CHAPTER II

SELECT REVIEW OF LITERATURE AND METHODOLOGY
INTRODUCTION

The strategy of economic and social development oriented towards creating more productive employment and achieving equitable income distribution must be concerned with the range of technological choice available in the production of goods and services demanded domestically and abroad\(^1\). According to a F.A.O. study growing pressures of population in rural areas, especially within the agricultural sector, would add to the number of landless and small holders, even if there would be no aggravation of inequalities. In countries like India, Bangladesh,

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Malaysia, Kenya, Iran and Mexico landless labourers and small farmers form the bulk of rural poor. It further said that there would likely to be an addition of 50 million households of small holders and landless in 90 developing countries and majority of the small holders would be near landless.

Most of the unemployment in the developing countries of Asia is in the countryside. With rapid decline in mortality rates and resulting population growth, the labour force in the rural areas has also been increasing rapidly. At the same time, there is little prospect, except in a few countries, that expansion of manufacturing industries and productive services will be high enough to absorb the growing labour force. Therefore, it is recognised that a large part of the additional employment opportunities needed has to be generated within agriculture itself at any rate in the next one or two decades. The so called Green Revolution technology in India has been associated with the growth and development of market and non-market forces.


which, in turn, influence the extent and nature of yield and employment opportunities in agriculture. It is held that the new technology with its resource bias in favour of large farmers increased production and job opportunities. On the contrary, some studies concluded that the employment opportunities had been reduced due to the new technology. Thus there is no consensus among researchers as to the exact impact of new technology on yield and employment.

In view of recent policy thrust on 'trickling down' effects of development and thereby attaching importance to growth with distributive justice, and rapidly growing unemployment problem, the literature on this subject is growing at a rapid pace. An attempt is made here to review select literature on yield and employment effects of new technology.

SELECT REVIEW OF LITERATURE

Johnston and Cownie in their paper on "The Seed Fertilizer Revolution and the Labour Force Absorption Problem", concluded that the spectacular success achieved by agricultural scientists and the world fertilizer industry had

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abruptly altered the dimensions of the world's food and population problems. Although still difficult, the problems posed by rapid growth of population and labour force in the underdeveloped countries now appear to be manageable. Over the next two or three decades, the improved production possibilities resulting from the seed-fertilizer revolution offer the hope of rapid and relatively low-cost increases in agricultural output. This can be achieved by an intensification of agricultural production which offers the possibility of absorbing a considerable fraction of the growing labour force into productive employment. However, it is significant for countries in which the transformation of the economic structure has been limited, and the farm labour force still bulking large in the total will continue to increase in absolute size for several decades at least. In the light of the sectoral interdependence between agriculture and advantages of a broad thrust, 'unimodal' approach to agricultural development, similar to the pattern pursued in Japan and Taiwan, appears to be very great for such countries. What remains unclear is the actual mix of policies needed to influence the pattern of agricultural development in the desired direction. Certain policy implications seem fairly evident: for example, confining government subsidies on farm inputs
to items that are essentially complementary to the abundant non-farm resources, and imposing import duties and taxes on inputs that are unduly labour displacing. Much needs to be done, however, in developing analytical techniques for qualifying such judgements.

The book "Consequences of Small Farm Mechanisation"\(^6\), published by the International Rice Research Institute and Agricultural Development Council, principally provides evidence that corroborates the conclusions that emerge from a critical examination of distributional implications of mechanisation in Asia. It is argued that if mechanisation increases food output, it would benefit all classes of consumers through lower foodgrain prices, while in the absence of output increases, and with labour displacement, there could be adverse distributional consequences.

While examining the adoption of biological-hydrological-chemical technology and its income and employment effect, Khan\(^7\) found that the benefits from the 'Green Revolution' have been unequally distributed between large and small farmers. Having studied the distributional effects of

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Green Revolution in progressive and backward areas he found that the benefits have been considerably greater in the progressive districts and disparity between small and large farms is greater in the more backward areas.

Dharam Ghai et al.⁸, in a study prepared for the ILO within the framework of the World Employment Programme, analysed the performance of different systems of agriculture. While judging the performance of any system, a number of common criteria - such as productive efficiency, provision of employment, an egalitarian distribution of income and generation of surplus to sustain its growth on the basis of self-reliance are considered. After examining three categories of agrarian systems viz., individual farming, collective farming and an intermediate category with the co-existence of collective and private ownership of land and means of production they arrived at the conclusion that the diffusion of new strategy seems to convince and satisfy the productivity criterion but fails to attain equity in the reaping of benefits of all sections of farming community under a system of private ownership thwarted by extreme inequality in land ownership, and thus can lead to increasing inequality.

Farm Management Studies (FMS) conducted at national level during the mid-fifties and late sixties indicate that inverse relationship between farm size and benefits existing under traditional labour intensive technology during fifties no longer held good in areas that had undergone technological change in the sixties. The FMS conducted by the Ministry of Agriculture provided a wealth of data to examine the efficiency of Indian agriculture. A number of conclusions were drawn from these studies by different writers. The important issue debated upon during the early sixties was the question of the relationship between farm size and yield per unit of land. Although the results varied in comparability and significance, on the whole, the statistical evidence indicated a negative relationship between these two variables.

One explanation offered for the nexus was the superior quality of land under smaller holdings. More fertile the land that provides greater opportunities for earning income faster the rate at which family size grows quickening the sub-division of more fertile land over time. But Khusro


observes that the fertility differential which accounted for the negative relation between the size and yield, now disappears.

Using the same Farm Management Survey data Khusro\textsuperscript{11} finds that there is virtually no evidence of this negative relationship when individual crops are considered. However, this does not necessarily contradict the above hypothesis on the prevailing cropping pattern which usually takes into account fertility differences in the soil. This study does not reflect the possibilities of non-farm employment of members of large-families. A more important explanation offered perhaps is the selectively much higher labour input in smaller holdings. It is also found that not only smaller farms apply more labour per unit of land they also cultivate it more intensively in terms of other inputs.

The emergence of capital-intensive technology, in Saini's\textsuperscript{12} view, seems to have shifted the advantage of productivity per acre, hitherto enjoyed by small farmers, in favour of the big farmers. In his study he attributes this to the unlimited and relatively easy access to capital on the part of large farmers who also can make more rational

\textsuperscript{11} Khusro, A.M., The Economics of Land Reforms and Farm Size in India, Institute of Economic Growth, Delhi, 1969.

\textsuperscript{12} Saini, G.R., Green Revolution and the Distribution of Farm Incomes, Economic and Political Weekly, March 27, 1976.
use of it due to favourable farm size. Again, the greater risk bearing capacity of the big farmers puts them in a more advantageous position to exploit the new opportunities. He concludes that compared with smaller farmers, the big farmers stand to gain more from new technology.

A large volume of literature is available to show that biochemical technology increases both output and employment and that mechanical innovations increase output, though not necessarily employment. The employment effect of the latter can be both positive and negative, depending on whether mechanical methods enhance the resource base of agricultural economy or just raise the efficiency of agricultural operations, such as tilling, harvesting and threshing. On the positive side, multiple cropping made possible by gaining time at peak seasons, has come in for special mention. On the negative side, its direct displacement of manual and bullock power has been a major concern.\textsuperscript{13}

Binswanger\textsuperscript{14} maintains that there is still some controversy about the impact of tractors on yield and cropping intensity through deeper ploughing and ploughing of harder soil prior to the advent of wet season which enhances water


\textsuperscript{14} Binswanger, H.P., \textit{The Economics of Tractors in South Asia - Analytical Review}, Agricultural Development Council, New York and ICRISAT, Hyderabad, India.
retention capacity by breaking the time bottle-neck. With regard to labour use he concludes that the use of tractor is associated with neither increase nor decrease in labour use per hectare, although evidence may slightly favour a decreasing effect. That in all cases where there is a substantial increase in labour use by tractor farms, tractor use is associated with shifts in cropping pattern or irrigation.

Kahlon, in a study of Punjab, using regression results concludes that tractor leads to a shift in production function through cropping intensity and increases labour use particularly hired labour. Roy and Balse in their study of Punjab also arrived at the same conclusion.

Hanumantha Rao using aggregate data for 265 districts to analyse the impact of HYV technology on employment, pointed out that lack of positive association between fertilizer use and number of agricultural workers per acre is an indication that the use of fertilizers and irrigation are labour saving. He argues that technological displacement of labour

consequent on the use of tractors was roughly compensated by positive employment effects of the changes in cropping pattern and intensity associated with tractor use. However, this assumes that the cropping intensity and the use of HYV seeds are essentially dependent on tractorage which is not likely to be the case. The relationship between the various technology inputs such as seeds, fertilizers, labour and employment is a dynamic one and encompasses socio-economic as well as technical links between inputs and outputs.

Patel 18 based on benchmark survey data collected from 2,400 households from the 24 project areas under study analysed the likely impact of irrigation on employment in the proposed command areas of 14 medium-term irrigation projects in Gujarat. He attributed 31.78 per cent of the additional labour days per hectare to irrigation operation itself and the remaining 68.22 per cent to other changes brought about by irrigation like larger use of fertilizers, changes in cropping pattern and the resultant higher yield per acre. However, Patel's estimates of employment are specific to the impact of well irrigation and not to that of medium irrigation projects. It is well recognised that

well irrigation is more controllable, especially when mecha-
nised, and has more positive effects on cropping intensity.

Bardhan\textsuperscript{19} opines that the nexus between the inputs such
as seeds and fertilizers and labour employment is a dynamic
one and encompasses socio-economic as well as technical links
between inputs and output. He also states that an overall
inverse association at the macro-level between per acre
intensity of irrigation and fertilizer use on the one hand
and labour input on the other, however, is not a conclusive
indication of a negative impact of HYV technology on employ-
ment.

Chadha and Sharma\textsuperscript{20}, using district-wise agricultural
data for 1970-71, have confirmed the inverse relationship
for all regions except Kerala. In the Green Revolution
regions of Punjab, Haryana and Western Uttar Pradesh also
this relationship exists, which implies that the new tech-
ology has not led to a reversal in this relationship.

Despite the fact that larger farms have better quality of
irrigation, cropping intensity is higher in smaller farms.

\textsuperscript{19} Bardhan, K., "Rural Employment, Wages and Labour Market
in India, A Survey of Research", Economic and Political

\textsuperscript{20} Chadha, G.K., and R.K. Sharma, "Farm Size, Irrigation
and Intensity of Land Use in Indian Agriculture", Artha
This is due, the authors argue to the assured and flexible all-time supply of family labour in smaller forms.

Using Farm Management Studies data (1956-57 and 1969-70) Agricultural Census (1970-71) data for different agro-climatic zones within Punjab, Chadha comes to the similar conclusions. His family supply argument is substantiated as irrigation and farm size are not found to be inversely related and even cropping pattern is found to be uniform across farm sizes. He, however, noticed that the inverse relationship has disappeared for farm size and output per acre of gross cropped area and it is disappearing in the farm size-net area sown version also in those regions where capital-labour ratios in large farms have increased. Thus the cropping intensity (through labour availability) advantage for small farms is disappearing.

Dasgupta and others using the data of Agro-Economic Research Centres (AERC) found that while total amount of labour time demanded has usually shown an increase in the Green Revolution areas, the overall participation rate, especially for intermittent workers, had declined. In particular, harvesting and transplanting, which traditionally employed a large number of women, children and old


aged (intermittent workers) were being handled increasingly by migrant contract workers. Thus while the volume of work has increased under the new technology, a smaller number of labourers are being employed for longer hours to undertake it. While studying the dynamic nature of the relationship between technology and employment, Dasgupta in another study indicated that the spread of HYV seeds has led to an increased dependence of the farmer for supply of inputs and for the sale of output which in turn affects the extent and nature of labour size in agriculture.

Using agricultural census data (1970-71) Parthasarathy found an inverse relation between farm size on the one hand and cropping intensity and land utilization on the other for Mahbubnagar and West Godavari districts of Andhra Pradesh. This inverse relation and high value cropping in small farms is somewhat modified by technical factors like irrigation.

Oberai and Ahmed using survey data from Ludhiana of Punjab bring out that labour intensity is positively associated with improved farm practices like row sowing and seed

treatment. There is no evidence regarding the overall long-run effects of mechanisation on farm employment. It is argued that the new technology is essentially bullock displacing rather than labour displacing. It is observed that the total labour use has been negatively associated with tractor use and several mechanisation packages have been significant only in the case of tractor with cultivator package.

Agarwal using the primary data of cost of cultivation of 272 farms compares tractor using and bullock using farms. It is argued that tractor use significantly reduced labour time requirements, though their effect on the number of workers employed is small. In another study Agarwal argues that decrease in casual labour time, however, would usually mean displacement of labourers affecting directly their earnings.

The Planning Commission using the data of the 27th Round of the NSS (only first two sub-rounds were considered) examined the employment generation effects of irrigation through pumpsets. It is found that fertilizer application


per hectare, was positively related to employment per hectare only in the developed regions, in which output per hectare, irrigated area as a percentage of total cropped area and fertilizer application were high.

Hartsch has analysed the employment implications of new technology under different techniques - traditional, intermediate and mechanical. He concluded that a shift from traditional to mechanised techniques, with technology unchanged, is usually labour displacing per unit of cultivated area since any increase in cropping intensity associated with a change to mechanical techniques usually results in reduction in labour input per cropped area. Thus both 'intermediate' and 'mechanised' techniques are found to be labour-saving. But when such mechanisation is associated with HYV technology there is no substantial evidence on change in employment, in terms of labour input per unit of cultivated area, with changing techniques.

Billings and Singh in their study of Punjab, show a 3 per cent fall in employment per cultivated hectare because of changing technology and techniques. In an


other study they found that with a change from traditional technology and techniques to HYV technology and the progressive introduction of mechanical innovations, the total worker-days for crop production fall by 5.5 percent. Thus the employment effects of alternative technologies and techniques in terms of unit of output are the most unequivocal; any innovation, whether biological, chemical or mechanical, reduces worker-hours of labour input per unit of output, the most drastic reduction being for mechanical innovation.

Ishikawa opines that the intensity of human labour use in agriculture is much higher in some parts of Asia compared with others and within India also wide variations in input and labour use exist across regions. Using the Farm Economic Survey Data for West Bengal and Madras in India in 1956-57 and for Japan (excluding Hokkaido) relating to 1961, he found that per hectare labour input in rice production in Madras was nearly twice as high as in West Bengal, although yield differentials were not large.


Lakdawala too recognized that there are significant variations in the intensity of human labour-use between crops, regions and farms of different sizes.

NCAER, in a study on tractorisation based on a survey conducted during 1977-78 covering seven states of India, held that the role of bio-chemical technology and processes in agriculture is more fundamental than that of mechanisation. The yield and output effects of mechanisation can be meaningfully measured and tested only when it is construed as a land-saving device through deep ploughing, removal of weeds and timeliness of operations. On the other hand, the impact of mechanisation as a labour substituting device can be meaningfully analysed only through a comparison of marginal product of energy unit of machine and alternate source which in the case of agriculture is drought power and their relative cost. According to this study the energy constraint and its cost implications in the case of time-bound operations influence the pace of mechanisation in agriculture.


Bardhan's regression analysis of specific operations for a single crop paddy in Hooghly district of West Bengal shows that the labour input in harvesting per acre of paddy area has been positively associated with the production of paddy area under irrigation and the proportion of paddy area under improved high yielding varieties.

Recognizing the basic distinction between bio-chemical and agro-mechanical components of agricultural technology, Vaidyanathan stratified production factors into bio-chemical and energy inputs. Bio-chemical inputs (quality of soil, availability of moisture, fertilizer, genetic potential of seeds, etc.) are treated as prime determinants of yield while the energy inputs are considered to be secondary determinants of yield.

Bharadwaj questioned the authenticity of this distinction on the ground that labour use in land improvements can


directly affect yield and that this distinction assumes the role of institutions in determining the extent and type of labour.

Parikh\textsuperscript{38} opined that irrigation increases employment per acre even without corresponding improvement in fertilizer technology. Mehra\textsuperscript{39} held that like irrigation the seed-fertilizer technology also increases the cropping intensity and even more importantly by ways of changes in the cropping pattern in the form of more labour-intensive crop. But since its spread was accompanied by mechanisation, the substitution of capital for labour has led to a reduction rather than an increase in the labour input per hectare on individual crops.

In a study of erstwhile North Arcot district of Tamilnadu Chinnappa and Silva\textsuperscript{40} showed that the use of HYVs paddy led to an increase in the total demand for labour, mainly in respect of peak period operations like harvesting and threshing.

\textsuperscript{38} Parikh, A., "Impact of Technical Change on Employment in Indian Agriculture", Economic Discussion Papers, 1986, University of East Anglia, No. 58.

\textsuperscript{39} Mehra, S., "Some Aspects of Labour Use in Indian Agriculture", Indian Journal of Agricultural Economics, 1976, Vol. XXXI, No. 4.

The studies reviewed above have analysed the yield and employment effects of new technology at international, national and regional levels by the individual researchers, institutions and government. The conclusions arrived at by these studies not only differ from one another but they are also contradictory and there is no consensus among writers as to the impact of new agricultural technology on yield and employment. This is primarily due to varied agro-climatic and socio-economic conditions in different regions. Area-specific studies, which assume significance in the implementation of agricultural programmes, are comparatively limited in number. A careful investigation at micro-level is therefore necessary to take a correct stand in regard to the effects of HYV technology on yield and employment and the relationship between farm size and yield/employment. The present study is an attempt in this direction.

OBJECTIVES

The objectives of this study are:

i) to analyse the yield rates under local and HYV technologies;

ii) to study the structure and magnitude of employment under traditional and HYV technologies; and

iii) to examine the farm size-yield and size-employment relations under local and HYV technologies.
HYPOTHESES

Keeping these objectives in view the following hypotheses have been tested.

i) there is no significant difference between traditional and HYV technologies in respect of yield rates.

ii) the difference between traditional and modern technologies in the case of total employment and also in respect of structure of employment is not significant.

iii) there is no significant change in the size-benefits relations in respect of yield and employment under local and HYV technologies.

SOURCES OF DATA

The study makes use of both secondary and primary data for analysis, drawing inferences and arriving at conclusions. The major sources of secondary data include the publications of Food and Agricultural Organisation of the United Nations, the publications of Government of India, the Reserve Bank of India and the National Institute of Rural Development, Statistical Abstracts of Andhra Pradesh and Season and Crop Reports published by the Bureau of Economics and Statistics, Government of Andhra Pradesh, publications such as Hand Book of Statistics published by Chief Planning Officer, Chittoor and
District Credit Plans published by Indian Bank, the Lead Bank of the district and published and unpublished research works of individuals and institutions.

However, the present study is mainly based on primary data collected by way of field study. Schedules specially designed for the study, after pre-testing, are canvassed through personal interview. The primary data have been collected from sample farmers in selected villages during the year 1989-90 in Chittoor district of Andhra Pradesh.

SAMPLE DESIGN

For the collection of primary data, multi-stage sampling frame is used. All the sixty six mandals in Chittoor district have been divided into three divisions on the basis of percentage of irrigated area to total cultivated area (with above 50 per cent, between 25-50 per cent and below 25 per cent of irrigated area) since irrigation is indispensable for the adoption of HYV technology. Two mandals from each division have been selected at random and from each mandal one village has been selected. Lists of farmers with landholding particulars are prepared for the selected villages and the farmers are arranged in an ascending order on the basis of landholdings. The farmers in the lists are stratified into five groups on the basis of their landholdings.
(0-1 hectares, 1-2 hectares, 2-3 hectares, 3-4 hectares and 4 hectares and above). From each stratum, 10 per cent of the farmers (255 in total) are selected at random as ultimate units of the study. The structure of the selected holdings is given in Table 2.1.
<table>
<thead>
<tr>
<th>Divisions</th>
<th>Mandal</th>
<th>Village</th>
<th>Number of Farms</th>
<th>Cultivated Area(hects)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>In the village</td>
<td>In the Sample</td>
</tr>
<tr>
<td>I</td>
<td>Thavanampalle</td>
<td>Karakampalle</td>
<td>432</td>
<td>43</td>
</tr>
<tr>
<td>I</td>
<td>Irala</td>
<td>Gundlapalle</td>
<td>495</td>
<td>50</td>
</tr>
<tr>
<td>II</td>
<td>Karvetnagar</td>
<td>R.K.V.V. Pet</td>
<td>584</td>
<td>58</td>
</tr>
<tr>
<td>II</td>
<td>Tirupati</td>
<td>Mallavaram</td>
<td>292</td>
<td>29</td>
</tr>
<tr>
<td>II</td>
<td>Rural</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Thottambedu</td>
<td>Peddakarabhanti</td>
<td>340</td>
<td>34</td>
</tr>
<tr>
<td>III</td>
<td>Srikalahasti</td>
<td>Thondamanadu</td>
<td>505</td>
<td>51</td>
</tr>
</tbody>
</table>

Source: Village Paper from Mandal Officers concerned.
TOOLS OF ANALYSIS

Besides simple averages and percentages, co-efficient of variation has been used to study the degree of variation in rainfall in Chittoor district, Rayalaseema and Andhra Pradesh.

Linear growth rates have been computed to study the long-run trend in the growth of area, yield and production of food grains, rice and wheat at all-India level and the growth of area, yield and production of rice/groundnut in Andhra Pradesh and Chittoor district using the following trend equation:

\[ y = a + bx \]

where, \( y \) = Index numbers of area/production/yield

\( x \) = Time

\( a \) and \( b \) are constants

For testing the significance of linear growth rate, \( t \)-test of the following form is employed.

\[ t = bx(n-2) \frac{ \left( \Sigma (x_i - \bar{x})^2 \right)^{1/2} }{ \left( \Sigma (y_1 - y)^2 \right)^{1/2} } \]

where, \( b = \frac{ \Sigma (x_i - \bar{x})(y_i - \bar{y}) }{ (x_i - \bar{x})^2 } \)

and \( (y_1 - y)^2 = \Sigma (y_1 - y)^2 - b^2 \Sigma (x_i - x)^2 \)
To study the relation between farm size and the area under local and high yielding varieties in the sample villages, between the farm size and labour input per hectare of paddy crop and groundnut under traditional and HYV technologies, and between farm size and labour requirement per quintal of paddy/groundnut under traditional and high yielding varieties, the following functional relation has been fitted:

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

where, $y$ = Irrigated area/labour input per hectare/ labour input per quintal of paddy/groundnut

$x$ = Average farm size

$a$ and $\alpha$ are constants

The method of least squares has been used in estimating the parameters. The 'F' test has been carried out to test the level of significance.

In order to test the significance of the difference between means of the average yield/employment (total operations) of high yielding varieties and local varieties of paddy and also the difference between the means of the average yield/employment (total operations) of groundnut of sample households, 't' test of the following farm has been employed.
where, \( \bar{x}_1 = \) Mean of the yield of local varieties of paddy/groundnut

\( \bar{x}_2 = \) Mean of the yield of high yielding varieties of paddy/groundnut

\( S = \) Combined standard deviation

\( n_1 = \) Number of observations in respect of local varieties of paddy/groundnut

\( n_2 = \) Number of observations in respect of high yielding varieties of paddy/groundnut

The resource use, productivity, employment requirements of farms belonging to different size groups under local and high yielding variety technologies in Chittoor district is examined by using Cobb-Douglas production function. In the functional analysis, the gross crop income per hectare, which would reflect the crop productivity and total labour requirement were taken as the dependent variables. Variables like value of fertilizers and pesticides and value of seeds used were taken as explanatory variables influencing the gross crop income, yield and employment. The postulated production function relationship in agriculture is reflected in the algebraic form

\[
y = a + \sum_{i=1}^{n} b_i x_i + e
\]
This function was transformed into the logarithmic form so that it could be solved by the method of least squares and it is stated as

$$\log y = \log a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 \ldots + b_n \log x_n + \epsilon$$

where, $y$ = gross income of local/high yielding varieties of paddy and groundnut

$a$ = the constant term

$x_1$ = size of land holding

$x_2$ = value of seeds (Rs.)

$x_3$ = value of fertilizers and pesticides (Rs.)

$x_4$ = human labour employed in man hours (total operations)

$x_5$ = percentage of irrigated area to total paddy/groundnut area

$x_6$ = proportion of HYV area to total paddy/groundnut cropped area

$b_1$, $b_2$, $b_3$, $b_4$, $b_5$ and $b_6$ are partial regression co-efficients for the respective variables

$\epsilon$ = error or disturbance term

**DEFINITION OF CONCEPTS**

The following concepts are used in this study:

1) **Traditional Technology**

   Traditional technology is a technology which is associated with local varieties of seeds.
2) **New Agricultural Technology**

New agricultural technology is a technology associated with the use of high pay-off inputs, such as, high yielding variety seeds, chemical fertilizers and pesticides, along with effective water management.

3) **Farm Size**

Regarding farm size, operational holding was used in the present study. Operational holding is defined as land owned plus land leased-in minus land leased-out (land owned + land leased-in — land leased-out).

Farmers are divided into five groups on the basis of operational holdings, namely, those operating up to 1 hectare, between 1 and 2 hectares, between 2 and 3 hectares, between 3 and 4 hectares and 4 hectares and above. For the purpose of comparison, those owning up to 2 hectares were designated as small farmers, between 2 and 4 hectares as medium farmers and 4 hectares and above as large farmers.

3) **Intensity of Cropping**

Intensity of cropping is the percentage of cropped area to cultivated area.

5) **Labour Hours**

Labour hours are computed by taking 1 man-day = 8 work hours.
LIMITATIONS

This is a micro level study confined to Chittoor district of Andhra Pradesh and therefore conclusions drawn are area-specific. The reference period for the study is two consecutive seasons of cropping (kharif and rabi) during 1989-90. The analysis relates to paddy and groundnut, the important food and commercial crops of the district.

Further, year to year variations in output, particularly in agriculture are common. Apart from the vagaries of nature, the character of agriculture is determined by the changing price structure, which greatly influences production decisions on farms in the short-run and this is another limitation of the study. As the study is limited to single year cross-sectional analysis is carried out.

As the primary data is obtained by survey method and as the farmers in the study area do not have the practice of maintenance of accounts, they had to recollect the information from memory. As such the data collected could only be an approximation to actual facts and figures.

In spite of these limitations, the study does throw some light on certain broad features of Chittoor agriculture and is useful in the policy formulations and preparation of schemes for agricultural development at the district level.
The thesis is organised into seven chapters.

The first chapter, which deals with the strategies of agricultural development, the origin and spread of new agricultural technology and its yield and employment effects, provides the background for the study.

A select review of literature and methodology of the study are presented in chapter two.

In chapter three agricultural profile of Chittoor district is given.

Chapter four, besides providing profile of the selected mandals and villages, examines the resource use and productivity of various inputs under traditional and modern technologies of paddy and groundnut.

Employment effects of the new agricultural technology in the area under study are analysed in chapter V.

In chapter six, size-benefits relation pertaining to yield and employment under local and HYV technology of paddy and groundnut are discussed.

Summary of findings and conclusions are presented in the final chapter.