in total production among Indian States in 1982-83. Kerala ranked seventh in yield rate among the States in India in 1982-83.

Kerala has been cultivating rice from very ancient times. But rice production per unit area as an average has remained low in Kerala compared to the neighbouring States. The relative area under rice, fell almost continuously throughout the period of study in the whole of Kerala. After 1974-75, both the absolute and relative area under rice fell.

Between 1952-53 and 1968-69, when the proportion of area under rice declined significantly, the absolute gross area rose sharply. This implies that the area under some other crops increased more rapidly than rice area like that of coconut in some districts and rubber in some other districts. From 1969-70 to 1974-75, the period in which the State-wise gross area under rice stagnated, total cropped area and net area sown increased significantly. The period also indicated that the area under some other crop, like coconut and rubber etc. have increased. After 1974-75, not only the absolute and relative rice area but also total cropped area and net sown area fell. This is due to fall in absolute and net area under some other crops like coconut, tapioca etc.

In the case of productivity of rice, the rise between 1952-53 and 1964-65 was 43.99 per cent while that between 1964-65 and 1985-86 was only 23.41 per cent.

It was in the year 1972-73 the State recorded the all time high production of 13,76,370 tonnes of rice. The highest productivity per hectare of rice (1729) was recorded during the year 1985-86. Production in all the subsequent years has been below the 1972-73 level.

The rising trend of farm harvest price of paddy which continued over the major part of the period since 1952-53, was reversed from 1974-75 while the cost of production began to rise.

6.1.1. Changes in Cropping Pattern

There had been a shift of land area towards coffee, cardamom, rubber, cashewnut and banana and other plantains. Positive change in yield of rice and tea had not been sufficient to offset the decline in area and hence decline in production also. Thus there had been a shift of land area towards non-food crops from food crops during 1960-61 to 1984-85.

Topographical possibilities indicated a trend towards substitution of paddy in favour of coconut on paddy lands and coconut in favour of rubber on coconut gardens. The net area under rice had been falling from the early 1960s in some districts, but more markedly in recent years. On the other hand coconut had been gaining rapidly upto 1974-75 and then falling year after year upto 1981-82 and then increasing slightly upto 1985-86. But, rubber had been gaining rapidly upto 1974-75 and even more rapidly since then. The districts which showed the greatest tendency to shift away from coconut experienced also greatest increase in rubber area (eg. Kottayam, Quilon, Ernakulam, Trivandrum, Palghat etc.).

Thus the area under rice is on the decrease especially after 1974-75 while the area under coconut was on the increase upto 1974-75. Whereas the area under rubber was on the increase especially after 1974-75. It depicted a trend towards substitution of paddy in favour of coconut on paddy land upto 1974-75 and coconut in favour of rubber on coconut gardens particularly after 1974-75.

6.1.2. Trends in Area, Yield and Production of Rice

6.1.2.1. State Level Analysis

Of the total area under rice during 1985-86, 41.24 per cent was cultivated in autumn, 46.21 per cent in winter and 12.55 per cent in summer.

The annual average was greatly influenced by the performance of the summer crop. During the 26 years (1960-61 to 1985-86) summer yield was above the annual average yield in 24 years and only twice it was below the average.

The share of autumn production in the total production ranged between 38.9 per cent in 1976-77 and 52.3 per cent in 1965-66. Winter production shares ranged between 39.1 per cent in 1965-66 and 46.9 per cent in 1976-77 and summer production shares ranged between 8.6 per cent in 1965-66 and 15.8 per cent in 1979-80.

6.1.2.2. District Level Analysis

In general, area under winter crop was higher in six districts, viz., Trivandrum, Kottayam, Quilon, Ernakulam, Trichur and Kozhikode. Area under autumn rice was higher in Palghat and Canannore districts and only in one district, viz., Alleppey, area under summer rice was higher and very meagre in all the other districts.

The average yield was greatly influenced by the yield under summer rice in Alleppey, Kottayam, Trichur, Kozhikode and Canannore, whereas the average yield was greatly influenced by winter crop in Trivandrum, Quilon, Palghat and Ernakulam followed by autumn and summer.

The highest average yield was obtained from Palghat followed by Kottayam, Alleppey, Quilon, Trivandrum, Ernakulam, Trichur, Canannore and Kozhikode districts respectively. The yield levels in Palghat were always above the state average and those in Trichur, Canannore and Kozhikode were always below the State average. In majority of years, ie., Alleppey in 22 years, Kottayam in 20 years and Quilon in 14 years, yield levels were above the State average.

In general, the yield levels were lower in northern - districts of Kerala except Palghat. Yield concentration was seen in Palghat, Kottayam and Alleppey districts.

Winter production was higher than autumn and summer production in 26, 25, 18, 18, 17, 14 and 13 years in Trichur Quilon, Kottayam Kozhikode, Trivandrum, all Kerala and Ernakulam respectively. Autumn production was higher than winter and summer production in 26, 26, 13, 12, 9, 8, 7 and one year in Palghat, Canannore, Ernakulam, all Kerala, Trivandrum, Kozhikode, Kottayam and Quilon respectively. All the 26 years, Alleppey district and one year, Kottayam district showed higher production levels during summer than autumn and winter production levels.

Palghat district ranked first with regard to area, production and yield of rice during the period 1960-61 to 1985-86. Palghat was exclusively different from all other districts in the case of rice crop. Trichur, Kozhikode, Ernakulam and Canannore had high percentage area under rice, but yield rate was very low compared with other districts. Percentage production of rice was also moving in the same direction of land area under rice, except in the case of Alleppey. Percentage share of production was high in the case of Alleppey due to high productivit per hectare. The relation between area and production was high, production and yield was very low and area and yield was very meagre.

Growth Rates of Area, Production and Yield of Rice

Trichur, Palghat, Canannore and Kerala as a whole had positive growth rates of area, yield and production for the first period. Whereas Quilon, Alleppey, Kottayam and Ernakulam had positive growth rates of area and production but negative growth rates of yield. Trivandrum and Kozhikode had positive growth rates of area and negative growth rates of yield and production for the same period.

Output growth rates were negative for Kozhikode and Alleppey districts during autumn, Trivandrum, Alleppey and Kottayam districts during winter and Kottayam during summer in the first period. The negative growth rate of output in Kozhikode was influenced by both negative growth rates of yield and area, and Alleppey, Trivandrum and Kottayam by negative growth rates of yield over the positive growth rates of area.

The growth rates of production for the second period were positive for all seasons and districts except for Kozhikode during autumn. The negative growth rate of output in Kozhikode district was the outcome of dominant negative growth rate of area over positive growth rate of yield.

During autumn, winter and summer for the third period, output growth rates were negative in Trivandrum, Alleppey, Palghat, Kozhikode and Canannore, Alleppey, Kottayam, Trichur and Canannore, Trivandrum, Quilon, Alleppey and Kottayam respectively, all because of dominant negative growth rates of yield. Thus all the observed third period negative growth rates of output levels during autumn, four out of eight negative growth rates of output levels during winter and four out of five negative growth rates of output levels during summer were mainly influenced by the negative growth rates of area. But during winter for the same period output growth rates were negative in Trivandrum, Quilon, Ernakulam and Palghat and durin summer in Palghat were influenced by both negative growth rates in area and yield.

Again, during autumn, winter and summer for the combined period, output growth rates were negative in Trivandrum, Kozhikode and Canannore, Quilon and Trivandrum and Kottayam respectively, all on account of negative growth rates in area over positive growth rates in yield. But negative output growth rates in Trivandrum during winter and Quilon during summer were influenced by both negative growth rates of area and yield.

6.1.2.3. Taluk Level Analysis

When the taluks are classified according to positive and negative growth rates for the period 1974-75 to 1985-86, 7 taluks were having positive growth rates of area, yield and production and those taluks were distributed among six district out of nine districts.

Eight taluks were having negative growth rates of area but positive growth rates of yield and production. This is because yield rates were high enough to offset decline in area

Eleven taluks were having negative growth rates of area, yield and output.

While all the districts and the State were having positive growth rates of yield, 13 taluks were having negativ growth rates of yield.

Seventeen taluks were having positive growth rates of production, whereas only two districts were having positive growth rates of production.

While all the districts and the State indicated only negative growth rates of area, nine taluks showed positive growth rates of area.

Yield level of rice was higher in south Kerala compared to north Kerala.

The general trend in the State during this period was positive growth rate of yield and negative growth rates of area and production. Six districts out of nine and 29 taluks out of 57 belonged to this group. Positive growth rates of yield were not sufficient to overcome the negative growth rates of area. Hence production growth rates remained negative in the above said taluks, districts and the State as a whole.

The rate of growth of output and yield was very poor in most of the taluks even though the growth rate of yield was higher compared to the growth rate of output of rice. Taluks having exclusively negative growth rate of yield or output were 13 only.

The correlation between rate of growth of output and yield was quite low. That is, the growth rates of yield were not sufficient to overcome the fast decline in area under rice. Hence what will be the impact of such a faster fall in area under rice or output? How much faster yield can grow to offset the faster fall in land area under rice?

The total number of taluks under different ranges of output growth generally increased with the decline in the growth rate. The number of taluks increased with the decline in the concentration of rice crop. Thus the concentration of rice crop and the growth in its output are going together as there is some positive association between the two.

Of the 57 taluks, 11 taluks had more than two per cent growth rate of yield, 16 taluks between one and two per cent, 17 taluks between zero and one per cent and 13 negative growth rate of yield. The inequality in the level of rice yield had increased. If this pattern of growth continues in the taluks, it would not only slow down the general growth rate of rice output, but would also lead to regional inequality in the agricultural development.

Season-wise analysis gives a more clear picture of the trends in area, yield and production. That is, 14 taluks and two districts during autumn, 12 taluks during winter and 22 taluks and four districts during summer had positive growth rates of area, while all the districts and the State as a whole had negative growth rates of area during combined seasons.

Twenty one taluks and four districts, 16 taluks and one district and 27 taluks and four districts had positive growth rates of production during autumn, winter and summer respectively, whereas all the districts and all Kerala except Quilon and Ernakulam districts had negative growth rates of production during combined seasons.

Four taluks during autumn, 24 taluks and four districts during winter, 19 taluks and two districts during summer had negative growth rates of yield, while all the districts and the State as a whole had positive growth rates of yield during combined seasons.

6.1.2.4. Growth and Stability

In general, fluctuations of area, yield and output indicated an increasing tendency in most of the southern districts and the northern most districts of Kerala. However, the opposite tendency in most of the northern districts and some of the southern districts (different districts for different seasons) had a dominant role so that for the State as a whole, the fluctuations of area, yield and output declined or remained stagnant except area during the combined seasons and yield during autumn.

6.1.2.5. Difference in Yield of Paddy

6.1.2.5.1. H Y V Area

Positive growth rate of summer paddy area in all the districts except Trivandrum, Quilon, Kottayam and Malappuram for the third period can be explained by the increased non-HYV area. For the combined seasons, positive growth rates were obtained for HYV in Quilon, Kottayam, and Palghat and for non-HYV only in Ernakulam. Alleppey, Kozhikode, Canannore and all Kerala had consistently negative growth rates for both HYV and non-HYV areas during all seasons except non-HYV area during summer. Trivandrum showed positive growth rate only during autumn for HYV area and Malappuram for non-HYV area during winter.

6.1.2.5.2. HYV Yield

The growth rates of yield were positive in all areas during autumn and summer for non-HYV and during all seasons for HYV and non-HYV except in Trivandrum (all seasons) and in Canannore (summer) for non-HYV. For HYV, negative growth rates were observed in Trivandrum (summer), Quilon (winter and summer) Kottayam, Ernakulam and Trichur (autumn and summer), Palghat and Malappuram (all the three seasons) and Canannore (summer). During autumn, the growth rates of yield of HYV exceeded those of non-HYV only in Quilon and Kozhikode, but during winter this was true for Trivandrum, Kottayam, Idukki, Ernakulam, Kozhikode and all Kerala. During summer growth rates of yield of HYV exceeded non-HYV only in Idukki. Thus yield of HYV has declined remarkably compared to non-HYV.

6.1.2.5.3. Association between Yield of HYV and non-HYV

On the whole yields of HYV and non-HYV moved in the same direction during all seasons except some divergence in the movement pattern in a few districts. That is, the movement of HYV and non-HYV yield was dissimilar in Trivandrum, Alleppey, Idukki, Ernakulam and Canannore during autumn, Alleppey, Trichur and Palghat during winter and Quilon, Ernakulam and Trichur during summer.

6.1.2.5.4. HYV Production

The growth rate of production in Trivandrum was negative during autumn, winter, summer and all seasons for both HYV and non-HYV except during autumn for HYV. In Quilon and Kottayam the growth rates of HYV production were positive during all seasons except during summer, but the rates for non-HYV production were negative during all seasons. In Alleppey positive growth rates were observed for non-HYV during all seasons except during autumn. In Ernakulam and Trichur, negative growth rates were observed for HYV production, but positive growth rates for non-HYV production during all seasons except during summer. The other cases of negative growth rates for HYV production were in Idukki (autumn and summer), Palghat (summer), Malappuram and Canannore (autumn, winter and summer), Kozhikode (Autumn and winter) and all Kerala (winter and summer)

The observed positive growth rate of production for paddy during autumn was influenced by a high rate of growth of yield for HYV. The negative growth rates of HYV production of paddy during winter and summer were influenced by the negative growth rates of area under paddy during the same seasons.

6.1.2.5.6. Fertiliser Consumption in Kerala

The consumption rate of fertilisers is very low in Kerala compared to the other rice growing States in India.

Hence one of the causes of low productivity of rice in Kerala is lack of fertiliser consumption in the State as a whole.

The percentage consumption of fertiliser was higher in Kottayam, Palghat, Quilon and Alleppey during 1984-85. Consumption per hectare of gross cropped area was also higher in Kottayam, Alleppey, Palghat and Quilon during the same year. So where there is more consumption of fertilisers, the productivity rate of rice also is high.

Thus it is mainly due to paucity of irrigation facilities that the growth rate of area under paddy particularly HYV has been declining during recent years. And it is because of the considerable fall in area under paddy that production of paddy also has been decreasing. Inadequate irrigation facilities limit the use of available fertilisers. The combined effect of all the above said factors were principally responsibl for low yield per hectare of paddy in Kerala.

6.1.3. Trends in Input and Output Prices

The relative price, price of rice/price of coconut, moved in favour of rice till 1967-68 for all Kerala. It fluctuated between 1967-68 and 1974-75, but with a declining trend. After 1974-75 the relative price of rice to coconut fell sharply upto 1984-85, even though there was fluctuation after 1980-81. Thus the relative price moved in favour of coconut after 1967-68.

A similar trend is seen in all the districts. In Kozhikode and Trichur though the rise in relative price in favour of rice in 1974-75 went above the peak in 1967-68, but tapers off immediately after. This resulted in increases in rice area until 1967-68 as the relative price moved in favour of it, but then began to stagnate and started falling after 1974-75 as the relative price began to move in favour of coconut after 1967-68.

In the case of coconut, the price increased steadily almost throughout the period from 1960-61 to 1984-85. But the relative price of coconut fluctuated rather erratically. It was perhaps because rice is not the only substitute for coconut. Coconut can substitute other garden land crops or plantation crops like rubber.

These absolute and relative price movements over the last 26 years could have some impact on the profitability of cultivation of the two crops. On the one hand, fluctuating prices and relative prices of rice and their plunge in the later years, together with rising input prices added to the insecurity of rice cultivation and to the consequent fall in area under rice. On the other hand, the consistent rise in coconut prices led to the buoyancy of coconut cultivation and the continued increase in area under coconut.

Apart from the sharp increase in price of rice in the first phase, a fall in fertiliser price might also have contributed to making rice cultivation a profitable venture during 1960-61 to 1967-68 and to increase the area under rice cultivation. But after 1966 the price of fertilisers began to rise sharply adding to the already difficult situation created by the sharp increase in wage rates and fluctuating paddy prices.

The relative profitability of rice cultivation has been continuously decreasing consequent on increase in input prices such as labour and fertilisers and fluctuating paddy prices. The profitability of paddy reduced further after 1974-75 because of the steep rise in the wage rates of agricultural labour and comparatively low price of paddy.

The growth rates of wage rates and farm level price of coconut were higher than the growth rates of farm level price of paddy and fertiliser price. Continuous low growth rate of paddy farm price and higher growth rate of farm price of coconut and wage rate resulted in continuous and steep fall in area under paddy especially after 1974-75.

6.1.4. Estimates of Area, Production and Yield Response

Acreage responses are higher than both the production and the yield responses.

Area, yield and production are more responsive to current year regressors than to previous year regressors.

Wage rate can be considered as the single and strong regressor in both the estimates, current year and previous year.

Twenty seven relationships out of 30 indicated negative response of acreage with wage rate, 22 with farm price of coconut and 20 with fertiliser price. But out of 30 relationships, 23 explained positive relationship between farm price of paddy and acreage. It is evident from the above description that high rate of wage, coconut farm price, fertiliser price and very low paddy price led to the decline in acreage under paddy during the third period.

The responsiveness of acreage to wage rate was negatively correlated during the third and the combined periods. This indicate the inverse relationship between acreage and wage rate.

The four regressors shared 52 to 97 per cent variation in acreage under paddy. The estimates were having very high value of 'F' ratio. Hence the conclusions regarding acreage response are highly reliable.

Only during combined period fertiliser price ranked first in the order of supply shifters in previous year estimates and the second one in current year estimates. In all the other periods wage rate ranked first in the order of supply shifters. The main difference is because of greater number of significant yield response related to fertiliser price rather than acreage and production responses.

Coconut area has greater impact on paddy area than rubber area.

The impact of time trend on acreage, production and yield was greater during the third period and the combined periods rather than during the first and the second periods.

Growth rates of yield had increased during the third period compared to the first and the second periods but growth rates of production and area had declined during the third period.

Yield had greater impact on production than on area except during the third period. It was because of the increased growth rate in yield the trend of decline in production was not so steep as the decline in area.

As a result of steep decline in area during the third period, its impact on production was the lowest during the same period and hence the rate of growth of production also declined.

In the case of impact of production on yield, the highest impact was during the second period and the lowest during the third period since the third period depicted decline in production and the second period increase in production.

The second period indicated the highest acreage and production responses when we take each regressor separately and calculate regression co-efficients, R^2 values and values of 'F' ratios. It is clear from the above results that more positive responses of production and acreage can be seen upto the second period and yield response after the second period, ie., yield increased during the third period compared to the first and the second periods which may be due to the progress in technological development. The results showed the concentration of the highest area and production responses during the second period and yield responses during the third period.

6.2. Recommendations

A striking fact that emerges from this scenario (Tables 6.1 and 6.2 in the Appendix) is, as Mr. P.K. Sivanandan points out that the declining trend in yield and cropping pattern in Kerala is particularly disturbing because of the very low land-man ratio and diminishing land frontier for expansion of area under cultivation.[2] It is also equally striking that our production growth has been mainly influenced by the expansion in area till 1975-76 and not so much by adoption of new agricultural practices including HYV of seeds. It has been observed that the HYV programme suffered a set-back in extending the area under cultivation and in improving the yield during the last decade though adoption of HYV was fast in the initial stage.

Whether Kerala would be self-sufficient in rice production is a matter for debate. Yet the fact remains that we never reached the set targets of production in paddy in our plans. To reduce the gap between the internal requirement and the production of rice through effective planning and execution of programmes we should consider the following measure

---

2. K. Govindan Kutty (1987), Page 7.

1. To increase the coverage of the HYV in all seasons and to study the slow progress in this regard, a constraint analysis may be undertaken to throw light on policy issues to be tackled.
2. Irrigation facilities should be increased, so that more area can be brought under punja crop (summer).
3. The variation in productivity in and between taluks in respect of all the crop seasons should be analysed and studied in order to raise productivity in areas where now it is relatively low.
4. The rate of growth of price of paddy is very low compared to the rate of growth of wage rate, price of coconut, price of fertiliser etc. Hence to increase production of paddy, the price should be increased according to the rate of increase in other output and input prices over time.

There is another fundamental question of cost and price factors relating to the economics of rice production. Since the labour cost has been rising steeply, the role of the other factors, viz., land, capital and entrepreneurship and their remuneration have not received adequate attention in the discussions relating to cultivation costs. It is, therefore, necessary to re-examine the share of land, labour, capital and entrepreneurship in rice production.

Again, the present ad hoc agricultural price policy should be changed to a well integrated policy, so that the problems related to price and cost factors can be avoided.

To sum up, the studies conducted prior to this do not focus attention on the economics of rice cultivation in all its varied aspects. Those studies are largely fragmentary in nature. Again, there does not seem to have been any attempt made to study the problems of rice cultivation in Kerala within a perspective framework. Therefore it was found necessary to analyse the trends in input and output prices and their impact on area, yield and total production of rice at the State, districts and taluk level. It is expected the present study would fill the gap in our understanding of the rice economy of Kerala.

Appendix

Table - 6.1 Kerala's Emerging Foodgrains Syndrome

(Lakh Tonnes)

	Items	1991	1996	2001
1.	Requirement of cereals	45.25	48.37	50.97
2.	Requirements of roots and tubers	9.61	10.28	10.83
3.	Rice Equivalent of items (2) Total requirements	4.33 49.58	4.63 53.00	4.88 55.85
4.	Requirements of tapioca at the present rate of Consumption	16.67	17.83	18.78
5.	Rice equivalent of item (4) above	7.58	8.10	8.51
6.	Balance requirement of Cereals	42.00	44.90	47.31

Source: K. Govindan Kutty "Green Revolution Yet to take off" Indian Express, November 9, 1987, Page 7.

Table - 6.2 Uncovered Gap in Requirement of Rice

(Lakh tonnes)

	Items	1991	1996	2001
1.	Balance requirement of cereals as in Table 6.1	42.00	44.90	47.31
2.	Allotment to Kerala at the present rates per capita	15.24	16.39	17.17
3.	Internal Production at 1981-82 level less 10 per cent for seed, feed and wastage	12.06	12.06	12.06
4.	Balance requirement	14.70	16.55	18.08

Source: Same as in Table 6.1.

BIBLIOGRAPHY

Books

1. Bansil, P.C., Agricultural Statistics in India, Oxford & IBH, New Delhi (1984).

2. Behrman J.R., Supply Response in under Developed Agriculture: A Case Study of Four Major Annual Crops in Thailand 1937-63, North Holand Publishing Company, Amsterdom (1968).

3. B'eteille Andr'e, Studies in Agrarian Social Structure, Oxford University Press, New Delhi (1974).

4. Bhaduri A., The Economic Structure of Backward Agriculture, Macmillan, Delhi (1984).

5. Bharadwaj K., Production Conditions in Indian Agriculture, Cambridge University Press, Cambridge (1974).

6. Bhattacharya A., Some Aspects of the Rubber Economy in Kerala, M.Phil Dissertation, Trivandrum, C.D.S., (1976).

7. Ghose A.K., Agrarian Reform in Contemporary Developing Countries, Select Book Service Syndicate, New Delhi (1984).

8. Griffin K., The Political Economy of Agrarian Change, Macmillan, London (1979).

9. Gupta R.P., Agricultural Prices in a Backward Economy, National, Delhi (1973).

10. Gupta, S.C. and Majit A., Producers' Response to Change in Prices and Marketing Policies, Asian Publishing House, Bombay, (1962).

11. Hali, R., Survey of Important Markets in Kerala, Agricultural Marketing Section, Department of Agriculture, Kerala (1967).

12. Heady, E.O. and Tweeten, L.G., Resource Demand and Structure of Agricultural Industry, Lowa State University Press, Ames (1963).

13. Herdt,R.W. and Mandac,A.M., Modern Technology and Economic Efficiency of Philippine Rice Farmers, Economic Development and Cultural change, IRRI, Los Banos, Philippines (1980).

14. Hrushikesh Panda, Impact of Irrigation on Farmers Acreage Response to Price: A Case Study of Andhra Pradesh, M.Phil dissertation, C.D.S,, Trivandrum (1982).

15. Jeemol Unni, An Analysis of Change in the Cropping Pattern in Kerala with particular Reference to the Substitution of coconut for Rice 1960-61 to 1978-79, M.Phil Dissertation, Jawaharlal Nehru University, New Delhi, C.D.S. Trivandrum (1981).

16. Kahlon,A.S. and Tyagi,D.S., Agricultural Price Policy in India, Allied, New Delhi (1983).

17. Khusro,A.M., Buffer Stocks and Storage of Foodgrains in India Tata Mc Grow-Hill Publishing Co. Ltd., Bombay (1973).

18. Koyek, L.M., Distributed Lags and Investment Analysis, North Holland Publishing Company, Amsterdom (1954).

19. Kurian,C.T., Dynamics of Rural Transformation, Orient Longman (1981).

20. Kuttappan,M., Coconut Production in Kerala - An Economic Analysis, Ph.D. Thesis, University of Kerala (1979).

21. Mathew,A., A Study of Coconut Economy of Kerala, 1956-1983, Ph.D. Thesis submitted to the Cochin University of Science and Technology (1987).

22. Mishra,S.K., Evaluation of Public Policies for Agricultural Development in Less Developed Regions, Indian Institute of Technology, Kharagpur, India (1984).

23. Myrdal,G., Asian Drama: An Inquiry into the Poverty of Nations, Vol.II, Kalyani Publishers, New Delhi (1982).

24. Nandakumar,M., Supply Response of Paddy in Kerala: An Econometric Study, M.Phil Dissertation submitted to the University of Cochin, Department of Applied Economics (1982).

25. Nair,P.K., A Plan for Rice Production in Kerala, (1964-65 to 1975-76), Neo-Saraswathi Printing Works, Trichur (1964).

26. Narain,D., Impact of Price Movements on Area under Selected Crops in India: 1900 - 1939, Cambridge University Press (1965).

27. Nerlove,M., Dynamics of Supply Estimation of Farmers' Response to Price, John Hopkins Press, Baltimore (1958).

28. Ninan,K.N., Cereal Substitutes in a Developing Economy, Concept Publishing Company, New Delhi (1986).

29. Oommen, M.A. (ed), Kerala Economy Since Independence, Oxford and IBH, New Delhi (1979).

30. Oommen, M.A., Land Reforms and Agrarian Change in Kerala Economy since Independence, Oxford and IBH, New Delhi (1979).

31. Panikar, P.G.K. et.al., Population Growth and Agricultural Development, FAO and the United Nations, Rome (1978).

32. Pillai, V.R. and Panikar, P.G.K., Land Reclamation in Kerala, Asia Publishing House, Bombay (1965).

33. Pranab, K.B., Land, Labour and Rural Poverty, Oxford University Press, Delhi (1984).

34. Raj, K.N. et.al., Poverty, Unemployment and Development Policy: A Study of Selected Issues with Reference to Kerala, Centre for Development Studies, Trivandrum, United Nations (1975) and Orient Longman (1977).

35. Rajabans Kaur, Agricultural Price Policy in Economic Development, Kalyani Publishers, Ludhiana (1975).

36. Rao, C.H.H., Technological Change and Distribution of Gains in Indian Agriculture, Macmillan (1975).

37. Rao, V.K.R.V., Food, Nutrition and Poverty in India, Vikas Publishing House, New Delhi (1982).

38. Sahadevan, P.C., Rice in Kerala, Agricultural Information Service, Department of Agriculture, Kerala State (1966).

39. Sankaranarayanan, K.C. and Karunakaran, V., Kerala Economy, Oxford and I.B.H., New Delhi (1985).

40. Shashikala Sawant, Supply Behaviour in Agriculture, Himalaya Publishing House, Bombay (1978).

41. Som Nath Pandit, Critical Study of Agricultural Productivity in Uttar Pradesh 1951-75, Concept Publishing Company, New Delhi (1983).

42. Surajit,K. De Datta, Principles and Practices of Rice Production, A Wiley Inter Science Publication, John Wiley and Sons, New York (1981).

43. Tyagi,D.S., Farmer's Response to Agricultural Price in India, Heritage Publishers, Delhi (1974).

44. Varghese, T.C., Agrarian Change and Economic Consequences 1850-1960, Allied, Bombay (1970).

45. Verma,R.N. An Inter-Regional Trend Analysis of Agricultural Prices in India since 1939, Atma Ram and Sons (1980).

46. Yujiro Hayami, et.al., A Century of Agricultural Growth in Japan: Its Relevance to Asian Development, University of Tokyo Press (1975).

Articles and Working Papers

1. Abraham,C.C., "Pest Management Strategy for Breaking the Yield Barriers in Rice Production", Seminar on Stagnation of Rice Production in Kerala, College of Agriculture, Vellayani, I to III July, 1983.

2. Acharya,S.S. and Satish Bhatia, "Acreage Response to Price, Yield and Rainfall Changes in Rajasthan", Agricultural Situation in India (A.S.I.), XXIX (a), 209-214, 1974.

3. Acharya,G.S. and Sengupta,J.K., "Acreage Substitution between Jute and Rice", Arthaniti, Nos. 1 and 2, 28 - 47, 1966.

4. Aiyer,R.S., "Nutrition Management for Increased Production of Rice", Seminar on Stagnation of Rice Production in Kerala, College of Agriculture, Vellayani, I to II July, 1983.

5. Alagh,Y.K. and Sharma,P.S., "Growth of Crop Production: 1960-61 to 1978-79, is it decelerating? Indian Journal of Agricultural Economics (I.J.A.E.), XXXV (2), 104-118, April-June, 1980.

6. Alain de Janvry and K. Subbarao, "Agricultural Price Policy and Income Distributions in India", Economic and Political Weekly (E.P.W.), XIX, Nos. 52 and 53, A - 166 to A - 178, December 22-29, 1984.

7. Alexander,K.C., "Nature and Background of Agrarian unrest in Kuttanad, Kerala", Journal of Kerala Studies, 2 (2), June 1975.

8. Bansil,P., "Core Area under Jute", Commerce 126 (32), 1012-1013, 1973.

9. Balwinder Singh and Manmohan Singh,M.K., "Acreage Response for Economic and Non-Economic Factors for Groundnut, Sugarcane and Potato in Punjab", Agricultural Marketing, XX(1), 1 - 4, 1977.

10. Bardhan,K., "Price and Output Response of Marketed Surplus of Foodgrains: A Cross Sectional Study of some North Indian Villages", Amer. Jour. Agr. Econ., 52 (2), 1970.

11. Charles,E. Staley, "A Case Study of Response to Agricultural Prices in Costa Rica", The Economic Journal, LXXI (282), 432-436, 1961.

12. Cummings,J.T., "The Supply Responsiveness of Indian Farmers in the Post Independence Production: Major Cereal and cash Crops" I.J.A.E., XXX(1), 25-40, 1975.

13. Dandekar,V.M., "Introduction to the Seminar on Data Base and Methodology for the Study of Growth Rates in Agriculture, I.J.A.E., XXXV (2) 1 - 12, April - June, 1980.

14. Dantwala,M.L., "Prices and Cropping Pattern", E.P.W., XXI(16), 694 - 695, April 19, 1986.

15. Devi,P. Kamala, "Response of Acreage to Change in Price: A Study in Madras State", The Economic Weekly, XVI (38), 1535-1536, 1964.

16. Devi,P. Kamala and Rajagopalan,R., "Price and Acreage Response: A Case Study of Groundnut Crop in North Arcot District", I.J.A.E., XX (1), 31-35, 1965.

17. Dharm Narain, "Growth and Productivity in Indian Agriculture," I.J.A.E., XXXII (1), January, 1 - 44, March 1977.

18. Dhawan,B.D., "How Stable is Indian Irrigated Agriculture?" E.P.W., XXII(39), A - 93 to A - 96, September 26, 1987.

19. Evans, "Acreage Response of Cotton in United States - A Regional Analysis", Amer. Jour. Agri. Econ., 1978.

20. Felcon,W.P., "Farmers Response to Rice in a Subsistance Economy", Amer. Eco. Rev., LIV (3), 580-591, 1964.

21. George,M.V., "Impact of Relative Changes in Prices on the Cropping Pattern of Kerala", I.J.A.E., XX(1), 48 - 51, 1965.

22. George,M.V., "Yela Programme: An Experiment in area development in Crop Production" Southern Economist, Nov. 1975.

23. George,M.V. et.al., "Price, Production and Income Variability of Commercial Crops in Kerala", Southern Economist, II(20), 15 February, 1973.

24. ——————————, "Cost-Benefit Analysis of Investment in Tree Crops", I.J.A.E., 28 (4), Oct. - Dec. 1973.

25. George,M.V. and Nair,N.G., "Irrigation and Agricultural Development in Kerala", Seminar on Agricultural Development in Kerala, Economics Department, Calicut University, Trichur, 1981.

26. George P.S., "Agricultural Price Movements in Kerala", Seminar on Agricultural Development in Kerala, Economics Department, Calicut University, Trichur, 1981.

27. ——————————, "Some Aspects of Public Distribution of Foodgrains in India", E.P.W., XIX (39), A - 106 to A - 110 September, 29, 1984.

28. ——————————, "Emerging Trends in Size Distribution of operational holdings in Kerala", E.P.W., XXI (5), 198 - 20 February 1, 1986.

29. —————————— and Chandan Mukherjee, "Rice Economy of Kerala: A Disaggregate Analysis of Performance", Working Paper (W.P.) 213, C.D.S., Trivandrum, 1986.

30. Govindan Kutty,K., "Green Revolution Yet to Take off", Indian Express, November 9, Page 7, 1987.

31. Hannan,E.J., "The estimation of Relationships Involving Distributed Lags", Econometrica, 33 (2), 206 - 224, April, 1965.

32. Hrushikesh Panda, "Impact of Irrigation on Farmers' Acreage Response to Price: Case of Andhra Pradesh", E.P.W., XX(13), A - 11 to A - 16, March, 30, 1985.

33. Jagdish Lal, Katsingh', "Determinants of Sugarcane Acreage Fluctuations in Uttar Pradesh", I.J.A.E., XXXVI (1), 101-109, 1981.

34. Jasveen Jairath, "Social Conditioning of Technology use: A Study of Irrigation and Production in Punjab, 1965 - 1970" E.P.W., XXI (13), A - 26 to A - 37, March 19, 1986.

35. Jeemol Unni, "Changes in the cropping pattern in Kerala: Some Evidence on Substitution of Coconut for Rice 1960-61 to 1978-79", E.P.W., 18 (39), Sept. 24, 1985.

36. Jekhade,V.M. and Majumdar,N.A., "Response of Agricultural Produce: The Case of Jute and Rice in India", The Journal of Agricultural Economics,, XIX (3 and 4), 204 - 209, 1964.

37. Jha,D., "Acreage Response to Sugarcane in Factory Area of North Rihar", I.J.A.E., XXV(1), 79 - 91, 1970.

38. Jhala,M.L., "Farmers' Response to Economic Incentives: An Analysis of Inter-Regional Groundnut Supply Response in India", I.J.A.E., XXXIV (1), 56-57, 1979.

39. John, P.V., "Responsiveness of Relative Area-output of Sugarcane and Rice to Change in their Relative Price in Uttar Pradesh 1954-62", I.J.A.E., XX(1), 40-47, 1965.

40. Jorgenson,D.W., "Rational Distributed Lag Functions", Econometrica, 34 (1), 135 - 146, January 1966.

41. Jose,A.V., "Wage Rates of Agricultural Labourers in Kerala" E.P.W., Annual Number, February, 1973.

42. Kahlon,A.S., et.al., "Structure of Farm Prices in Punjab", I.J.A.E., XX(1), 35 - 40, 1965.

43. Kalirajan,K. and Flinn,J.C., "Allocative Efficiency and Supply Response in Irrigated Rice Production", I.J.A.E., XXXVI (2), 16 - 24, 1981.

44. Karunakaran,K., "High Yielding Rice Varieties - Their Adoption and Productivity as Influenced by the Rice seasons of Kerala", Seminar on Stagnation of Rice Production in Kerala, I to III July, College of Agriculture, Vellayani, 1983.

45. Klein,L.R.,"The estimation of Distributed Lags", Econometrica, 26 (4), October 553-565, October 1958.

46. Krishna Bharadwaj, "Analytics of Agriculture-Industry Relation", E.P.W., XXII (19, 20 & 21), AN - 15 to AN - 20, May 1987.

47. Krishna Jai and Rao,M.S., "Dynamics of Acreage Allocation for wheat in Uttar Pradesh", I.J.A.E., XXVI (4), 427 - 434, 1967.

48. Krishna,R., "Farm Supply Response in India-Pakistan: A Case Study of Punjab Region", The Economic Journal,LXXIII, 477-487, September 1963.

49. Krishnaji,N. et.al., "Economics of Inter and Mixed Cropping in the Coconut Gardens of Kerala: Some Preliminary Findings" W.P. 41, C.D.S., Trivandrum.

50. Krishnan,T.N., "The Marketed Surplus of Foodgrains: Is it Inversely Delated to Price", The Economic Weekly, XVII (Annual Number), 325-328, February 1965.

51. Kunhaman,M., "The Dual Labour Market for Agricultural Labour in the Hilly Regions of Kerala - Some Explanatory Hypothesis", Seminar on Agricultural Development in Kerala, Economics Department, Calicut University, Trichur, 1981.

52. Kuruvilla,K.K. (1988), "Rubber at the Expense of Paddy: Disastrous for Kerala", Indian Express, Page 5, January 19, 1988.

53. Lalitha Sud and Kahlon,A.S., "Estimation of Acreage Response to Rice of Selected Crops in Punjab State", I.J.A.E., XXIV (3), 46-50, 1969.

54. Liviatan,N., "Consistent Estimation of Distribution Lags", The International Economic Review, 4(1), 44 - 52, January 1963.

55. Madhavan,M.C., "Acreage Response of Indian Farmers: A Case Study of Tamil Nadu", I.J.A.E., XXVI(1), 67 - 84, 1972.

56. Madhava Menon,T., "Rice in Kerala - Prospects and Strategies", Seminar on Stagnation of Rice Production in Kerala, I to III July, College of Agriculture, Vellayani, 1983.

57. Madhusudan Ghosh, "Technological Change and Employment Generation in a Rice - Based Agriculture", A.S.I., Jan. 1988.

58. Mahendradev,S., "Growth and Stability in Foodgrains Production - An Inter-State Analysis", E.P.W., XXII(39), A - 82 to A - 92, Sept. 26, 1987.

59. ——————————, "Direction of Change in Performance of All Crops in Indian Agriculture in Late 1970's: A Look at the Level of Districts and Agro-climatic Regions", E.P.W., XX (51 & 52), A - 130 to A - 136, 1985.

60. ——————————, "Growth of Labour Productivity in Indian Agriculture: Regional Dimensions" E.P.W., XXI(25 & 26), A - 65 to A - 74, June 21 - 28, 1986.

61. Maji,C.C. and Jha,D., "Cobweb Phenomenon and Fluctuation in Sugarcane Acreage in North Bihar", I.J.A.E., XXVI(4), 415 - 420, 1971.

62. Mangahas et.al., "Production and Market Relationships of Rice and Corn in Philippines", Tech. Bulletin No.9, I.R.R.I., Philippines, 1965.

63. Mathur,P. and Ezekiel,H., "The Marketable Surplus of Food and Price Fluctuations in a Developing Economy", Kylos, XIV, 396 - 406, 1961.

64. Mencher, John,P., "The Lessons and Non-Lessons of Kerala Agricultural Labourers and Poverty", E.P.W., 15 (41 - 43), Oct. 1980.

65. ——————————, "Agrarian Relations in Two Rice Regions in Kerala", E.P.W., 13 (6 - 7), February 1978.

66. Michael Tharakan,P.K., "Dimensions and Characteristics of the Migration of Farmers from Travancore to Malabar 1930-1950", Jrl. of Kerala Studies, 5(2), June 1978.

67. Minhas,B.S. and Vaidyanathan,A., "Growth of Crop output in India 1951-54 to 1958-61, An Analysis by component Elements, Jrl. of the Indian Society of Agrl. Stat., XVII (2), 230 - 252, December, 1965.

68. Mishra,V.N. and Radhakrishna,R., "Econometric Models for Acreage Response: A Case Study of Groundnut and Bajra in Gujarat", Anvesak, I (2), 165 - 174, 1973.

69. Nair,K.N. and Narayana,D., "Linkage of Irrigation with Development, Kerala Experience", C.D.S., W.P. 161, Trivandrum, 1983.

70. Natarajan,S., "Labour Input in Rice Farming in Kerala - An Inter-Regional Inter-Temporal Analysis", Seminar on Agricultural Development in Kerala, Economics Department, Calicut University, Trichur, 1981.

71. Nerlove, Marc, "Estimation of Elasticities of Supply of Selected Agricultural Commodities", Journal of Farm Economics, 38 (1), 496 - 508, 1956.

72. Nerlove, Marc, "Distributed Lags and Estimation of Supply and Demand Elasticities, Theoretical Considerations, Jrl. of Farm Economics, 40 (2), 302 - 311, 1958.

73. Ninan,K.N., "Edible Oil Seeds: Growth and Area Responses" E.P.W., XXII (39), A - 97 to A - 110, September 26, 1987.

74. Ninan,K.N., "Labour use in Agriculture: Case Studies of Tapioca and Paddy", E.P.W., 19 (51 and 52), December 22 - 29, 1984.

75. Oommen,M.A., "Agricultural Productivity in Kerala", A.S.I., July 1962.

76. ————————————, "Development of Capitalising Kerala Agriculture: Some Preliminary Observation", Mainstream, 15 (29), March 17, 1977.

77. Oommen,T.K., "Green Revolution and Agrarian Conflict" E.P.W., 6 (26), June 26, 1971.

78. Panikar, P.G.K., "Environmental Factors in the Production and Productivity of Rice in Kerala", W.P. 15, C.D.S., Trivandrum, 1973.

79. ————————————, "Recent Trends in Production and Productivity in Kerala Agriculture", W.P.116, C.D.S., Trivandrum, 1981.

80. ————————————, "High Yielding Varieties of Rice - A Study of Selected Areas in Kerala", W.P. 140, C.D.S., Trivandrum, 1981.

81. Pillai,P.P., "Impact of Price Movements on Area, Productivity and Production of Paddy in Kerala State", A.S.I., 24 (9), 819 - 822, 1969.

82. Pillai,P.P., "Growth of Agricultural Output in Kerala During 1952-53 to 1978-79", Seminar on Agricultural Development in Kerala, Economics Department, Calicut University, Trichur, 1981.

83. ——————————, "Price Elasticity of Acreage under Paddy in Kerala", W.P. 5, State Planning Board, Trivandrum, June 1968.

84. Prakash,B.A., "Agrarian Kerala down the Centuries", State and Society, 5 (1), Jan. - Mar. 1984.

85. Raj,K.N., "Price behaviour of Foodgrains in India 1951-64 - An Explanatory Hypothesis", Indian Economic Review, 1966.

86. Ramachandran Nair,K., "A Study of Wage Structure of Agricultural Labour in Kuttanad", Seminar on Agricultural Development in Kerala, Economics Department, Calicut University, Trichur, 1981.

87. Ranade,C.G., "Growth of Productivity in Indian Agriculture: Some unfinished Components of Dharm Narain's Work", E.P.W., XXI (25 & 26), A - 75 to A - 80, June 21 - 28, 1986.

88. Rao,C.H.H., "Current Agrarian Scene: Policy Alternatives", E.P.W., XXIII (13), A - 2 to A - 5, March 24, 1988.

89. Rao,G.N., "Transition from Subsistence to Commercialised Agriculture: A Study of Krishna District of Andhra 1850 - 1900", E.P.W., XX (25 and 26), A - 60 to A - 69, June 22 - 29, 1985.

90. Rao, K.P.C. and Pandey,V.K., "Supply Response of Paddy in Andhra Pradesh", I.J.A.E., XXXI (2), 46 - 53, 1976.

91. Rath, Nilakanta, "A note on Agricultural Production in India during 1955-78", I.J.A.E., XXXV (2), 94 - 103, April - June, 1980.

92. Recto,A.E., "Marketed Relationships for Cone in the Philippines", Philippines Agriculturists Los Barvos, 49 (9), 816 - 832, 1966.

93. Reddy,J.N., "Estimation of Farmers' Supply Response: A Case Study of Groundnut", I.J.A.E., XXX (4), 57 - 63, 1970.

94. Reddy,V.N., "Pattern of Commercial Farming in Guntur District", E.P.W., XX (51 and 52), A - 137 to A - 152, December 21 - 28, 1985.

95. Robert Herdt,"A Disaggregate Approach to Aggregate Supply", Amer. Jour. Agri. Econ. 52 (4), 512 - 520, 1970.

96. Sanyal,S.K., "Agricultural Productivity, unemployment and Landholdings Structure: Some Tentative Hypothesis", E.P.W., XIX (52 and 53), A - 179 to A - 188, December 22 - 29, 1984.

97. Sawhney,B.L., "Farm Supply Response: A Case Study of the Bombay Region", Asian Economic Review, X(2), 106 - 112,1968.

98. Selvarathnam, "Where Sunlight is Scarce: Changes in Cropping Pattern in Kanyakumari,E.P.W., XX (45, 46 and 47), 1961 to 1966, November, 1985.

99. Sen,S.R., "Growth and Instability in Indian Agriculture", A.S.I., XXI (10), 1967.

100. Sidhu,D.S., "Price Responsiveness of Punjab Wheat Yields", I.J.A.E., XXXIII (2), 1978.

101. Sidhu and Kaul, "Acreage Response to Prices for Major Crops in Punjab", I.J.A.E., XXVI(4), 427 - 434, 1971.

102. Singh, Ram,D., "Shifts in Pulses Acreage: An Inter-Regional Analysis of Dynamics of Farmers' Response: Uttar Pradesh", I.J.A.E., 34 (3), 1 - 18, 1979.

103. Smith,B.B., "Forecasting and Acreage of Cotton", Jour. Amer. Statis. Assoc.,XX, 31 - 47 (New Series), 1925.

104. Stern,R.M., "The Price Responsiveness of Primary Producers", The Review of Economics and Statistics, XXIV (2), 202 - 207, 1962.

105. Subharao,K., "Farm Supply Response: A Case Study of Sugarcan in Andhra Pradesh", I.J.A.E., XXIV (2), 84 - 88, 1969.

106. Subhramanian,S.R.,et.al., "Farmers' Supply Response", I.J.A.E., Summary of Paper, 31st Conf. XXVI (4), 444 - 445, 1971.

107. Suhay,K.K., "Acreage Response of Groundnut in Major Groundnu Zones: A Case Study in the Dynamics of Supply", A.S.I., XXVI (7), 477 - 481, 1971.

108. Surendran,P.S. and Krishnan,S., "Fertiliser for Higher Productivity", Seminar on Agricultural Development in Kerala, Economics Department, Calicut University, Trichur, 1981.

109. Syamasundaran Nair,K.N., "What ails Rice Production in High Rainfall Tropics - Kerala - A Case", Symposium on Rice Research and Development, Patambi, 21 - 23, December 1977.

110. Thamarajakshi,R., "Intersectoral Terms of Trade and Marketed Surplus of Agricultural Products 1951-52 to 1965-66", E.P.W., 4 (26), A - 91 to A - 102, June 1969.

111. Thingalaya,N.K., "Has the Farmer Benefited from High Prices? A Comparison of Trends in Harvest and Annual Prices", E.P.W., June 5, 1965.

112. Thingalaya,N.K. and Shetty,N.S., "Foodgrains Prices and cost of Cultivation", E.P.W., Sept. 25, 1965.

113. Tomak,W.G., "Distributed Lag Models of Cotton Acreage Response: A Further Result", Amer. Jour. Agrl. Econ. 54 (1), 108 - 110, 1972.

114. Thyagarajan and Nambiar,K.V., "Rice Production in Kerala", Seminar on Stagnation of Rice Production in Kerala, Agricultural College, Vellayani, Trivandrum, 1983.

115. Umadevi,S., "State Policy towards the Cultivation of Cash Crops in Travancore 1860 - 1960" Seminar on Commercialisation in Indian Agriculture: C.D.S., Trivandrum, November, 1981.

116. Vamadevan,V.K., "Effective Water Management for Increased Rice Production and Productivity", Seminar on Stagnation of Rice Production in Kerala, I to III - July, College of Agriculture, Vellayani, Trivandrum, 1983.

117. Venkataramanan,L.S. et.al., "Dynamic Supply and demand Models for Better Estimation and Projections: An Econometric Study for Major Food Grains in the Punjab Region", I.J.A.E., XXVI (1), 21 - 34, 1971.

118. Venkiteswaran,S., "Changing Cropping Pattern and Food Economy of Kerala", A.S.I., April, 9 - 13, 1984.

119. Venugopalan,S. and George,M.V., "Effect of Modern Technology in Labour and Productivity in Rice Production in Kerala", Seminar on Rural Labour in Kerala, Kerala Agricultural University and Department of Economics, 1978.

120. Walsh,R.M., "Response to Rice in Production of Cotton and Cotton Seed", Jour. Amer. Econ., XXVI (7), 359 - 372, 1944.

121. Wilf,L.J. and Bawden, D.L., "Reliability of Supply Functions Derived from Production Function Estimates", Amer. Jour. Agri. Econ., 51 (1), 170 - 178, 1969.

122. Zaki, "Estimation of Price Responsiveness of Egyptian Cotton", Tech. Bulletin, Department of Agriculture, Cairo, 1976.

123. Zvi. Griliches, "Demand for Inputs in Agriculture and a Derived Supply Elasticity", Jour. of Farm Econ., 41 (2), 309 - 322, 1959.

124. ——————————, "Estimates of the Aggregate United States' Farm Supply Function", Jour. of Farm Econ., 42 (2), 282 - 293, 1960.

125. ——————————, "Distributed Lags: A Survey" Econometrica, 35 (1), 16 - 49, January, 1967.

Reports and Other Government Publications

1. India, Directorate of Economics and Statistics: Studies in the Economics of Farm Management in Kerala for the years 1962-63, 1963-64 and 1964-65, New Delhi.

2. ——————————: Estimates of Area and Production of Principal Crops in India, 1978-79 (1980), 1981-84 (1985).

3. ——————————: Comprehensive Scheme to Study the cost of Cultivation of Principal Crops in Kerala State (unpublished), Kerala University, Department of Economics.

4. Census of India 1981, Series - 10, Kerala.

5. National Council of Applied Economic Research: Techno-Economic Survey of Kerala, New Delhi, 1962.

6. India, Planning Commission: Evaluation Study of the HYVP - Report for Ragi, Paddy, Jowar 1967-68 (1968).

7. Kerala, Department of Economics and Statistics: Statistical Abstract of Kerala, 1960 and 1975.

8. —————————— : Statistical Hand Book of Kerala, 1965, 1968, 1970, 1972, 1975 and 1979.

9. —————————— : Statistics for Planning, 1977, 1980, 1983 and 1986.

10. ——————————: Basic Statistics Relating to Kerala Economy, 1956-57 to 1973-74 (1975).

11. Kerala, Department of Economics and Statistics: Progress of Kerala in two Decades, 1956-57 to 1976-77 (1978).

12. ———————— : Data Base of Kerala Economy, 1983.

13. ———————— : Kerala Economy, 1984, 1985 and 1986.

14. ———————— : Selected Indicators of development in India and Kerala, 1985.

15. ———————— : Progress of Kerala in Three Decades, 1957-1985 (1986).

16. ———————— : Crop Estimation Survey of Paddy and Tapioca, 1965-66 to 1981-82.

17. ———————— : Season and Crop Report of Kerala, 1957-58 to 1983-84.

18. ———————— : Agricultural Census, 1976-77 (1981).

19. ———————— : Agricultural Statistics, 1975 (1977).

20. ———————— : Findings of the Agricultural Field Experiments in Kerala 1956-60 to 1974-75 (1976)

21. ———————— : Extent and Productivity of HYV of Paddy, 1975-76 (1977)

22. ———————— : Report on the Timely Reporting Survey of Agricultural Statistics in Kerala, 1975-76 to 1982-83.

23. Kerala, Department of Economics and Statistics: Index Number of Agricultural Production, Area and Productivity, 1980 (1982).

24. —————————— : Price Trends in Kerala, 1966 (1967).

25. —————————— : Review of the Movement of Prices of some Essential Commodities in Kerala, 1976 to 1979 (1980).

26. Kerala State Planning Board: Cost of Cultivation of Paddy: An Analytical Tool for Evaluation, 1971 (Evaluation Report).

27. —————————— : Emerging Management Operational Prob[redacted] Consequent on the Extension on Irrigation and Introduction of HYV in Kerala, 1973.

28. —————————— : Possibilities of obtaining Food Self-sufficiency in Kerala, 1973.

29. ——[redacted] Kerala, Viripu Paddy [redacted].

30. —————————— : HYVP in Kerala (Mundakan and Punja Paddy; 1973-74) Evaluation Report, 1976.

31. —————————— : Intensive Development (Yela) Programme; Evaluation Report, 1977.

32. —————————— : Index Numbers of Area, Production and Yield of Principal Crops in Kerala, 1976.

G 3914 -

33. Kerala State Planning Board: A Quarter Century of Agricultural Development in Kerala - An Over Review, 1977.

34. ———————————— : Economic Review, 1959 to 1986.

35. ———————————— : Report of the High Level Committee on Land and Water Resources, 1984.

36. Kerala: Report of the Committee on Agro-climatic zones and Cropping Patterns, Department of Agriculture, Trivandrum, April, 1974.

37. Kerala, Farm Information Bureau: Farm Guide, 1986.

38. Kerala: Kuttanad Enquiry Commission Report, Trivandrum 1972.

39. ———————————— : Rice Deal Enquiry Commission Report, 1959.

40. FAO: Production Year Book 1965 to 1986

41. International Food Policy Research Institute: Food Needs of Developing Countries: Projections of Production and Consumption to 1990, Res. Rep. 3, Washington, D.C. 1977.

42. International Rice Research Institute: Constraints to High Yield on Asian Rice Farms: An Interim Report, Los Banos, Philippines, 1977.