CHAPTER I

SHIFTS IN CROPPING PATTERN IN KERALA
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CHAPTER I

SHIFTS IN CROPPING PATTERN IN KERALA

INTRODUCTION:

India is a large country having substantial agricultural diversities. Different regions exhibit entirely different characteristics so that no one Plan can be conceived for all agricultural regions of the country. The share of agriculture in national income is often taken as an indicator of economic development. Agriculture sector in India has demonstrated an admirable performance over the past four decades but still there is abundant scope to improve for occupying the premier position in the global market. With a 24.2 per cent (in Triennium Ending 2001-02) contribution to gross domestic product, the sector provides employment to 56.7 per cent of country’s work force and it is the single largest private sector occupation. Growth of real GDP originating from agriculture and allied sectors in the country decelerated sharply to 1.1 per cent during 2004-05 from 9.6 per cent a year ago due to uneven and deficient South West monsoon. Over all GDP growth in 2004-05 was 6.9 per cent at the national level.¹

Unlike the other regions in India, Kerala State is characterised by extreme diversity in its physical resources and agro-climatic endowments. In earlier periods the choice of cropping pattern was guided by agronomic considerations and consumption needs of farmers but now the market forces decide it. Official reports show that agricultural income in Kerala showed a steady growth up to mid seventies began to decline thereafter and showed a vacillating trend in the eighties. By the end of eighties cash crops started generating higher income to the farm sector. The contribution of agriculture to State income (share) has been on
the decline as the other sectors registered higher rates of growth. The provisional estimate for 2003-04 indicated an increase of 1.8 per cent growth contributed to 13.62 per cent to State income while quick estimate for 2004-05 showed an increase of 1.7 per cent over the previous year but the share to State income declined to 12.68 per cent. Even though the sector has recorded positive trend in growth performance in nineties, it has not been consistent. Food crops in general have suffered a setback in area and production despite a sizable investment.

Marginalisation of agricultural holdings due to extreme sub division and fragmentation and the decreasing trend in family participation in farm operations with resultant increase in production costs and dominance of perennial crops make Kerala agriculture more vulnerable. Agriculture development experience of the State since the late seventies has been characterised by sharp decline in the area under food crops, mainly paddy and the substantial expansion in the area under commercial agriculture dominated by plantation crops. Relatively higher profitability of cash crops and plantations, the higher labour intensive and seasonal nature of cultivation and the increasing wage rate, the exemption of plantation crops from land reforms act, phenomenal increase in the export price of many of the plantation crops and cashew nut, the promotional activities by the Government in the area of plantations and cash crops etc. have definitely encouraged the cultivators in Kerala to opt for higher valued cash crops or plantations wherever possible and to curtail the area under rice and other food grains to the minimum.²

The declining growth rates of area under food crops in Kerala have well been documented. According to Pillai (1982) the seventies was a period of
decelerated growth in agricultural output in Kerala mainly due to a sharp decline in area under crops, especially food crops. Sawat (1983) observed Kerala to be the only State to register a deceleration in the growth of food grain production brought about mainly by fall in acreage. George and Mukherjee (1984) Kannan and Pushpangadan (1988) and Krishnan et.al (1991) also reported negative growth rates in area under food crops. According to Lakshmi and Pal (1988) one of the major changes that had been taking place in Kerala was the gradual shifting of the area from food crops like rice to plantation crops like rubber and coffee and cash crops coconut and cashew. Persistently deteriorating food crop scenario and perpetually poor yielding commercial crops along with the wide gap between the productivity potential and the productivity realized were the main factors of challenge, which was reported by Bastine C L and Palanisamy (1994). The rapid shift in cropping pattern away from food crops has reported by Joseph (1996).

Mani and Jose (1997) reported significant shifts in cropping pattern had taken place in the northern districts of the State and area diverted for non-economic activities had risen. A shift in cropping pattern, in favour of cash and plantation crops, at the expense of probably the less remunerative crops had seen in the analysis by Jayakumar and Velayudhan (2002). Mani (2004) noted a significant reduction in area under rice and increased area under coconut and rubber and claimed that Kerala farmers were shifting the area under rice to coconut and rubber. Thomas (2004) observed from the analysis of the changes in cropping pattern of the State that since its formation in 1956 it clearly showed that there had been a persistent shift in favour of garden crops and plantation crops at the expense of food crops. Cropping pattern of Kerala triggered by market
conditions and most important structural change is the relative decline in the proportion of food grains is noted by Mohandas (2005).

In this context it is important to examine critically the past performance of agriculture and based on it future prospects of growth can be estimated.

1.1 PRESENT SCENARIO OF AGRICULTURE IN KERALA:

The agriculture scenario of Kerala indicates a heavy concentration of non-food crops. Against the national average of over three-quarters of land under food grains, in Kerala only about one-fifth of the land is under food grains. The two main characteristics of the cropping pattern of agriculture in Kerala are the predominance of crops, which are dependent on world market conditions, and the dominance of perennial crops as against seasonal or annual crops. The most notable feature of Kerala’s agricultural development is the emergence of cash crops as a dominant sector over the last four decades. The change in cropping pattern is noted, which reflects decline in area under traditional crops and commercial presence of new cash crops like vanilla. Since spices, plantation crops and coconut together account for three-fifth of the cropped area and approximately four-fifth of the agricultural output in the State, the vagaries in international market conditions affect the prospects of Kerala farmers.

The ever-widening supply gap in food grains has grown to alarming proportion of 90 per cent. This not only created irreversible threat on Kerala’s food security, but also aggravated the adverse ecological consequences due to increasing conversion of low-lying paddy lands for non-agricultural purposes after filling the land. The filling of paddy lands and over exploitation of irrigation facilities have affected water conservation very adversely and a growing tendency
is also aroused to leave the paddy lands as fallow due to low income from cultivation. Environmentalists and scientists say the economic and real estate boom swallowing the farmlands, including paddy fields, which are also areas for water conservation, will have serious ecological fallout. Since productivity of major commercial crop is low, the cost of production is higher in the State, which makes the products less competitive. Since most of the farmers are owned and operated by persons whose primary occupation is outside agriculture and they have little interest in investing in lands or maximizing income from agriculture.

Keeping in view the importance of the agriculture, quantitative assessment of contribution of the various factors to growth of crop output and productivity at the State or district level is helpful in reorienting the programmes and priorities of agricultural development so as to achieve higher growth. There are many factors, which affect the growth of crop output and productivity. The sources of output growth like area effect; yield effect and cropping pattern effect have relevance in deciding the programmes of agricultural development and priorities of investment in it (Ranade, 1980). The growth rates as such offer no explanation for desperate performance of agriculture. Thus it becomes important to find why these growth rates differ from one another so that the bottlenecks could be removed to achieve the speedy development of agricultural sector (Sikka and Vaidya, 1985).

1.2 CONTEXT OF THE STUDY:

The analytical devices pursued in the study incorporate a metamorphic of agriculture situation as generally understood and how far our understanding related to this area can be substantiated by a detailed investigation. In approaching the study under review our general understanding can be sharpened through a
methodological approach incorporating a scientific decomposition of variables under investigation. The pruning of the idea and the substantiation attempted for the angle of the agriculture scenario emerged from the general nature of Kerala agricultural situation as commonly believed i.e. the decelerating trend of area, production and productivity. In this context an earnest attempt is being made to evaluate the above things through models. For this purpose the data relating to these from 1974-75 to 2004-05 (the span of 30 years) has been analysed to arrive at a genuine and valid conclusions. And hence the present context of the study is shaped in such a way as to assimilate to the bygone and ongoing transitional phases of the major crops taken for the detailed study.

1.3 SIGNIFICANCE OF THE STUDY:

Several studies on Kerala agriculture somehow or other concentrated on certain specific areas like the land utilization pattern and cropping pattern and the analysis of the specific trends related to area, production and productivity growth, particularly of plantation crops like rubber, coffee, cardamom and tea. The research studies conducted here and there specified some specific issues of the cultivation of crops and the impacts on them due to the occurrence of price changes, relative attractiveness of some crops on account of relative low cost and high profit. The earlier exercises of research on the cropping pattern front of Kerala agricultural situation attempted the issues separately and the conclusions derived thereon.

Though the general observation and the detailed studies earlier done clustered around the area effect and yield effect, the locational component on productivity aspect has not so far known to be conducted. For the purpose of
identifying and extracting locational component, the methodology adopted by Narain (1988) in Indian context is utilized in present context of analyzing the cropping pattern effect, yield effect and locational effect.

Majumdar and Basu’s (2005) methodological device of decomposing output growth into area, yield and cropping pattern effects without introducing any interaction term, which was used in the district level study of West Bengal, is also used in the analysis of the decomposition in the district level of Kerala. District wise segregation of output growth into area, yield and cropping pattern effects using regression model without interaction term has not been seriously attempted in Kerala context.

The significance of the present study lies in the fact that the decomposition effects mentioned above has not so far been addressed in a detailed and comprehensive manner in the earlier studies and hence a novel attempt is made here so as to address the issues laid down in the objectives and hence the importance of the study.

1.4 RESEARCH DESIGN:

1.4.1 Research Issues:

1. What is the impact of growth trends of area and yield in the determination of the growth trends in production?

2. Whether the effect of locational component of individual crops, cropping pattern and pure yield effect are present in Kerala Agriculture?

3. Is the impact of cropping pattern effect significant in the districts along with yield effect?
4. Is the shift in cropping pattern occurred in the districts?
5. What is the extent of crop diversification and changes there in the agriculture of the State?

1.4.2 Objectives:

The present study is conducted with the following specific objectives of analysing the shifts in cropping pattern in Kerala Agriculture.

The specific objectives of the study are the following:

1. To analyse the growth trends of area, production and productivity of major crops in Kerala.
2. To decompose the total change in productivity into its constituent forces like cropping pattern effect, locational effect of individual crops and yield effect.
3. To study the cropping pattern of selected crops in the districts of Kerala.
4. To decompose the total output growth into its components like area effect, yield effect and cropping pattern effect in district wise pattern.
5. To analyse the extent of crop diversification in Kerala agriculture scenario.

1.4.3 Hypotheses:

1. There is a positive relationship between yield and total productivity.
2. Locational effect is positively related to the growth of total productivity.
3. There is a negative relation exists between the cropping pattern effect and the growth of total productivity in Kerala State.
4. Cropping pattern effect is positively related to output growth in the districts under study.
5. The impact of yield effect is positive in the determination of output growth in the districts under study.

1.4.4 Scope and Coverage of the Study:

Present study is based on Kerala agriculture to study the impact of various components of total productivity growth and total output growth. All fourteen districts are taken to analyse the cropping pattern of the districts and the State. Major crops- Paddy, Tapioca, Coconut, Rubber, Pepper, Cashew nut, Areca nut, Banana and Plantains, Cardamom, Coffee, Tea and Ginger- of Kerala State which occupy more than 80 per cent of the total cropped area of the State are taken for the decomposition analysis. Reference period of the study is from 1974-75 to 2003-04. In order to understand the impact of each component the reference period split into three-sub periods- Period I (1974-75 to 1980-81), Period II (1981-82 to 1991-92) and Period III (1992-93 to 2003-04). For State level analysis data up to 2004-05 are taken for the analysis.

Decomposition techniques are used to estimate the importance of each component on productivity and output growth. Two decomposition models are used for the entire analysis. One is to decompose the total productivity growth and other used for the output growth. To know extend of crop diversification an index of diversification is computed.

The universe of the study is the State as a whole and all districts are taken for the study. Among the crops of the State twelve major crops are taken according to their share in the total cropped area. First twelve crops are taken which covered more than 85 per cent of total cropped area of the State in 1974-75 and now they cover more than 80 per cent of the total cropped area.
1.4.5 Data and Methodology:

The State has a diversified cropping pattern in different regions depending upon agro-climatic conditions and hence all important food and cash crops are selected for the present study. Selected crops accounted for more than 80 per cent of the total cropped area. The study is restricted to principal crops with the assumption that the excluded crops do not affect cropping pattern and in turn would not vitiate the main conclusions of the study. Crops selected for the study are relatively important in the context of Kerala’s agro-situation. The data on area, production and productivity of the selected 12 crops rice, tapioca, coconut, rubber, pepper, cashew nut, areca nut, banana and other plantains, cardamom, tea, coffee and ginger are collected from the various publications of the Government of Kerala like Economic Review, Statistics for Planning, Agricultural Statistics and Season and Crop Reports.

The present study conducted for Kerala State pertains to the period 1974-75 to 2004-05. The study period is split up into three sub periods due to exogenously determined facts. The sub periods are Period I: 1974-75 to 1980-81; Period II: 1981-82 to 1991-92; Period III 1992-93 to 2003-04 and overall period 1974-75 to 2004-05.

(a) Estimation of Growth in Area, Production and Yield:

The pace of agricultural development of a region can be ascertained through a measuring growth in area, production and yield of crops in the region. In the present study, compound growth rates of area, production and yield of the selected crops for each period were estimated to study the growth in area,
production and yield of these crops. Compound growth rates were estimated with the following exponential model.

\[ Y = a \cdot b^t \]

\[ \text{CGR (r)} = (b - 1) \times 100 \]

The ‘F’ test has applied to test the significance of ‘b’.

**b) Decomposition of Total Productivity Growth:**

To measure the relative contribution of yield and area to total productivity for the total crops and individual crops Narain’s (1997) component analysis model is used. Index of productivity is decomposed into cropping pattern effect (pure and interaction), locational effect (pure and interaction) of individual crops and yield effect.

\[ I_t = 1 + \left\{ \sum_i \sum_s C_{io} \cdot d_{iso} \cdot (Y_{ist} - Y_{iso}) \cdot P_{io} + \sum_i \sum_s C_{io} \cdot (d_{ist} - d_{iso}) \cdot Y_{iso} \cdot P_{io} \right\} / \sum_i \sum_s C_{io} \cdot d_{iso} \cdot Y_{iso} \cdot P_{io} \]

where first three term measure pure effects of yield, location and cropping pattern simultaneously. The remaining four terms capture the interaction effects of area, yield and location simultaneously.

**c) Decomposition of Total Output Growth in a District -Wise Pattern:**
The data used for the study include the State and district level of output, yield, area and farm harvest prices of different crops. An additive decomposition model 6 without any residual term has used for the study. Output growth decomposed into area effect; yield effect and cropping pattern effect. Model used is as follows:

Output growth = $A_t \sum w_i c_{it} y_{it} - A_o \sum w_i c_{io} y_{io}$

Area Effect = $1/3 \{ (A_t - A_o) \{ \sum w_i c_{io} y_{io} + \sum w_i c_{io} y_{it} + \frac{1}{2} (\sum w_i c_{io} y_{it} + \sum w_i c_{it} y_{io}) \} \}$

Yield Effect = $1/3 A_o \sum w_i (y_{it} - y_{io}) c_{io} + 1/3 A_t \sum w_i (y_{it} - y_{io}) c_{it}$

Cropping Pattern Effect = $1/3 A_o \sum w_i (c_{it} - c_{io}) y_{io} + 1/3 A_t \sum w_i (c_{it} - c_{io}) y_{it}$

The variables and notations used in the model are

$A_t = \sum a_{it}$ = Gross Cropped Area where $a_i$ is the area under $i^{th}$ crop.

$y_{it} = V_{it} / A_t$ = yield of the $i^{th}$ crop.

$c_{it} = a_{it} / A_t$ = share of the $i^{th}$ crop in gross cropped area all at time t.

$w = $ Constant price weight.

The subscripts ‘0’ and ‘t’ refer respectively to the base and $t^{th}$ period. Subscript ‘i’ is used for the $i^{th}$ crop ($i = 1,2,3 \ldots \ldots \ldots \ldots 12$).

Output growth = Area effect + Yield effect + Cropping Pattern effect.

Cropping pattern of each district is analysed by using the percentage share of each crop in each district during the four point of time. Triennium Ending 1976-77, 1983-84, 1994-95 and 2003-04 are taken as four point of time.

(d) Crop Diversification:
The level of crop diversification varies among regions because of varied agro climatic conditions and resource endowment of the farms. The introduction of new seed-fertilizer technology has not only led to intensification of farming but also results in large scale diversification of crop farming and the benefits gradually accrued to the whole farming community. Various studies conducted at State level indicated that there was gradual diversification in favour of secondary and tertiary sector and in general the farmers have shifted their cropping pattern from subsistence crops to the commercial crops. To study the extend of crop diversification in the State over last thirty years study divided in to four time points as mentioned earlier i.e. TE 1976-77, TE 1983-84, TE 1994-94, and TE 2003-04. Herfindahl index used for the measurement of diversification.

**Hirschman - Herfindahl Index:**

It is a measure of concentration. Index was computed by taking the sum of square of area proportion of each crop in the total cropped area.

$$\text{Herfindahl Index} = \sum_{i=1}^{N} P_i^2$$

‘N’ is the total number of crops and $P_i$ represents acreage proportion of the $i^{th}$ crop in total cropped area. With the increase in diversification, the index would decrease. This index takes a value one when there is a complete specialisation and approaches zero as ‘N’ large i.e diversification is perfect. The diversification index calculated as $\text{DI} = 1-H$, was used to capture the changes.

(e) **Hypotheses Testing Methods:**

In the language of significance tests, a statistic is said to be statistically significant if the value of the test statistics lies in the critical region. In this case
the null hypothesis is rejected. By the same token, a test is said to be statistically insignificant if the value of the test statistic lies in the acceptance region {A test of significance is a procedure by which sample results are used to verify the truth or falsify of a null hypothesis}.

To estimate the compound growth rates of area, production and yield of major crops exponential form of the equation is used. The significance of trend values is tested using F- ratio test. Both 1 per cent and 5 per cent level of significance is used.

The components of decomposition of total productivity and output growth are computed by the respective formulae. In both analyses each component follows a linear trend. So under linear framework model, growth rates are computed and significance of the trend values checked by using F- test. The level of significance in all analysis has taken as 1 percent and 5 percent. In the regression model to test the presence of auto correlation, Durbin – Watson test was used.

To test the major hypotheses of the study paired t-test is used. At 1 percent level of significance the significance calculated. Significance of correlation between two variables is also analysed.

1.4.6 Conceptual Framework:

Concepts used in the Study:

1. Cropping Pattern: The proportion of area under different crops at a point of time.
2. **Pure Yield Effect:** It measures the changes in productivity or output per hectare that would have occurred as a result of variations in the per hectare yield of the individual crops.

3. **Cropping Pattern Shift Effect:** Measures changes in productivity or output that would have occurred as a result of changes in the cropping pattern.

4. **Pure Locational Shift Effect:** It measures the changes in productivity that would have occurred as a result of locational shifts in the area under individual crops.

5. **Area Effect:** Measures the changes in output that would have occurred as a result of the growth of gross cropped area.

6. **Cropping Interaction Effect:** Represents the effect on productivity due to the simultaneous changes in cropping pattern change and yield change.

7. **Locational Interaction Effect:** Measures the changes in productivity due to the simultaneous changes in locational shift and yield effect.

8. **Food Crops** includes rice, tapioca, banana and other plantains, pulses and other cereals and millets.

9. Crops like coconut, areca nut, cashew nut and pepper are **Garden crops**.

10. Rubber, cardamom, coffee and tea are **Plantation crops**.

### 1.4.7 Theoretical framework of the Study:

Decomposition of growth trends was an interesting development in the analysis of agricultural growth. The systematic attempt in this field was put forwarded by Minhas and Vaidyanathan (1965) by using additive decomposition
model to measure the absolute change in the value of gross agricultural output. The impact of area, yield and cropping pattern on the agricultural output was analysed using the model.

Another development in the decomposition model was done by Minhas (1966) by giving a seven-component version of the additive scheme. Vidya Sagar (1977) gave a new dimension by the introduction of the change in the value of gross agricultural output at prevalent prices into three gross components- area, productivity and prices and their interactions. Introduction of current prices was the new addition of Sagar’s work.

One of the new components in the decomposition model was introduced by Dharm Narain (1977) by the addition of locational component in the decomposition of agricultural productivity. By the introduction of technological factors into the change of overall agricultural production Sagar (1978) further developed the model by including the main components as irrigation, fertilizer and high-yielding varieties and unexplained yield growth rate.

After a long period Kurosaki (2002) has given a new version for the decomposition analysis in three steps. First, decomposition of gross output into two components area and productivity, then the decomposition of productivity into three components yield, crop shift and the residual effect and lastly, yield into three components pure yield effect, static land reallocation effect and dynamic land reallocation effect. To study the relative contribution of area, yield and their interaction Dashora et al (2000), Sarkar and Chakraborty (2002) also split the aggregate crop output by seven-factor additive model.
Multiplicative scheme explains the compound rate of growth in terms of the component growth rates. In this field pioneering attempt was done by Parikh (1966) without any interaction term. Explaining the importance of interaction term in the multiplicative model Minhas (1966) split up the ratio of final and base year production into three factors area, yield and one interaction term.

With a new multiplicative model, Bhalla and Singh (1979) by introducing interaction term made a study in all India level by covering 289 districts. In discussing the problems of interaction or residual term in multiplicative model, Jamal and Azad (1992) formulated a decomposition model without a residual term.

In the additive framework, all decomposition models, which were developed, contained residual term. Consistent decomposition of output growth with the appropriate additive model without interaction term was developed by Majumdar and Basu (2005).

In the present study two additive decomposition models were used to know the impact of each components on output growth. To know the impact of yield, cropping pattern and locational effect and their interactions on total agriculture productivity in Kerala, Narain’s (1977) model was used. For analysing the impact of area, yield and cropping pattern, without any residual term, at the district level the model developed by Majumdar and Basu (2005) was used.

1.5 SOCIAL RELEVANCE OF THE STUDY:

Viewed from the angle of social feasibility and feasibility of the economy the present pattern of cultivation is some how or other detrimental to the
pace of the growth of the economy. This can be very well understood by the close examination of the trends revealed in the cropping pattern of Kerala Agriculture. A peep into the general trend of cultivation of crops tend one to conclude that people are always be in run after profit at the expense of local economic food security, especially in the cultivation of food crops like rice and tapioca.

In this context it is highly imperative to formulate certain legislations by the legislature, which should be implemented by the executives so as to protect the local economy from the evil effects of over commercialization of cultivation. This to a certain extent save the economy from the clutches of a consumer-oriented economy to a producer oriented economy and can rejuvenate the rice bowls of Kerala in its full might and vigour.

The enactment and enforcement of legislations by the competent authority in respect of the conversion of land can be to a great extent lead to the reduction in the intensity of ecological degradation and severity of water shortage. The message contained in the present study is that if implemented with indomitable will and courage the pathetic scenario of Kerala Agriculture scene can be very well be surpassed.

1.6 REVIEW OF LITERATURE:

A study on the economics of cropping pattern of Kerala by Oommen (1963) deeply examined the crop pattern of Kerala, which differed from that of India in some significant respects. The study was based on the principle of comparative advantage. The climate, topography and soil structure of Kerala make it eminently suitable for the production of several commercial crops and a
study based on the principle of comparative advantage would lead to the best utilization of agricultural resources.

The major problems cited in the study were the difficulty in the measurement of inter regional comparative advantage in cropping pattern and that of intra regional between crops, the adoption of regional specialisation, rigid acceptance of a cash crop oriented cropping pattern, frequent changes in cropping pattern due to changes in prices, techniques of production, operation of the law of diminishing returns etc. For measuring inter regional comparative advantage land productivity of Kerala and net income per acre were compared. While analysing the intra regional crop shift the study-cited scope for substitutability of paddy by sugar cane as per the net income criterion. The study concluded by remarking that a rational re-allocation of cropping pattern in India on the basis of comparative advantage might result in the maximization of income and output from the agricultural sector. But this involves numerous difficulties.\(^8\)

George (1965) analysed the impact of the relative change in prices on the cropping pattern in Kerala. The study examined in detail the changes in price structure and acreage response to price in Kerala during the decade of the first two five-year plans. Six commodities, which covered 73 per cent of the cultivated areas were taken and among the crops paddy recorded the highest rate of, raise in prices and tapioca the least. The study divided crops into two sectors and examined the shift in crop acreage between crops in the same group and change in prices relative to changes in acreage. Secondary data were used for study and statistical tools were used for finding the relative prices.
Major findings of the study were a close correspondence between changes in relative prices with change in relative area. The two major divisions of crops were group A which included paddy, sugarcane and coconut and group B including rubber, cashew nut and tapioca. Relative prices of paddy increased a little more than others but relative acreage has registered a slight fall. A shift from coconut to paddy cultivation is impossible and from sugarcane to paddy had not been favoured. Acreage response to price was related to the stability of prices.

Conclusions derived from the study were that the cropping pattern of Kerala has undergone a slight shift from food crops to cash crops. The acreage response to price had been positive for most crops, the increased area under rubber and cashew nut cultivation were the result of the relative increment in their prices and a decline in acreage for tapioca cultivation was due to the fall in relative prices. Major suggestions of the study were that a price policy would not succeed by merely fixing a floor price; it should seek to stabilize the relative prices of food crops in terms of other agricultural commodities produced in the state.⁹

Jeemol (1983) made a detailed study on the changes in the cropping pattern of Kerala from 1960-61 to 1978-79 in which major emphasis was given to the substitution of coconut for rice. Since paddy is a highly labour intensive crop and coconut is a garden crop a shift from paddy to coconut was given more importance. The study was based on secondary data and district wise analysis of change in gross and relative area under paddy cultivation was found out.
Some of the conclusions derived from the study were that paddy growing was losing area both absolutely and relatively and that coconut cultivation was gaining. In the district wise analysis most of the districts showed large increase in area under coconut. Topographically coconut and rice could be grown in the same condition so it was possible for rice to be substituted by coconut in the lowlands, valleys and midlands. Topographical features of Kerala are suitable for the substitutability of paddy by coconut. Area analysis revealed that the reduction of area under paddy and increased area under coconut and except in one district Alappuzha the substitution possibilities were limited where fallow lands had sharply increased.  

Performance of agriculture in Kerala, a study by Sivanandan (1983), looked at the growth performance of a number of crops aggregates at All India level. Also an analysis of growth performance of Kerala was done and examined as to how the critical factors (essential ingredients of agricultural strategy) behaved across crops and regions over time. At the All India level (1950-1983) there was no evidence of a break in trends in output on the total food production after the introduction of new technology. For the analysis of growth rates in Kerala four major crops- rice, coconut, tapioca and rubber- all crops, food grains and non-food grains were taken. The period of study was between 1960-61 and 1982-83 and used official published data.

A declining trend in yield and cropping pattern was observed in the study for all crops. The decline in the growth rate of area for both food grains and non-food grains and a decline in the growth rate of yield and cropping pattern non-food grains were primarily responsible for the overall decline in production in
agriculture. While considering rice, the study noted a spectacular decline in area, which was the reason for low production even though growth rate of yield was on an increasing trend. In the case of coconut, production was increased during 1965-66 to 1971-72 due to increase in area and after 1972-73 indicated a decline in production, area and yield. Tapioca production also suffered decline of area after 1974-75 where both the rise and fall in the growth of tapioca was much sharper compared to coconut. In the case of rubber the study noticed a slow and steady increase in area but a very sharp increase in yield till 1975-76 and it was again a sharp decline in yield that accounted for the decline in production.

The major conclusion put forward by the study was since different group of crops and different crops showed various trends in area, production and yield agro climatic preferences were there due to dominant agro climatic zones in each district. The study advocated for a district wise analysis of crops to understand the impact of agro climatic factors on growth performance of crops.

Venkiteswaran (1984) examined the changing cropping pattern and food economy of Kerala. The study analysed in depth the reasons for conversion of paddy fields into other crops-cultivations, mainly coconut and forecasted the posterior probabilities of the conversion process of paddy fields and its resultant impact on the food and agriculture economy of Kerala. Primary data were mainly used for the analysis. The farmers were categorized into converters and non-converters and observed that the converters group transformed paddy fields into coconut groves since June 1967. Non-converters group continued to cultivate seasonal crops. Major findings were that 67 per cent of converters were in the age group of 50 and above and 25 per cent among them got college education.
per cent of the non-converters were in the age group of 35-50 and of these 13 per cent got college education. While examining the economic profiles of converters and non-converters the conclusion drawn was that the average income of converters was greater than that of non-converters and this was due to larger farm size and higher value of assets. When the year-wise trend of conversion by converters group was examined the peak year of conversion was found to be 1972. The major reasons mentioned by the farmers were that the converted marginal lands were lying in the border area, lack of irrigation facilities, shade of trees, soil erosion etc. which made those lands uneconomic for paddy cultivation. Also low yield from paddy promoted 80 per cent of the farmers for conversion. Sixty per cent of farmers reported risk potential inherent in paddy cultivation and 73 per cent the long run benefit of cash crops. Labour shortage, higher wages, engagement in other activities, easier management of cash crops, increase in land value, adopting the practice of neighbouring cultivators too were the reasons cited by the farmers for land conversion.12

Kannan and Pushpangadan (1988) analysed Agricultural stagnation in Kerala on an exploratory analysis. Study attempted to explain the agricultural stagnation that set in Kerala since mid seventies. Period under consideration was from 1962-63 to 1985-86 using secondary data. In the study the major two factors responsible for stagnation were one was the absence of the provision of inputs such as water and land development and the other the environmental degradation which affect the water availability and soil quality. There are two methods available to know the overall performance of agricultural sector, which
are the decomposition method and statistical estimation using different functional forms. Authors used the second method to reach at final conclusions.

Main conclusion emerged from the analysis was that the decline that took place in Kerala’s agriculture since the mid seventies had been such that it had wiped off the growth rate during the sixties and early seventies. Deforestation reduced the number of rainy days, which effected the environmental degradation that took place in Kerala since the mid seventies. Also acreage allocation decision depended on the weighted average of past prices.¹³

Lakshmi and Pal (1988) made an attempt to analyze growth of crop output in Kerala based on secondary data during 1952-53 to 1984-85. Since agricultural production in a region is determined by gross cropped area, cropping pattern and unit area yield, a change in gross output might occur due to the change in gross cropped area, a change in cropping pattern, a change in unit area yield or any combination of the above. Decomposition of aggregate crop output into the component elements (seven factor model) was the method used in the study. Compound growth rate for the individual crops were worked out for area, production and yield by fitting exponential function.

One of the major changes that had been taking place in Kerala was the gradual shifting of area from food crops to plantation crops. From the analysis it was noted that both production and area of crops under consideration major ten crops) showed increasing trend till 1974-75 and after that these started declining. Even though production rose again in 1984-85 no such recovery was noticed for area. In Kerala, which is well known for the mixed cropping and multiple cropping system in agriculture, further increase in gross cropped area is not
possible. One of the alternative was to effect fundamental changes in cropping pattern through appropriate crop planning with high-yielding cultivars and steady improvement in crop yield through scientific management so as to introduce an element of dynamism in the State agriculture for maximizing the crop output.\textsuperscript{14}

Radhakrishnan, Thomas and Jessy (1988) made an analysis regarding the performance of rice crop in Kerala with the main objective of a spatio-temporal analytical review of changes in area, production and productivity of rice. Period of study was from 1960-61 to 1986-87. From the analysis of data collected from official sources it could be stated that area and production of rice in Kerala had shown a generally rising trend till about mid 1970’s and there after both had shown a declining trend and the rate of decline had been steeper in area. Since productivity had shown a rising trend and so declining trend in production had been less than that of area. Apart from the cost price squeeze, rising land prices on account of the rising demand for house sites; rising urbanization and disparity between land prices and return from crops paddy lands were converted for non agricultural uses. Paddy cultivation is labour intensive. Rising labour costs and unmanageability of labour had prompted resourceful rice cultivators to convert paddy lands.

The study concluded by stating that even though there were many reasons for the falling area and production of rice in Kerala falling profitability appeared to be the most important among them. Some of the policy implications put forward by the study included substantial increase in productivity, providing an attractive support price and to have a ceiling price for competing crops.\textsuperscript{15}
Jessy, Thomas and Indira (1990) analysed in depth the cropping pattern in Kerala based on physical, economic and sociological considerations. Major changes in agricultural output might occur due to the changes in gross cropped area, a change in cropping pattern, a change in unit area yield or any combinations of the above. The major objective of the study was to analyse the changes in the cropping pattern in Kerala over the period from 1973-74 to 1986-87 for 16 principal crops. The study was based on secondary data and used compound growth rate of area by fitting exponential function, Spearman’s rank correlation coefficient and Kendall’s coefficient of concordance were worked out to analyse the total change over the period.

Major results of the study were that food crops had shown a declining trend in area-wise and the correlation coefficient indicated that there was no significant shift in cropping pattern. Kendall’s coefficient of concordance also justified the opinion that no significant shift in cropping pattern was observed during the period under study. The study concluded by stating that climatic conditions of the state as well as the farmer’s high expectations about future prices for some crops resulted in the increased trend in acreage of those crops. In Kerala since the scope for further increase in gross cropped area is limited the other alternative is to make effective fundamental changes in the cropping pattern through scientifically managed crop planning.16

Growth and Instability in Kerala agriculture was analyzed by Krishnan, Vasisht and Sharma (1991) using time series data for seventeen years, 1970-71 to 1986-87, to study the trends in growth rates of area, production and productivity of major crops of Kerala state, the magnitude of instability of those variables and
to measure percentage contribution of area and productivity towards increased production of major crops of Kerala. To measure the compound growth rate exponential function was used and the yield change, which was occurred as the result of productivity contribution, were classified according to contribution and interaction effect.

The paddy cultivation had became economically unviable, a shift in cropping pattern in favour of plantation and commercial crops was indicated making the state deficient in rice and the shift in cropping pattern which can be attributed to the exorbitant wage levels and socio-economic factors such as gulf boom contributed to the changing agricultural scenario in Kerala were the main results of the study.  

An analysis of growth trends of principal crops in Kerala was a study by Bastine C.L and Palaniswami (1994) under the assumption that the cropping pattern was unique in the sense that homestead system of cultivation is prevalent in almost all parts of the state. The study analyses the trends in growth rates over the period 1965-66 to 1989-90 and the contribution of area and productivity towards increasing the production of major crops in Kerala.

The exponential function was fitted to the data, which was collected from official sources to compute compound growth rates. To measure the instability of each crop coefficient of variation was used. Decomposition method was used to measure the contribution of area and productivity towards increasing production of major crops of the state.

From the analysis of compound growth rates while considered area under pepper and coconut showed a positive trend but not significant, rice, tapioca and
tea showed significant negative trend and areca nut showed growth rate but not significant. Regarding production ginger, tea, coffee and rubber showed positive and significant growth rates, pepper showed positive growth rate but insignificant and all other crops showed insignificant negative growth rates.

In the case of productivity rice, ginger, tea and rubber showed positive significant growth rates; coconut, cashew and coffee negative growth rate which was significant only for first two but positive and insignificant growth rates were shown by pepper, areca nut and tapioca.

The area instability was high in the case of tapioca, coffee and rubber; production instability was of a higher order for crops like pepper, ginger, coffee, rubber and tapioca; and productivity instability was high in the case of ginger, cashew, coffee and rubber.

The productivity effect had a greater role for the crops areca nut, ginger, cashew and tea and change in production because of change in acreage was evident in rice, tapioca, coconut, pepper, coffee and rubber.

Major strategies that could make significant changes included augmenting production of smallholder cash crops such as coconut, pepper, ginger, and cashew through improvement in productivity and sustaining the area under food crops and stepping up production through productivity enhancement.18

‘Agricultural Development in Kerala’ was deeply analysed by Pillai (1994). The study has taken every aspect of agriculture in Kerala during 1958-59 to 1989-90. Secondary data was used in the study. Relative share of agriculture production sector in the State Domestic Product, land utilization
pattern, cropping pattern and annual growth rates of area, production and productivity of major crops were taken into consideration.

The study found out some major characteristics of agriculture in Kerala. The relative share of agriculture to State Domestic Product has been gradually declining, since 1975-76 the tendency of farmers to withdraw from rice cultivation increased which should be a matter of serious concern, steep falling of rice production, expansion of area under coconut accompanied by steep fall in productivity and increase in the productivity of rice accompanied by steep decline its area were the major findings of the study. The major two crises explained in the study were- the serious situation of paddy and coconut stated since mid seventies and the shifting of area under food crops in favour of cash/plantation crops.19

Joseph (1996) made an analysis on Kerala agriculture with respect to cropping pattern changes. The study intended to infer upon the evolving structure of the State’s agriculture. By employing appropriate statistical tools projections of future cropping patterns were made and their long-term socio-economic implications were discussed.

By assuming that the past trend in change in crop acreages of major crops would continue, quinquennial time series data on cropping pattern from 1970-71 to 1990-91 were subject to a first order Markov- Chain analysis to obtain the transition probability matrix for cropping pattern changes. The crops considered were rice, tapioca, coconut, rubber, other plantains and cash crops and other crops.
In the analysis, rubber appeared to be the crop with the highest stability followed by paddy and coconut. Tapioca, other plantains and cash crops and other crops were found to be highly unstable. The project cropping patterns from 1975 to 2015 showed the declining tendency of rice and tapioca acreages and their share by 2000 would be around 16 per cent and 5 per cent respectively. Coconut acreage showed gradual increase and by 2015 AD its acreage would become 32.3 per cent and rubber 20.7 per cent. Other plantains and cash crops would occupy 24.2 per cent of the total cropped area of the State.

The acreage share of food crops of rice and tapioca in Kerala was projected to decline from the base year (1970-71) value of 41 percent and 15 per cent of 2015. The commercial crops would stand to gain considerably. The rapid shift in cropping pattern away from food crops was found to have its deleterious implications on the State’s food security. So the study suggested deliberating fiscal and financial measure to reduce the low profitability of food crops and to make their cultivation attractive.\textsuperscript{20}

Mani and Jose (1997) analysed shift in the cropping pattern in Kerala based on the inter district, intra district and inter temporal shifts in area, production and yield of rice, coconut and rubber. Secondary data was used for the study within the time span from 1975-76 to1995-96. The study argued that due to free trade strategy in India cropping pattern shift occurred in favour of superior cereals, horticultural crops, vegetables and live stock. In the major states of India the share of area under food crops recorded significant reduction.

A rare phenomenon that occurred in Kerala agriculture was the sharp decline in the area of food crops, which was explained with the help of official
estimates. When the state was in shortage of food grains the area under food grains considerably lowered and for non-food crops a growth of area expansion was noted especially for coconut and rubber.

The study revealed that the area under paddy cultivation come down steeply in the districts of Kerala especially in Thrissur, Kozhikkode, Palakkad and Alappuzha. Another notable feature was the increased area for rubber and coconut cultivation and the yield of rubber notably increased specially due to the effort made by the Rubber Board.

One of the major conclusions that emerged from the study was the significant shift in cropping pattern in northern district and also that the area diverted for non-economic activities became very large in the state.\textsuperscript{21}

Mahesh (1999) analysed the causes and consequences of changes in the cropping pattern in Kerala, a location – specific study. The study emphasized the pattern of Kerala agriculture was in earlier periods guided by agronomic considerations and consumption needs of farmers but it seems that today mainly market forces determine the emerging trends. Based on secondary data the study showed a steady growth in agricultural income up to mid seventies began to decline and showed a vacillating trend in eighties. At the time of study agricultural income was high due to the contribution of cash crops.

The major problem under consideration was the sustainability of the performance and emergence of the cropping pattern. Based on the official reports obtained due to deforestation only a small part of the land could be used for agricultural purposes. Analysis of changes in cropping pattern cited that the area under paddy had nearly halved during the past two decades. According to the
study the paddy land conversion took place in three phases, viz the area used for the cultivation of vegetables, banana and plantains and tapioca, second part used for the cultivation of coconut, areca nut and pepper and the third part used for non agricultural purposes.

The major causes explained were the demand for land for non-agricultural purposes, State intervention, technological changes and increased pressure on land and neighbourhood aspects. The consequences of this practice were the reduction in rice production which led to the dependence of Kerala on other states, reduction in cattle rearing, reduced area for tapioca cultivation which is a cereal substitute, affected the employment pattern, displaced agricultural labourers especially women, the rhythm of village life was affected, lowered the bio diversity in the rural areas and cash crops had to face severe competition in the global market. 22

A study by Thomas PM (1999) on agricultural performance in Kerala revealed that the changes in the cropping pattern and low growth rate in crop productivity were the two factors in the pattern of agricultural development in Kerala since beginning of 1980s. A detailed examination of the major factors responsible for cropping pattern change was analysed in the study using secondary data during 80s and 90s. Study found that low growth rate in the price of rice, shortage of farm labourers and rapid increase in their daily wages, low price of land under food crops like paddy and tapioca, migration of people to urban areas, rational course of profit maximization were the main reasons for the conversion of land from cultivating food crops to other uses.
The study also concentrated on the conversion of agricultural land for non-agricultural purposes. The growing pressure of population and development of the secondary and tertiary sectors forced the conversion of agricultural land for the construction of residential buildings, commercial establishments, roads, health and educational institutions etc, which reduces the total area under cultivation.

The study concluded with the remark that two salient features of the pattern of agricultural development were the better growth performance of cash crops and changes in cropping pattern. Declining profitability, shortage of farm labourers, high price of agricultural land and its conversion for non-agricultural uses were the major problems of the state cited by the study.23

Santhakumar and Narayanan Nair (1999) made an attempt to study Kerala’s agriculture trends and prospects with the factors shaping the performance of agriculture as the main objective and also to comment on the prospects of growth in the near future. The study reached the conclusion that the factors that shaped the present status of Kerala’s agriculture were the price factors and the profitability, the changes in the land holding pattern and the agro climatic factors in the state have influenced the cropping pattern and the input levels. The study also made some suggestions for the future scenario of Kerala agriculture.

Paddy cultivation might continue without a further drastic reduction in the area of cultivation. The market for coconut might continue to face uncertain fluctuations and expansion of rubber would also decline and future increase in yield rate might not be drastic. Even though the gap between international and
national price would come down rubber might continue to be a major income earner of the state. On the general tendencies, the small holders might continue with traditional varieties and those who had an economic size of holdings might orient production to the market. Lease market might emerge for profitable short-term crops. New institutional mechanism might emerge to produce and distribute water. The investment in agriculture depended to a great extent on the non-agricultural opportunities available to the members of the farm family. The existing institutional framework appeared to prevent any radical change in the allocation of resources and power to make the decentralized planning and governance effective. Local level assessment of resources and the use of information by the local government can help the location specific and resource based planning of agriculture.  

Viswanathan (2002) made an attempt to study irrigation and agricultural development in Kerala based on the secondary data. The main objectives of the study were to examine the development experience of Kerala in respect of state intervention in irrigation development in the post independence period and its impact on the agrarian performance of the region. In the analysis of the performance of the irrigation system in Kerala it was found that shift in cropping pattern occurred in favour of perennial cash crops. The observed shift in cropping pattern was antithetical to the conventional notion of irrigation induced agricultural development. The changes in the share of area under individual crops in the total cropped area in the state indicated that among major crops the share of paddy which was in 33 per cent in 1960-61 declined to 13 per cent in 1997-98,
where as the share of coconut increased from 21 per cent to 30 per cent followed by rubber which increased from 6 per cent to 16 per cent.

The study revealed that shift in cropping pattern went a long way in explaining the performance of the irrigation sector. From the analysis it could be found that the share of paddy in the gross irrigated area had declined from 73 per cent in 1980-81 to 48 per cent in 1997-98, profitability ratio of alternate cropping system made paddy cultivation non-viable. From the estimates based on productivity and prices it was found paddy constituted only 13 per cent of the income, the area under paddy in almost all irrigation projects declined and marginal and less productive paddy lands went out of cultivation.

The major conclusions of the study were the paradigm shift in cropping pattern from paddy to perennial cash crops, which resulted in the substantial decline of area under paddy cultivation. Since the irrigation projects had been conceived and technically designed for paddy growth the shift in cropping pattern acted as an obstacle for irrigation, infrastructure and the shift in cropping pattern towards rain fed crops obstructed the irrigation development in the state.25

Jayakumar and Velayudhan (2002) tried to analyse the cause and consequence of agricultural stagnation in Kerala. The study limited to important food crops and cash crops. Secondary data was used in the study. Growth indices of various crops were computed from 1960-61 to 1999-2000.

The study revealed a significant decrease in the growth of area under paddy and tapioca while for coconut and pepper, nominal increase were noted but the rubber has showed a four-fold increase. All crops showed increasing
trend in production. Rubber depicted the highest growth in productivity and coconut showed the least. The study pointed out the role of obsolete technology prevailing in the State, which effected adversely in the total production and price movement. Relative profitability would influence the farmer’s decision and the high wage cost hypotheses is not meaningful unless the other related relevant factors were taken into consideration.  

Viswanathan (2004) studied about Economics of on-farm development—a study of major irrigation projects in Kerala. One of the major objective of the study was to understand the agrarian changes characterised by tremendous decline in area under irrigated food crops mainly paddy to dry/ perennial cash crops dominated by rubber. The analysis of returns to scale or relative profitability of various cropping systems as determined by Cobb-Douglas production function showed that the returns to scale from cultivation of paddy had been the lowest compared to cultivation of coconut and banana in Peechi irrigation project. The share of paddy area converted into wet crops, the age of the farmer and the full time farming status had been found to be positively influencing the farm level adoption of on farm development.  

The various problems and operational constraints in the process of effective utilization of land and water resources in Kerala had been broadly identified as institutional, socio-economic and technological as well as water management related factors. Major institutional constraints were the declining size of operational holdings leading to the failure of institutional intervention for promoting paddy cultivation, labour related problems, un-remunerative prices for
paddy coupled with rising wage rates and large scale conversion of paddy lands for other crops and also for non-agricultural purposes.

The important socio-economic factors were the lack of interest in labour intensive farming operations, regulation of the status of farming into a secondary activity and sociological reason including the growing share of elderly among the farmers as well as labourers. One of the issues that needed addressing was to examine the implications of crop conversion from paddy based food crops to commercial crops on the water balance and status of utilization of water resources in the state.27

Omana Cheriyan (2004) examined the changes in the mode of labour due to shift in the land use pattern and in the analysis of land- use-pattern changes noted some important patterns. The area put to non-agricultural purposes had increased mainly due to population pressures; area under forest has dwindled due to expansion of plantations, river valley projects and rise in the cost of cultivation of traditional crops. More land was left fallow or used for less labour absorbing crops. The study was mainly based on secondary data. According to official records during the past 20 years the extent of cultivable land increased from 60.79 per cent to 70.33 per cent. Land put to non- agricultural uses increased from 6.67 per cent to 8.06 per cent. Before 1968 the area converted for cultivation of perennial crops and non-agricultural uses was only 0.63 lakh hectares but between 1968-1992 the figure became 1.72 lakh hectares. Between 1952-1997 the share of area under paddy had nearly halved. A portion of the shift of wetlands had been for non-agricultural activities and the remaining portion was available for re-conversion to paddy fields.
The major conclusion arrived at was that the overall effect of reduction of wetlands was the reduction of area under paddy. That lead to unemployment of agricultural labourers and some of them became rubber tappers and others continued as casual agricultural labourers. High wage rates and fall in rubber prices reduced the workdays. Hence labourers and tappers cultivated seasonal crops on a lease basis.\(^{28}\)

Mani (2004) studied institutional framework for agricultural input supply in Kerala and remarked that agricultural production had been accompanied by an equally impressive increase in production and distribution of inputs. Secondary data, collected from official reports, was used for the study. The study covered a long span of time 1960-61 to 1999-2000. Even though gross cropped area consistently increased over the years the share of cropped area under paddy came down sharply in absolute terms and also in percentage terms. The area under coconut and rubber rose sharply during the same time span. Rice, coconut and rubber together constituted 60 per cent of the gross cropped area in 1960-61 and 62 per cent in 1999-2000 and the trends established the claim that Kerala farmers were shifting the area under paddy to coconut and rubber.

The major conclusion put forward in the study was that trends in the cropping pattern of Kerala state was sufficient for the demand and use of inputs was large in the state because the three major crops which dominated in the State required large quantity of inputs.\(^{29}\)

Amiya (1963) studied about inter state differences in cropping pattern and productivity under the hypotheses that technical condition of production and structure and relationship of market prices determine the pattern use of the farm.
Secondary data were used for the study and the data revealed wide variations in resource productivity between the states and larger the area allocated to a crop the more the concern about climate, soil etc.

The major conclusion of the study were that analysis showed a positive relationship between increase in area and increase in yields, and the knowledge of price was necessary for resource allocation.  

A study by Singh (1963) about the factors responsible for shifts in ground nut acreage on all India level based on field survey revealed that 18 per cent of total farmers gave real clues for shifting the ground nut acreage. The main finding of the study was that the farmers of India were to a considerable extent motivated by income consideration in adopting cash crops.

Meenakshi Malya (1963) analysed the relation between urbanization and cropping pattern based on primary data, which were collected using multistage random sampling method. Physical, economic and sociological factors were seen responsible for variations in cropping pattern. Based on the assumptions about the factors such as urbanisation the distance to market centres from villages and some other economic factors the study tried to analyse the influence of these factors on cropping pattern using chi-square test.

The study concluded by finding that the main feature, which influenced the cropping pattern, was a good market center with well-connected roads and facilities.

Balasubramainan (1963) analysed the economics of the cropping pattern in India using secondary data. Inter state comparison of the percentage of area under food crops showed that in Bombay and Kerala only 65.2 per cent and
68.5 per cent of sown area were under food crops where as in almost all other states it was above 90 per cent. During the second plan period the area under non-food crops was greater than that under food crops. Between 1900-1954-55, due to the relative profitability, the commercial crops showed an upward trend. The major conclusion of the study was that increase in percentage share of non-food crops in the total acreage could be interpreted as an indication that the economic incentives were beginning to be felt to a larger extent than before.33

A study by Muthaiah (1963) about the economics of cropping pattern in India for cotton tracts was based on secondary data. The major cash crop of India was cotton during the period of study 1952-53 to 1960-61. The Main objectives of the study were to examine the existing cropping pattern in India, the factors which determined the total cropped area and to study whether there was any scope and advisability for a shift. Analysis showed that there was a shift of land from cotton in favour of groundnut in the recent years due to the relatively higher price prevailing for that crop. Transforming the area in certain cases would lead to some monetary loss to the cultivators and whenever there was a loss, appreciable incentives may be given in the form of higher prices or through the subsidy of inputs and increased facilities for processing and marketing.34

John (1963) made an attempt to analyse the economics of wheat cultivation in three selected regions of India based on secondary data. The selected areas were U P, Punjab and Bombay and found that the cropping pattern of a region was not only determined by natural conditions but also by economic conditions i.e. profitability in an absolute sense. Crops would be substituted on net income basis. Cost was divided into three types, which are A cost which
included all cash and kind payments B cost which included A cost and interest on owned capital and evaluated rental value of owned land and C cost which included B cost and imputed value of family labour.

The major conclusions of the analysis were cultivation was profitable on irrigated lands only; a shift from wheat to gram or from gram to wheat in both irrigated and unirrigated lands was beneficial and extension of irrigation which would benefit the farmers should be worth considering.  

Studying cropping pattern in relation to irrigation was an attempt by Shah (1963) with the major objectives as to how irrigation led to expansion of area, replaced cultivation of inferior crops by superior ones and led to greater monetisation of agriculture. The data collected from Farm Management Survey during 1956-57 to 1958-59 was used for the study. The study discussed the situation of before and after the introduction of irrigation and area covered by irrigation projects and control was also analysed. The major results obtained from the study were that different area have different results, for paddy growing areas where water supply was given as incentive there was no establishment of new commercial crops and value of total inputs was much higher on irrigated compared to unirrigated areas.  

Ramalingam (1963) focused his study on some economic aspect of cropping pattern at micro level. Using farm management data based on the hypothesis that farms in smaller size groups and the tenant-operated farms were associated with larger proportion area under non-food grains. Farms in the bigger size groups and owner-operated farms were associated with cash crop acreage. From the analysis it was clear that because of plentiful supply of family
labour small farms concentrated on vegetable growing and tenant operated farms had a large proportion of area under food grains than owner cultivated farms. Area under paddy cultivation was higher in fully and partially irrigated than on unirrigated areas. Profitability of one-crop verses another depends both on relative yield and price levels of crops concerned.\(^\text{37}\)

Analysis of growth components and method of constructing the index number of Agricultural production under constant cropping pattern was studied by Parikh (1966). Basic assumption of the study was that the agricultural production changes were due to changes in productivity average and changes in cropping pattern. A multiplicative model was used for the study using secondary data. Study was conducted at all India level and state wise analysis conducted for measuring the changes in agricultural production under constant cropping pattern and changes in cropping pattern. One of the remarkable result obtained in Maharashtra was changes in cropping pattern alone contributed 72 per cent of the growth in output, area changes contributed 11 per cent and productivity changes contributed 17 per cent of the total growth in agricultural output.\(^\text{38}\)

Savale (1966) studied about intensive development approach to agricultural development with special emphasis on role of irrigation and cropping pattern in agricultural development. Cross sectional data were used to study the extent of growth, which could be achieved from development of well irrigation and changes in cropping pattern. Data was collected in the farm management scheme of Planning Commission, Government of India in Nasik district during 1954-57 by cost accounting method. Changes in cropping pattern were affected in course of time due to changes in technology, price structure and other factors.
The study revealed that the net return / acre realised from the crops play an important role in bringing out changes in cropping pattern. Optimum production plans were worked out using linear programming technique.  

John (1967) analysed the impact of cropping pattern on agricultural output based on secondary data on Indian agriculture. Changes in output were explained by the changes in area, price and yield rate of individual crops. Changes in area were again divided into two parts i.e. change in total sown area with no change in cropping pattern and the other involving change in cropping pattern. The study divided the total change in total output into pure effect and interaction effect. In the pure effect, changes due to cropping pattern were the difference between pure area effect and changes in total sown area. The conclusion was that the total change due to cropping pattern was the sum of pure effect and interaction effect caused by cropping pattern change.  

Narain (1977) made a study on growth of productivity in Indian agriculture and the study made a detailed analysis on cropping pattern and growth of productivity. Among non-price factors apart from the new technology the expansion of irrigation was an important force bearing upon cropping pattern change. Prices plays dominant roles in inter crop allocation of area. The study revealed that price became an important factor in determining the share of non-food grains. In the cropping pattern non price factors had loomed large in the case of food grains .The leading force behind the locational shift in rice acreage derived from the locational differences in the faster expansions of irrigation and cropped area than from market. The main deviation of the study from other decomposition studies was the introduction of the locational effect. The total
productivity index decomposed into pure yield effect, cropping pattern effect and locational effect. Both pure and interaction effects of cropping pattern and location were considered. Price when confronted with the force of technological change had not been able to counter its pressure on areas even under non-food grain crops.\textsuperscript{41}

Growth rates and cropping pattern changes in agriculture in six states was analysed by Venkataramanan and Prahaladachar (1980) during 1950-1975. The study estimated and analysed the growth rate in area, yield and output of major crops in six states (Punjab, Rajasthan, UP, Bihar, Maharastra and Andhra Pradesh) and studied the impact of disparate growth rates of crops on cropping pattern. Decomposition method was used for the study. The analysis showed that a significant portion of output growth was explained by yield increases. Total change in cropping pattern was the sum of substitution effect i.e. decline in area under some crops and corresponding equivalent increase in area under substitutable crops and expansion effect i.e. increase in the gross cropped area.

The major conclusion of the study was that the total output growth in different states was due to different reasons. But the yield increased due to technological changes. Spread of HYV crops, irrigation and increased gross cropped area were the common reasons for the increment of yield and thereby the increased output.\textsuperscript{42}

Ranade (1980) examined the impact of cropping pattern on agricultural production using secondary data on Indian agriculture. The main objective of the study was the effect of cropping pattern along with fertilizer effect and irrigation upon agricultural production. The study covered 54 agro climate regions
covering 16 states for pre-green revolution period, from 1962-65, post green revolution 1970-73. Cropping pattern index is computed using the data on area, yield and price. Findings did not imply that cropping pattern index and agriculture always move in the same direction. Usage of regression analysis to study the effect of fertilizers, irrigation and cropping pattern revealed that the higher the cropping pattern index the higher was the agricultural productivity. Marginal manipulations in the cropping pattern in a region can increase agricultural productivity even in fertilizer and irrigation use remained unchanged.43

Re-orientation of the cropping pattern on the basis of probabilistic moisture availability index was an analysis by Biswas and Khambete (1980) where rainfall was taken as a prime factor of crop production. The index was the ratio of assured rainfall to potential evaporation of the corresponding period had been calculated for each states. The study concluded that type of cropping pattern that would increase or stabilize the crop out-turn, especially in climatically vulnerable areas and it also helped to identify the time of minimum irrigation so as to get optimum yield.44

Ray, George and Singh (1985) made an attempt to study the impact of changes in cropping pattern on farm income. The study sought to examine the spatial and temporal disparities in agricultural income in India and its reasons with a view to suggest corrective measures for removing regional imbalances in agricultural development. Importance of the study was the technological development and its impact on crops and regions. All major crops and most of the states were taken for the study and secondary data was used for the
period 1963-66 to 1978-81 which was the periods before and after Green Revolution. In order to neutralize the weather effect on cropping pattern triennium averages had calculated. Coefficient of variation was used to measure the variability in income and holdings. Rank correlation was used to find the relationship between average income and size of holdings.

The main findings were the change in the pattern of income distribution was related to cropping patterns, traditionally rice growing states which ranked high in per hectare income during the earlier periods slipped back in their position in favour of states with new and diversified cropping patterns, there was a shift in the cropping pattern of traditionally rice growing states and also that irrigation played a key role in improving the cropping pattern and cropping intensity, that the agricultural income gap between state had widened due to the nature of cropping pattern difference and traditionally grown high income crops such as rice and wheat could not take full advantage of new technology due to the paucity of infrastructural development were the main implications of the study.45

Dantwala (1986) studied about the relationship between prices and cropping pattern of India using secondary data. Economic survey of 1985-86 found that the most important factor, which influenced cropping pattern, was the relative prices between different crops. The decision of a farmer in choosing cropping pattern depends on net return and not simply on the price of the crop. Economic survey of 1985-86 revealed that farmer’s behaviour was guided by net revenue or comparative revenue rather than yield. The study put forward the clash between cropping pattern under optimum use of land, based on
comparative advantage and cropping pattern for the balance between domestic
demand and supply. The study repeatedly argued that the most crucial issue for
Indian agriculture was the rising unit cost of production of almost all crops.
Emphasis on a rational cost reducing technology strategy would be more
meaningful.

Praduman Kumar (1989) analysed crop economics and cropping pattern
changes in India during 1972-1986 using secondary data. The main objectives
under consideration were the changes in input use, productivity, and cost of
production, profitability and employment in crops cultivation, to identify and
explain cropping pattern changes and to suggest ways of controlling the
imbalances in the cropping pattern. Using compound growth rate cropping
pattern changes in different states of India was studied due to 1972-86. In the
analysis of cropping pattern changes cost reducing technological developments
along with product price policy had their own impact on the rate of profit,
income to farmers and shifts in cropping pattern. After 1984 all states increased
area under paddy cultivation because of improvement in production of paddy due
to special rice production programmes and rice technology. During 1972-83 the
total change in cropping pattern overtime was the sum total of substitution effect
and expansion effect.

The main conclusions were that the area under paddy and wheat
cultivation had increased continuously in many states due to technological
support, price support, infrastructure support and the important costs of this
development were serious imbalances in cropping pattern, increased instability in
production and unplanned import of commodities. The green revolution strategy had thus to be reexamined and set right.\textsuperscript{47}

Gulati and Sharma (1990) analysed employment, foreign exchange and environment-implications for cropping pattern on Indian agriculture. A desirable cropping pattern would be one, which favours crops that are labour intensive and have greater employment effects. Cropping pattern should attempt to minimize returns and favour crops that were ecologically sustainable. Also it should favour crops, which were either efficient import substitutes to save foreign exchange or efficient exportable things.

Major conclusions aroused from the study were studying cropping pattern changes purely from demand supply point of view could lead to crop-mix which had high economic cost. Direct impact of movement of cropping pattern towards more labour using crops might be rather limited. A shift of resources in favour of disprotected crops (wheat and rice) would have saved foreign exchange in balance. Study examined if the domestic incentive structure as revealed by crop specific probabilities was in line with the desirable cropping pattern.\textsuperscript{48}

Acharya (2003) made an attempt to study crop diversification in Indian agriculture. The main objective of the study was to analyse the extent and nature of crop diversification in Indian Agriculture at the National and State levels. At the national level to recognize the major crop diversification the author used compound growth rates of area by using secondary data. Another way of looking at crop diversification was by analyzing change in the composition crops in value terms in the post green revolution period between TE 1980-81 and TE 1998-99. Crop area diversification at the state level was done at two points of
time i.e. 1980-81 and 1998-99. In Kerala during in 1980-81 food grains occupied only 29.4 per cent of GCA while the dominance of non-food grains in the cropping pattern increased during 1998-99 with area under food grains declined to 13.4 per cent of GCA. Rice area in Kerala declined from 28 per cent to 11.9 per cent of GCA during the last 20 years. In Kerala the rice crop lost its dominant position to coconut and rubber, which increased from 22.7 per cent to 37 per cent and 7.5 per cent to 16.1 per cent of GCA respectively. In the analysis of change in the ranking of first five crops in terms of area as percentage of GCA in Kerala black pepper replaced cashew nut and coconut and rubber improved their ranking among the first five crops. For the assessment of the extent of crop diversification in Indian agriculture at the state level an index of diversification was worked out at two points of time i.e. 1980-81 and 1998-99. At the national level there was a very high degree of crop diversification and the estimates of index at the state level Punjab, Haryana, Kerala and Bihar recorded considerable decrease in the degree during the period of analysis.

Major suggestions put forward in the study were the availability of adequate marketing infrastructure and the extension of enable environment for marketing, infrastructure needed for sustaining crop diversification and the legal regulatory framework to be simplified to enable the private sector to invest. Also training of the farmers to maintain the quality of products and production according to demand had to be given prime importance. 49

Praduman and Mittal (2003) analyzed Crop Diversification in India-Analysis by State and farm size groups since agricultural diversification is an important instrument for economic growth. The study examined the changes in
cropping pattern that took place in various states of India in three decades during 1970s, 1980s and 1990s and measured the aggregate changes in cropping pattern in terms of the substitution and expansion effects. Also it examined the degree of crop diversification in various farm size groups.

The result obtained from the analysis was the overall change during 1967-96 about 57.5 per cent of the increase in crop area was due to substitution effect and 42.5 per cent due to expansion effect. There had been a major change in the area under non-food grains in the States of Southern India and that increase in the area of non-food grains had been at the expense of a substantial decline in the area of coarse grains.\(^{50}\)

Goswami and Challa (2004) made an analysis on Indian land use scenario. The main assumption of the study was the changes in cropping showed a gradual shift. Shift in area from food crops to non-food crops indicated more diversification in recent times. Authors assumed income, demand, price and preference, rural-urban interferences, infrastructure development, government policy and global market as some of the socio-economic factors affecting land use planning. The study was based on secondary data, which were collected from various issues of Agriculture in Brief published by the Ministry of Agriculture. Five measures of crop diversification such as Herfindahl Index, Ogive Index, Entropy Index, Modified Entropy Index and Composite Entropy Index were used to measure crop diversification. From the analysis of changes in the cropping pattern of India for the periods 1950-51 to 1997-98 it could be seen that the proportion of area under total cereals to total cropped area decreased from 61.1 per cent in 1950-51 to 53.8 per cent in 1997-98. The change from subsistence
cropping to commercial cropping was noticed in the area shift between just after independence and 1997-98. Food crops area, which was 76 per cent of total cropped area, came down to 65.8 per cent and non-food crops increased to 34.2 per cent. Authors found some major issues in land use pattern of India which included the conversion of land for non agricultural uses due to urbanization, industrialization, demand for land for housing etc. the impact of WTO for more diversified agriculture, problem of soil salinity etc. which caused changes in cropping pattern. The major socio-economic factors were the population pressure, changes in income levels, increased demand for product and factor inputs, long-term price trends, tastes and preferences, migration from rural to urban areas, infrastructure development and government policy. The future increase in production must be accrued essentially through the increase in per hectare yield. The exploitation of land and water in a sustainable manner would be the center of the growth process.51

‘Economics of cropping pattern under tank irrigation in south eastern dry region of Mysore’ was analysed by Patil and Hira (1963) with the major objective to study the economics of present cropping pattern in a region to determine the factors that influenced the present pattern and to ascertain the productivity of water and labour and intensity of cultivation. The study was also intended to suggest the most profitable cropping pattern for increasing the productivity of resources.

The study was based on primary data and samples were taken using purposive sampling methods. By using three categories of cropping pattern i.e. rearing a single crop of paddy (87 per cent), paddy after paddy (3.98 per cent)
and paddy after vegetables showed that paddy after paddy gave maximum returns/unit of labour. The study concluded that the net return under the existing cropping pattern increased due to new investments in fertilizers and pesticides etc.\textsuperscript{52}

Mathur (1963) analysed the effect of cropping pattern on the distribution of employment over the different months of a year in Vidarbha. Secondary data was used for the study and the analysis showed that prices seemed to have hardly influenced the cropping pattern. Stable cropping pattern helped the farmers to use their labour power throughout a year. Seasonality affected the female labour than male labour.\textsuperscript{53}

Rationale of cropping pattern in Madhya Pradesh was studied by Lakshman Singh (1963) by using secondary data with the assumption that producers were more prices conscious and utilized their scarce resources for their best economic advantage. The producers used more intensive method of cultivation and yield and gross value of the produce played an important role in the allocation of their land to different crops.

The major conclusions of the study were that topographical soil and climatic factors played a great part in the allocation of land to different crops. There was a close relationship between yield and irrigation factors.\textsuperscript{54}

‘The optimality of land allocation- a case study of Punjab’ was an analysis by Raj Krishna (1963) based on the assumption that farmers allocated the land for different crops in response to variations in expected rainfall and expected relative return. Based on the secondary data three approaches were made which were acreage response function approach, modified
linear programming approach and excess return approach. Allocation of land to different crops was systematically determined by relative price and weather conditions. Also the land allocation depended upon the return from different crops. Other income determining variables such as yield, rainfall, irrigation, costs etc. also had some influence on the allocation process.\textsuperscript{55}

Mandal and Suresh (1963) studied about some aspects of the Economics of cropping pattern based on a district of Bihar. The study was based on primary data for which samples were collected by two stage stratified random sample. Diversification or specialisation was to be taken. Both had their own advantages. Analysis was based on the terms of family labour and farm size capacity. The merit of a particular cropping pattern was to be assessed with reference to net return derived from it. The major tool used for the study was contingency table and chi-square test of independence of association between the number of crops grown and size of farms.

The conclusion derived from the study was that the mere number of crops was not enough to determine the cropping pattern but the nature of crops and percentage area given to each crop had also to be ascertained.\textsuperscript{56}

The study of crop patterns on an urban fringe by Joglekar (1963) was based on the assumption that decisions of the farmers regarding agriculture depended upon the availability of good transport system, nearness to market, occupations of some members of family, ready demand for perishable agricultural products, shortage of field labour and high cost etc.. The farmers were divided into three categories according to the size of holdings. Farmers having middle size holdings select a crop pattern, which is indicative of a
compromise between self-sufficiency economy and money economy. Farmers with large size holdings grew larger number of crops. Socio economic conditions of the cultivating family and patterns of crop set by long practice were the major governing factors.\(^{57}\)

Economics of cropping pattern was studied by Desai (1963) based on the state of Gujarat. The study was based on secondary data and tried to study the cropping pattern of the data as a whole during 1951-52 to 1960-61. The chief attempt of the study was to locate the weak points in the cropping pattern and to suggest ways and means of removing these and to increase technical efficiency in agriculture. The chief method used for the study was the theory of comparative advantage. The yield per hectare was taken as an indicator of comparative advantage in physical terms. The State could adopt the policies of differential treatment to crops according to the comparative advantage of crops in certain areas. Liberal crop loans, subsidies in fertilizers and seeds, preferential treatment in providing storage facilities and propaganda for growing these crops would give good results.\(^{58}\)

Johl and Kahlon (1963) studied economics of cropping pattern as an analytical case study of Ludhiyana Development Block of IADP. The major objectives of the study were to analyse the existing cropping pattern and to suggest some suitable cropping patterns. The purpose of the study was to find out the highest return cropping system. A synthetic model was built taking into consideration the important variables such as land, labour, irrigation etc. Problem matrix was programmed and optimum-cropping pattern obtained. The results demonstrated that there was a great scope for increasing intensity of cropping
and levels of income by making rational adjustments in the existing resource use and cropping pattern of the area.\textsuperscript{59}

Chawdhari, Desai, Jindal and De (1963) analysed the optimum combination of competitive crops in the intensive cultivation scheme. The area selected was Delhi. Efficiency measure of cropping pattern was done using comparison between actual and optimum allocation of individual crops. Using 29 farms frequency distribution was constructed. Usually, the value of efficiency measure varies between $-1$ and $+1$.

The analysis showed that 19 out of 29 fall in between the above values. The conclusion derived was that most farmers were operating close to optimum crop combination level with the existing technical knowledge.\textsuperscript{60}

Economics of cropping pattern of irrigated farms was analysed by Divakar Jha (1963) North Bihar. Major crops under study were paddy, wheat, sugar cane, pulses and oil seeds in which paddy was the most predominant crop. The study reached the conclusion that farmer’s resource position was an important factor in choosing cropping pattern. Input cost also became another important factor, which determine cropping pattern. The best choice for farmers was to combine paddy and some other crops such as pulse crop, which was actually done by most farmers in that area.\textsuperscript{61}

Optimum cropping pattern for Upper-Dhaia region of IADP district Ludhiana, Punjab was an analysis by Tilak Raj and Kahlon (1967) using primary data collected from five randomly selected villages. The major objectives of the study were to appraise existing cropping pattern and to determine
optimum-cropping pattern based on existing production techniques and improved production techniques.

From the study it was clear that through the shift in crop combinations and adoption of yield increasing technology the return to the fixed farm resources increased by 99.46 per cent, 98.69 per cent and 76.73 per cent on small, medium and large size farms for existing cropping pattern. Net returns to fixed farm resources and net farm earnings could be increased by rationalizing the farm resource use and by adopting improved production techniques in all different sized synthetic farm situations.\textsuperscript{62}

Mann and Johl (1968) studied about projections of shift in cropping pattern of Punjab using primary data collected from samples of 150 farmers in ten villages. The major assumption made was that minor changes in cropping pattern because of extension in cultivated area and provision of additional irrigation facilities. The objective of the study were to find the existing production plans of farmers, to work out optimum cropping plans and to estimate cropping pattern for the state under given conditions of input supply. Linear programming technique was used for the study. Findings of the study were high yielding varieties of paddy; wheat etc had made these crops relatively more paying than the other crops and these developments demanded major adjustments in cropping pattern.\textsuperscript{63}

Moorthy and Mellor (1972) attempted to analyse cropping pattern, yield and incomes of different sources of irrigation with special reference to IADP district Aligarh (UP). The main objectives of the study were to analyse the differences in cropping pattern and yield under different sources of irrigation and
to find the differences in gross incomes from various crops under different sources of irrigation. The study was based on primary data collected through interviews and from samples, which were selected by random sampling method.

The major finding of the study was that irrigation happened to be the single major factor, which influenced the cropping pattern. The conclusion drawn from the study was that the quantity and timing of water application result in the farming pattern and ultimately affect the income.\textsuperscript{64}

Sharma and Kahlon (1972) examined the impact of technological development on the normative shifts in cropping patterns. The study was based on Punjab agriculture with the hypothesis that developments in agricultural farm technology led to some changes in cropping pattern and raised the level of cropping intensity. The main objective of the study was to examine the shifts in cropping pattern due to the adoption of improved seed – irrigation- fertilizer-pesticide technology, multiple cropping and progressive mechanization of agricultural operations. Primary data was collected from samples, which was taken by multi-stage random sampling techniques. There was little variation in the optimum cropping patterns and intensity of cropping on completely mechanized farm situations where various power machine combinations were introduced. Except in large farm organizations there was little variation in the crop pattern and cropping intensity. In the case of large synthetic farms, intensity of cropping varied.

The major conclusions were that the area under the traditional crops were diverted to income bright crops and the intensity of cropping in the normative
plans for partly and completely mechanized farms showed a considerable increase over the existing situations.\textsuperscript{65}

Desai (1977) made an analysis of the cropping pattern on the farm families of Surat district from 85 sample farmers. A model was used to predict the changes in cropping pattern as a result of change in the initial availability of net irrigable land with sample farmers. Two analytical approaches were used which were the optimizing approach using linear programming technique and non optimizing and positive economic approach. The final conclusion derived from the approach was the increased availability of net irrigable land would shift the crop pattern in favour of more remunerative and also labour intensive crops. This shift in turn would increase the net income of an average farmer.\textsuperscript{66}

Sridharan and Radhakrishnan (1978) studied the factors affecting changes in cropping pattern in Nilgiris district of Tamil Nadu using the data published by season and crop reports of Government. The main objective was to study the changes in cropping pattern of Nilgiris district (hill district of TN) over a period and to identify the causes thereof.

The major findings of the study were that the selection and allocation of land to different crops was the result of a number of decisions taken by individual farmers based on physical, economic and sociological factors. Cropping pattern in plains was more elastic and it was inelastic in hilly regions. Economic factors were of two types internal economic factors, which included size of farmer’s family; labour, capital and ownership and external factors included market location and price. Price was seemed to be one major factors influencing acreage of crops.\textsuperscript{67}
Impact of lift irrigation on cropping pattern and crop yield by Sinha (1978) based on five village survey in Bhivani, Haryana was a study with the main objective to find out the impact of irrigation on cropping pattern and yield. Data was collected from five villages during 1976 using circular systematic sampling method. Assumptions of the study were that the agriculture depended on rains and cropping pattern depended on seasonality and inadequacy of rainfall. Also lift irrigation brought a significant change in cropping pattern.

The changes in cropping pattern and increment in crop yields did take place through lift irrigation system. But no dramatic results could be expected or achieved.68

Study of cropping pattern changes in Andhra Pradesh during 1950-1975 by Venkataramanan and Prahladachar (1978) was an attempt at linear programming technique and elasticity concept. Major objectives of the study were to review the changes in cropping pattern and to analyze the growth rates in area, yield and output of major crops and compare the increase in area under each crop with the corresponding increase in output and to analyze the behavioral response of farmers in allocating areas under major crops. Area allocation decisions of farmers were motivated by costs and returns and that the farmers acted rationally and desire to maximize their net returns. Supply response model was used and it had been empirically well established that supply elasticity for any subsistence crop is lower provided that larger the area under the subsistence crop and smaller the production substitution possibility.

Major conclusion of the study was that obtained by evaluation of growth rates in area, yield and output under different crops and hypothesized that given
the possibilities of crops substitution farmers acting rationally and desiring to maximize returns would expand area under crops whose yield increased and which responded favourably to irrigation and that they would also positively respond to favourable price expectations. Total change in cropping pattern in terms of substitution effect was 35 per cent and in terms of expansion effect 65 per cent. Study of change in cropping pattern was only a means to understand the effect of changes in prices and growth rates in yield, irrigation and other shifter variables.69

Arora and Sharma (1981) made an attempt to study the impact of fertilizers on cropping pattern and production levels of Uttar Pradesh. The main objective of the study was to estimate the potential economic consequences of an allocation on regional cropping pattern and production levels. Four stages random sampling method was used to collect data and inter regional programming model was used to study the impact on cropping pattern. The results obtained from the study were that significant variations had occurred in some regions as a result of optimal allocation of fertilizers pertaining to the allocation of land to various crops. Also the area under paddy cultivation showed a declining trend. The conclusion of the study was that the area under pulses or other non- fertilizer using crops needed to be increased whereas high yielding verities of wheat and paddy may be raised under irrigated conditions.70

Sikka and Vaidya (1985) studied about Growth rates and cropping pattern changes in agriculture in Himachal Pradesh. Main objectives of the study were to find out the growth rates of area, production and productivity of important crops and also to know the share of changes in area and productivity in total output
using seven factors ‘Decomposition Model’. The study was based on secondary data, which was collected from official sources during 1966-67 to 1979-80.

Major conclusions that arose from the study were- uneven and rugged topography constituted major constraints and significant portion of output growth in the State was by increase in area and not by yield.

Off - farm assistance, latest technology to be adopted by farmers, depending more on purchased inputs by farmers strengthening of credit structure and marketing of produced goods were some of the suggestions of the study.71

Changes in cropping pattern in Kanyakumari were a study by Selvarathnam (1985) using secondary data. The main focus of the study was on extra economic factors, which was possibly the major reason behind the transformation in cropping pattern. There was neighbourhood effect i.e. the changes introduced in one plot affects the rest of the plots. Shades of trees affected the annual crops. Financial advantages were many in converting paddy to rubber or coconut. Cost benefit arguments were there. The study noted some adverse effects of conversion such as the tenants becoming jobless. Landless labourers also faced crisis, investments were high and returns only after 10 years. Loss of tapioca acreage affected poor sections ownership concentration. Neighbourhood effect was found everywhere. The conclusion of the study was all over India there were changes in cropping pattern and that affected Kanyakumari also.72

Bhat, Dhar, Beig and Zutshi (1989) analyzed the crop concentration and cropping pattern in Jammu and Kashmir State using the data available from official reports. Cropping pattern played an important role in determining the
level of agricultural production and reflected agricultural development. Major objectives of the study were to analyze changes in cropping pattern, causes of changes and crop concentration of mainly three food crops.

Study observed two types of cropping pattern namely shift and deviation. Shift meant two or more cropping pattern for same crops and deviation meant changes within cropping pattern due to difference in allocation of land between the same set of crops. Study revealed that no shift in cropping pattern occurred between years and all along the post 14 years. Changes signified that there had been a diversion from cereal economy to market economy, which was a very healthy sign for the development of agricultural sector of the state.73

Impact of cropping pattern agricultural production at the disaggregated district level in Andhra Pradesh was a study by Devasena (1989) based on the assumption that growth of output was influenced by cropping pattern during 1956-67 and yielded growth lead to output growth during 1967-81. Research gap of earlier studies was highlighted in the study and cropping pattern index calculated with a little modification of Ranade model. Study revealed that marginal manipulations in cropping pattern in most of the districts could help increment in agricultural productivity even if fertilizer and irrigation use remained unchanged. For reducing variations in yield and crop index among districts in the state change in cropping pattern and irrigation strategy might be the right solution.74

Shrivastava, Mishra, Baghel, Sabu and Singh (1991) tried to study dynamics of land use and cropping pattern in Tawa Command Area of Hoshangabad district of Madhya Pradesh. The objective of the study was
to examine the pre and post project land use pattern, cropping pattern and
cropping systems and cropping intensity of area. Hypothesis put forward in the
study was that cropping pattern during the pre and post project periods remained
the same. Tests showed no significant change in cropping pattern during pre and
post project periods. The shift in non-food crops was positive over time. The
changing crop acreage due to irrigation was logical and in response to price
behavior of the products.\textsuperscript{75}

Vivekananda and Satyapriya (1994) examined Karnataka’s changing
cropping pattern by using the data from 1955-56 to 1990-91. Stagnation in
productivity of cereal crops lead to change in cropping pattern in response to the
relative profitability of crops. To analyze the shift in cropping pattern compound
growth rates of area and productivity was analyzed and found that correlation
between area growth and productivity growth across the total period was positive
but not significant. Changes in cropping pattern were induced by their relative
prices or profitability rather than productivity.

The main conclusion of the study was that changes in cropping pattern
towards relatively high valued crops had given impetus to increment in the
aggregate value of agricultural output.\textsuperscript{76}

Padma (1999) analyzed changing cropping pattern and employment
conditions of women workers, which was a case study of Andhra Pradesh. Due to
the economic reforms of 1991 liberalized policies were introduced in agricultural
sector. Government relaxed rules and regulations existing in agricultural sector,
the new land policy that was introduced i.e shifting cropping pattern from food
crops to non-food crops became more convenient. Primary survey was conducted and also secondary data used to supplement it.

Major findings of the study were the shift in cropping pattern from paddy to fish cultivation had resulted in marginalisation of women workers, no change in the pattern of employment of women new types of employment created was captured by men and that price rate and contract system affected the income.  

Goswami, Dubey, Sen and Challa (2003) made a study on land use dynamics in Mizoram using the secondary data on land use pattern area, production and productivity of principal crops. Using exponential distribution compound growth rates of various categories of land use, compound growth rates of area, yield and production of major crops were computed. For measuring variability of different land use coefficient of variation was used and to measure crop diversification Herfindahl index was used. Period of study was 1992-93 to 2000-01. The overall cropping pattern indicated that less and less number of crops was grown in the recent years as compared to the number of crops grown in the initial years of study. Reduction in the area of available wasteland may be due to the diversion of the land for cultivation and also for non-agricultural uses.

Changing cropping pattern in theory and practice was a study by Utpal Kumar (2003) with special reference to Agrarian West Bengal. Based on earlier studies the study made some assumptions that cropping pattern was introduced to raise the expected farm income and changes in technology might influence cropping pattern. Also improvement of infrastructure, expected normal price, expansion of irrigation, market forces and rainfall played a dominant role in the
determination of area allocation among the food crops. Relative price, irrigation facility, soil condition, price policies of the government, yield of crops, technology, infrastructure etc. were responsible for crop diversification in different places.

Main objective of the study was to examine the basic reason for crop diversification in the context of agricultural situation. A stochastic form of equation was considered to analyse the impact of different factors.

Analysis revealed that the farmers were highly influenced by last year’s price of the crop, which was to be chosen for cultivation. Relative profitability expected by the farmers and maximum possible net revenue from different combinations of crops decided the area allocation of crops.79

Agricultural development and source of output growth in Maharastra state was a study by Shrikant Kalemkar (2003), which attempted to analyse agricultural growth of the state during 1961-62 to 1997-98. The productivity growth and shift in cropping pattern were major factors that accounted for the growth of crop output in the state. The study was based on secondary data and main tools of analysis were- estimation of growth in area, production and yield by compound growth rates using exponential model, decomposition technique for individual crop and total output growth and to find crop diversification Herfindhal Index and Entropy Index were calculated.

From the analysis it emerged that the growth in area of major crops in the state revealed a mixed trend. During the last four decades population growth rate is higher than food grain output growth in the state. So the expenditure on agriculture and allied activities needed to be increased substantially.
Efforts had to be directed towards further increasing of productivity of various crops and changes in crop pattern towards optimum shift in cropping pattern in favour of high value crops and improvement in crop yield through scientific management and also the introduction of an element of dynamism was necessary for maximizing the crop output. Since there was little scope for the increment of arable land, the enhancement of productivity alone could contribute to increase in production.\(^8^0\)

Singh and Sidhu (2004) analysed factors in declining crop diversification, which was a case study of Punjab. Agricultural production in Punjab had been characterised by a sharp decline in diversity in the cropping pattern and the emergence of wheat-rice specialization over the past few decades. Over use of natural resources, ecological problems and growing income risk were the serious repercussions of that declining diversity. Due to improved yields and increased area wheat and rice experienced the highest growth in output. Diversification index was calculated to know crop diversity. Growth in the aggregate value of output was decomposed into growth in area and average yield.

Impact of area and aggregate yield on growth was almost the same during the green revolution period and post green revolution period the effect of crop yield was almost double that of the area. Future growth in agriculture with the present crop patterns and technology would come largely from the area expansion. It was found that as diversity in the production pattern declines the variability in the gross value of production increases.\(^8^1\)
‘Growth Decomposition of Foodgrains Output in West Bengal’ was a study by Majumdar and Basu (2005) where the decomposition model was used to study the district level output growth. Secondary data was used for the analysis.

The study attempted a component-wise analysis of the growth of foodgrains output valued at constant prices for the State and its districts during the time period 1970-71 to 1999-2000. An additive decomposition model without interaction was used to study the impact of components namely area effect, yield effect and cropping pattern effect.

The study found a remarkable improvement in the yield growth during 1980s but it was not sustained for a long time. A decline had also been noticed in the growth rates of area and cropping pattern. Therefore, the study advocated for new reforms to give a new dimension to the yield growth in West Bengal in the present decade.82

1.7 RESEARCH GAP:

In the earlier studies conducted in Kerala Agriculture, only few studies used decomposition techniques. No detailed study has conducted in the districts of Kerala using major twelve crops. Only percentage share has used in the earlier studies to analyse the cropping pattern changes.

In order to analyse the impact of the components of total productivity and output growth, decomposition models are used. In the analysis of growth of total productivity, the major components are cropping pattern effect, locational effect and yield effect. Interaction effects are also included. No study has taken into consideration the impact of locational component in the total productivity change earlier. This is the first attempt in Kerala agriculture to analyse the impact of
locational effect of individual crops in the growth of total productivity change. Cropping pattern effect has explained according to the change in the share of crops in the total cropped area.

Very few studies made the attempt in the district level analysis of output growth. Decomposition models used earlier included interaction effects but the study does not taken the interaction effects in the analysis. Output growth in each district in three time periods with a common base year has decomposed into three pure effects namely area effect, yield effect and cropping pattern effect and this study included in this category at the first time. Decomposition of output growth for individual crops also estimated. Use of regression techniques to find out growth rates in Kerala agriculture is rare.

Crop diversification at the State level and district level was also computed unlike in many of the earlier studies. Also the district wise share of each crops for the four time periods was also calculated which makes the study more meaningful.

Thus in the present study, an earnest attempt has been made to analyse agricultural productivity and output growth and the contribution of various components to the overall growth of Kerala State for the reference period.

1.8 CHAPTER SCHEME:

The study is divided into five chapters. The contents of each chapter are explained as follows:

Chapter I deal with the introductory one in which context, significance and the scope of the study are explained in detail. Research design deals in the next section. Major research issues, objectives, hypotheses and research methodology
are presented in that section. Theoretical background of the study and major concepts used are also included. Review of earlier studies, social relevance of the present study, research gap, chapter scheme and limitations of the study are also presented in the first chapter.

In Chapter II different aspects of agriculture in Kerala are explained. Land utilisation pattern, agro- ecological environment of the State and cropping pattern in India, other States and in Kerala particularly elaborated in detail in crop wise. By using exponential form of the equation compound growth rates of area, production and yield of major twelve crops are computed for three sub periods and overall period together. Growth rates in production have explained in detail using the rates of growth of area or yield or both.

Decomposition of total productivity growth has included in Chapter III. Decomposition model has used, which was used in the Indian context, by including locational component in Kerala agriculture. Results of the analysis have explained in detail in period wise and crop wise in this chapter. Crop diversification index has computed and that also included in the Chapter III.

In Chapter IV district wise analysis of cropping pattern of major crops have presented in detail. The share of each crop in each district has discussed in four time points. Decomposition of output growth into its components in the districts has been done using the model, which has no interaction term. In three sub periods and crop wise each effect has analysed elaborately.

The last chapter, Chapter V, discusses the summary, conclusion and major suggestions of the study. Important conclusions, summary of the work done and suggestions for further research are explained in this chapter.
1.9 LIMITATIONS OF THE STUDY:

The study ‘Shifts in Cropping Pattern in Kerala’ has been analysed by using secondary data. All the limitations and drawbacks of a study while using secondary data can be seen in this study also. Total productivity growth and output growth are decomposed into its components using the models for three time periods. In each time period average absolute value is taken. Since economic meaning of interaction terms are not explained in the model the interpretations based on these terms are very difficult. The major components, which are affecting the productivity growth and output growth, are influenced by exogenous factors. These factors are not taken into the study due to the wide coverage of those factors.

In the analysis only major twelve crops are taken into consideration due to the non-availability of the data of other crops. The study is restricted to thirty years. The study does not make an effort to probe into various factors, which led to the shifts in cropping pattern. The role of the State in the changed scenario was not analysed in the present study. Also no comparison with other States was attempted in this study. The global warming and climate changes are yet another factors which led to these changes especially in the third sub period, which is also excluded in the present study. All these are left to the future researchers in this field.
NOTES AND REFERENCES:


51 Goswami and Challa (2004): “Indian Land Use Scenario”, *Agriculture Situation in India*, Special Number, August, pp. 281-290.


