CHAPTER – II
REVIEW OF LITERATURE

Review of literature is an essential part of any investigation as it not only gives an idea of the work completed in the past, but also provides the basis for interpretation and discussion of the findings. The present study was intended to know the extent of knowledge, impact of technological intervention including adoption of farm mechanization practices by Paddy, Ragi and Sugarcane growers. Considerable efforts are made to review the available literature as having a direct or indirect bearing on present study. For the sake of convenience, the available related reviews are presented under the following headings.

2.1 Cropping pattern and Land use pattern
2.2 Socio-Economic status
2.3 Technology adopted in Major Agricultural crops
2.4 Conclusion

2.1 CROPPING PATTERNS AND LAND USE PATTERN

Pandey and Tewari (1987) studied the ecological implications of land use dynamics in Uttar Pradesh. The study revealed that there was a consistent increase in fallow lands in all the regions, despite about a steady net cultivated area. The cultivable waste was also declining consistently, except in the hills. These change pointed towards the operation of the vicious circle in land use dynamics in the agricultural sector.

Chahal and Chahal (1989) studied the economics of irrigated crops in Punjab and proposed that the variable costs per hectare is highest for paddy, followed by maize, sugarcane, wheat, cotton and groundnut. Among the crop combinations, the annual returns to fixed farm resources were highest for sugarcane, followed by paddy-wheat, cotton-wheat, groundnut-wheat and maize-wheat. The returns to fixed farm resources per unit of irrigation were the lowest for paddy-wheat combination, follow by cotton-wheat, sugarcane and maize-wheat. They concluded that cotton and groundnut should be encouraged in their respective farming areas, as their returns per unit of irrigation were higher than sugar cane.

A study was conducted by Singh (1990) to understand the inter-regional disparities in the pattern of land utilization in Uttar Pradesh. The study revealed that the hill region had the highest area under forest, permanent pastures, grazing land, tree crops and groves, non-cultivable wastelands and land under non-agricultural uses. The
area sown more than once and the total cropped area, as well as the intensity of cropping had been found to be the highest in the eastern region and the lowest in the hill region. He concluded that the slopes of the hilly areas of UP could be successfully developed for the plantation of temperate fruits.

Sharma (1990) attempted to study interstate disparities in growth of agriculture in India from 1966-67 to 1987-88. It was observed that four states viz, Punjab, Haryana, Uttar Pradesh and Maharashtra experienced a growth rate of food grain production, higher than the national average of 2.72 per cent per annum. He suggested that throughw disparities in growth performance of agriculture in India can be minimized by bringing the farmer in the ambit of efficient extension education and training activities, sound government policies and efficient supply network of various inputs.

Krishnan et al (1991) studied the growth and instability of agriculture in Kerala and observed a shift in the cropping pattern. The cropping pattern shifted in good turn of plantation and commercial crops. They concluded that though this shift in cropping pattern is a welcome shift in terms of the theories of economic development, it is at the cost of making the state deficient in rice, the staple crop of the state.

Shrivastava et al (1991) studied the dynamics of land use and cropping system in the Tawa Command Area of Hoshangabad district of Madhya Pradesh. They assess the impact of the Tawa irrigation project on cropping pattern and land use in the area during the pre-project period (1973-71 to 1974-75) and the post project period (1975-76 to 1979-80). They observed a turn down in the forestland as a result of illegal felling of trees for domestic purposes. They also report that fallow land had increased since the foreword of the Tawa irrigation project.

Singh and Kaur (1991) studied the changing pattern of land utilization in Punjab since the inception of new farm technology in the mid sixties i.e. from 1966-67 to 1987-88. The study revealed that the reported area for land utilization remained constant while the area under forests, area not available for cultivation and net area sown increased through the period. Due to the intensification of agriculture, gross cropped area and cropping intensity increased. He concluded that Punjab agriculture had recorded drastic structural changes since the start of the green revolution.

Vaidy and Sikka (1991) studied the land utilization pattern in Himachal Pradesh using secondary data for the period from 1966-67 to 1986-87. They observed that there had been no uniform trend in the change in the land use classes. The area
under forest showed an increasing trend while that on other category shown declining trend.

Singh and Mohammed (1992) made an attempt to study the dynamics of cropping pattern in northern India. The study reveals that the total cropped area and area under cereals and vegetables had increased while it has decreased in the case of millets and cash crops. As far as the special organization of land use is concerned and despite the continuation economy prevalent in the area, the predictions of Van-Thunen’s theory would appear to be supported by the facts.

Behura and Naik (1994) studied the change in the cropping pattern for the period from 1966-67 to 1990-1991 in Orissa. The consequences revealed that the area under rice, which is the most important crop of the district, declined from 58 per cent of the gross cropped area in 1966-67 to 38 per cent of the gross cropped area in 1990-1991. They observed that the decrease in area under rice was mainly due to substitution of paddy-by other crops.

Lal and Singh (1994) deliberate the structural changes in Haryana agriculture. The study revealed shift in the cropping pattern and value shares in favor of paddy and wheat primarily grown in relatively better resource endowed area. This resulted in an imposing growth in the production of these two superior cereals where as the coarse cereals were bypassing the growth process. They felt that more notice should be given towards yield improvement in non-food grain crops so that the balance could be maintained in the food grain basket of the state.

Shivakumar (1994) reported that in Karnataka, there was a statewide shift from food based agriculture to horticulture, sericulture, dry land crops, forestry and the like. The area under food crops declined from 75.76 lakh ha in 1989-90 to 72.91 lakh ha in 1991-92 and the area under oilseeds greater than before from 22.65 lakh ha in 1989-99 to 29.09 lakh hectares in 1991-92, but it fell marginally to 27.81 lakh hectares in 1992-93.

Vivekananda and Satyapriya (1994) in their effort to study the Karnataka’s changing cropping pattern reported that the share of area under all cereal crops declined from 55 per cent to 47 per cent between 1956–1957 and 1989–90; the decline is a great deal sharper during the eighties. The decline is under jowar, bajra and wheat with an increase in the share of area under rice and ragi among the cereal crops. Maize, a new applicant in the cropping pattern of the state.
Mishra (1994) studied the changing profile of agriculture in Orissa and report the change in cropping pattern for the period from 1950-51 to 1990-1991. They observed that there was a gradual increase in the amount of the net area sown at the cost of land under categories such as area not available for cultivation, other uncultivated land without fallow and fallow land. They reported that there was a gradual fall in the share of area under rice and other cereals which has been diverted for production of pulses and oilseeds, the quantity of which has consistently increased.

Nagabhushan (1994) deliberate the dynamics of land use in Dharwad district of Karnataka for a period of 21 years from 1970 to 1991. He employed cluster analysis and compound growth rate for the analysis and the study revealed that the growth rates of area under forests, land put to non-agricultural uses, current fallow, net area sown, total cropped area and area sown more that once were important and positive. The growth rates of remaining land use categories were significant and negative.

A study was conducted by Padmanaban and Chinnadurai (1994) to study the land use pattern in Tamil Nadu for the period 1960-61 to 1988-89. They reported that the total cropped area in Tamil Nadu had declined from 7.32 m. Ha to 6.44 m. Ha during the period and the area sown more than once had declined from 1.32 m. Ha to 0.90 m. Ha during the same period. Over the years, the total cropped area had been consistently declining, at the same time the area under current fallow, other fallow lands under non-agricultural use had been increasing year after year.

Damayanthi (1995) carried out a study to understand the changes in cropping pattern in the Pookod village in Trichur district of Kerala. They reported that most of the households surveyed had either sold their paddy fields or the fields were lying idle for years together. In many cases, the paddy fields were rehabilitated to or were under conversion to garden lands. The tendency of paddy land conversion along with increased demand for housing sites was attributed as the causative factors for the declining availability of land for agricultural purposes and thus reducing the share of agriculture in providing employment of rural population.

Majid Husan (1996) in his book proposed that cropping pattern means the “proportion of area under various crops at a point of time”. He found that the cropping patterns of a region are closely influenced by the geo climatic, socio cultural, economic, historical and political factors.
Managoli (1997) studied the land use dimensions in Bijapur district for a period of 21 years from 1971-72 to 1992-93. The study revealed that there was no change in the forest cover in almost all the taluks of Bijapur district. The growth rate for area sown more than once and land put to non-agricultural use were positive and significant in almost all the taluks studied. The growth rates of area under crops like jowar, bajra and maize were positive and significant.

Kumar and Singh (1998) made an attempt to analyze the cropping pattern in north Bihar during post-green revolution period (1970-71 to 1993-94). The study revealed that the cropping pattern of north Bihar is still predominate by cereal crops. Among the cereals, wheat has emerged as major cereal crop. They concluded that the predominance of cereal crops in the cropping pattern was credited to the food grain scarcity in the project area and bio-chemical and genetic innovations in principal cereal crops during post green revolution period.

Rajesh and Ramasamy (1998) considered the trends in under utilization of land in Tamil Nadu and identified the determinants for the same. The results indicated that there is a better scope for further extension of the area of land under cultivation, as the survival of a vast area of land under current flow, other fellow and cultivable wastes which can be brought under cultivation in Tamil Nadu. They reported that the occurrence of landlords or large holdings has been accountable for the highest percentage of land uncultivated, as the high percentage of land is not cultivable in large size operational holdings. The resource crunch faced by the farmers seems to have aggravated after the advent of new technology due to the capital-intensive nature of modern inputs. This has led to the neglect of other lands.

Kebebe et al (2000) studied the diversification of agriculture in Haryana. The study revealed that cereals, commercial crops, vegetables and fruits were found to be relatively more diversified as compared to pulses and oilseeds among the crop groups. Diversification towards high-tech, innovative enterprises within the agricultural sector, such as vegetables, fruits and towards agro-food processing and rural non-farm sector has been gaining momentum in the State.

Das (2000) studied the agricultural cropping pattern in different zones; their average yields in comparison to National average yield potential. Multiplicity of cropping systems has been one of the main features of Indian agriculture and it is attributed to rain fed agriculture and prevailing socio-economic situations of the farming community. He estimated that more than 250 double cropping systems are
followed throughout the country and based on the rationale of spread of crops in each
district in the country, 30 important cropping systems have been identified.

**Reddy and Achoth (2000)** studied the determinants of cropping pattern changes in dryland agriculture of Karnataka. The study exposed that most of the dry land, food crops such as rage, jowar and Bengal gram were non-responsive to own price and oilseed crops such as sunflower and groundnut responded largely to their own prices. Most of the crops respond positively to the rainfall except groundnut area.

**Subhashini (2001)** Studied the shift in cropping pattern in Tamil Nadu state and South Arcot district with special reference to oilseed crops. She conducted analysis of the three year average of area under major crops in four categories viz., (1) Paddy, (2) Oilseeds, (3) other food crops and (4) non-food crops before and after removing open general license. The results indicated that in Tamil Nadu except paddy, the other three categories experienced a reduction in the area by 16.69, 10.85 and 2.76 per cent, respectively. In the South Arcot district, there was a huge fall in the share of groundnut area i.e. by 36.2 per cent. Other non-food crops also experienced a fall in the area by 7.21 per cent.

**Hazra (2001)** deliberate the changes in cropping pattern at the all India level by considering the area share of crops and crop groups at four time points, capturing, respectively the Triennium ending average of areas at 1966-67, 1976-77, 1986-87 and 1996-97. The study revealed that there was a shift from traditional grown less remunerative crops to more remunerative crops. This crop shift took place due to government policies and thrust on some crops in a given time.

**Virender Kumar (2002)** in their work to examine the changing cropping pattern in Himachal Pradesh reported that total cropped area increased by about 21 thousand hectares from 16.69 per cent to 17.06 per cent of the total geographical area during the period 1972-96. The area under wheat, as percent of total cropped area, increased from 34.27 per cent to 37.66 per cent that of maize went up from 28.11 per cent to 32.58 per cent. The magnitude of decline in percentage share in the area in Ragi and other millets was much higher than that of barley.

A study was conducted by **Goswani et al (2003)** to evaluate the changes of cropping pattern in Mizoram. They stated that during the period under study maximum growth rate in area achieved in pulses (13.82 per cent) followed by tapioca (9.46 percent), oil seed (7.06 per cent) and maize (3.25 per cent). Area under sugarcane and cotton was showing a significant negative growth rate of 2.56 per cent.
Joshi et al (2004) studied the determinants of agricultural diversification in South Asia. Independent variables such as irrigation, productivity, markets, literacy, land holdings and rainfall were considered for study. They concluded that the irrigated area significantly contributed for diversification and the regression coefficient of the irrigation variable also showed negative relationship with diversification.

A study was conducted by Goswami and Challa (2004) to understand the land use pattern in India for the period 1950-51 to 1997-98. The results indicated that forest area had increased from 40.08 million Ha in 1950-51 to 68.65 million Ha in 1997-98. There was significant increase in area under non-agricultural uses from 9.36 million Ha in 1950-51 to 12.3 million Ha in 1997-98. They also revealed that the net area sown increased during the period 1951-1971. However, after 1971 the area is established to have remained same till 1997-98.

Sreeja (2004) conducted a study to understand the changes in land use pattern in Kollam district of Kerala. The results indicated that there was a considerable growth in the current fallow, which reflects the consequence of year to year rainfall variations presentation the inverse relationship between rainfall and current fallow. Barren and uncultivated land, permanent pastures, land under miscellaneous tree crops and groves and cultivable waste recorded a significant negative growth.

Mohammad Shafi (2006) opined that land use and cropping pattern was integrated. He found out that cropping pattern in any place is largely determined by the amount and distribution of rainfall.

A study was conducted by Munish (2007) to understand the growth and changes of Indian agriculture since the eighties. The study revealed that agriculture sector was traditionally regarded as having low price responses. Cropping patterns were different in different areas because of economic reasons or technological reasons, but the change was slower.

Subrata (2007) conducted a micro level study on economics of cropping pattern changes in relation to credit in West Bengal. The study concluded that the credit availability from both institutional and non-institutional sources had made an important contribution to the change in cropping pattern. But the impact of credit availability on cropping pattern change had been more significant in the case of the smaller size of land holdings. Again, the profitability was also higher in the case of small and marginal farmers.
Batla (2008) studied the regional dimensions of inter-crop diversification in India and observed that inter-crop area shifted in favor of high yielding crops like wheat, paddy, oilseeds, cotton and sugarcane, up to the eighties and towards paddy, sugarcane, fruits, vegetables, fibers, plantations, condiments and spices during the nineties and early 2000. The area under wheat and paddy had expended solely at the cost of low yield growth crops like coarse cereals and pulses due to price support and HYV program.

Tingre et al (2008) made an attempt to study the cropping pattern changes and crop diversification in Akola district of Vidarbha. The study exposed that majority of cereal crops showed negative and low growth rates of area during the study period. Soybean had attained an important position in the cropping pattern. The trend of crop diversification and cropping intensity increased significantly.

Ramappa and Naidu (2009) conducted a study to understand the land utilization pattern in Andhra Pradesh. The study revealed that the possibility of extensive agriculture was very limited since the area under agricultural uses had by now reached the maximum level. The area under non-agricultural uses had increased from time to time. This certainly reduces the size of cultivable land. Modify in cropping pattern was also necessary to make the most efficient use of land. 2.2 Factors accountable for temporal changes in land use pattern.

A study was conducted by Wani et al (2009) to understand the determinants of productive and unproductive land utilization in Jammu and Kashmir. The study had chosen cropping intensity as an endogenous variable in productive land utilization and current fallow as variable in unproductive land utilization. The estimates of exponential function for productive land use revealed that the net irrigated area, literacy level and are not available for cultivation were positive and important determinants of the variation in cropping intensity.

Meenakshi and Indumathy (2009) studied the land utilization and cropping pattern in Tamil Nadu. The study revealed that there was a substantial reduction in the cultivated area and hence output was affected to a great extent. The cropping pattern in the state had a high degree of maladjustment for crops. Roughly 53 per cent of the cultivated area was being used for growing unsuitable crops. 2.4 Factors contributing to changes in cropping pattern.

An attempt has been made by Todkari et al (2010) to analyse the agricultural land use pattern at the micro level in Solapur District based on the secondary data. Agriculture production is influenced by physical, climatological, socioeconomic,
technological and organizational factors. Thirteen crops have been considered for crop ranking and crop combination. Among these, jawar, wheat, bajara, sugarcane, gram, maize, safflower, cotton, etc. are the major crops. By computing crop ranks and crop combination in Solapur District has identified ten crop combinations.

**Bhupinder and Santosh (2010)** analyzed the diversification of agriculture in Haryana. Primary data was collected from a total of 420 respondents covering three districts, six blocks and six villages. They have chosen variables for the study based on the problems expressed by sample farmers. Farmers have reported problems like price, number of regulated markets, transport, finance, literacy, irrigation, etc. The major problems faced by the farmers were price fluctuation and finance related aspects.

**Bhat and Shah (2011)** studied the Land Use and Cropping Pattern in Jammu and Kashmir. The State depends on subsistence farming without any surplus, but from the last few decades a great change has taken place in the variety of crops. The cropping pattern is influenced by physical, technological and institutional factors like land reformation, consolidation of holdings and credit facilities, price structure, procurement policies and storage facilities.

**Barakade et al (2011)** in this paper an attempt has been made to analyze the agricultural land use pattern at the micro level in Satara District. Agricultural production is influenced by physical, climatologically, socio-economic, technological and organizational factors. An endeavor is made here to study crop combinatorial regions in Satara District for the year 2008-09.

**Hangaragi (2011)** studied the spatio-temporal changes in cropping patterns in Bagalakot district of Karnataka. India witnessed considerable change in Land use and cropping pattern. The intensive growth of population pressure and attendant demand of land to accommodate various activities are the prime drivers of change. The cultivation of commercial crops has an impact on the socioeconomic development of farmers compared to food crops growing farmers.

**Gomatee (2012)** studied the agricultural land use pattern at the micro level in Bulandshahr district of upper Ganga-Yamuna Doab. Agricultural land use pattern and production are influenced by physical, weather, socio-economic, technological and organizational factors. An effort has been made here to study the changing land use pattern, cropping pattern, pattern of crop diversification, crop combination and ranking of the crops. The major crops of the area are wheat, rice, sugarcane, maize, pulses, millets, vegetables, barley, mustard, potato and fodder, etc.
Naik (2012) studied the soil salinity and its impact on cropping patterns in Shirol Taluk. About 187.8 million hectares (approximately 57%) out of 328.27 million hectares of land areas has been degraded in the country. Among these 10.1 million hectares suffers from soil salinity problem. Soil salinity occurs mainly due to two factors viz. Physical and chemical.

Appala Raju (2012) studied the patterns of crop concentration and diversification in Vizianagaram District of Andhra Pradesh. The term ‘crop specialization’ indicates cultivation of less number of crops and crop diversification implies raising a variety of crops from the soil. In this paper an attempt is made to analyze the crop concentration and diversification.

A study was conducted by Shakeel and Kanth (2012) to assess the land form and land use analysis of Liddar River Basin, Kashmir. The study revealed that second and third order land forms that are utilized by man and nature for different purposes. The land use/land cover status of older basin 1974-75 and 2001 have revealed that there has been a drastic change in the forest area as well as agricultural sector and other classes. The main reason behind this change is mainly due to large scale deforestation, erosion and biotic interference that has increased manifold with the passage of time.

Mohammad Maqbool Bhat (2013) studied the agricultural land-use pattern in Pulwama District of Kashmir Valley. They defined that agricultural land as the land which is used primarily for production of food and fiber. Cropping pattern in any region has undergone an evolutionary process. The choice of cropping system is dependent primarily on physical variables and secondarily on size of operational holding, market and transport facilities, capital, price policy of the government and techno-organizational factors. In any region cropping pattern is yield oriented because the farmers try to maximize their production.

Bagade and Chalwadi (2013) made an attempt to study the spatial analysis of crop combination in Belagavi District. They proposed that, crop combination is a scientific device to study the existing spatial relationship of crops in association with each other in agricultural Geography and land utilization. Crops are generally grown in combination and it is rarely that a particular crop occupies a position of total isolation from other crops in a given aerial at a given point of time. They concluded that in recent years, the concept of crop combination has engaged the attention of geographers and agricultural scientists and land use planners.
**Uppar et al (2013)** conducted a study to understand the land use patterns in Haveri District with a geographical perspective. Land utilization is an important predicament for the planning process because of the finite nature of land resources. Agricultural Scientists, Economists, Geographers and other experts are engaged in the study of agriculture. They proposed that land utilization required proper planning and land being a finite resource.

**Joydeep Saha (2013)** studied the crop diversification in Indian agriculture with Special Reference to Emerging Crops. He revealed that crop diversification is found to be continuing over the time period and most of the states are associated with this process. He also proposed that although food crop dependency persists strongly, commercial and horticultural crops are emerging significantly.

**Korade and Rakesh (2014)** conducted a study to understand integrated land use/land cover analysis of Surat District, Gujarat by using digital classification technique. They proposed that, land use and land cover assessment using satellite imagery provides reliable and accurate information, which is cost and time effective. It also offers a holistic view of large areas for better monitoring of land use and land cover occurrence and distribution.

**Mishra and Pankaj (2015)** studied the agricultural land resource utilization in Trans-Yamuna region in Allahabad District, Uttar Pradesh. They proposed that, Indian agriculture occupies a prominent place not only because it supplies food to the people, raw materials to the industries and various items of export trade, but also because it constitutes an integral part of our culture and tradition and the general fabric of life in the country.

### 2.2 SOCIO-ECONOMIC STATUS

A study was conducted by Pant and Baghel (1987) to assess sociological constraints and attitude to development of tribal farmers in the tribal area of Madhya Pradesh. The study have presented their findings related to information gaps and programmes with special reference to agriculture. It records the present knowledge situation of the tribals with respect to key technological opportunities, assess the magnitude of the information gap, and probes into attitudes to development in general and this ability to accept change. A pre-tested questionnaire was used to record the responses of a sample of tribal farmers. The finding confined that what is often interpreted as apathy on the part of the tribals should read as a cautious approach by people found to be aware of the means of increasing productivity, but held back by
lack of finance for investment, lack of knowledge of subsidies and an over-cautious attitude to possible improvements in production.

**Jabbi and Rajyalakshami (1999)** conducted a study on education for SC and ST Groups in Bihar. The study was conducted in two districts viz. Bhojpur and Bhumikaon which were based on the levels of literacy in 1981 and the changes during 1981-1991. The results showed that all the indicators of school education in Bhojpur were better than Bhumika. The study also found that the access to education was less for the SC/ST children and girls than for the children in the forward caste/non caste groups and boys respectively. Parental occupation, education and socio-economic status of the family influenced the enrollment of the children.

**Gadge (2003)** conducted a study on changes in the farmers’ Socio-economic status in Karanja blocks of Wardha district. The study reported that age, education, economic status, farm size, annual income, economic motivation and extension contact were significantly correlated with the change in cropping pattern. However age was negatively correlated in the study.

**Nath et al. (2003)** conducted a survey of Khasia tribe in Sylhet district of Bangladesh to investigate their socio-economic conditions, hill farming practices and impacts on rural livelihood and forest conservation. The authors reported that the lives of Khasia people are centered on the hills and hill resources and economy is basically forest based, using simple traditional technology. Their principal occupation and sources of livelihood is betel leaf based hill farming. Besides providing income and employment opportunities, this type of farming plays an important role in the 34 conservation of forest and its flora diversity. The study also revealed that a buoyant market for betel, ease of establishment and maintenance and the regulation of different age classes make it a sustainable production system that assists in conserving biodiversity and might be adapted for use elsewhere.

**Dashora and Sharma (2003)** conducted a study on the role of tribal women in education in three major districts from TSP region viz., Udaipur, Pungarpur and Banswara of Rajasthan. The study opined that education helps in the achievement of overall development, therefore, the tribal women should be educated and to speed up the literacy rate, the education for tribal women and girls needs special attention by the government. The extent of education among tribal women remained very low. Development of education among tribals and particularly among tribal women is the least among the all sections of population.
Sinha et al (2004) conducted a study to analyze the existing cropping pattern and possibilities for enhancing the productive potential of tribal farms in Ranchi district, Jharkhand. Data collected from a sample of 120 tribal farmers between 2000-01 were used for the analysis. Linear programming was used to develop optimum plans for each size group of selected farms. The results indicated that 20 percent of the existing area under rice cultivation (71.25 percent of the total cropped area) needs to be allocated to vegetables and pulses in order to maximum profit. Through the reallocation of resources, cropping intensity on the sample farms can be increased by up to 184.00 percent. Through the optimization of resources use, under condition of improved technology and unrestricted capital, net farm income can be increased by up to 275 percent. However, greater potential exists on irrigated farms than on un-irrigated ones. Also there exists great scope to utilize surplus human labour, which can go up to about 82.00 percent more of the existing employment on the sample farms.

Ogunsumi (2007) conducted a study to examine the socio-economic conditions of peasant farmers and the consequences on agricultural technologies in Southwest, Nigeria. Structured interview schedules as well as in-depth study devices were used to collect data, which were analyzed using appropriate descriptive and inferential statistics. The study revealed, though both categories of farmers had most demographic characteristics in common, sustained users were older and had larger farm size. The study further revealed that there were significant positive correlations between age and adoption pattern, age and soybean adoption level, age and cassava adoption level, organizational membership and extension contact, factors affecting sustained use of maize and cassava technologies. The study was also revealed that negative significant correlation existed between factors affecting sustained use of maize technology and extension contact. The study proposed that policy makers and rural development workers should be conscious of the fact that sustained users are older and therefore is likely to be more conservative to changes. The author also cautioned that younger people were moving away from agriculture and that both categories of farmers require constant contact with the extension services.

Singh et al (2009) conducted a study in Jaunpur District of Uttar Pradesh state to find out the relationship of socio-economic status with economic motivation of the farmers. The study exposed that majority of farmers belonged to medium socio-economic status followed by 18.0 percent belonged to low socioeconomic status, while 16.0 percent farmers possessed high score category of socioeconomic status. It
was observed that except education, age, land holding and socio-economic status have been found to have significant association with economic motivation.

A study was conducted by Okwu and Umoru (2009) to assess the women’s agricultural information needs and accessibility. The study shows that agricultural information to women farmers and accessibility of information from these sources was relatively high. However sufficient information was not available with respect to age, educational level and income of women farmers. Hence, it was recommended that enough information should be provided in the needed areas and women’s adult literacy and economic empowerment programmers should be given serious attention to enhance their access to needed agricultural information.

Bolarinwa and Fakoya (2011) conducted as study to understand the impact of Farm Credit on Farmers Socioeconomic Status. The study shows that there is inadequate provision of loan from formal credit institutions with about 40% of beneficiaries secure loans from formal credit institution and 80% for the informal credit institution. Beneficiaries recorded higher 80,000tons cocoa production compared to lower 21,000 tons of cocoa production recorded by non-credit beneficiaries. Consequently, 28% of beneficiaries recoded higher mean income of between N 21,000-50,000 compared to 10.4% of non-beneficiaries. Beneficiaries 54.1% were of higher socio-economic status compared to 10.4% of non-beneficiaries in the same category.

An attempt was made to study the impact of Farm Credit on Farmers Socioeconomic Status by Kolade Kamulu Bolarinwa and Fakoya (2011). The study shows that there is inadequate provision of loan from formal credit institutions with about 40% of beneficiaries securing loans from formal credit institution and 80% from the informal credit institution. 54.1% of beneficiaries were of higher socio-economic status compared to 10.4% of non-beneficiaries in the same category. The study recommends that for positive impact to be recorded on farmers’ socio-economic status, credit should be given to the farmers and research should be intensified at the farm level for farmers to benefit.

Ghulam et al (2011) conducted a research study based on primary data collected from sunflower growers to assess the socioeconomic factors that are affecting the adoption of sunflower varieties in Sindh. Data samples have been selected from two districts; Badin and Thatta, as these districts are considered main sunflower growing areas in Sindh. The results reveal that Sunflower growers are using Hybrid varieties i.e. 43 percent planted Hysun-33, 29 percent Hysun-38 and 28
percent Hysun-37 varieties. The finding of research using multinomial logistic regression suggests that farm size and level of education significantly affected the adoption of sunflower varieties. These factors are statistically significant. The other variables such as tenancy status and source of income are not statistically significant in the adoption of sunflower varieties in Sindh.

Folayan (2011) conducted a study to examine the socio economic status of Fadama farmers in Akure South Local Government area of Ondo State. The findings from the study showed that majority of the respondents had one constraint or the other with the suggestion of new technology, adequate funding and improved input supply and provision of infrastructure to cushion their problems. The gross margin per annum of fadama farmer showed that farming was profitable in the study. The regression analysis result showed that increase in the values of marital status, household size, level of education, experience and farm size imply and will increase fadama farmers productivity while an increase in age and gender will reduce the rate of Fadama farming productivity in the study area. The study recommended that education of farmers should be encouraged while soft loan, agricultural inputs and research assistance be provided by Government. The implication findings from this study were that men were more actively involved in Fadama farming than the female, enough profit was generated to sustain the family while cooperative society was a predominant source of capital in fadama farming in the study area.

Ojo et al (2012) Agricultural resource access and the influence of socioeconomic characteristics among women in Borno State, Nigeria was the main objective of this study. The major findings of the study showed that respondent’s socioeconomic characteristics indicated high levels of illiteracy, non-membership of cooperatives, no extension contact and low access to credit. Access to production resources including fertilizers, agrochemicals, family and hired labour and land ownership were low. Some socioeconomic factors influenced the likelihood of women’s access to production resources. These factors included cooperative membership, years of schooling, farm income, extension contact, off-farm income, family size, age, farming experience and farm size. The study recommended that agricultural development planners should work at enhancing rural women’s access to socioeconomic factors which enhance their access to production resources for more efficient agricultural productivity.
**Krishna Nandan Prasad (2012)** made a comparative study on education and Agricultural laborers in Western Chhattisgarh, India. Education is the crux of social, economic, cultural and political development of human society. Literate agricultural laborers are educationally lowly developed as most of the literates have a lower schooling degree. The main reason was due to presence of exceptionally higher drop-outs from education after primary and middle schooling.

**Ayoade and Akintonde (2012)** in their study assessed the adoption of agricultural innovations among rural women farmers in Isokan Local Government Area of Osun State. To achieve this major objective, the study identified the socio-economic characteristics of the respondents as well as agricultural innovations introduced and their extent of use. Also the study determined the effects of technologies used on agricultural production. The result of findings revealed that a positive and significant relationship exists between the constraints encountered and adoption level of Agricultural Innovation. It was also revealed that late adoption of innovations was due to irregular visits of extension agent. The major constraint revealed in the study was unstable market price, which has seriously affected the women’s activities. Therefore the study recommends that the government should enforce price stabilization policies which will control market prices so as to reduce shortage and losses.

**Jabir Hasan Khan et al (2014)** conducted a study has been made to analyze the spatial patterns of employment, income, variations in the socio-economic status of beggar population and the relationship between their employment rate and per capita income with selected variables of socio-economic development in Aligarh district of Uttar Pradesh. The study revealed that there was high and medium level of per capita income among the beggar population in the northern and eastern parts, while the high level of socioeconomic growth are witnessed in the southeastern and southwestern part of the study area.

### 2.3 TECHNOLOGY ADOPTED IN MAJOR AGRICULTURAL CROPS

In the era of science and technology, the mechanisms of modernization of agriculture have attracted wide interest among the researches. The emphasis on agricultural development is based on the modern agricultural technology which can alter the structure of an economy. In the agricultural transition, from traditional one to modern, technology has been singled out as the most dominant variable affecting agricultural development and productivity. Technology is a stock concept and is not
merely a matter of tools and equipment, but is a body of skills, knowledge and collection of all available means which is applied for carrying our economic activities. The brief review of literature on all aspects of technology adoption is presented in the following paragraphs.

A study was conducted by Srikanthamurthy (1986) to assess the resource productivity in agriculture in Bangalore district, Karnataka. In his learn on resource productivity in agriculture in Bangalore district observed that, the cost of cultivation of paddy per acre was originated to be highest on marginal farms and lowest on large farms. Thus the being of scale of economies was noticed in the cultivation of paddy. But the revise did not notice economies of extent in Ragi production.

Singh et al (1987) conducted a study in Sultanpur of Uttar Pradesh in command to compute the cost of production and profitability in paddy on different farm sizes. The use of superior quantities of resources by large farms resulted in higher yield and higher value of production per hectare of paddy. The authors opined that advanced expenditure incurred by large farmers by way of using modern farm inputs such as fertilizers, irrigation, plant shield chemicals and borrowed human labor resulted in higher production, productivity and income of these farmers as compared to small and marginal farmers.

Naik and Mohanty (1991) studied the trends in area, production and productivity of groundnut in different districts of Orissa. The growth rates of area and production of groundnut during the period 1970-71 to 1987-88 were statistically significant for all districts except Koraput. Even though the groundnut yield in Orissa was higher than that of India during 1985-88, the growth rate of yield over the years was negative and non-significant.

Chowdhary and Aziz (1992) studied the feasibility of export of rice by Bangladesh. The study indicated that the need for such a trade arose from the likely surplus of rice that might be generated in the future due to a higher growth rate of production of rice than its expenditure and the deficit of wheat from the stagnation of production against a higher growth rate of its consumption and the deficit of wheat from the stagnation of production against a higher growth rate of its consumption.

Alex. F Mc Call (1994) assessed the impact of agricultural technology improvements in developing countries in the presence of policy distortions. This paper focuses on how policies most normally used by developing countries affect both the size and the distribution of the benefits from technical change. In some cases the benefits from the new technology are enhanced by the policy distortion, in others they
are reduced. Even when the benefits from the new technology with the policy distortion in place are similar as those that would occur in a distortion-free world market, their distribution is different.

Singh and Grewal (1996) studied the Economic profile of rice production in India. The study worked out the composite growth rate of area, production and yield of rice in India and four different states using the function \( Y = ab^x \).

Baliyan et al. (1998) studied on costs and returns in sugarcane production vis-à-vis its competing crops in the Muzaffarnagar district, Western Uttar Pradesh predictable that per hectare cost of production of sugarcane (planed) was Rs.9188, Rs.19681 and Rs.20229 on small, medium and large farms respectively. The major components of cost of production where the prepared cost rental value of land and material cost. The major component of operating cost were transportation, harvesting and intercultural operations in all the three sizes of farms with a per cent share of 40.04 to 40.81 in total cost of production.

Naik (1998) while studying economics of farming systems in Uttara Kannada district, identified the problems faced by the farmers in all the three agricultural regions of the district. He classified the problem broadly into production, finance, marketing and infrastructural/extension problems. The major problems faced by the farmers in the production front were shortage of labor during peak season, non-availability of chemicals and fertilizers and non-availability of improved breeds of livestock. Exploitation by commission agents and traders were the major constraints under marketing while, lack of extension and training facilities was the main constraint among the infrastructural or extension constraints.

Joginder Singh (2000) studied the scope, progress and constraints of farm mechanization in India. They reported that there has been an increase in the use of farm machinery in Indian Agriculture as it contributed to the increase in output due to timeliness of operations and increasing precision in input application. Most of the mechanical inputs have displaced human and bullock labor, which is socially unjustified. Some states, like Punjab, Haryana excelled in farm mechanization, but have experienced it as overinvestment.

Pandey (2000) studied the present status and future requirement of farm equipment for crop production and reported that the tractor mounted implements such as moldboard plows, disc plows, cultivators and other crop-specific equipment are widely being used for seed bed preparation. Seed drills and planters, both animals drawn and tractor mounted, have become popular. Mechanical transplants for rice and
vegetable crops are catching up with farmers. Long handle tools and power weeder
for weeding and intercultural and manual and power operated sprayers and dusters for
application of chemicals have been commercialized. A further requirement for farm
equipment and technologies include Rota-tiller for seedbed preparation, till planter,
strip till drill, pneumatic precision planter, sugarcane seat cutter planter, vegetable
transplants and check-row planter, for sowing and planting. Power weeder and
equipment for chemical-mechanical weed management, electro-static spraying and
tall tree spraying are required. Harvesting equipment for sugarcane and cotton are
required to be developed.

Ganesh (2000) studied the assessment of the alternative farming system in
gazani lands of Karnataka. The analysis made an evaluation of the substitute farming
systems viz., Paddy cultivation, paddy cum prawn farming and mixed farming in
Gazani lands of coastal Karnataka.

Sanatha Kumar and Dandapani (2000) studied frequency, intensity and the
determinants of pesticide use in rain-fed cotton, by using farm level cross sectional
data from Nanded district of Maharashtra. Average pesticide use was 3.2 kg active
ingredient per hectare of cotton area. Farmers also used a number of cultural and
physical methods directly or indirectly to limit the crop loss due to pest and diseases.
The attitude of farmers towards insect pest risk varied and accordingly the use of
pesticides. Risk averse farmers used pesticides excessively and indiscriminately.
Findings suggested that improving existing stock of knowledge of pests and
management practices could help reduce pesticide use.

Yogeshwari (2002) studied economics and environmental implications of
pesticide use in paddy in Shimoga district. The study revealed that the average
frequency of pesticide applications made by the sample farmers was 18 sprays with
range of 12 to 28 sprays during the paddy crop for period of 140 to 145 days as
against the 11sprays recommended. It was found that expenditure on pesticide (Rs.
8,389) formed the major portion (31%) of total cost of cultivation of paddy crop. The
total cost of cultivation of paddy was Rs. 27,258 per ha. Majority of the farmers used
pesticides in the form of organophosphorus and organochlorine and 23 per cent
farmers used organophosphorus chemical (monocrotophos) under the brand name
Novocron.

Crissman et al (2002) studied potato production and pesticide use in Ecuador
and evaluated research and rural development intervention for greater eco-system
health. The study reported that the sample farmers employed three of the four main
groups of insecticides while using 28 different commercial products. The sample farmers did not use organ chlorine insecticides though found in Ecuador.

A study was conducted by Laura German et al (2005) to develop a methodology for tracking the fate of technological interventions in agriculture. This article presents a more encompassing methodology for tracking the fate of technological interventions, illustrating the possible applications of findings for enhancing the positive impact of agricultural research and extension in the region.

Singh et al (2005) conducted research on assess the effect of crop establishment methods, weed management and split nitrogen application on weeds and yield of rice. The study revealed that, rice crop suffers more from weed competition unlike other cereal crops. The degree of competition and extent of yield losses varies greatly with rice cultures. Weed competes with crop plants for moisture, nutrients, light, space and other growth factors. In the absence of an effective control measure it leads to removal of considerable quantity of applied nutrients resulting in a significant yield loss. To realize the maximum benefit of applied expensive inputs like nitrogen and higher yield, an effective control of weeds is of utmost important.

Cheryl (2005) analyzed the technology adoption using micro studies and assessed the limitations, challenges, and opportunities for improvement. He proposed that the policy makers and interest groups have many questions about the use of improved technologies in developing country agriculture. Drawing on an extensive review of the literature on the adoption of agricultural technologies, this article suggests alternative approaches for designing technology adoption studies to make them useful for policy makers.

Srivastava et al (2005) conducted a study on weed dynamic and their management in sugarcane under different preceding crops and tillage systems. They reported that sugar cane crop faced intense competition with sedges (abundance index >4) at tillering stage (60 days after planting) irrespective of preceding crops, viz wheat or Indian mustard and tillage systems, viz conventional or minimum.

Jayanthi and Kombairaju (2005) studied the pest management practices in four important vegetable crops, viz. chillies, cauliflower, brinjal and bhendi using farm level cross sectional data. The study reported that average pesticide usage has been estimated at 5.13, 2.77, 4.64 and 3.71 kg active ingredient per hectare on chillies, cauliflower and brinjal and bhendi crops, respectively. On an average, cauliflower and brinjal were each given 15 applications, chillies was given 13 and bhendi was given 12 applications. The study suggested for reducing pesticide-use and
went on to conclude that farmers needs to be educated about different non-chemical control methods and should be encouraged to adopt integrated pest management practices.

**Suresh and Reddy (2006)** conducted a study to assess the resource use efficiency of paddy cultivation in the Peechi command area of Thrissur district of Kerala. Their results showed that average technical efficiency of the paddy farmer in the command area was found to be 66.8 per cent. They also pointed out that education of the farmer and supplementary irrigation provided during the water-stress days have been identified as the major factors, which could enhance the technical efficiency. The study has called for an equitable distribution of canal water and enhanced extension services for resource management in the area.

**Das and Nag (2006)** conducted a review study on traditional agricultural tools. They proposed that, the agricultural tools are as old as the stone-age and were necessary to facilitate working and to increase the productivity of human workers. New tools were developed using copper, bronze stones, other non-metals like wood, leather, bamboo and fibers were used in tools, but most of them became extinct which the introduction of iron. Starting with the original iron Bakhar blade for tillage in central Indian after the discovery of iron smelting in a mud hearth in Bastar of Chattisgarh state, agricultural tools was designed and produced in scores by village blacksmiths.

**Shakirullah et al (2006)** studied the nature and extent of adoption of pesticides among small, medium and large farmers in Union Council Palosi, District Peshawar. The results revealed that pesticides were used by 78.75 per cent of the farmers, while 2.25 per cent did not use them. Majority of the farmers (41.25%) started using pesticides 6-15 years ago for different pests. The per annum average cost of pesticide purchase was significantly higher at 1 per cent level for large farmers than medium and small farmers. This shows that the larger farms applied more pesticides.

**Erappa (2006)** defined contract farming as an agreement between farmers and processing or marketing firms for the production and supply of agricultural products under a onward agreement, generally at predetermined prices. The agreements also allow the procurer to provide a degree of production support through inputs and technical guidance for the crop cultivation. From the farmer’s side, there is a commitment to produce the specified agricultural products within the quality and quantity standards prescribed by the purchaser, and the firm supports, in turn, the farmer’s production, and also purchases the produce.
Prabuddha (2007) studied the pattern of pest infestation on vegetables and the extent of the use of pesticides by vegetable growers in 18 villages in Katwa-I block, Bardhaman district, West Bengal, India. The study found that the intensity of insect pest infestation on aubergine, pointed gourd (Trichosanthes dioica), cabbage and cauliflower was greatest during the Rabi season, followed by the kharif and pre-kharif seasons over the last five years. Most of the farmers applied pesticides on aubergine and cabbage, but the application rates, number of chemical groups of pesticides and application frequency adopted by the farmers were more than the recommended. This practice was most pronounced for aubergine, followed by cauliflower, cabbage and pointed gourd.

Ngowi et al (2007) studied pesticide use by smallholder farmers in Northern Tanzania who grew vegetables that include tomatoes, cabbages and onions. They observed that the types of pesticides used by the farmers in the study areas were insecticides (59%), fungicides (29%) and herbicides (10%) with the remaining two per cent being rodenticides. More than 50 per cent of the respondents applied pesticides up to five times or more per cropping season depending upon the crop. Insecticides and fungicides were routinely applied by 77 and 7 per cent, respectively. Majority of the farmers reported that the trend of pesticide use was increasing. Sixty-eight per cent of farmers reported having fell sick after routine application of pesticides.

Shailaja and Thirumeni (2007) in their study evaluated 19 finger millet genotypes for seedling characters in seed germinator maintained at 90% (relative humidity) and 25 °C (temperature). Moderate (EC: 6 dS/m) and high (EC: 12 design) salt-stress was compulsory through moistening of filter paper besides distilled water as a control. Four replicates of hundred seed genotype for each of the treatments imposed were maintained.

Mariapia Mendola (2007) studied the agricultural technology adoption and poverty reduction in rural Bangladesh. This study was aimed at shedding some light on the possible impact of agricultural technology adoption on poverty mitigation strategies. As technology adoption is not randomly assigned but there is ‘self-selection into treatment’, the paper tackles a practical issue in assessing the causal effect of technology on farm-household wellbeing through the non-parametric p-score matching analyses. It pursues a targeted evaluation of whether adopting a modern seed technology causes resource-poor farmers to perk up their income and decrease the propensity to fall below the poverty line.
Udayakumar (2008) studied the economic consequence of pesticides used in paddy Kopal district, Karnataka. The excess use of pesticides in agriculture has not only increased production costs but also led to ill effects of pesticide usage. The total cost of cultivation of paddy was found to be Rs 65591.53/ha of which the cost of pesticide accounted for 5.50 per cent. On an average the expenditure on pesticides in paddy cultivation was Rs. 3607.57/ha. The yield obtained by the sample farmers was 66.90 quintals. The farmers realized net returns of Rs. 17145.14/ha of paddy cultivation.

Karthikeyan et al (2009) undertook a study to identify various traditional tools used for agricultural operation by the farmers of Tamil Nadu. They proposed that traditional agricultural tools were economical in terms of labour, money and time saving. These tools were made up of locally accessible materials like stones, wood, etc. traditional tools are operated easily without any special skills. The study was conducted in Combatore, Erode, Salem, Krishnagiri, Villupuram, Dindigal, Madurai, Kovilpatty, Aruppukottan and Virudhunagar districts of Tamil Nadu. Information was documented by using Participatory Rural Appraisal techniques like observation and discussion.

Mandhata and Singh (2010) conducted a field experiment during the rainy (kharif) season of 2006 and 2007 to study the efficacy of herbicides under different methods of direct-seeded rice (Oryza sativa L.). Organization of rice by drum seeding significantly reduced the weed density and their dry weight and increased the yield-attributing characters finally led to 0.28 and 0.64 tonnes/ha higher rice yield over the wet (4.27 tonnes/ha) and dry seeding (3.91 tonnes/ha) of rice. Weed control efficiency (84.23%) was maximum under this action compared with the other sequential application of herbicides, IE butachlor (71.90%) and pendimethalin (73.85%), followed by 2, 4–D as well as theirs alone applications.

Gangwar and Singh (2010) undertook a field study during 2003–07 at Modipuram to assess the effect of rice (Oryza sativa L.) crop establishment methods (direct seeding, drum seeding, mechanical transplanting puddle, mechanical transplanting on puddle and manual transplanting) on ‘PHB 71’ hybrid rice and their carry over effect on wheat (Triticum aestivum L. Emend. Fiori & Paul), mustard (Brassica juncea L. Czernj. Cos), and Chickpea (Cicer arietinum L.) yield and soil properties. Maximum mean yield of rice (8.5 tonnes/ha) was obtained with drum seeding-wet bed. The direct seeding dry bed adopted in rice crop resulted in higher
yield of succeeding crops of wheat (5.71 tonnes/ha), chickpea (2.20 tonnes/ha) and mustard (1.86 tonnes/ha).

Franklin Simtowe et al (2010) studied the determinants of agricultural technology adoption in improved groundnut varieties in Malawi. They proposed that since not all farmers are exposed to the new technologies it makes it difficult to obtain consistent estimates of population, adoption rates and their determinants using direct sample estimates and traditional adoption models such as profit or Tobit. The findings are indicative of the relatively large unmet command for improved groundnut varieties, suggesting that there is scope for increasing the adoption rate of better groundnut varieties in Malawi once the farmers are made aware of the technologies and if other constraints such as lack of access to credit are addressed.

Anoop et al (2010) conducted a field experiment during 2009 at Ludhiana to test the performance of the direct-seeded drill against manual transplanted. Four treatments were evaluated, voice T1, direct-seeded drill with an adjustment of 30 kg/ha seed rate, T2, direct-seeded drill with a change of 15 kg/ha seed rate, T3, drum-seeded puddled transplanted rice with a seed rate of 50 kg/ha, T4, transplanting with a Japanese manual transplanter. Grain yield found to be highest in T4 treatment (7.85 tonnes/ha), followed by T1 (7.8 tonnes/ha), T2 (7.2 tonnes/ha) and T3 treatments (6.1 tonnes/ha), respectively. However, it was found statistically same in T1, T2 and T4 treatments. Grain yield in drum-seeded puddled transplanted rice decreased due to poor crop organization which favored more crop-weed competition at the early stage caused a reduction in panicles/m2 and 1 000-grain weight. Yield attributes were also found statistically same in T1, T2 and T4 method. In direct seeded crop, T1 showed more superiority than T2 treatment revealed that 30 kg/ha seed rate in direct-seeded drill is optimum which favored better plant growth, especially at the early stage due to having a smothering effect on weeds.

Varsha and Singh (2011) conducted a study to assess the agricultural mechanization in Chakai development block in Chandaul district. Agricultural mechanization has made a significant contribution to agricultural production, contributing to overall rural development. The contributing of agricultural mechanization has been well recognized in enhancing the production together with increased irrigation, frequent use of high yielding varieties, biological and chemical fertilizers, pesticides, etc. The present study is confined to the analysis of agricultural mechanization and its variation in different nyaya panchayats.
Rajula Shanthy (2011) conducted a study to formulate strategies for effective dissemination of appropriate technologies to sugarcane growers in India. They proposed that, the chances of successful technology dissemination are enhanced by understanding the technology transfer process, the players involved in the process of technology transfer, and by developing strategies that can enhance the prospects of successful transfer. The paper also discusses the thought in detail-if a single extension model/strategy would suffice by itself or an integrated approach tailor made to the situation need to be evolved.

Ghosal et al (2011) conducted an experiment at College of Agricultural Engineering and Technology (CAET), Orissa University of Agriculture and Technology, Bhubaneswar. The bullocks were loaded with 9.8% of their body weight and their speed was measured. The draft and power delivered by the pair of bullocks were also calculated. The paddy thresher was run with a pair of bullocks in rotary mode of operation and three persons were employed for threshing.

Vishwakarma (2011) conducted a study to assess diffusion of high yielding variety of seeds in Chhindwara District, Madhya Pradesh. Knowledge and use of HYVs of tribal and non-tribal communities were evaluated along with inter and inter-community variation. They proposed that lower socio-economic status of farmers, particularly tribal vulnerable peasantry system and their limited perceptual behavior and less connectivity are other characteristics which persist in the trickle down affects the diffusion according to growth pole theory.

Tapas Pal (2011) in his study proposed that agriculture is the base pavement, Industry is the roof and technology is the pillar architecture of any social development. From Vedic society, Indian agriculture was firmly adopting with traditional techno knowledge. Farmers were mainly eco-lover and to increase their agro-production in relevant of demand-supply ratio they were dependent on natural manure based organic elements. But in 2001 we have crossed 100 crores population's food demand. So, from upper politicians, scientists to lower peasants were thinking that how this food-crisis disaster can be checked? All of them decided that we have to use chemical fertilizers, pesticides, insecticides instead of natural manure. Farmers are doing this in their agro-field and trying to increase the production rate. And the resulting outcome, the production has increased but these contemporary modern techniques are not fruitful and produced for local environment for long term effect and we are staying a risk associate vulnerable periphery
Ajuruchukwu and Future (2011) conducted a study on performance of smallholder agriculture under limited mechanization and the fast track land reform program in Zimbabwe under the unpopular fast track land reform program (FTLRP). They encouraged acquisition and use of tractors by arable crop farmers in communal and resettlement state land. The Stochastic Frontier Model revealed the significant impact of the program on participating farmers, highlighting the significance of land and other productive factors. While overall production and productivity remain low, triggering a hyperinflationary situation due to supply constraints, practical implications for agribusinesses are foreseen.

Tewari et al (2012) conducted a study on farm mechanization status of West Bengal in India. The second Indian Green Revolution to full fill our future food requirements to benefit the small, medium and large size farms needs farm mechanization. They proposed that farm mechanization enhances the production and productivity of different crops due to timeliness of operations, better quality of operations and precision in the application of the inputs. The popular and effective machinery for paddy and potato cultivation in the State has been in use among the farmers.

Raj K. Adhikari (2012) conducted a study to assess economics of finger millet production and marketing in the Peoria urban area of Pokhara valley of Nepal in 2006 AD. They analysed that the cost of production (NRs. 23847.60/ha) and gross revenue (NRs. 24638.23/ha) of finger millet was significantly higher at Kalabang. The price of finger millet was NRs. 16.91/kg at Kalabang and NRs. 17.35/kg at Begnas. Profit of finger millet cultivation was higher (NRs. 790.58/ha) at Kalabang than in Begnas (NRs 602.45/ha) while the higher benefit cost ratio (1.05) was in Begnas.

Raheleh Fadavi et al (2012) studied the estimation of a Mechanization Index and its impact on energy and economic factors in apple orchard in Iran. The Energy Ratio, Energy Productivity, Economic Productivity and Mechanization Index were estimated for apple production. Mechanization was considered at three levels including level 1 for spraying only, level 2 for spraying and plotting, and level 3 for spraying and fertilizing operations. The Energy Ratio was found to be less than one for all mechanization levels having the highest value in level 2 (0.58). The highest economic productivity was calculated as 1.9 for level 2. Results showed that increasing the Mechanization Index, will not necessarily increase the energy ratio and economic productivity.
Patil (2012) conducted a micro level analysis of Banage Resettlement wrt irrigation and agricultural development. They proposed that socio economic development of farmer's family depends upon agricultural development. Irrigation has profound impact on the development of agriculture than land size. They concluded that there has been a great change in agricultural development, though families have been resettled with small land holding capacity.

Babar Someshwar (2012) studied the sustainable agricultural development and organic farming in India. They proposed that Agricultural sector, world over, has experienced a phenomenal growth since the mid-twentieth century. The growth, driven by Green Revolution technology, has made a significant dent on aggregate supply of food grains, ensuring food security to the growing population. The next stage of growth however, faces a serious challenge in terms of sustainability.

Shwetha and Narayana (2012) conducted a study under irrigated conditions during kharif season of 2006-07 at Kuvempu University campus to evaluate the performance of organic (Vermicompost and FYM) manures and inorganic fertilizers on paddy crop and their effect on soil fertility. Despite higher soil reserve of available nitrogen (298kg ha\(^{-1}\)), available phosphorus (30kg ha\(^{-1}\)) and available potassium (336kg ha\(^{-1}\)) were found both in the application of vermicompost $15t \text{ ha}^{-1}$ than application of conventional RDF alone and no fertilizer application. The result indicated that application of vermicompost @ $15t \text{ ha}^{-1}$ and @ $10t \text{ ha}^{-1} +$ RDF increases the grain yield besides sustaining the fertility status of the soil as compared with $100\%$ of RDF alone.

Mali et al (2013) studied the regional imbalance in the levels of agricultural development of Maharashtra. They simply expressed the development of agriculture in the form of increased productivity and production. They also proposed that agriculture development is depended on use of new agricultural technology, use of fertilizer and irrigation facilities.

Suresh and Hurakadli (2013) conducted a study to assess the impact of irrigation on agricultural development in Malaprabha command area, Karnataka State. They proposed that irrigation is the adjunct of civilization and is one of the most essential inputs next only to land for the agricultural development. Agriculture plays an essential role in the process of economic development of developing countries like India. Agricultural development is an integral part of overall economic development. Only rainfall is the natural source of water for irrigation, but rainfall is the most
unreliable and is marked by wide variations in different parts of the nation and also variation from year to year in its quantity, incidence and duration.

*Abhay et al* (2013) studied the regional disparities in the levels of agricultural productivity. They proposed that agricultural development has a multi-dimensional phenomenon, which denotes the quality of an agricultural system in terms of productivity, diversification and commercialization. It is also a manifestation of the combined effect of many factors viz. environmental, technological and institutional. The level of agricultural development may be considered as the degree to which agrarian structure gets strengthened leading thereby to increase production. This also includes increase in the income level of farmers thereby promoting socio-economic transformations.

*Chisango and Dzama* (2013) conducted a study to assess agricultural mechanization index and evaluate agricultural productivity of some fast track resettlement farms in Bindura district of Mashonaland central province, Zimbabwe. The levels of Agricultural mechanization at some farms in two wards of Bindura North district of Zimbabwe were measured and the productivity of each of the surveyed farms was analyzed. The study concluded that, level of mechanization in the two wards is pathetic and lower than the expected national mechanization level. Mechanization of the irrigation systems was totally neglected signifying lack of a comprehensive national irrigation policy to buffer the effects of recurrent droughts which are a result of climate change.

*Anderson et al* (2013) conducted a study to analyze mechanization Index of wheel tractors in rural farm holdings. The study was aimed to analyze the mechanization of agricultural properties in the municipality of Dracena/SP. The study reported that the mechanization index and the farmed area by tractor were, respectively, 2.53 kW/ha and 103.9 ha/tractor. The analysis further revealed that the field operational cost was minimized with the maximization of the effective operational capacity for any area group.

*Nagaraj et al* (2013) conducted a study to assess the knowledge and adoption level of paddy growers of Raichur district about farm mechanization practices. The study reported that majority of the respondents had complete knowledge, i.e., mode of operation, frequency of use and specification of the implements such as moldboard plow, harrow, cultivator, power tiller, cage wheel, paddler, sprayer, combine harvester and thresher. Further, less than half of the respondents (42.50%) belonged to medium level of adoption category. As in case of knowledge level, the large majority of
farmers used the implements views, Mould board Plough, Harrow, paddler, cultivator, cage wheel, power tiller, sprayer, combine harvester and thresher. However, only (15.00%) of the paddy growers possessed skill in the use of paddy transplanted due to its recent introduction.

2.4 CONCLUSION

Thus, a large number of studies have been made in different part of the world on technological adoption in agriculture. In India, several studies have focused on the socio-economic factors underlying the adoption of modern techniques. Trends in the productivity of different crops on the basic of the adoption of improved practices have been assessed many attempts. In Karnataka, certain attempts have been made by the Government agencies and individual researchers to study about the extent and productivity of high yielding varieties of paddy which is the main food crop of the state.