CHAPTER – II

REVIEW OF LITERATURE

INTRODUCTION

Diversification is an integral part of the process of structural transformation of an economy. In India, as in other developing countries, the economy is diversifying at the macro level, with the secondary and tertiary sectors becoming progressively more important in terms of contribution to national income as well as disposition of the work force. Within agriculture, some of the sub-sectors like animal husbandry, forestry and fisheries progressively occupy a more significant place compared to crop production and within the crop-mix the ‘superior cereals’ (i.e., wheat and rice) progress faster compared to the inferior cereals (e.g., sorghum or pearl millet or minor cereals). These developments are fairly common. However, the factors promoting diversification and the speed with which the change occur vary in different situations.

In the last few years the need for rapid diversification is strongly articulated in the context of the rice economics of South-East Asia. A number of countries where rice was a predominant crop were faced with a secular decline in rice prices in the 1980s. There were two options open to such countries, either to support the domestic rice prices by giving huge subsidies, or to allow rice to ‘adjust’ to the decline in prices of this stable crop. Both these options were unattractive. In this context, a forced pace of withdrawal of farm resources, including manpower, from agriculture and significant changes in crop diversification were advanced as a more desirable alternative (World Bank, 1988). In the Indian context, the need for diversification is advocated on certain grounds.
CROP DIVERSIFICATION

The all India compound growth rates in area, production and yield of principal crops are presented in Table-2.1, separately for the two periods from 1967-68 to 1980-81 and from 1980-81 to 1994-95 (due to differential performance in each period). The growth rates for area indicate a moderate increase in the area under non-food grains during the first period (1967-68 to 1980-81). This pattern changed during the second period (1980-81 to 1994-95) witnessing marginal decrease in the area under food grains, along with a substantial increase in the area under non-food grains. These observations indicated some area diversification towards non-food grains crops, like potato, sugarcane and oilseeds which have exhibited quite high growth in their area, while cotton, total fibers and tobacco witnessed negative growth rates in their area, during the period. Among food grains, the positive growth rates in the area under rice, wheat and turf crops and negative growth rates in the area under coarse cereals, total cereals and total pulses indicate increasing specialization under rice, wheat and turf crops, particularly during the second period.

To examine the crop diversification in India, the Herfindhal Index was worked out by Vyas (1996) for each year from 1970-71 to 1994-95. Then, to facilitate direct interpretation, Crop Diversification Index (CDI) was calculated as one minus Herfindhal Index. Thus, the value of CDI closer to one will indicate diversification and close to zero specialization. To examine the nature of crop within different crop groups, the following three sets of CDI were calculated for each year.

To study the change in diversification over time, simple linear trend equation was estimated for each of the three sets of CDIs for the period from 1970-71 to 1994-95. The diversification indices are presented in Table 2.2 for the decennial years
of 1970-71, 1980-81, 1990-91 and also for 1994-95, along with their estimated trend equations. These results indicate a high level of diversification among all the crops as well as within food grains, as revealed by highly significant negative trend co-efficient for CDI-1 and CDI-2. On the other hand, a significant positive trend is being observed in CDI-3, indicating increasing diversification over time among the non-food grains.

Table 2.1 Compound growth rates of area, production and yield of principal crops (per cent per annum) in India

<table>
<thead>
<tr>
<th>Crops</th>
<th>1967-68 to 1980-81</th>
<th>1980-81 to 1994-95</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area</td>
<td>Production</td>
</tr>
<tr>
<td>Rice</td>
<td>0.77</td>
<td>2.22</td>
</tr>
<tr>
<td>Wheat</td>
<td>2.94</td>
<td>5.65</td>
</tr>
<tr>
<td>Cereals</td>
<td>-1.03</td>
<td>0.67</td>
</tr>
<tr>
<td>T. Cereals</td>
<td>0.37</td>
<td>2.61</td>
</tr>
<tr>
<td>Gram</td>
<td>-0.55</td>
<td>-1.02</td>
</tr>
<tr>
<td>Turf</td>
<td>0.38</td>
<td>0.56</td>
</tr>
<tr>
<td>T.Pulses</td>
<td>0.44</td>
<td>-0.40</td>
</tr>
<tr>
<td>T.F.G.</td>
<td>0.38</td>
<td>2.15</td>
</tr>
<tr>
<td>S.Cane</td>
<td>1.78</td>
<td>2.60</td>
</tr>
<tr>
<td>T.O.seeds</td>
<td>0.28</td>
<td>0.98</td>
</tr>
<tr>
<td>Cotton</td>
<td>0.07</td>
<td>2.61</td>
</tr>
<tr>
<td>T.Fibres</td>
<td>0.19</td>
<td>2.53</td>
</tr>
<tr>
<td>Potato</td>
<td>4.29</td>
<td>7.78</td>
</tr>
<tr>
<td>Tobacco</td>
<td>-0.08</td>
<td>2.22</td>
</tr>
<tr>
<td>T.N.F.G.</td>
<td>0.94</td>
<td>2.26</td>
</tr>
</tbody>
</table>

Table 2.2 All India crop diversification indices

<table>
<thead>
<tr>
<th>Particulars</th>
<th>CDI-1</th>
<th>CDI-2</th>
<th>CDI-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1970-71</td>
<td>0.8840</td>
<td>0.8344</td>
<td>0.8029</td>
</tr>
<tr>
<td>1980-81</td>
<td>0.8794</td>
<td>0.8242</td>
<td>0.8197</td>
</tr>
<tr>
<td>1994-95</td>
<td>0.8807</td>
<td>0.8060</td>
<td>0.8435</td>
</tr>
</tbody>
</table>

Trend in CDI (1970-71 to 1994-95)

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.8825</td>
<td>0.8372</td>
<td>0.7975</td>
</tr>
<tr>
<td></td>
<td>-0.00016*</td>
<td>-0.00119*</td>
<td>0.00181*</td>
</tr>
<tr>
<td>SE</td>
<td>0.00004</td>
<td>0.00007</td>
<td>0.00006</td>
</tr>
<tr>
<td>R Square</td>
<td>0.39</td>
<td>0.91</td>
<td>0.97</td>
</tr>
</tbody>
</table>


Note: * indicates statistical significance at one per cent level.

(CDI = 1-Herfindhal index)

**CDI-1** for rice, wheat, jowar, bajra, maize, other cereals, gram, turf, other pulses, groundnut, rapeseed and mustard soya bean, other oilseeds, cotton, jute and mesta, sugarcane, potato, onion and tobacco.

**CDI-2** for disaggregated nine food grain crops and crop groups as in CDI-1 above

**CEI-3** for disaggregated ten non-food grain crops and crop groups in CDI-1 above

Agriculture is one of the most important sectors in India which accounts for about 22 per cent of the national income. It provides employment to about 65 per cent of its labour force in 19980-81. The post-independence period saw phenomenal changes in the history of agricultural development in India. The total agricultural
output recorded an increase in the annual growth rate of 2.6 per cent during 1947. The demand for food grains is tremendously increasing due to the increase in population. In order to meet the increase in demand for food grains and to avoid the dependence on the import of agricultural commodities, achieving self-sufficiency in agricultural production was given top priority with the state as the basic unit. Very few researchers have undertaken to analyze the trend of crop diversification at the district level. It is admitted that it would be more useful if the analysis of crop diversification was carried out at national level or state level. But, factors such as time and cost preclude such a study. Hence, there is no alternative, but to undertake a district level study.

Supply of raw materials and food grains are very important for economic development. In a developing economy, the demand for agricultural raw materials will be increasing. For instance, the expansion of industries like cotton, jute, sugar and oils depends only on the availability of raw materials. Apart from meeting a huge demand in the home market, a sizeable portion of the foreign exchanges is earned by exporting agricultural products.

Starting with the use of high yielding seeds, fertilizers and pesticides, the green revolution achieved increase in yields per acre and had its beginning in Tamil Nadu after Second Plan period. Striking changes in agriculture became manifest the Fourth Plan when the state achieved a remarkable break-through in production. Through improved technology, multiple cropping high yielding varieties and improved dry farming techniques, further improvements in agriculture are now aimed at in the state.
It is difficult to design a process of transforming agriculture on a uniform basis for all regions or states. At the sectoral level is however clear that agricultural developments has to be viewed in terms of prices, incomes and technological inter-relationship when develop policies are proposed.

Besides, Dharmapuri and Ramanathapuram districts, Thanjavur and South Arcot districts are also taken up for special development because these areas also have pockets in which neither industry nor agriculture are flourished. In these areas, the diversification of agriculture, from the traditional paddy growing, into sugarcane cultivation in wet lands and into sunflower, banana and cashew cultivation in the dry and garden lands of the region is contemplated. The labour employed in agriculture was found to be responding favourably in terms of higher marginal productivity when complementary inputs were available. Besides, canals, tanks and wells occupy a place of importance in the state where irrigation facilities usually are availed of for paddy cultivation to a larger extent than for other crops.

2.1. STUDIES IN CROP DIVERSIFICATION AND THEIR CRITICAL DISCUSSION

Many contributions have recorded and reflected on the main tendencies in the crop pattern in the country since earlier sixties. But, only a few relevant studies have been considered for the present discussion.

Small Millets and Bajra

- Where the yield per hectare is well below the national average-shift or transfer of the areas of small millets and bajra to the higher yielding ragi and khariff cereals and millets having yield above the national average.
- Where the yield per hectare is well above the national average evolution and use of improved strains of small millets and bajra so that the yield per hectare could increase considerably.

Cereals and Millets (rice, wheat, barley, jowar, maize and ragi)

- Where the yield per hectare is well below the national average by 50 per cent or more (because of relative importance of area even with low yield per hectare) and where the acreage under these crops is below 2 per cent of total acreage under all cereals and millets irrespective of yield per hectare (because of relative unimportance of area even with high yield per hectare) shift of acreage under rice, wheat, barley, jowar, maize and ragi to cereals and millets or pulses, the yield per hectare of which is equivalent to or above the national average or cash crops.

- Where, the yield per hectare is below the national average by less than 50 per cent, use of a package of improved and tested agricultural practices to enable the yield per hectare to rise above the national average or at least equivalent to national average.

2.2. REVIEW OF LITERATURE RELATED TO CROP DIVERSIFICATION

Sharad Chandra Jain\(^1\) (1962) this study covered the crop diversification of the entire state and it is a macro-level study. The study period was from 1951-1952 to 1973-1974. The crop diversification trend of Tamil Nadu from 1951-1952 to 1973-1974 has changed considerable in subsequent years, particularly in the 1980s. Hence, a fresh look at the pattern of cropping is necessary.
One of the criteria for judging the desirability of a crop pattern in the economy of emergency for the country as a whole is the differences in average yield per hectare in the form of low and high yielding varieties of various crops and area under them over a given period of time. Such a state-wise study for eight cereals and millets over a period of three years i.e., 1958-1959, 1959-1960 and 1960-1961 shows vast differences in yield per hectare as well as area under them and suggests changes and improvements in the present crop pattern for limiting production variations of these crops.

In an economy of emergency production variations should be on a limited scale. With the view the study of differences in yield per hectare of cereals and millets and area under them suggests the following minimum programmed of changes and improvement in the present crop diversification.

A study on the economics of crop diversification of Kerala by Oomen\(^2\) (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 problem cited in the study was the difficulty in the measurement of inter regional comparative advantage in crop diversification and that of intra regional between crops, the adoption of regional specialization, rigid acceptance of a cash crop oriented crop diversification, frequent changes in crop diversification 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 was compared. While analyzing the intra regional crop shift, the study cited scope for substitutability of paddy by sugarcane as per the net income criterion.

The study concluded by remarking that a rational re-allocation of crop diversification 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.

Pathi and Hiregoudan\(^3\) (1964) studies the economics of crop diversification under tank irrigation is South Eastern Dry Region of Mysore state. The Mysore state was divided into four agricultural regions based on soil and climatic conditions. The two objectives of the study were (i) to study the economics of existing crop diversification in a region with a view to determined the factors that influence the pattern and (ii) to suggest a crop diversification which would increase the productivity of resources and maximize returns. The study covered a crop diversification which would increase the productivity of resources and maximize returns. The study covered a period of three years from 1959-1960 to 1961-1962. The crop diversification was classified into three categories and input-output of crops per acre of sample village were calculated.

The study revealed that it was possible to increase the net return of the crop diversification through new investments in fertilizers and pesticides etc. It suggested that introducing a pattern of double cropping like groundnut and irrigated ragi would maximize the returns. This would enable the farmers to put their land under more intensive use, increase productivity of labour and employ for a greater part of the year.
One of the objectives of the study was to suggest a most profitable crop diversification. But, it failed to project precisely how fast the new crop diversification suggested would bring about maximum returns. They did not adopt any systematic production function or programming to suggest an optimum cropping plan. They analyzed cost and returns of various crops by adopting the conventional method.

George (1965) analyzed the impact of the relative change in prices on the crop diversification 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 changes 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 changes 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 crop diversification of Kerala has undergone a slight shift from food crops to cash crops. The acreage response to priced had been positive for most, 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.

Minhas B.S. and Vaidyanathan R. (1965) The decomposition of agricultural
output growth with the help of Minhas Seven Factor additive Model at the
disaggregated district level in Andhra Pradesh reveals that yield is the major
During the pre-green revolution period (1956-1967), the growth of output was
influenced more by crop diversification in eleven district, five by the yield growth and
the remaining four by area growth. Contrary to this, post-green revolution period
(1967-1981) recorded a dominant contribution from yield was much higher and
predominant during post-green revolution period while the contribution of other
factors was almost nil or negligible. Precisely, this period was marked by sweeping
changes in technology and effective implementation of development programmes in
agriculture. The favourable factors responsible for yield growth either singly or jointly
were: use of high-yielding varieties, irrigation and fertilizers. Consequently, crop
output growth in almost all the districts during 1967-1981, was largely the result of
technological transformation coupled with the spread of HYV crops, crop
diversification, irrigation and fertilizers which resulted in Green Revolution was
largely influenced by changes in the crop diversification during 1956-1967 and by

Since both crop diversification and yield are the composite indicators of
growth in output, further attempt is necessary to go deep into the details of individual
factors responsible for growth in output. In other words, the factors of growth of agricultural production and their relative importance in different districts or regions are characterized by different agro-climatic conditions like climate, soil, rainfall, etc., and other related factors like irrigation, prices, fertilizers and pesticides. As the fixation of gradation for some indicators like agro-climatic conditions are inadequate and unscientific at the district level, it is not possible to estimate the relative importance of each factor in the total increase in agricultural output scientifically. Hence, an attempt has been made here only to examine the effect of crop diversification, irrigation and fertilizers on agricultural productivity and there by production since it is widely realized that extension of irrigation and use of fertilizer coupled with crop diversification explain a good part of the existing variation among districts and regions. This knowledge about the sources of growth of agricultural production and their relative importance in different region characterized by different agro-climatic is desirable for effective agricultural planning at the district and region level.

There have been only a few attempts in the past to examine the crop diversification shift upon growth in agricultural production overtime. The decomposition of the growth of agricultural lies in, yield and crop diversification, the contribution of area, yield and crop diversification and the interaction of the latter two factors to the increase in output was assessed by using an additive scheme of decomposition. Dharm Narain’s work is an extension of the study of Minhas and vaidyanathan. He decomposed the growth of productivity in agriculture into three factors, viz. change in crop diversification, location shifts of area under individual crops and pure yield effect. His study concluded that the growth of productivity during the fifties was mainly due to the first two facts, i.e., crop diversification effect
and location shift effect. During the sixties the major influencing growth of productivity was identified as pure yield effect, which was the result of technological change.

The level of output growth rate, we know, is jointly determined by the growth rate in area and the growth rate in yield. Following the hypothesis that farmers are rational in their production behaviour and that they maximize their net returns, we can state that their input allocating decisions including area allocation area based on expectations relating to relative price and relative yield from the concerned crop, relative to substitutable crops.

Sridharan B. and Radhakrishnan S.A.\(^6\) (1978) attempted a micro-level study on factors influencing crop diversification in the Nilgiris district. The study directed its attention towards the problem of identifying the determinants of crop diversification under varying technical, economic and institutional situations.

A two-stage stratified random sampling design with village as the primary unit and holding as the secondary unit of sampling was adopted for the study. The study was carried out in Coimbatore district which then consisted of nine taluks. The study periods were three continuous years that is 1964-1965, 1965-1966 and 1966-1967.

Only two taluks namely Avinashi taluk and Coimbatore taluk were taken into consideration. In order to divide these two taluks into different agro-climate zones, the soil and rainfall distribution were taken into consideration. The villages were selected with reference to their distances from market to facilitate the study of the influence of market location of crop diversification. 18 villages were selected for the study. From each village, nine farms were taken into consideration and thus the sample size was 162.
It was a micro-level study and it attempted to analyze the crop diversification of Coimbatore district in an intensive manner. But it has some defects. The study covers two out of nine taluks. It does not reflect the cropping in pattern of the whole district. The agro-climatic structure of these two taluks may not be similar to the other taluks of the district. Moreover, the study period is only three years. Crop diversification changes cannot be traced out within this short span of time.

Lalitha P.S.\textsuperscript{7} (1978) analyzed the changes in crop diversification in Tamilnadu. The researcher was analyzing the directional changes in the crop diversification and the factors that led to these changes with a view to formulate general crop pattern changes in Tamilnadu agriculture. The period of study was 23 years that is, from 1951-1952 to 1973-1974. The study revealed that the net area sown increased by 19.56 per cent and at the same time, the area more than sown once increased by 58.28 per cent because of increased intensity of cropping, increased irrigation facilities and increased use of early maturing varieties. A more desirable pattern of cropping was drawn up for the state of Tamilnadu based on future needs and the present trend in the crop pattern. The study covered only very few villages from each district of Tamilnadu state. For example, in Madurai district, only two villages namely Oddaipatty for commercialization and crop diversification and Kidurivarpatti for the impact of urbanization on crop diversification were studied.

Venkataraman L.S. and Prahladachav M.\textsuperscript{8} (1980) explained all unchanged crop diversification as a situation where the respective areas under all crops bear the same proportion to the gross cropped area over the years, then it implies that the rate of growth in area under individual crops must equal the rate of growth in the gross cropped area over the same time period. We can express such a change in the form of a liner homogeneous gross cropped area function, where given proportionate changes
in area under individual crops are related to equal proportionate change in the gross 
cropped area. The rates of growth in the area of individual crops which differ from the 
rate of growth of gross cropped area therefore provide evidence of change in the crop 
diversification. The ‘area’ gross cropped are elasticity which can be defined either as 
the ratio of the rate of growth of area under a crop to the rate of growth in the gross 
cropped area, or as the ratio of the area under the crop to the gross cropped are after 
and before the change can be used to measure the shift in the crop diversification.

On the basis of “area-gross cropped area elasticity’s” we can distinguish the 
individual crops into three categories.

**Category 1:** Crops whose area growth rates are equal to or exceed the rate of growth 
of gross.

**Category 2:** Crops whose area growth rates are less than the gross cropped area but positive, i.e., their elasticity's being positive, but less than one.

**Category 3:** Crops whose area growth rates are negative, i.e., their elasticity being less than zero.

It is to consider the differential elasticity above-mentioned to reflect the fact that crops falling in category 1 and 2 gains in area partly at the expense of area from category 3 crops.

The total change in the crop diversification over time is the sum total of the substitution effect-the relative decline in area under some crops and corresponding equivalent increase in area under other substitutable crops for a given cropped area and the expansion effect (effect of increase in the gross cropped area).
It is to consider the total decline in acreage under category 3 crops to measure the substitution effect of the aggregate crop diversification change. The increase in area under category 1 and 2 crops, we consider, is the sum total of the substitution and expansion effects. The substitution part of the gain in acreage under the aggregate of category 1 and 2 crops may be taken to have been derived at the expense of the aggregate of category 3 crops. This permits us to ‘separate’ the total gain in acreage that took place in category 1 and 2 crops in terms of substitution and expansion effects, and thereby in arriving at the ‘expansion effect’ of the aggregate change in the crop diversification.

The exercise that have suggested above for measuring the ‘aggregate’ change in the crop diversification in terms of ‘substitution’ and ‘expansion’ effects may be one for irrigated and rain fed portion of gross cropped area separately.

Jeemol (1983) makes a detailed study of the changes in the crop diversification of Kerala from 1960-1961 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 areas under paddy cultivation was found out.

The conclusion derived from the study was 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 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\textsuperscript{10} (1983) looked at the growth performance of a number of crop 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.

A declining trend in yield and crop diversification 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 crop diversification 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 from 1965-1966 to 1971-1972 due to increase in area and after 1972-1973 indicated a decline in production, area and yield. Tapioca production also suffered decline of area after 1974-1975 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 1975-1976 and it was again a sharp decline in yield that accounted for the decline in production.
A major conclusion put forward by the study was that since different groups of crops and different crops showed various trends in area, production and yield based on 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\textsuperscript{11} (1984) examined the changing crop diversification and food economy of Kerala. The study analyzed in depth the reasons for conversion of paddy fields into other crops-cultivations, mainly coconut and forecast the posterior probabilities of the conversion prices 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 continued to cultivate seasonal crops. Major findings were that 67 per cent of converters were in the age group of 50 and above a 25 per cent among them had college education. 53 per cent of the non-converters were in the age group of 35-80 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.

The major reasons mentioned by the farmers were that the converted marginal lands were laying in the border area, lack irrigation facilities, have shade of trees, soil erosion etc., while those lands were uneconomic for paddy cultivation. Also low yield of 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 of long range benefit of cash crops.
Kavi P.S., Prabhakar A.S. and Ratnam B.P.\textsuperscript{12} (1990) state that the agricultural production is intimately related to the harnessing of favourable weather conditions during every cropping season. It is an established fact that crop yield is the integral result of a number of mutually interacting physical and physiological processes that take place during the crop growth period. The prevailing weather conditions along with soil and water management practices constitute the physical part of the process; whereas, the physiological aspect deals with the seed from germination to reproduction. Water plays an important role in influencing the physiological process and in most of the times it conditions the growth of the plant depending upon its erratic behaviour. For proper planning of any crop, a better understanding of rainfall, which is the only source of moisture.

In an ideal setting the prevailing crop pattern in any region should reflect the best possible use of physical environment in the shape of land; by best possible use we mean economic use. In actual practice, non-economic factors also have their influence. The physic-geographical factors set a broad limit to the type of crop that can be raised in any region. For example, jute and paddy require a different degree of rainfall and temperature and different type of soil say groundnut or millet. However, the physic-geographical limits cannot be regarded as fixed in this fast age of growing science and technology. Man is continuously changing his environment-chemical composition of the soil by fertilizers, the moisture content by damming rivers and digging canals. Atomic energy and developments in plant genetics (for example the possibility of growing two crops in the plant) open endless possibilities in these directions.

Even if we assume these macro-factors as given there is a choice of alternatives and quite a lot of maneuverability is possible within these broad limits.
For example, jute and paddy can be grown on the same piece of land. Similar is the case with paddy and sugarcane, wheat and barley or gram, crop for human consumption and fodder for cattle.

Seema Bathla\textsuperscript{13} (2008) analyses that agricultural diversification is considered to be the most appropriate strategy that augments growth, stabilizes farm income especially of the small and marginal farmers, generates full employment, protects natural resources and attains the goals of food security. There is substantial evidence on crop area shifts from coarse cereals and pulses to rice, wheat, sugarcane and oilseeds during the seventies and the eighties and in the subsequent period from crop sector to high value fruits-vegetable crops, forestry, livestock and fishery activities (Sawant and Achuthan, 1995; Chand, 1996; Vyas, 1996; Pandey and Sharma, 1996; Naik and Jain 1999, Saleth, 1999; Joshi, Gulati, Birthal and Tiwari, 2004).

The patterns of diversification have contributed towards attainment of food self-sufficiency in the country, increase in export earnings and employment opportunities, higher rate of agricultural growth, especially of cereals and better growth performance of regions that specialize in activities other than cereals. While area changes within the cropping sector are stated to have induced by favourable price structure, adoption of high yielding varieties, Technology, Mission Programme on oilseeds and a restrictive trade policy, a move towards horticultural crops and allied activities has got instigated by liberal external trade policies under the structural adjustment programme. A greater openness of agriculture to world trade along with streamlining of trading rules under the URAOA of the WTO is further expected to provide incentives to alter crop area changes in favour of those commodities that have greater demand at the global level and are also price competitive.
2.3. REVIEW OF LITERATURE RELATED TO PRICE AND CROP DIVERSIFICATION

Shyam Nandan Sinha\(^4\) (1964) The influence of relative prices on crop diversification is subsumed under profitability since the value of output is a function of yield per ha and price. As between price and productivity, it has been the latter which had the predominant influence. Price “when confronted with the force of technological change has not been able to counter its pressure on area”.

Sebastian M.\(^5\) (1981) argued that the price mechanism is a remarkably subtle and ingenious social contrivance. For prices are coefficients of social choice and serve as guide posts to resource use in an economy; and price mechanism assists the economy in allocating resources to different uses to achieve efficiency in production and distribution on the supposition that, there is perfect competition and consumers as such enjoy sovereignty. In spite of limitations, price mechanism is considered to be still a powerful tool to elicit decisions by producers and consumers.

The various analyses undertaken in the hypothesis enunciated that Tamil Nadu is price responsive. This conclusion however is qualified. Responses in most of the three, out of seven districts have not been significant, explanation for this limitation might be the years chosen include nearly fifteen years of stagnation. Production figures easily neutralize significant positive response years; such a thing has been proved true in case of paddy which was studied for agriculture period from 1965.

In recent years, there has been considerable interest from the agriculture price policy angle in studying the effects of relative prices on acreage allocation, production and growth.
Narain D.\textsuperscript{16} (1988), while studying the impact of price movements on areas under selected crops during the years 1900-1939, reports that the Indian farmer has been significantly responsive to price, and price has played a decisive role in the allocation of different cash crops and between cash crops and food crops. But, price has not been a vital consideration in the allocation of area between rival food grains because in subsistence agriculture self-sufficiency in food and requirements is the main consideration of the farmer. Kaul also strengthened Dharm Narain’s findings through a study in Punjab.

At the micro level also farmers’ price responsiveness has been studied and reported. While the study results of Raj Krishna, Dayanatha, Rathod Singh and Pillai have supported the price responsive hypothesis, it does not find favour with Gupta, Majid and John.

While Pillai even goes to the extent of saying that a country where decontrolling is impossible the only way of maintaining a desirable crop diversification would be to control the prices of all related agricultural commodities, Parikh’s conclusion does not support this view. After studying the trend of rice and wheat crops in different regions, Parikh concludes that the farmers respond to non-price and sometimes even significantly (statistically negative in most of the reduced forms of equations.

Cauvery R.\textsuperscript{17} (1993) as agricultural production is largely a private business, carried on in millions of farms, efforts to promote agricultural progress must be persuasive and must work through the market forces. Therefore, the price policy is an important instrument for change. Further, the success of any policy depends on the behaviour response of those who are affected by it and the impact of this response on
the objective of the policy. It is in this context that the acreage response of farmers to changes in prices of their products has attracted the attention of the economists and the policy makers.

The study on the impact of relative changes in prices in the crop diversification of Kerala by M.V. Geroge revealed that the crop diversification of Kerala has undergone a slight shift from food crops to cash crops during the last one decade and that the acreage response to price has been positive in the case of most crops. The increases in acreage under rubber and cashew nut & are the result of increases in their price. Similarly, the decline in the acreage under tapioca both in absolute and relative terms is due to fall in relative prices. Again what little evidence we have, shows that it is the relative increase in prices and not the absolute increase, which brings about a favourable response in acreage under a particular crop. Hence a price policy designed to stimulate production of food crops in Kerala is not likely to succeed by merely fixing a floor price for these commodities. On the other hand, it should seek to stabilize the relative prices of food crops in terms of the other agricultural commodities produced in the state and maintain the same by constant vigilance and supervision.

2.4. REVIEW OF LITERATURE RELATED ON CROP DIVERSIFICATION – INDIAN CONTEXT

At the very macro level the following estimates bring out the main story. The larger picture in terms of output and productivity growth and the shift away from food grains are shown in later estimates:
Table 2.3 Production trends of agriculture and area trends of all crops

1950-1951 to 2003-2004

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<tr>
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<tbody>
<tr>
<td>Production Growth rate of Agriculture</td>
<td>2.6</td>
<td>2.18</td>
<td>3.04</td>
</tr>
<tr>
<td>Area Growth Rate of All Crops</td>
<td>0.5</td>
<td>0.86</td>
<td>0.00</td>
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</table>


Growth rate of production goes up since the eighties for the agricultural sector as a whole. Output is now rising at 3.04 per cent compound annual as compared to 2.18 per cent compound annual earlier. There is no contribution of area in the second phase, yield being the only source of growth. As it is examined below, from the early fifties to the mid-seventies, food grains growth is 2.69 per cent annual and goes down to 2.25 per cent annual in the second phase. Area growth which was 0.86 per cent annual in the first phase goes down to a negative figure of minus 2.15 per cent annual in the second phase. Area allocation to non-food grains is the same as for food grains in the first phase, but in the second phase area under food grains is falling and that under non food grains is rising (Tables illustrate the results described in the text).

A study by Munish Alagh\(^18\) (2007) and others show that the technological changes of the sixties were addressed to the 71 per cent of the total-holding growing cereal. Growth in productivity does not induce area allocation as a rule, but there are
instances where area under crops has increased keeping in view productivity growth. Second, the emphasis on food grains has been going down over the decades and more sharply during the later part of the five decades. Consequently, the area allocation towards commercial crops is increasing.

Horticulture contributes 28.5 per cent of GDP in agriculture and 52 per cent of export share in agriculture from cultivated area of 8.5 per cent (Singh et al., 2004). Fruits and vegetables from the single largest sub-sector sharing about 63.8 per cent of area and over 80 per cent of the total production under horticulture. Fruits and vegetables are high value commercial crops grown in an area of about 11.7 million hectares with a production of 150.73 million tonne in India in 2004-2005. In mid-80s, the Government of India identified horticulture crops as mean of diversification for making agriculture more profitable. The development of horticulture took place under four different phases. In the first phase (pre-independence). Horticulture as a whole was not considered, but, efforts were made to grow fruits, vegetables, flowers, spices in isolated manner. During second phase (1948-1980), no planned efforts were made but specific problems were addressed as technical support and development efforts were made for specific commodities like species, coconut. Potato, etc.

During the third phase (1980-1992), consolidation of institutional support by Government of India coupled with the changes in economic policies allowing liberalized introduction of hybrid seed and plant material from other countries resulted in substantial increase in production and export of these crops. During the fourth phase (1993-2003), marked technological changes occurred. There was a quantum jump in plan allocation that resulted in an increase of production and enhanced availability of produce, which is now marked as Golden Revolution. To further develop horticulture Government of India launched National Horticulture
Mission Approach in May, 2005. Under this mission, an amount of Rs. 560.29 crores has been released up to December, 11, 2006 (Economics Survey, 2007). In spite of all such efforts by the government, only 16 per cent of the total plan allocation is spent on horticulture. Still there is a wide scope of utilization of funds for horticulture development. As horticultural crops are highly perishable in nature, there is an incidence of both pre and post-harvest losses. About 30 per cent of fruits and vegetables go waste due to lack of proper processing and packaging. However, understanding of production and marketing problems of fruits and vegetables in India would help to improve the marketing and production process of these products.

The study of (a) food crops and (b) commercial crops or non-food crops would reveals the stages of agricultural development and the nature of the economy. It is observed that, the larger the area under commercial crops, greater will be the development, indicating the larger scale mechanization in the agriculture sector, fertility of the land and agrarian structure of the particular region or state.

In most of the underdeveloped countries, farmers normally produce more food crops and generally the area under food crops is more as compared to the area under commercial crops. Various efforts have been made in these countries for changing the crop diversification. i.e., to bring more area under superior food crops and commercial crops but these efforts have negative effect on the economy. For instance, Indian Government has taken various measures for raising the agricultural output and changing the crop diversification but as a result only limited change has taken place in the crop diversification.

The crop diversification is in general, determined by regional and economical factors. Farmers, sometimes, switch over production programmes from food crops to
non-food crops on the part of farmers about higher incomes that cash crops are likely to fetch, food crops still account for 80 per cent of the total sown area in the country. Rice is relatively and important crop in the southern states and in Bihar, Orissa, West Bengal, Assam and Madhya Pradesh. Wheat is likewise a staple cereal in Punjab, Rajasthan, Uttar Pradesh and Madhya Pradesh. Jowar appears to be an important crop in Andhra Pradesh, Mumbai and Mysore. Bajra is staple millet in Rajasthan and is also grown on a sizable scale in Mumbai and Punjab. With regard to non-food crops, sugarcane is grown mainly in Uttar Pradesh, Bihar and Punjab, cotton in Madhya Pradesh, Chennai, Mumbai, Mysore and Punjab and Jute in Assam, West Bengal and Bihar.

Inter-state comparison of the percentage of area under food crops shows that in Mumbai and Kerala only 65.2 and 68.5 per cent respectively of the sown area was under food crops. The corresponding figure was near about or more than 90 per cent in Uttar Pradesh, Bihar and Orissa. As regards non-food crops the states in the southern, western and northern zonal council areas figure prominently, the percentage of area under non-food crops ranging from 20.1 (Rajasthan) to 34.8 (Mumbai).

Chadha G.K. and R.K. Sharma\textsuperscript{19} (1982) argued that raising land productivity is the only solid and enduring basis for Indian agriculture to achieve a continuous increase in production. A rise in land productivity can take place in many ways. One such possibility lies in increasing area under existing ones. The underlying assumption is that every unit of the incremental cropped area gives some additional output, albeit small, so that output per acre of net sown area rises although it may or may not give an increase in output per acre of gross cropped area. It is, therefore, in the fitness of things that the future thrust in Indian agriculture goes, inter alia, in the direction of increasing multiple cropping.
The National Commission of Agriculture (1976) has well recognized the importance of this fact and has given state wise projections of cropping intensity for 2000 and 2025 (Government of India, 1976, p.150-153). In this connection, it is relevant to pose the question how the prospective gains or rising cropping intensity are going to be shared by various farm size groups. In particular, what is the future of small farms in the matter of cropping intensity? For locating a meaningful answer to this question, we must look to the experience of the past and the interim changes that are taking place at present.

The farm management studies for the fifties and the sixties, conducted for a few states, provided evidence to an inverse relationship between farm sizes and cropping intensity. This pointed to the fact that large farmers were not utilizing land, a very scarce and non-reproducible national resource, as optimally as small farmers. A higher cropping intensity on small farms provided a powerful explanation for the well known inverse relationship between farm size and productivity per acre, as also larger employment potential on such farms.

On this basis a strong case for land redistribution was also made. If land is transferred, through a regulated tenancy arrangement or otherwise, from those who keep it idle for a good part of the year to those who keep cultivating the same for a much larger part of the year, it will obviously generate higher output and greater employment per unit of land area. Ranjit Sau says forthrightly that “In India, whoever has the ability but not the willingness to utilize the land properly, should have no right to cultivate the land, despite his ownership. Whoever has the willingness, but, not ability should receive land as well as other support from the state. Such a policy may impart dynamism to the rural sector”.

2.5. REVIEW OF LITERATURE RELATED ON PRODUCTION, PRODUCTIVITY AND CROP DIVERSIFICATION

Gyanedra Mani and Pandey U.K.\textsuperscript{20} (1990) analyzed that agriculture yield gap can be conceptualized at three different levels. First, the difference between the genetic potential yield and the research level yield obtained in controlled experiments can be termed as ‘theoretical yield gap’. Second, the difference between yield obtained at research level and yield of the progressive farmers adopting recommended technology, such as demonstration trials can be termed as ‘field level yield gap’. Third, the difference between yield of the progressive farmers and yield of the non-progressive average farmers of an area can be termed as ‘farm level yield gap’.

Whereas the first two types of yield gaps form the subject of investigation for the economists, policy makers and extension workers. The farm level yield gaps indicate non-exploitation of the available yield potential on the farms of an area under the existing state of technological development. Therefore, farm level yield gaps must be identified on area basis and agricultural production policy must aim at proper mobilization of resources along with technology transfer in order to reduce these yield gaps and raise agricultural production.

Kurien C.T.\textsuperscript{21} attempted to analyze and interpret the economic changes that have taken place in the state of Tamil Nadu between 1960 and 1970. The approach was done in terms of state’s regional units, district and taluks and in terms of economic activity represented by labour participation and occupational pattern, agricultural activity, non-agricultural activity and urbanization. In the analysis of Tamil Nadu agricultural development from 1960 to 1970, they analyzed the changes in crop diversification in a detailed manner. They divided crops into three groups
namely, rice, millets (non-fatty cereals) and a residual category of others. Attempts were made to discover changes in the crop diversifications and explain them in terms of other variables such as changes in gross cropped area and changes in irrigations, etc. The primary concern of the study was to decompose the increase in agricultural output into its components and thereby to identify, to the extent possible, the factor responsible for the increase. Therefore, they followed a modified Minhas-Vaidyanathan method.

They worked out the value of aggregate agricultural output in the state and in the districts. Observing the value of output in the base year 0\( (V_0) \) and in the terminal year \( t(V_t) \) the difference between the two was decomposed into eight component elements. They were due to (i) changes in area (ii) changes in yield per hectare (iii) changes in crop diversification (iv) the interaction between yield and crop diversification (v) the price change effect (iv) the interaction between price and crop diversification (vii) interaction between price and yield and (viii) interaction between price, crop diversification and yield.

The study assumed that the effect of yield, area and crop diversification were the main causes of the changes in the production of various crops. It failed to identify and analyze the other agro-biological and institutional factors responsible for the shift in the crop diversification.

2.6. REVIEW OF LITERATURE RELATED TO CROP DIVERSIFICATION IN TAMIL NADU

Cropping systems research is a subset of farming systems research that is confined to the farmers’ crop production enterprise. With the objective to increase the benefits derived by crop production with the available physical, biological and socio-
economic resources, research was carried out since 1981 in Tamil Nadu Agricultural University, after the selection, description of sites or rainfall distribution, soil characteristics and irrigation sources and identification of land types. Farm types and existing crop-based farming systems were done for six taluks of Coimbatore district (western zone). Two blocks were selected from each taluk by random sampling and a minimum of twenty farm holdings for irrigated land types were randomly selected for assessment of resources. The major crop diversification in this region is cotton-sorghum (53%). About 40 per cent of the farmers sow sorghum as a component crop, to meet the fodder requirement of their livestock. Scarcity of labour (89%), non-adoption of improved technology (70%), financial difficulties (58%), brackish irrigation water (31%) and non-remunerative price for produce (13%) were the major constraints for adoption of high intensity cropping system. Taking into consideration these constraints, suitable improved crop pattern models and component technologies were developed by super-imposed on-farm trials.

Several high intensity crop sequences were evaluated for their production potential at the three Model Agronomic Experiment Centres (Thanjavur, Bhavanisagar and Karaiyarippur) in Tamil Nadu from 1973-1974 to 1984-1985. In the alluvial soils of Thajavur, rice-rice-groundnut system performed better in five out of eight years while rice-rice-green gram recorded the maximum grain yield in other years. At Bhavanisagar in a sandy loam soil, rice-rice-rice (where water is available throughout the year) recorded highest yields and per day productivity under wetland conditions and rice-sunflower-green gram system gave higher yield under garden land conditions. Under the medium black soils of Karaiyarippu (Tirunelveli district) ragi-rice-bhendi, maize-rice-bajra and groundnut-rice-ragi systems recorded the highest grain yield and per day production in that order.
Reflecting on the agricultural scene in Tamil Nadu from mid sixties, it is noted that the gross cropped area has gone up considerably any paddy and sugarcane under food crop group and groundnut under non-food crop group have emerged as the main beneficiaries of the increased area and irrigation. Also, irrigation bias in agricultural development as well as private investment on irrigation and the additional benefits thereof have been witnessed. But yet, the balance between food and food crops has not been tilted very much.

The fertilizer consumption has increased 5 fold between mid sixties and end of seventies and the share of cooperative credit have increased two fold during the same period.

But still, agricultural growth seems to be crop specific and localized as the green revolution period seem to have touched irrigated areas only. But, a dichotomy of irrigation based growth is visible in the sense that even among irrigated areas, irrigation through private investment (wells) and irrigation by public systems (tanks and canals) are to be identified.

While analyzing the changes in the relative area shares of crops and crop groups in the sample districts and villages it is found that no change in crop pattern is recorded in Thanjavur district either at the village level or at the district level; but at the village level area under pulses has shown appreciable improvement in its status.

While it is desirable to reduce (if possible) and restrict further expansion of paddy and work on yield improvements form the more or less stabilized area in irrigated belts, it is also to be considered seriously whether the existing paddy area could be diverted to other high value crops. This has become necessary in the wake of the setting non-remunerative in paddy even with easy availability and more or less
zero irrigation cost. The prices fixed by APC for procurement purposes have been found to be less and less attractive in the wake of rising costs of cultivation. This should act as a spur for diversification. But, in public canal and tank irrigated areas, diversification from paddy culture has not been noticed in appreciable measures. Hence, a hike in water rates would indirectly make the farmers scout for alternative and paying crops suitable to the area and also to consider increasing yields, so that cost price-profit balance are achieved.

The diversification tendency, away from paddy and towards commercial crops under private irrigation zones strengthens this policy measure, as also already identified response behaviour of the farmers to product prices both in Tamil Nadu and other states.

Major food crops of Tamil Nadu other than paddy are capable of coming up both under irrigated and rain fed situations. A good chunk or irrigated area, raising such food crops could very well be diverted to non-food crops, while the rain fed food crop area is retained and yields are pushed with low cost technology. Low cost technology need not be equated to ‘No technology’ but, could be tried with more vigour for higher yield-based production results.

The recent tendency of garden land owners opting for tree crops, especially coconuts either for high profitability of for cutting mounting labour costs has to be taken note of and wherever advisable, tree culture could be given a boost. But near barren, dry lands need to be tackled first for agro-forestry schemes with added incentives and the tendency to convert garden lands for raising tree crops must be viewed with caution.
Fruits, flowers and vegetables have a great potential in several districts of Tamil Nadu including Madurai district. But the concerned area in this horticultural production is one of ‘market trap, and organized, production-market hook up policy is a priority.

The two main commercial crops that need special attention are groundnut and cotton, both being raised under rain fed and irrigated conditions in the state without appreciable increased in yield rates. This calls for corrective measures in the area of effective technology transfer.

In recent years, major emphasis has been given in increasing the agricultural production per unit area and per unit time. In this context, changing pattern in crop schedules-some of them induced-towards multiple and diversified cropping assumes importance. Better and effective utilization of limited land and irrigation resources, generation of gainful employment in agricultural sector, the changes in consumption behaviour of agriculture and agro based products and prevalence of varying levels of agro industrial demand pulls have been the main theme of research carried out from time to time in different part of India to indicate the changing pattern of cropping.

The importance of analyzing shifts in cultivation with their factor influence across districts / locations with different irrigation base and the possibility of developing plans for typical or difference regions which would possibly help increase in the income of the cultivating communities and thereby of the state, through adoption of suitable crop schedules-area specific though have well been recognized by researchers and agricultural scientists.

The recent report of the National Commission of Agriculture calls for studies of the growth possibilities in various regions and has suggested a careful appraisal for
completely restructuring the crop diversifications on the basis of agro climatic and other considerations with a view to achieving optimum yield levels. It has also indicated the existence of considerable scope for improving the cropping system, especially in the irrigated areas by adopting advantageous crop rotations through mixed cropping, relay cropping and inter-cropping with forage crops in between. Specific mention is made that changes are warranted in irrigated cropping as well as rain fed cropping in several states. Based on the projected irrigated area and projected rice yield, it opines that 1.0 mha of rice area in Tamil Nadu, Andhra Pradesh and Karnataka may be reduced diverted to cotton, groundnut and maize.

This observation by the National Commission on Agriculture is a reflection of the disturbance to the cereals pulses mix and food-non crop balance as a result of the impact of new technology in recent time on crop pattern, over which attention is being drawn by agriculture-economist in several parts of India, for the IADP along with HYVP have tended to increase agricultural production through increased yields and crop intensities by multiple cropping practices, even through difficulties of permanently converting the single crop lands into multiple crop lands have not been completely overcome. It is worthwhile to state that in spite of the fact that the physical, natural is not difficult to identify the methods of which the limiting factors could be eliminated so that the crop diversification is more in consonance with technical and economic possibilities, through a careful today. Moreover, in the contest of changing crop diversification due to various factors and the changes that has induced a crop pattern on different counts the primary problem might be one of adjustment in agriculture, consequent to growth, more specifically confining to the green revolution which has also been supported by the ICSSR document.
The quantum of literature generated and documented on Green Revolution in India and Tamil Nadu is large and the main focus was on concern area such as plant breeding, introduction and absorption modalities of various varieties and also economic gains in terms of area, production and yield and also sectors.

The development decades in Tamil Nadu have witnessed considerable growth on the agricultural front. The dimensional and the directional thrust of the development process were on extension of cropped area and introduction of new technology in agriculture. The upshot of this “two pronged attack” on agriculture has certain built-in constraints like limited available land, coupled with suitable crop mix is to be evolved on the basis of the trend in crop pattern changes and the factors influencing and fixing such a trend.

The area extension approach for increasing the food and raw material supplies is loaded with inbuilt constraints in the Indian context, as the country has almost reached the limit of physical frontiers of cultivation. One of the propositions has been to devise strategies in increasing the production per unit time, which has been given due importance in the last two decades.

Meenakshi Malya\(^2\) (1962) identified the extent of urbanization as influencing crop diversification in South Arcot and North Arcot districts. Higher yields are being obtained with the introduction of new high yielding varieties and large scale use of fertilizers and pesticides and strengthening of institutions for credit, marketing, processing and extension. Even though great efforts have been taken, the achievements are not so, impressive as they should be. The further challenges in agricultural development therefore, depend on dynamic changes in crop
diversification which involves diversified and multiple cropping practices subject to acceptance of innovation by the farming community.

Minhas and Vaidhyanathan\textsuperscript{23} (1965) with their state-wise analysis placed Tamil Nadu in the second position next to Gujarat by the contribution of crop pattern changes to the growth of crop output. Even within Tamil Nadu different factors were responsible for the changes in the crop pattern of the different regions during different times. There have been attempts to study these aspects of crop pattern shifts from researchers.

Irrigation as a factor influencing the crop diversification of a region is well brought out by Krishnamurthy. By a study of the influence of Mettur irrigation and Hydro-electric project on agriculture and agro-industries he showed that the Cauvery Mettur Project has considerably increased the value of the yield of paddy per acre.

Viswanathan R.\textsuperscript{24} (1977) analyzing the multiple crop diversification in the wet lands of Mannargudi Block in Thanjavur District, has concluded that inadequate capital supply and insufficient drainage facilities have been impediments to the adoption of multiple cropping and derived optimum plans using the linear programming technique.

Sridharan B. and Radhakrishnan S.A.\textsuperscript{25} (1978) by a multi-state stratified random sampling technique, attempted to bring out the technical (climate, irrigation, soil and crop rotation), economic (prices, proximity to market, transport and communication) and institutional (farm-size, family and family labour) factors that affect the crop diversification in Tamil Nadu specifically in garden lands in Avinashi and Coimbatore district. And he concluded that of all the factors, rainfall, irrigations and family size are more influential in determining the crop diversification.
In general, the crop diversification in Tamil Nadu coincides with the basic features of crop pattern in India. Like all over India, there are a wide variety of crops, dominance of food crops over non-food crops, preponderance of cereals among food crops and importance is given to inferior cereals in Tamil Nadu. Of the total cropped area of 60.56 lakh hectares in 1982-1983, nearly 76 per cent was under food crops and the remaining 24 per cent under non-food crops as against the All India level of 80 per cent and 20 per cent respectively.

Kurien C.T.\textsuperscript{26} (1980) stated that in Tamil Nadu also there have been changes in crop pattern. While analyzing the economic changes in Tamil Nadu for the period between 1961-1971, he has observed that among the 93 taluks of the state, 26 have shown changes in crop diversification, 15 of them showing significant changes. It is also found that in four taluks, inferior cereals have been substituted with paddy, in one taluk paddy has been replaced by cash crops and in the remaining ten taluks changes have been observed in terms of relative intensification of major cereals. The changes have also been substantial to have magnificent effect on the growth process of Tamil Nadu.

2.7. REVIEW OF LITERATURE RELATED TO IMPORTANCE OF CROP DIVERSIFICATION IN NATIONAL / STATE / DISTRICT LEVEL

The crop diversification can be considered in the wider perspective of a combination of activities leading to diversification or specialization in agriculture. It is important both from the individual and national points of view. In the case of individual, it is the problem of deciding the combination of crops to be grown on limited land area with the available quantities of labour, capital and irrigation resources. In the latter case, it is the question of determining the crop diversification
to be encouraged for attaining the national objective of self-sufficiency in agricultural sector.

Crop diversification obtained in any particular agricultural area is generally the outcome of trials and adjustments in respect of farm practices. It is believed that Indian agriculture is tradition-bound. In almost all Five Year Plans, the target for agricultural growth was fixed at 4.0 to 4.5 per cent per annum.

Accelerating the present agricultural growth rate is becoming more difficult because the total cultivable area in the country is exhausted. It is no longer possible to increase agricultural production by increasing the area alone. In the total increase of agricultural output, area increases contributed nearly 65 per cent and productivity increase 35 per cent during 1950s. In 1960s the productivity increased and contributed 71.4 per cent and area increased to 28.6 per cent. The data available for the ‘Seventies’ also confirmed productivity as the main source of growth in Indian agriculture.

It is thus clear that, development of agricultural sector depends upon the increase in productivity. Various disaggregated spatial analyses show that there have been wide regional variations in agricultural productivity in India. Therefore, steps should be taken by the Government to identify the environmental, institutional and technological factors responsible for the regional disparities in India.

In this connection, Hayami and Ruttan point out that the ability of an economy to achieve rapid economic growth in agricultural productivity and output depends to a large extent on its ability to choose among the alternative paths available to it. More specifically, it must be economic on scarce resource and facilitate its substitution with other scarce resources.
In India, land being the limiting factor offering no scope for increasing agricultural productivity, it becomes necessary to design the method of agricultural practices by making use of available resources. There are many factors such as introduction of high-yielding varieties, increasing irrigational facilities, improving the supply of fertilizers and manures, providing better price and market facilities for agriculture responsible for the adoption of particular crop diversification in a region. Besides, the study neglects the role of other factors that influence crop diversification. In the present study, factors influencing crop diversification of Madurai district are studied both at micro-level and macro-level. A study of crop diversification should provide alternative plans for the farmer to maximize his production per unit area and per unit time. It is also true that no crop diversification will be good for all times to come. It will need change as and when new and improved varieties come. It will need change as and when new and improved varieties dome into vogue. The efficient crop diversification must ensure the greatest efficiency of land, irrigation water and other inputs. Therefore, the present study directs its attention to analyzing the factors responsible for the existing crop diversification in Madurai district during the period 1965-1966 to 1980-1981 and it also tries to draw optimum crop diversifications for different agro-climatic zones of Madurai district after analyzing the performance of agriculture in this area during 1981-1982.

2.8. REVIEW OF LITERATURE RELATED TO IRRIGATION AND CROP DIVERSIFICATION

Subramanyam Chetty V.27 (1985), analyses that the irrigation is the prerequisite for the adoption of new technology in agriculture and for rapid growth of agriculture sector. In a country like India, where agriculture is a perpetual gamble with the monsoons, irrigation acts as a protective and stabilizing factors as well as a
productive input. In fact, in certain large pockets of the country, it has proved to be a catalyst of improved agriculture, especially where cash crops are concerned. An investment in irrigation leads to multiple benefits, both at the micro and macro levels. At the micro level, irrigation enhances the income of the land by providing them with an assured source of income from an income generating asset and it helps them to build up capital gain. The value of wet land is many times more than that of dry land. Investment in irrigation leads to the conversion of dry land into wet land. At the macro level, it provides security against the failure of rainfall, prevents crop failure, enables the country to get higher per acre yield.

If water is adequate, crop diversification can be changed. Here Hemalatha Rao states that “tank irrigation has led to a marked change in the crop diversification. There has been shift from ragi to paddy”.

The National Commission on Agriculture stated about the crop diversification according to various conditions. “In the low rainfall areas, the dominating crops are mainly millets, Jowar and Bajra. Mixed cropping is very common. Pulses are grown mixed with cereals. These are only in Khariff season. The cropping in the heavy rainfall areas shows the dominance of paddy over tuber crops, plantation crops and some cereal crops like maize and ragi or other millets also appear in between. They are mainly mono crops. In the areas where irrigation facilities are there, multiple cropping is possible. It can be even to the extent of 3 to 4 crops. If water is plenty, i.e., almost the whole year or eight months in a year, i.e., two seasons or just for one season in either Khariff or rabi or common crops can be grown. Where irrigation is available perennially, it is possible to grow crops like sugarcane, fruit crops and some plantation crops which are perennial in nature and require irrigation throughout the year. Crops like cotton also vanished if potential irrigation is available. Here like
HYVS vegetable, flower, in one word to say that all commercial type of crops are grown.

Chandra D.S. and Singh G.N. (1987) the impact of increase in irrigation facilities on the yield of wheat and rice crops in the ten districts of the command area was highly significant. These two constituted major crop of Rabi and Khariff seasons, respectively. Results of crop diversification changes also go in favour of these two crops. But, at the same time reduction in the canal irrigation and rapid increase in the tube well irrigation show that all that has been achieved is not entirely due to the facilities made available by the command area project in these districts. About 65 per cent increase in the tube well irrigation during 1980-1981 over 1972-1973 indicates the other side of the picture. Hence, there is obvious need to increase canal irrigation. It was only about 2.1 per cent in 1980-1981 and needs to be increased to, at least, 50 per cent in the years to come.

Water is indispensable to agricultural production. The main physical requisite for the development of agriculture is water which must be timely available and adequate. Irrigation makes possible the growth of more than one crop where one is grown and one or more than one crop when none is possible. This additional land use aspect of irrigation results in larger production. Double and multiple cropping are of great significance where land is scarce and therefore not much can be expected in the direction of extensive cultivation. Thus, it was an established fact that, income of the farm facility families generally increase along with increase in the irrigation facilities, Y.K. Murthy has rightly pointed out; “irrigation is the basic factor to improve the income of the cultivators by helping them to alter their crop diversification.
An investigation on cropping systems under constraints of irrigation water was conducted to find out the appropriate cropping system for varying levels of irrigation water supply and to study the effect of cropping system on soil properties.

The results revealed the amount the cropping systems tried. Groundnut-rice-black gram gave a higher net monetary return of Rs.300/- besides saving 22 per cent irrigation water and increasing the facility status of the soil compared to the existing rice-rice-black gram system. For rice irrigation, 5 cm one day after the disappearance of pond water registered higher yield. For groundnut and sorghum irrigating at 0.70 IW / CPE ratios recorded higher yield. For summer black gram and gingili, three irrigations (irrigation at sowing, flowering and pod development stages) ware sufficient.

An experiment was conducted at Agricultural Research station, Bhavanisagar, during 1986-1987 to find out a suitable rice-based cropping system for efficient use of canal and well water. Rice was grown in rabi season (Aug-Dec) followed by groundnut, pearl millet, sorghum, sunflower, gingili during summer season (Jan-Apr). Three levels of irrigation, with one above and one below the level were tried. The results indicated that the system, rice-groundnut recorded the highest net income of Rs. 18,881/- per ha with a total water consumption of 2689 mm. This system has given the highest return of Rs. 844 per mm of water used.

One should consider the fact that the Green Revolution has registered itself to already areas in the sixties. Then, in the late sixties and early seventies also, the benefits of new technology in agriculture have been availed of mainly by certain specific crops or crop groups and also some districts endowed with irrigation potential in both surface and ground water. While the district with public canals and tanks
absorbed the new technology as ‘early birds’, the changes in crop pattern behaviour in those districts do show a different pattern from those of other districts, where private irrigation well, tube wells are included which have influenced the crop pattern through the introduced technology in agriculture.

While the gross cropped area jumped from 47.6 per cent of the total geographical area to 59.10 per cent between early sixties and end of seventies due mainly to increased tapping of irrigation potential mostly by minor irrigation works, at the state level the two main irrigated crops that came out significantly are paddy and sugarcane by area, production and yield. Under non-food crops, groundnut both under irrigated as well as rain fed conditions emerged through.

However, the influence of irrigation backed up by new technology in agriculture even though has not reached the rain fed crops in full measure, it is noted that even among irrigated districts with differential irrigation system, the changes have tended to be different.

Irrigation as a very influential variable has been identified by several studies. While the studies conducted by Saini and Singh have brought out the impact of improved irrigation facilities on crop pattern alone, those of Soni, Singh and Undaichand, Anand, Patil and Savale focus on the impact of irrigation upon crop intensity pattern also, with the increased irrigation facilities, the tendency of the farmers to grow more of cash crops and superior cereals at the expense of other food grain crops has been reported by the former set of studies, whereas the latter set of studies have reported that with the introduction and improvement in irrigation facilities, the crop intensity has increased through the practice of double and multiple cropping programmes.
There has been a close relationship between expansion of irrigation and increase in paddy acreage while in respect of coarse grains and inverse relationship has been noticeable. In the state, paddy has been the crop which has been mostly irrigated. The proportion of gross irrigated area under paddy to total area under paddy rose from 91.5 per cent in 1960-1961 to 92.0 per cent in 1970-1971 and 91.9 per cent in 1981-1982. The gross area irrigated under paddy increased consequently by 4.7 per cent between 1960-1961 and 1970-1971 and remained practically stationary between 1970-1971 and 1971-1982. In contrast to paddy, the percentage of irrigated area under coarse paddy, the percentage of irrigated area under coarse grains with the exception of cumbu has shown a decline.

2.9. REVIEW OF LITERATURE RELATED ON NEED FOR SUITABLE CROP DIVERSIFICATION

The study of economics of the crop diversification is assuming great significance in view of the greater emphasis on the balanced development of agriculture to meet the food, fodder, fibre, oilseeds and other requirements of the population. If the country has to be self-sufficient in major agricultural products, it is to be seen by the planner, and policy makers that lopsided development of certain crops resulting from their higher prices does not take place to the detriment of other crops which are not so profitable, but essential for agricultural economy of country. The crop diversification differs from country to country, state to state, district to district and even in the same district from village to village depending upon such physical and economic factors as temperature, rainfall, humidity, soil, prices, market situation etc., it calls for conducting regional studies in order to know the various crop diversifications prevalent in different regions to make adjustments in crops and crop combinations as they increase farmer’s profit.
In a developing economy the management of land in an efficient way is assuming greater importance to feed the increasing population and also to accelerate the growth of industrial sector.

The study of the prevailing crop diversification of a region helps to judge the efficient use of land. Subsistence economy is the core of the agricultural economy in the state in spite of different developmental measures undertaken during the course of the Five-Year plans.

With ever increasing population, the pressure on land is mounting fast. The land is a limited resource and therefore efficient and judicious use of the same has got to be made. In order words, we have to devise ways and means to realize better yield from the available land. This would call for better resource allocation by the concerned farmers. However, the decision of the farmers to allocate more resources would much depend on price-expectation and productivity of the concerned crop in relation to prices and productivity of substitute crops. The same holds good in case of hill farmers like those of Himachal Pradesh although they are still operating on subsistence level.

Knowledge about source of growth in agriculture and their relative importance in different parts with different agro-climatic conditions is desirable for effective planning at regional or state level. The growth rates as such offer no explanations for desperate performance of agriculture in different parts. 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 in agriculture sector.
2.10. REVIEW OF LITERATURE RELATE TO CONSTRAINTS ON RESOURCES

Yet another growing concern is that in Tamil Nadu, nearly 80 per cent of the surface water potential and about 90 per cent of the ground water potential has already been utilized. Again, the availability of land is inelastic as land resource is finite in nature. Therefore, the alternative to land as a production base is enhanced productivity.

Almost one-half of the agricultural land depends entirely on rainfall. Over the years, steps taken to improve the cultivation of millets have been inadequate. Horticultural development programmes have almost failed to receive necessary attention as the soil deficiency has not been corrected. Crop planning has to be based on requirement and soil suitability.

With increasing demand for vegetable-oil, pulses, fruits, vegetables and millets it has been a steep increase in prices. Within the existing resource constraints, the present need is to enhance production by improving the production technology to meet the growing demand. As a first step, the existing crop pattern should accommodate changes and similar change in the existing irrigation system for the fullest utilization of all agricultural lands and irrigation sources.

Reduction in fallows takes place as a result of land development and soil conservation measures, rationalization of crop rotation and fertilizers to restore soil fertility without keeping current or long fallows. Abolition of non-cultivation ownership and improvement in economic condition of the farmers or extension of credit facilities to enable them to make investment for developing fallows are other factors inducing ploughing up of fallows. Extends cultivation of cultivable waste,
miscellaneous tree crop land, etc., are made possible through land reclamation and land development measures and extension of irrigation.

Land development, irrigation and fertilizer use contribute not only towards increasing sown area, but towards introducing more rational and intensive crop diversification and improving yield-rates.

Giri R. ²⁹ (1966) Changes in crop diversification are effected in course of time due to changes in technology, price structure and other factors. This however requires very considerable period. The changes in crop diversification indicate special feature of decrease in area under dry cotton, which has been replaced by groundnut, irrigated cotton and grain crops. The recent change in prices from 1963-1964, more in favour of grain crops, would bring increased areas under crops like bajra, wheat and jowar.

The net returns per acre realized from the crops play an important role in bringing out changes in crop diversification. The net value of growth for current year therefore can be worked out in relation to any base year, when this type of data was available.

The largest increase in the net area sown has been contributed by the old fallow and cultivable waste land. It is revealing that even what is classed as barren and uncultivable land has been brought into use to the extent of 0.5 mha. These three land-use categories constitute the area which is not put to any use. The fall in this area and its utilization is an encouraging feature. But, increase in current fallow is a disturbing feature. There has also been sizable increase in the area of the land under on-agricultural uses as a result of construction of house, factories, irrigation works, etc., and to some extent, this increase has involved encroachment on arable land. At
this stage, an analysis of the changes in the land use pattern over the plan periods may be more revealing.

With the construction of houses, roads and railways, workshops and factories, dams and reservoirs, canals and waterways, etc., as a result of rising population, increasing urbanization, industrial growth and irrigational development, the land under non-agricultural uses increased at a sharp rate during the First Plan, at a less rapid rate during the Second Plan and at a slow rate during the Third Plan. So far as the increase in land under non-agricultural use involved encroachment on arable land, it limited the scope for extension of cultivation of pasture, etc.

Misra V.N. (1971) cited statistics to stress the point that the real problem in India is the low productivity of agriculture. Accordingly, he argues that the appropriate strategy for solving the problem of shortage of both food grains and non-food grains lies in raising their per-acre yield to the levels attained by some of the progressive and enterprising countries like Japan and the USA through

- The application of quality inputs such as increased irrigation, fertilizers, improved seeds and pesticides.
- Multiple cropping and other improved techniques and
- Less reliance on inter-crop diversions. And he rightly concludes that, in emphasizing the need for higher per acre productivity, greater stress should be laid on making agriculture a profitable business, so that the farmers may not only cover the production expenses and get a fair reward for his labour but also secure reasonably stable cash for his family.

With the advancement of crop production technology at various research institutes, double or triple cropping or even fewer crops have been made possible to
grow during a year under scientific management on the same piece of land in quite succession.

The success of multiple cropping depends on the assured irrigation, supply of required quantity of fertilizers, plant protection chemicals, good quality of disease free seeds, adequate supply of labour, implements and machines, managerial and technical skill, credit supply to the low income groups of farmers and regulated market for the farmers produce to the best advantage.

2.11. REVIEW OF LITERATURE RELATED TO THE DETERMINANTS OF CROP DIVERSIFICATION

There is no unique measure of crop diversification available from the existing research. In general, it shows that percentage of area under each crop to all crops put together. Variation over studies lies in the type of classification by seasons worthwhile for cropping decision analysis is open to question. For to a farmer confronted with the choice problem an ideal measure of crop diversification would be that with respect to a particular season. In order words, given a piece of land at a point of time, it would be interesting to see how he allocated it between different crops. But hardly any study gives importance to this aspect.

Some researchers probe into reasons behind the existing pattern or changes over a period of time. Each study highlights each different factor as the cause. Some of the important determinants of crop diversification are farm size, employment, irrigation, resource endowment at the micro level and price and Government policies at the macro level. These studies have either used descriptive measures or estimated functional relationships to determine the extent of influence of these factors. A few
studies try to examine land allocation applying the theory of farm household behaviour to a multi crop economy production and consumption decisions.

Changes in the consumption pattern determined by the level of income may also influence crop diversification changes. Expenditure elasticity of demand in rural and urban area calculated from the N.S.S 27th Round Consumer Expenditure Survey (1972-1973) indicates that while for lower income groups in rural and urban areas of the state, the expenditure elasticity for coarse grains is positive, that for high income groups both in rural and urban areas it is negative. This indicates that an award shift in real income of the lower income groups will push up the demand for coarse cereals in rural areas but up to a point. What has been noticeable is that while the consumption of superior cereals (rice and wheat) per person month in urban areas of the state has been higher than that in rural areas, the consumption of coarse cereals has been less, indicating a tendency between 1973-1974 and 1977-1978 while the consumption of coarse cereals especially jowar and bajra has gone up in rural areas, there has not been any perceptible change in urban consumption of these commodities. Thus, the income effect has reinforced the influence of other factors on the crop diversification.

Risks and uncertainties in the agricultural sector arise not only due to factors external to the farm economy but also due to those factors inherent in the economy itself. Such factors like price fluctuations influence a great deal in bringing area under cultivation particularly of each crop. Supply and demand in the market at a point of time determine the market prices irrespective of any consideration of the cost of cultivation. The parity between that harvest prices and the cost of cultivation is also the determining factor in extensive cultivation for any crop.
The massive shift in crop diversification was due to major consideration such as productivity, marketability, relative productivity and suitable improvement in yield rates, low profitability in the case of jowar, bajra and groundnut crops, comparatively lesser growth in yield rates profitability in the case of jowar, bajra and groundnut crops, comparatively lesser growth in yield rates profitability in the case of chillies and Virginia tobacco crops acted as push factors towards cotton cultivation. Marketing problem of Virginia tobacco was another factor. Suitability of the soil impressive growth in yield rates and comparatively higher gravitational pull act towards cotton cultivation.

Progressive commercialization and the dynamic aspect of agriculture among Gujarat farmers are found to have been responsible for a reduction in the percentage of land allotted to food crops with the consequent increase in high income yielding commercial crops like cotton and groundnut.

Further, Sapre, Singh and John are among those who have observed that the allocation decision of the farmers is determined by profit possibilities rather than by price alone.

The switch over in area from low value coarse grains to high value paddy is also to be explained by the higher profitability from growing the latter. This became particularly pronounced with the adoption of the seed-fertilizer technology from the middle sixties. Studies in the Economics of Farm Management in Coimbatore districts covering the period 1970-1971 to 1972-1973 estimate that even under irrigated conditions the average (1970-1972) net income per ha from cholam had been only Rs.692.1; from cumbu Rs.397.1; and that from ragi Rs.559.6 compared to the average net income from paddy of Rs.1,049.9. Thus the growing of paddy is about 152 per
cent more profitable than cholam; 264 per cent more profitable than cumbu 188 per cent more profitable than ragi. Since irrigation permits double and even triple cropping of paddy, the income differential in favour of paddy has been very pronounced indeed.

It is interesting to note that the change in the area under rice has not been significant in the traditionally rice growing states. The change was negative in Tamil Nadu, Orissa and marginally higher in West Bengal and Bihar. This may be an important reason why the share of rice in total farm income has also declined in these states, except in Tamil Nadu. Similarly, in the case of high income crops, such as, wheat in Punjab and Karnataka the percentage of area as well as the total farm income has gone up. No wonder with the shift in their crop diversifications, they have moved up in their ranking in terms of per hectare income during the second triennium.

Economic theory rests and takes as its starting point the assumption that each economic subject tries to maximize his individual gain, that profit motivation governs the behaviour of producers.

Tilak Raj Kapur and Kahlon A.S.\(^ {31} \) (1980) The relative profitability of crop enterprises has changes in recent years due to improvement in the use of new fertilizers, plant protection measures and evolution of new high-yielding varieties such as dwarf Mexican wheat PV-18 and Kalyan 227, hybrid maize, hybrid bajra and Napier grass, etc. As a result of all such technological and economic developments, the existing enterprise combinations have become less than the optimum. There was thus a need to evolve new crop diversifications based on relative profitability of enterprises and their production relationships.
Groundnut being the most profitable crop, its acreage was increased to its full land use capability classification, i.e., from 0.69 to 3 acres. Desi maize was largely replaced by hybrid maize because the latter was more profitable. Only a small extent of land under maize (0.75 acre) was kept for household consumption. The yield of maize was budgeted at 12 quintals against 20 quintals of hybrid maize. The area under American cotton was kept almost the same i.e., 0.50 acre because the former was more profitable. Fallowing activity was reduced and sugarcane acreage was increased from 1.12 to 1.5 acres. In the Rabi season, wheat after fallow activity and gram area were eliminated because this land could be but to better use. Wheat PV-18 was introduced in two acres because of its economic advantage. Sufficient irrigation was available from tube-well which necessitated intensive cropping plans for fuller utilization water resources and other farm resources.

2.12. REVIEW OF LITERATURE RELATED TO FACTORS FOR CHANGES IN CROP DIVERSIFICATION

Oommen M.A.\(^{32}\) (1963) Crop planning have taken into account the fodder and foodstuff needs of the dairy cattle and poultry farms, if these are envisaged in the command area. In fact, they ought to be built into the programme instead of leaving them to the free play of economic forces. It is hardly necessary to make out a case for augmenting the supply of protective foods (mild, meat and eggs) both for rural as well as urban population. It is in the interest of the farming community as well to develop them because they bring ready cash and make possible the use of crop residues which, otherwise, would go waste. The cattle and the poultry are also a source of organic manure. Adequate attention has to be paid to all these factors in laying down the crop pattern.
India has a diversified crop diversification with considerable variation from region to region. The existing crop diversification of a region may be the result of a number of factors such as the ecological adjustments of different crops to the particular regions, physical environments of consumption needs of the farmers and net returns from farming.

The crop pattern of Kerala differs from that of India in some significant respects. While some of the major all-India crops like wheat, barley, bajra, maize, jute, linseed, castor, mesta, indigo, etc., are not grown in the state, Kerala cultivates a variety of crops rarely found in the other parts of the country.

The data clearly shows the place of cash crops in the crop diversification of Kerala. The total area under food grains accounts for only 36 per cent of Kerala (tea, coffee and rubber) account for about 8 per cent of the gross cropped area as against 0.3 per cent for the country as a whole. As matter of fact Kerala enjoys near monopoly in regard to lemongrass, rubber and paper and is the single largest producer among the states in India of a large variety of crops such as coconut, cashew nut, cardamom, ginger, tapioca and banana.

The problem of crop pattern change cannot be isolated from the geographical facts concerning the distributional pattern of crops in India as well as from the functional pulses in the agricultural landscape. The crops that can be grown in an area depend upon a variety of factors particularly climate, soil and slope. The length of the growth season and the availability of moisture are the chief macro-factors operating on a regional basis while the site factors determine the details of the mosaic of agricultural landscape.
Ram Patil (1967) reveals that the crop pattern in newly irrigated areas is determined by the water requirements and the value of crop output. Water needs have to be assessed in designing the canal and distributing capacities and the extent of area to be irrigated. The value of output will help in cost / benefit analysis.

Besides these two, there are other factors which are also equally vital. Among them are; size of the holding, tenure system, profitability (or rate of return), risk element (which can be put in terms of probability), supply inputs and credit requirements, switchover problems involved in the change of crop pattern (that is, problems connected with rotation, cultural practices and pest control), marketing facilities and the existence of possibility of establishing industries. Special report (2010) focused that the 2010 wheat cropping season, out of 408,000 hectares of the total forecasted wheat planted area by the Ministry of Agriculture (MoA), 271,000 hectares were for the winter planting and 137,000 hectares for spring planting. The targeted seed requirement amounted to about 60,000 tonnes for winter and 30,000 tonnes for spring wheat (the MoA target assumes 100 per cent seed replacement by farmers and a high seed rate).

The production of seeds in the country supplied 98 per cent of the total winter wheat requirements and 99 per cent of the spring wheat requirements. Moreover, there was carry-over stocks of seeds that farmers could not marketed in the previous season due to the 2009 bumper crop and the fact the private seed farmers do no longer have agreements with the Government to procure certified seeds. Until 2009, the Government allocated funds for direct seed purchase to ensure provision of good quality seeds to farmers. In 2009 the Government allocated KGS 20-30 million, enough to procure approximately 2,000-3,000 tonnes of seed (equivalent to 3-5 per cent of the seed production), for redistribution on credit basis.
REFERENCES


ShriShyamNandan Sinha\textsuperscript{14}, “Economics of Cropping Pattern”, AICC Economic Review.


Narain D.\textsuperscript{16} (1988), Studies on Indian Agriculture, Oxford University Press.


Munish Alagh\textsuperscript{18} (2007), “Indian Agriculture – Growth and Change”,

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