CHAPTER – II
REVIEW OF LITERATURE

Review of earlier research studies on performance of dryland agriculture presented in this Chapter. This review explains conceptual issues relating to the assessment of dryland crop production, farm income and employment in dryland areas. This will help us to resolve the problems encountered in the earlier studies and to concentrate on the aspects which need more systematic examination. The research of various studies on dryland agriculture, in different countries and their observations are helpful to understand the agriculture status in dryland regions. As no study is likely to be absolutely completed, the available literature will not help to broaden the scope and nature of successive research. Therefore, the present study is taken up to bridge this gap.

In this chapter, an attempt has been made to synthesize the conclusions of the earlier studies on the economic analysis of dryland agriculture. Results of the other relevant studies, which have investigated the performance of dryland agriculture on different aspects, have also been briefly discussed to facilitate the comparison between different agro-climatical regions of the country.

A.S. Khlon, S.S. Miglani, and Harwant Singh (1971) made a study on “The Cropping Pattern and The Related Profitability Under Irrigated Conditions” in Ferozepur District (Punjab). The cross-sectional data on cropping pattern, yield, cost and return for the year 1969 – 70 were collected from the selected holdings, Guava, Desi Bajra and gram were found to give higher returns on unirrigated farms, whereas, gram mixed with wheat and also with bajra, was found to be more profitable on the later.

Borud and N.M. Joglekar (1971) in their study “Crop Insurance to Protect Farmers under Dry Farming Conditions in Maharashtra” have found crop insurance programme as a safe guard against crop yield instability. Very low and
uncertain rainfall causes uncertainty in crop yields and uncertainty of yields is the basic risk which every farmer has to face. The result is that there is often a serious decline in farm incomes and consequent failure on the part of farmers to pay their land revenue and other taxes, diminishing purchasing power leading to decline in their demand and their inability to repay the loans which results in mounting of debts. In the selected districts average risk to the unirrigated crop of Rabi, Jowar is nearly 46 per cent greater than the irrigated one. The average per acre yield under dry farming conditions is very low which means poor incomes to farmers which ultimately means very low ability of farmers to stand the risk of crop failure and finally concludes that under dry farming conditions the ability to withstand the risk is low as the chances of crop failure are always greater.

L.R. Singh and U.K. Pandey (1971)\(^3\) have made a study on the “Cropping Pattern and Resource Use Efficiency in A Dry Farming” in the district of Banda. The authors find that farmers are rational in the use of only bullock labour since its per hour Marginal Value of Product (MVP) (Rs. 0.79 ps) is close to the per hour acquisition cost (Rs. 0.75 Ps) expenditure on manure and other inputs including irrigation is below optimum. Human labour use is found to be excessive and accordingly a one-fourth reduction in its use is subjected to increase farm income by 10.2 per cent. Therefore policy for growth of this dryland farming area should be formulated such that new irrigation potential is developed, improved varieties of crops thriving under low rainfed condition are evolved and adequate provision for credit and non-farm employment is made for raising the farm productivity and for uplifting the standard of living of the people in the regions.

M.V. Nadkarni (1971)\(^4\) calculates the coefficient of variation for different crops in Maharashtra to measure their yield uncertainty. At the district level irrigation is not found to affect the cotton yield throughout the state level it does. The correlation coefficient is 0.3822 which is significant at 10 per cent level. In the inter region picture, therefore, we do not find a high level of yield being associated with a lower magnitude of uncertainty. Finally he concludes that
irrigation is not expected to be a major factor in inter-district variations in yield rates. However it should be logical to expect that to the extent crop yield variability is due to variation in rainfall. Irrigation would not only increase the average yield but also would reduce the year to year variation.

N.S. Jodha and S.D. Purohit (1971) in their study, “The Problem of Crop Yield Instability and Survey” the effects of weather variability on semi major crops in dryland (arid) regions of Rajasthan. The coefficient of variation is taken as a measure for crop yield instability. After having mentioned the time-honoured device like diversification etc as adjustment devices to crop yield instability, the authors come forward to suggest remedial measures such as increased irrigation facilities, bending, shelter-belts and wind breaks and perennial grass farming. But none of these remedial measures is considered to be feasible by the authors because of operational limitations and thus ultimately the study hangs in the air without being conclusive.

Parmatma Singh and D.D Gupta (1971) in their study observed that the average input-output returns of crops were very low in the dry farming areas with the result that the economic condition of the farmers remained very precise. The empirical data results further showed that the farmers of this area were aware of the technological advance made in the field of agricultural and their adopting improved practices was only inhibited due to locational limitations. In the case of employment opportunities, it was observed that on an average a farm worker got hardly 100 days work on farms below 10 acres and 140 days on farm above 100 acres in a year. The study suggests that urgent steps should be taken to increase the irrigation facilities in these areas and also to establish small scale industries to utilize the labour potential which are presently under-utilised. It further shows that there is enough potential to increase agricultural production in these areas if resources are channelized properly.
R.C. Agrawal and S.L. Shah (1971)\(^7\) in their study use official statistics to determine the extent of crop yield variability among few important crops in the dry farming districts of Uttar Pradesh. The coefficient of variation which is estimated as a measure of crop yield variability on the basis of 20 years (1950 – 70) data says that the coefficient variation is lowest for Barley (19.82) followed by Wheat (28.71) Jowar (33.94) Bajra (34.80) Rice (39.21) and Maize(44.87). The authors have suggested that the crop insurance may be introduced in these district and improved breeds of milch animals and sheep etc., are suggested to reduce income instability.

S.S. Kahlon and H.S. Sandhu (1971)\(^8\) in their study “Economic Evaluation of Dry Farming in Punjab” identify dry farming zones in Punjab and makes an interesting study of the zonal characteristics, moisture conservation methods and pattern of input use and net profits from crops grown in these zones. Groundnut is found to be giving maximum net returns in the North and Central zones while sesamam (mustard) in southern zone. The cultivation of wheat in the southern zone resulted in a loss of 124 rupees per acre. This shows that the production potential of dry farmed land is extremely poor in Punjab. The answer is expansion of irrigation. Until that possible moisture conservation measures might be strongly developed and adopted by the farmers to render dry farming meaningful, particularly in the southern and central zones.

Saroj Kanti Chaudhuri (1971)\(^9\) in his study “Semi Arid Agriculture in West Bengal”, finds that the cultivators in the semi-arid zones are no less enterprising than those in the irrigated zones. Some natural impediments, more specifically scarcity of water stand in their way of adoption of improved agricultural practices in a district which has the privilege of being one of the most agriculturally advanced districts in West Bengal. Finally, he suggests that the cultivator may be induced to grow drought resistant varieties of crops which are
suitable for the arid-region such as high-yielding Bajra, Maize, etc. Although these crops are not taken as food by the inhabitants of this area, these crops, if they give good results, may be marketed and the cultivators are of the opinion that if the rivers that flow by the area are utilized by making dams, they may get water sufficient for growing high-yielding varieties of crops and can well raise some rabi crops.

V.P. Shukla (1971)\(^{10}\) in his study examines a sample of farms in Jabalpur District of Madhya Pradesh for assessing the economics of present resource use under rainfed conditional and advanced technology that should achieve net income over a given range of resource. The author finds that the use of fertilizers and improved seeds increase form incomes by 32 per cent and 48 per cent on un-irrigated and irrigated farms respectively.

Patel and Gangwar (1983)\(^{11}\) examined the income and employment effects of dry farming technology. The study indicated that due to technology, risk in the income of small farmers was higher than that of in medium and large farmers.

According to K.P.C. Rao and R.P. Singh’s (1986)\(^{12}\) view for the poor resources base of the dryland farmers and underdeveloped institutional facilities in the dryland areas, a massive effort is needed on institutional front to help move the dryland agriculture forward. Special attention should be given to credit service as capital is the most limiting resource in the dryland areas. Regarding the minimum support price and the procurement operations, unless the wrong done is set right and favourable market system is created, there will be no incentive to the dryland farmers to produce more. A strong input supply program is needed to facilitate adoption of new technologies and a strong extension support to enhance the skills and capabilities of dryland farmers. Above all, a crop insurance coverage should be provided to dryland farming to enable the farmers take risks.
and invest in it. Finally, this study suggests the need for heavy investments and also subsidies to some extent. They are inescapable if the dryland farming is to progress. Such investments, subsidies and preferential treatment were earlier provided to several industries and also to irrigated farming. Above all, it is necessary for the survival of a large mass of the population which will ever be dependent on dryland farming.

N.S. Jodha (1986)\textsuperscript{13} in his study examines that the strategy to find circumstances emanating from the major characteristics of natural resources base of dry regions, emerging scenario about problems and performance of dryland agriculture. In this data clearer idea of weightage is given by the policy makers to specific implications of new technologies and detailed projections about future demand and supply of major inputs, including fertiliser, draft power and crop output, could be worked out. Finally it may be added that owing to the small size of holding, on the one hand and ecological limitations of dryland agriculture, on the other, the latter even with strong support of new technologies, may not prove a total answer to the problem of low income of those who depend on dryland farming. The need for non-farm activities as a part of rural development programme, therefore, cannot be overstated. New farm technology can at best serve as an important component of the development strategy.

Ananth S. Rao and M.N. Dandekar (1989)\textsuperscript{14} in their study examined the potential for improving the income on limited resources of the farms by adopting the improved dryland area technology and by diversifying the crop pattern. LP (linear programming)technique with the help of micro-computer was used for measuring the impact of dryland technology on income and employment of the farm families. The authors concluded that the net farm income increased by 330, 568 and 470 per cent under plan IV compared to that of under Plan I. Thus with the use of improved technology and adequate credit facilities, potential for
optimal utilisation of resources in all farm size groups was greater. The adoption of improved technology was labour-intensive indicating the scope for increased employment of human labour in the enterprises.

Singh (1989)\textsuperscript{15} in his article, “Dry Land Watershed Development and Management. A Case Study in Karnataka” reviewed the experience of four watershed projects: Mittermari and PIDOW in Karnataka, Ralegaon-Siddhi in Maharashtra, and Sukhomajri in Haryana. The review reiterated that program interventions seeking to enhance the expected benefits to people, or reduce the expected costs, were likely to elicit stronger people's participation. Other determinants were organisation of people into small groups (as in PIDOW) and leadership (as in Maharashtra), equitable sharing of benefits from collective action (as in Sukhomajri), and availability of complementary investment from government.

Y.V. Ramaiah and Y.V. Kumar Reddy’s (1990)\textsuperscript{16}, study revealed the crop diversification in Ananthapur district. Gibbs – Martin Index of Diversification was employed for measuring the degree of diversification in the cropping pattern of the district. The degree of crop diversification was patently high with as much as 0.83 in the district in 1962 – 65. In 1972 – 75 it had declined to 0.8 and got decreased further to 0.6 in 1982 – 87. It shows that the pattern of crop farming has been tending towards the cultivation of less number of crops or specialisation of crops farming. During 1962 – 65 the crop diversification was ranking between a maximum of 0.83 in Hindupur, and Penukonda taluks to a minimum of 0.71 in Uravakonda and Kadiri taluks. During 1972–75 the highest degree of crop diversification was 0.81 (Madakasira taluk), which the lowest was 0.57 (Kadiri taluk). During 1982–85, the pattern of diversification had been further changed and that the maximum diversification was 0.82 noticed in Rayadurg taluk while the lowest level of diversification was 0.13 in Penukonda taluk. This reveals that
the degree of group of diversification has declined both at maximum and minimum levels but the sharp decrease is at the lowest level in the last 20 years period in the district.

V.M. Rao (1991)\textsuperscript{17} in his study “Dryland Agriculture in Karnataka,” states that agriculture has experienced in recent years contrasting phases of a modest measure of growth followed by nearly a decade of stagnation. This study makes use of the cost of cultivation reports of the Government of Karnataka to analyse the growth potential of new dryland technology and characteristics of market environment. The data and contextual evidence suggest that dryland agriculture in Karnataka is capped by a combination of three unfavourable factors: harsh physical conditions, Indifferent policies and completion from the more productive parts of agriculture, which are an adverse impact on the thrust for growth of the new dryland technology and on the market environment for dryland.

T. Narasimha Reddy and H.G. Shankara Murthy (1992)\textsuperscript{18} carried their study based on secondary data related to the yield and output of different groups of crops in Bijapur district for the study period from 1970 to 1988. Annual compound growth rates were computed and compared. They found that the new technology had a significant impact on the output of cereals during the first phase of the programme. In the case of oilseeds and pulses, a part of the progress could be attributed to soil conservation and yield increasing methods and in the case of fibres impact could not be realised.

S.P. Singh and C. Prasad (1992)\textsuperscript{19} in their study, “Second Phase of Green Revolution: Rainfed Agriculture,” made an attempt to examine the production trends in the present agricultural scenario. Their study reveals that there has been a marked positive relationship between increase in productivity and concomitant increase in irrigation. In contrary, production of crops has been lagging far behind
in the rainfed areas where irrigation facility has not increased appreciably. This study examines the availability and application of resources and technologies to improve rainfed farming in the context of ushering in the second phase of green revolution.

K.N. Nian and H. Chandrasekhar (1993) in their study “Green Revolution: Dryland Agriculture and Sustainability” analyse the growth experience of Indian agriculture and its implications for growth, and sustainability. The study examines the association between growth and instability and factor behind yield instability, using crop wise and disaggregated time series data analyses the cost economics of Indian agriculture covering several crops and regions. The authors observe that while irrigated crops and those with acres to modern farm technology have dominated the growth process, dry crops and drought-prone regions like Karnataka in South India they have shared the gains of agricultural growth. But this growth process has been accompanied by higher instability in yields and increasing costs of cultivation. The strategies for promoting sustained agricultural growth will have to keep in view the diverse environment and constraints under which agriculture growth is taking place.

R.P. Singh, P.B.R. Hazell (1993) in their study examined poverty in a dynamic sense in three agro-climatic regions of India’s Semi Arid Tropic regions (SAT). This study covers 10 villages in five agro-climatic regions. It first focuses on the identification and determinants of rural poverty. Then it examines the effects of policy interventions on poverty. The most important policy intervention for poverty alleviation is the complete package of land with a pair of bullocks and a minimum of eight years of schooling increasing education levels, providing bullocks, increasing irrigation by 40 per cent and increasing wage rates are equally effective in reducing poverty in semi-arid tropics.
C.J. Intnal, M.I. Belgaumi, V.P. Badanur, V.S. Surkod and Q.C. Sajjan (1994)\(^\text{22}\) in their study have pointed out that the productivity levels of different crops in dryland areas are not encouraging because of low and erratic rainfall, poor fertility status of the soils and non-adoption of improved land, water and crop management practices. In their study they suggest to improve soil and water management practices, use of surface run-off water collected in farm ponds for supplemental introducing of crops and cropping systems with higher water and alternate land use systems for sustained production would pave the way for enhancing the crop yields by 100 to 150 percent compared to the traditional practices.

Singh (1994)\(^\text{23}\) attempted to analyse the impact of new technology in the rural areas of Semi-Arid Tropes. The findings indicated that the income of rural households were low in general, where as the villages with assured rainfall were having highest levels of adoption of new technology. The mean income levels of such villages were higher as compared to the villages having restricted use of fertilisers and limited access to irrigation.

T.M. Gajanana and B.M. Sharma (1994)\(^\text{24}\) in their article "Instability in Dryland Agriculture: A Study of a Drought Prone District in Karnataka" analysed the instability in dryland agriculture with respect to yields and product prices. The techniques of coefficient of variation around the trend (CVT) have been employed for the analysis. The study was conducted in Tumkur district of Karnataka state. A time series data from 1968 – 69 to 1985 – 86 was considered. The results show that all the enterprises except dairying had very high index of instability indicating that there was very high magnitude of risk. Among the crops almost all the pulses and millets besides paddy were found to be highly unstable in yields during drought years. In the paper an important observation was made that normal rainfall alone could not affect crop yields. With respective crop price variability as measured by (CVT) it was found that there was 20 per cent of price
variability. The authors concluded that crop enterprises were riskier than sericulture and dairy enterprises. Therefore these enterprises might be combined with crop cultivation to fight drought.

The results of S.M. More, S.P. Mulik, and J.D. Patil’s (1994) study indicated that by adopting soil conservation measures, the ground water storage of dug wells in the watersheds increased substantially. The area under seasonal irrigation increased from 1 to 15 hectares. Compartmental bunding tried as an inter-bond practice for soil and moisture conservation, increased the grain and fodder production of rabi sorghum by 38 and 50 percent respectively. Overall increase in crop production by use of improved seed over local seed of crops had grown ranging between 25 and 125 percent. An increase in grain and fodder yield of rabi sorghum by 72 and 75 percent respectively due to cultivation on deep soil as compared to medium soil was noted. Use of available water for life saving irrigation was an added advantage. Cropping intensity increased from 95 percent to 134 percent. Use of two bowl ferti-seed-drill for placement of fertilizers increased crop yields considerably. As a result despite the fluctuations in the rainfall over the five years of the study, the improved crop production technologies increased the overall crop productivity by 200 – 300 percent. Constraints in technology transfer and feed back mechanism were also identified for future developmental needs of dryland areas taken up for improvement on a watershed basis.

Madhusudhan Ghosh (1996), made his study on “Agriculture Development and Rural Poverty in India’ The study is carried on using state wise cross section data at four points of time, 1972 – 73, 1977 – 78, 1983 and 1986 – 87. The study examines the effects of agricultural development and some other variables on rural poverty in India. The result of the study suggest that the incidence of rural poverty can be reduced significantly by increasing productive
employment in the rural areas and by maintaining the rural wage rate at a reasonable level. Its incidence can also be reduced by increasing the average size of the marginal and small operational holdings through re-distributive land reforms. Alternatively, this can be achieved by increasing their land productivity by providing agricultural inputs including credit at subsidy rates.

Dilip Kumar Bastia and Ajoy Kumar Rout’s (1998) study was based on Secondary data. The daily rainfall data was collected for 22 years (1976 to 1997) and its seasonal, monthly and weekly fluctuations were calculated as well as weekly rainfall associated with different dates of onset of Southwest Monsoon was also calculated. It was observed that when onset of monsoon was from 28th May to 10th June, the area got around 14 weeks of cropping season with high variation of rainfall in 25th and 26th standard meteorological weeks and an intermittent dry spell around 32nd week. Hence, adequate soil moisture build up before sowing of crop and life saving irrigation at transition phase of crop should be insured article planning for a successful cropping schedule. When monsoon breaks late i.e., after 25th of June, it withdraws as early as 9th of September. In such an occasion, the area hardly gets 10 weeks of cropping season with a dry spell around 33rd standard meteorological week where short duration crops like Sunflower, Blackgram, Jowar, Groundnut etc., and their drought resistant varieties have been suggested.

Rainfall is one of the most important weather factors that control the crop production in rainfed areas. The crop production is virtually dictated by the availability of rain in such areas. Analysis of rainfall and its characterisation helps in identifying suitable crops and cropping system of a region. The analysis of J.B. Singh and C.R. Hazra (1998) on rainfall pattern of Jhansi over the years on decadal basis for three decades was made with a view to find out the possible change in rainfall pattern in relation to onset termination and length of rainy
seasons including probable periods of occurrence of dry spells. Analysis indicates a possible shift of pattern of rainy season over the year. Delay in few days in onset and also an early cessation of rains together have reduced the effective period by one week on each decade suggesting there by shortened growing period of crops over the decades. This short duration of rainy season will affect the production of traditional Kharif crops in this region. An alternative approach based on short growing period of crops is required for successful crop production in rainfed areas of Jhansi.

Rajesh and Kombairaju (1998) studied on the use of tractor drawn implements like basin, lister, boardbed, fertilizer-cum-seed drill which help cultivator to save operation time and to conserve the monsoon rain water in site resulting in better germination, crop growth and yield. Through the use of improved tractor drawn implements resulted in increased energy use and cost, the additional income realised from higher yield was more compensated than the additional cost generated and more profit as compared to non-using farms. The level of mechanisation in the rainfed agriculture is still very low. The main reasons for this are small and scattered holdings, poor intense capabilities of the farmers and non-availability of quality implements and mechanization in the vicinity of village. Since the investment required on agricultural machinery is quite high and these machineries could be used only for a few ways in a year, the farmers give low priority for mechanisation in dry farming in comparison to other inputs. Hence custom of machinery and contractual fields operations have to be popularised through proper extension of education.

S. Erappa (1998) carried out his study on “Sustainability of Watershed Development Programmes to Dryland Agriculture in Karnataka”. He finds that there has been an increase in the productivity of almost all crops, as a result of watershed development programme across all land holding sizes. However, the
study also reports that there has been a drop in yields of few crops like ragi, and maize. Another study on Gulbarga shows that there has been an increase in the productivity of crops like tur, hybrid jowar and bajra.

Manoranjan Sharma (1998)\textsuperscript{31} in his article, “Sustainable Agriculture Growth: Accent on Dryland Farming” stated that scientific watershed management was beneficial both to the individual farmer and the entire area by reducing the inherent instability in agriculture production. It was felt that watershed management projects in Kerala included a combination of engineering and agronomic measures like Peurto Rican type contour terrace wall, contour trenches and embankment, gully plugging and landslide stabilization. Watershed management projects in Punjab emphasised drainage and watershed canalization works like earthen embankment, gabion structure like sturs, spurs, revetment, etc.

Food grains play a major role in the agricultural production of any country. In India, rice and wheat among the cereals and maize among the millets took a large share in the country. Y. Radha and Y. Eswara Prasad (1999)\textsuperscript{32} in their, study based on secondary data on Area, Production and Productivity of Rice and Maize was collected from five districts viz., Nizamabad, Warangal, Khammam, Karimnagar and Adilabad over a period of twenty years from 1973 – 74 to 1992 – 93 revealed that in maize the area was found to be decreased during ex-post NARP over extent, but the mean value of production and yield exhibited a positive change. Though the coefficient of variation was found to be increased in area and yield, the production variation decreased. Instability indices of rice and maize decreased during sound period over the former in all the variables except for area in maize which is coinciding with the negative change in area but without affecting the production levels. The decreasing instability value revealed the attainment of instability in agricultural production of rice and maize.
M.C. Swaminathan (2000)\textsuperscript{33} feels that the approaches and policies adopted for agriculture development in the last half century have fulfilled the objectives to a large extent. Self sufficiency in food gains has been achieved. Rural incomes have risen and have generated demand for the products of other sectors and contributed surplus for investment in them. Poverty has also declined in rural areas. The factors that contributed to these achievements are agricultural research; irrigation and other infrastructure, flow of institutional credit, subsidising of yield augmenting inputs, minimum price support operations and the public distribution system. The focus on achieving food security has, however by passed less endowed regions leading to regional disparities in income and incidence of poverty. Output growth has also stagnated in the last decade.

Rice is the basic source of household income in the study villages, accounting for about 46 per cent of total income A Janaiah, Manik, L. Bose, A.G. Agarwal (2000)\textsuperscript{34} pointed out that the distribution of total income was relatively less unequal in the rainfed ecosystem than that of in the irrigated ecosystem. But agriculture and/or rice contributed a higher proportion to overall income inequality in the irrigated ecosystem because of the higher share of income that originated from these sources and not because of higher inequality of agriculture or income. Income inequality in rainfed ecosystem could minimise the creation of productive non-farm employment opportunities so that disguised unemployment got absorbed. The incidence, depth, and severity of poverty were substantially lower in the irrigated ecosystem. Therefore adoption of modern rice technology and the expansion of reliable irrigation had significant positive impact on rural poverty in the Chattishghar.

I.Sekar and K. Palani Sami (2000)\textsuperscript{35} made their study on “Farm Planning under Risk in Dry Farmers of Palladam Block Coimbatore District in Tamil Nadu”. In his study using the MOTAD (Minimisation of Total Absolute Deviation) model an initial optimal plan was derived. In the optimal plan, second
season green gram was found to be feasible instead of cholam I in existing plan and 33.3 layers entered additionally in the new plan. Where a 10 per cent increase in the net income of maize, cow and layer was made, the risk was reduced from the initial optimal plan to the sum of Rs. 2859.68, Rs. 2636.79 and Rs. 2897.52 respectively. This emphasised the need for fixing appropriate price policy for these commodities to stabilise the income of dryland farmers. A decrease of 12.5 per cent in capital of maize would reduce the risk marginally. It implies that there would be a reduction in risk if capital saving technology is employed for maize.

When a 10 per cent increase in the capital level was made it was found to minimise risk to greater extent. Finally he suggested that the financial institutions should provide the needed capital to farm sector to raise the income in crop and livestock activities efficiently. More area under pulses and new technology such as poultry was entered in the new plan. Agricultural allied activities such as livestock/poultry should be encouraged to ensure regular flow of income even in drought conditions.

P.K. Joshi, B.S. Chandel, S.M. Virmani and J.C. Katyal (2001) made their study on ‘Agriculture Performance in Semi-Arid Tropics of India”, annual compound growth rates of all major crops calculated in the study were based on secondary data. The growth rates were computed for two time periods 1970-71 to 1979-80 and 1980-81 to 1990-91. All the indicators like agricultural income, yield levels, their stability, cropping intensity and crop diversity selected to investigate agricultural performance revealed large variations in them within the SAT regions. The performance of superior crops like rice and wheat was remarkable, while that of interior crops like pearl millet and sorghum was quiet dismal. Pearl millet-sorghum, cotton-sorghum, and sorghum based cropping system proved to be the systems of low income and high risk in comparison to rice and rice based cropping system. The crops like chickpea, ragi and sorghum were either pushed to more marginal lands are neglected due to expansion of a few relatively higher
profitable crops which resulted in poor performance or land degradation might be posing a constraining in enhancing the crop yields. The variation in agriculture performance was largely due to difference in agricultural potential, which was influenced by the uneven endowments of natural resources, besides lack of diffusion of improved technology, inadequacy of bank credit and other infrastructures, and low status of socio-economic factors especially literacy.

R. Rajesh (2001)\textsuperscript{37} in his study found that the average level of adoption of technology was 51.29 per cent and the largest number of 102 farms was seen in the class intervals of 51-60 per cent adoption. In functional analysis, a log-log production function was used to evaluate the resource use efficiency separately for each of the reference crops. In sorghum and bajra the farmers could increase the yield by applying more of nitrogen fertilisers and using more human labour and machine power. The result revealed that the farmers could increase the yield in cotton by applying more of farm yard manure, nitrogen fertiliser and using more of human labour and machine power. The fact that many farms lagged far behind would suggest that there might be farm specific constraints and relaxing them would therefore offer way to enhance the adoption of technology by individual and for faster diffusion of technology in general. Finally he gives some implications for policy. Operational constraints in dry farming continue to be lack of awareness, inadequate knowledge, lack of conviction and risk aversion. The only panacea for all these ills is more of extension of education and physical resource constraints of dry farms, specify of finance in farms and low credit worthiness of farmers with high risk on returns. Encouraging collective farming (either co-operative joint farming or informal group farming) may solve all these problems.

M.A.Khan (2001)\textsuperscript{38} in his article, “Rainwater Harvesting Technology for Sustainable Water Management” examined maximizing water availability in the face of increasing demand for domestic consumption and for biomass production
Management of rain-run off involved harvesting of excess rain falling on land surface by creating a storage facility either in field or in a constructed structure.

In D.H. Vlemale and P.B. Paranjape’s (2002) point of view water is most important single requirement for the growth of agriculture to be raised successfully. Irrigation is required not only in low rainfall areas and during non-rainy season but also during long breaks in rains in good rainfall areas. Therefore to use available water efficiency remains the only way to increase agriculture production. Due to fluctuation in monsoon, available scarce water must be conserved by using various water conservation devices under water conservation programme is almost a necessity of Indian agriculture. The authors use Gabion structure for the development of dryland agriculture. It is water conservation device. They concluded that the cropping intensity was higher on beneficiary farmers than on non-beneficiary farmers. Use of various inputs on beneficiary farmers was slightly higher but per hectare yield of selected farmers of beneficiary was more than non-beneficiary. Production on beneficiary was higher than non-beneficiary. It was due to water conservation. Capital investment of Gabion structure was cheaper and most economical as they were made by farmers, only cost of chain links was included in estimation cost.

K.G. Kshira Sagar, S. Pandey, M.R. Bellon (2002) carried out their study, based on the primary data of rice production practices of 50 rainfed lowland farmers from Garh Madhupur village in Orissa. In this study farmer perceptions regarding traditional and improved rice varieties in a rainfed village in Orissa are used as a basis for explaining the low adoption of improved varieties and the high degree of varietal diversity. The result indicates that quality characteristics loom very large in farmer’s choice of rice varieties.
Md. Alibaba, D. Kumara Charyulu, D. Anil Kishore and Y. Eswara Prasad (2002) have carried out a study on the temporal variation in source of irrigation and the impact on the rainfed agriculture of Telangana region of Andhra Pradesh. This study is based on secondary data for a period of twenty years, the simple statistical technique compound annual growth rates was used. It is found that there has been only a marginal increase in the total irrigation area in the study period. A high positive growth rate in the area by tube well may lead to over exploitation of ground water resulting in further lower of water table. They have suggested that Government should take adequate measures to check over exploitation of ground water, desilting of canals and tanks should be taken up to utilize their maximum capacity and increase the irrigated area. Change in the food habits of people led to changes in cropping pattern away from cereals and millets. Due to better returns there is a shift in the cropping pattern from food crops or oil seeds to commercial crops.

Rainfed Agriculture in India contributes 40 per cent of food grains production and livelihood security to 70 per cent of the rural community. The development of technology for dry farming has remained a neglected area. Farming is a risky venture especially where it is dominated by small and marginal farmers. L.S. Gangwar (2002) made a study based on primary data by using multi-stage random sampling technique in a sugar-mill command area. Cobb-Douglas production function for different crops grown on irrigated and un-irrigated group of farms was formulated using per hectare return as dependent variable for the analysis. The results revealed that there was a one per cent increase in expenditure on irrigation in canal irrigation. The returns per hectare from sugarcane ratoon fell by 0.15 per cent. It reveals that there was over use of canal water in sugarcane ratoon. The regression co-efficient of investment on plant protection chemicals for all crops grown on canal PTW and GTW irrigated farms and un-irrigated farm groups were found in significant expenditure on
fertilizers, machinery, human labour and irrigation contributed significantly to crop productivity on all three groups of farms. Finally he suggests that for the motivating to adoption of HYV seeds, for better transfer of technology and extension work, it is necessary to give information about new innovation, through the farmer awareness camps, frontline demonstration, village meetings with members of Gram Sabha. The emphasis should be given on crop diversification with livestock, poultry activity to minimize risk and generating income from alternative in adverse climatic conditions.

V.M. Rao and R.S. Desh Pandae (1998) emphasized that the performance of public distribution system in drought prone areas was poor with the help of illustrative data from two drought prone districts of Karantaka. Further they have suggested for an alternative system of food security of providing equal food security to all areas with the help of decentralized debureaucratized and depoliticised system.

A. Maharajan, G.K. Hiremath and B.L. Patil (2003) in their study measured the profitability of grouping various crops in the Northern dry zone of Karnataka. The cost, output and other estimates of crops for the area of study as available in the centrally sponsored scheme on cost of cultivation of principle crops in Karnataka were collected from the published reports. Breakeven yield found to be relatively quite stable in crops of HYV paddy, sunflower and cotton in Kharif season, Bengal gram and sunflower in Rabi season, ground nut in summer season annual crop sugarcane were found to be profitable as the actual yield was greater than the breakeven yield for these crops over the year.

Maintaining India’s food security in next two decades and beyond is a challenging. Since the productivity in irrigated area is reaching a plateau, the bulk of rising food demand in the country has to be met by enhancing the productivity
of drylands. According to H.P. Singh, K.K. Sharma, G.R. Korwar (2003)\textsuperscript{45}, the dryland agriculture faces so many problems like, diffusion of improved technologies, which can be accelerated if the introduction of land uses have clarity in economic transparency in terms of higher income from the same unit of land through value addition. This has to be core strategy for the future, at least for those dryland areas having better resource endowment, poor diffusion of dryland farming technologies. More on farm research/testing is required with farmers participation. Finally the authors suggest that involving NGOs can do this more effectively, simultaneously a better interfacing between ‘the input supply agencies and institutions that provide technological back stopping is necessary.

N. Sakthivel and A. Balasubramanian (2003)\textsuperscript{46} carried out a “study on Influence of Dryland Technologies on Rainfed Maize”. A field experiment was conducted during the North East Monsoon season of 1995 – 96 at Coimbattore to study the influence of date of sowing, land management practices and seed hardening techniques on rainfed maize. The experiment was laid out in split plot design taking time of sowing and land management practices as main plots and seed hardening techniques as subplot treatment observations on growth components, yield parameters and yield were recorded. The results showed that pre monsoon sown crop recorded 40 per cent higher grain yield (3795 Kg\,ha) over monsoon crop (2678 Kg\,ha). Among the land management practices, ridges and furrows were superior in recording better growth and yield components. Significant response was not observed between hardening methods studied on maize grain yield.

G. Sastry, Y.V.R.Reddy, Om Prakash and H.P.Singh (2003)\textsuperscript{47} in their study, “Reshaping of Dryland Agriculture Watershed Management Programs in Different Areas of India” stated that community approach was needed for augmentation of groundwater through surface water resources. Water Resource
Development, was an important element of watershed development programmes and key to the success in India. Productivity level increased by 60 to more than 100 per cent due to supplemental irrigation associated with fertilizer consumption. Fertilizer consumption increased from almost zero to about 40 kg/ha. Productivity of dry crops responded positively when integrated with watershed management that included water resources development and fertilizer consumption.

R.L. Shiyani, B.H. Kakadia and V.D. Tarpara (2003) in their study have concluded that the drought is a major cause of concern for the policy makers of the state. The best way to develop dryland agriculture in Saurashtra is by following the watershed approach. Proper management of natural resources towards obtaining a suitable and steady growth in productivity can help to break the major constraints of Saurashtra agriculture. Creation of more number of fodder banks and distribution of fodder at reasonable rate to the affected farmers would help to save the livestock economy in the region. The government should accord high priority on the relief works pertaining to the development of irrigation work.

Hanish Kumar Sinha and Chandra Sen (2004) in their study, made an attempt to examine the impact of drought on area and productivity of crops and on the income and employment of various categories of farmers. Multistage stratified random sampling procedures were adopted for the selection of district, block, village and farmers’. Indices were worked out to examine the impact of drought year with the normal proceeding year. It could be inferred from the study that due to drought the cost of cultivation of all crops on all sizes of farms was decreased to a minor extent. This decrease in the total cost and unfavourable climatic conditions resulted in a drastic decrease in total returns obtained through cropping activities on the sample farms. Aggregate income and employment generated through the cropping activities on various sizes of farmers during two years were estimated and it was found that both income and employment showed
significantly negative trends during drought year on each category. The severity of the effect of drought on income and employment generation was maximum in case of marginal farmers followed by small, medium and large farmers in the same order.

Jai Singh Rathore (2004) in his study made an attempt to analyse the impact of drought on various aspects of rural lives in order to understand the strategies and practices adoption by the drought affected people to cope with drought. Livestock provides supportive income, employment and nutrition to the households in the drought prone areas. The households adopted a strategy to sell larger quantities of milk and milk products to meet their cash requirements. None of the households migrated with animals. It was observed that the better-off households took advantage of the situation and purchased assets sold by poor households under distress. A small ruminant became very convenient in sale/purchase value within the affordable limit.

K.A. Rasur’s (2004), study was based on both primary and secondary sources. By a three stage stratified random sampling method, 200 farmers were selected from the dry farming areas of Sedam Block, Gulbarga district of Karnataka. It’s a comparative study of farms with poor technology adoption with those having higher level of adoption would bring to identify the constraints in diffusions of new technology. There is a positive correlation between crop income and technology adoption in India, firmly showing the impact of technology on crop production. In contrast the relationship was a negative correlation between non-crop income and TAI (Technology Adoption Index). The technology adoption had positive impact on family labour. It increased from 14.59 man days in first group to 75.69 man days/ hectares in third group firm. A similar effect was seen in technology use of third labour also but the impact was negligible from 66.86 percent in group I to just 70.51 per cent in groups III. It was due to adoption of improved farm technology, which increased the demand for additional labour.
Thus it was concluded that technology change in crop production had contributed not only to family labour employment, but also to the employment of agricultural labourer by providing additional days of employment to them and the addition was significant.

K.P.C. Rao (2004) in his study provides micro-level evidence from the village study of Mahabubnagar, Kurnool and Nalgonda districts during 2001 – 2002. The study concludes that crop and livestock rearing activities in dryland areas of Andhra Pradesh are not remunerative. The study also highlights the infructuous investments in water exploration and migration of labour force, which are the responses of agricultural population to the deepening crisis in dryland agriculture. It argues for greater public investment for land and water development and for the development of relevant technologies to benefit the dryland farmers. It also pleads for several policy initiatives to correct the bias that has inadvertently crept into the government policies while perusing the objectives of self sufficiency and quick development.

V.M.Rao (2004) in his study “Rainfed Agriculture”, discussed the main lesson emerging from the perspective on farmers in rainfed agriculture. In this study, it is said that the immediate barrier ahead, blocking the farmer’s progress is posed by policy constraints rather than by limitations of resources or non-availability of new technologies. He focuses the analysis on the socio-economic foundation of rainfed agriculture influencing farmer performance and his development status. In this foundation remains weak, the breakthroughs achieving improvements in growth, development and equity in rainfed agriculture.

R.K.Sivanappan (2004) in his article, “Water Harvesting and Conservation for Increasing Production in Dry Watershed Basis” opined that public participation was very much essential for success of watershed management. This is needed on global priority to restore lands degraded due to
human mistakes. The people's participation was very essential in soil land conservation and water harvesting and also to increase production from the rainfed lands.

S.P.Wani, A.Ramakrishna and T.K.Sreedevi (2004)\textsuperscript{55} in their study, “Unlocking the Potential of Rainfed through Integrated Watershed Management” stated that integrated watershed management allowed in-situ conservation of soil nutrients, which gradually offered the opportunity to harvest several crops in a given year through supplementary irrigation.

Y.V.R. Reddy (2004)\textsuperscript{56} in his study revealed that India developed suitable technologies graded package for drylands so as to improve the productivity of crops and there by profitability to farmers. Technologies on watershed development programme, intercropping, sequence cropping, agro forestry system suitable farm implements, bio-pesticides and fertilizer application were discussed in addition to explaining the problem in dryland technologies. All these technologies established their superiority and profitability over traditional technologies. However dryland farmers were at disadvantage position compared to irrigated farmers due to delayed monsoon or prolonged droughts, non-availability of certified seeds, genuine supply of plant products, lack of risk aversion mechanism during monsoon failure or drought. Need based and production based mechanism are required for the benefit of farmers in drylands.

A.R.Verma, A.M. Rajput and R.N. Srivastava (2004)\textsuperscript{57} in their study, “Economic Evaluation of National Watershed Development Program for Rainfed Agriculture in Indore District, Madhya Pradesh” examined the cropping pattern, cropping intensity, production cost and returns and input-output ratio on farms of different sizes in National Watershed Development Programme for Rainfed Agriculture (NWDPRRA) and Non-NWDPRRA areas. They adopted a multi-stage
random sampling technique to select the cultivators under NWDPRA during 1999-2000. This study found rise in the levels of income, employment and productivity of various crops in watershed area on small, medium and large farms. This study suggested measures such as adoption of land, soil and water conservation practices by the farmers, better co-ordination among government functionaries, and better co-ordination between development activities for effective implementation of NWDPRA in rainfed areas.

Satyendra P. Gupta (2004) in their article, “Watershed Development Program in the Rainfed Area of Chattisgarh State: An Economic Evaluation”, assessed the effectiveness of Chamara Nala Watershed Project launched under NWDPRA. The assessment of occupational pattern, employment generation, and extent of migration, financial assets, liabilities and repayment capacity were some of the socio-economic indicators taken into consideration from various objectives of the project. The study found that the average holding was 2.57 ha and 2.10 ha of which 28.02 per cent and 13.33 per cent were under irrigation in watershed and control area respectively. The employment generated in the watershed area was estimated as 448 labour days per farm per year which were 58 per cent more than employment than that of account in the control area. The total migration was observed to be 7,830 labour days from 75 families in control areas as compared to 1580 labour days from 8 families in watershed area. The study concluded that farmers of control area could also achieve some of the benefits on account of horizontal diffusion of agricultural technology in the whole of the community development block.

P.Kumarsen, G.Srinivasa and N.B.Vijaya (2005) in their study “Productivity and Profitability in Rainfed Sericulture –A Study in the District of Chamaraja Nagar in Karnataka”, have revealed that the cash input such as chemical fertilisers and disinfectant chemicals are used less than the
recommended quantities where as labour used in excess. The production function analysis has indicated that the bullock power, human labour quantum of feed and disinfectants are the important inputs which significantly influence cocoon production. As regards the allocative efficiency of resource use, bullock power is being used efficiently. Leaf, fertiliser and disinfectants are used at sub-optimal levels. The labour is being used in an uneconomical manner. It is suggested that intensified efforts would bear fruitful results in popularizing the improved sericulture in rainfed areas.

S.N. Sudhakara Babu and T. Vishnu Murthy (2005) in their study reveal that Andhra Pradesh is well endowed with agro-climatic situations for profitable agriculture. With the mean annual rainfall of 915mm, it can support a wide range of crops suitable from arid to sub-humid regions. The focus of sustainable development of dryland regions of the state (Telangana and Rayalaseema regions) requires wiser exploitation of the resources. Though macro level characterization of resource has been done to achieve a break through, micro-level assessment of natural resources and their utilization or exploitation as per their capability are essential and immediate attention to soil conservation and adoption of improved crop management technologies will result in dividends in terms of profitability even under vagaries and uncertainties of rainfall. Finally the authors have recommended that the cop production to be combined with animal husbandry for sustainable livelihood. Dryland horticulture has to be adopted either as a sole system and micro level assessment of natural resources including social and gender issues and their utilization as per capability is essential.

Shaik Haffis and Y.V.R. Reddy (2005) in their study revealed that the technological factors such as manures, fertilisers ($\text{P}_2\text{O}_5$) and pesticides turned out to be significant and showed positive effect on productivity of groundnut in Ananthapur and Chittore districts of Andhra Pradesh. It was found that under rainfed conditions in this district, manure, fertiliser (NPK) and human labour
utilisation turned out to be significant and exerted positive impact on productivity while P_2O_5 showed negative effect on it. It was also found that the seed rate in Chittore district and bullock labour and tractor power utilisation in both the districts of Andhra Pradesh did not turn out to be significant factors in increasing productivity. Thus, under different situation, different factors influenced productivity at different levels. However it was clear that manures and fertilisers had a major role to play in influencing productivity.

Andhra Pradesh continues to face water scarcity, which results in regional disparities and political turmoil. V. Ratna Reddy’s (2006) study reveals that the Government of Andhra Pradesh has constructed 32 new irrigation projects under ‘Jalayagnam’ with an estimated cost of Rs. 93,078/-crore. All these projects are expected to increase the gross area under irrigation from 44 percent (57.97 lakh ha) to 90 per cent (117.55 lakh hect) with their completion by utilising the water in the state. A lion share of these investments is expected to be in presently less irrigated region of Telangana and Rayalaseema which account for Rs. 20,812/-crore. Therefore the government’s irrigation policies should focus on alternatives for strengthening the resource based and enhancing livelihoods in the fragile resource areas. This approach would provide the much needed stability to the agricultural sector and minimise agrarian distress in these region.

H.R. Sharma carried out (2006) a study on “Incidence of Indebtedness in Rural Areas: A State Level Analysis”. The study was based on NSS data which covered 20 major states of the country. The data showed that in most of the states cultivation was the major source of income for more than one-half of the indebted farmer households and that more than 70 per cent of such households were marginal farmers. The amount of outstanding debt had positive and statistically significant relationship with size class of land possessed and per capita monthly expenditure in most of the states. In so far as the purpose of borrowing was concerned, capital and current expenditure on farm business together accounted
for more than one-half of the total outstanding debt in a majority of the states like Andhra Pradesh, Bihar, Chattisgarh, Gujarat, Haryana, Himachal Pradesh, Jammu & Khasmir, Orissa, Utter pradesh and Uttaranchal. The debt outstanding to money lenders and traders was around three-fifths in Andhra Pradesh and Rajasthan, two – fifths in the Punjab and Tamilnadu and one-third in Assam, Bihar, Haryana and Madhya Pradesh. And the empirical studies on socio-economic and agrarian background of the farmers who committed suicides have reported indebtedness, especially to input dealers and money lenders as one of the important factor leading to such death.

P. Samuel, B.C. Barah and Pandey (2006)\(^4\) studied on the livelihood systems of farm households in Costal Orissa. This study was based on primary data, collected from 193 farmers. It was found from the study that the incomes of these households were quite diversified. As against the general impression that the crop income dominates household incomes, it is observed that the non-farm income has emerged important in the Costal Orissa. Rice, which has been traditionally the main source of income in this area, has slipped to the third position. The income from non-farm works and rice has respectively accounted for 71 percent and 20 percent of total income. The non-farm income sources have contributed more than 90 percent towards income inequality. The source wise income share has also shown a similar trend at the disaggregated level of farm size categories. The income share from livestock has been comparatively high for large farmers. Their non-farm income is three times higher than that of the non-farm incomes for the small farmers and two times in case of the larger category. Finally this study suggests for creation of more non-farm employment opportunities, increasing in investment on human resource development, more of R&D on development of rice varieties and tube well irrigation will be needed to increase and stabilize household income in Costal Orrisa.
The depletion of soil moisture, occurrence of drought reduction in the bio-mass availability, extension of cropping to sub-marginal areas to meet the production deficits, enhanced weed growth are the resultant impact of the degradation of soil and water leading towards environmental degradation in drought prone areas. In this view, Ch. Radika Rani (2006) in her paper entitled “Environmental and Sustainable Agriculture in Drought Prone Areas: A Case Study of Andhra Pradesh”, has examined the linkages between the agriculture and environment and means for their growth and sustainability without competing with each other. The author concludes that the community decision regarding controlling the livestock grazing has existed an influence on the rejuvenation of green cover in the developed village. The decline in rainfall and depletion of vegetative cover due to over grazing by goats, improper agricultural practices have complemented each other accelerating degradation of land in the underdeveloped village. There was a devious mismatch between water availability and cropping pattern in this village resulting in apparent drought conditions.

A. Narayana Murthy (2007) in his study “Declarations in Agricultural Growth Technology Fatigue or policy Fatigue” highlighted a number of problems currently being encountered by Indian farmers and agricultural sector as a whole. The technology fatigue is the prime reason for the decline in agricultural growth. This is the only reason for the slowdown or can it be attributed to ineffective policies as well.

J.D. Jeromi (2007) revealed that following trade liberalisation and also due to a host of other factors like deficient rainfall, excessive concentration on export oriented perennial crops, decline in production and productivity, fall in price etc., the agricultural sector of the state has been facing a crisis during the last one decade leading to rise in farmer’s indebtedness and suicides, majority of whom were marginal and small farmers and average loan liability was Rs. 72,000/-; many farmers had private borrowings from friends and relatives.
Their inability to repay these loans (liquidity) is considered to be the proximate reason for committing suicides. The State Government passed a bill to solve the indebtedness of the farmers. The Central Government has provided some financial assistance, taken up projects for water shed development, earth rearing and fisheries development, imposed restrictions on import of some other agricultural commodities like paper, assisted coffee growers, etc. Commercial banks, on their part, took some steps like writing off loans of the deceased farmers up to 1 lakh, introduced OTS scheme for re-scheduled loans etc.,

Tulus Tambunan (2007)\textsuperscript{68} in his study examined the importance of Agricultural growth for poverty reduction in Indonesia. This implies not only for Indonesia but also for other agriculture based developing countries, that promoting agriculture is crucial for pro-poor growth. Finally the author suggested that the green revolution did contribute to the reduction in poverty in Indonesia, particularly in rural areas during the new order government.

B.K.Panda, R.K.Panda and P.Sarangi (2007)\textsuperscript{69} in their study, “Impact of Watersheds Development on Dryland Farming In KBK Districts of Orissa” observed that in recent years, there was growing opinion on the need to initiate soil and water conservation, to develop watersheds and to provide protective and supplementary irrigation particularly to wastelands, drylands, hill terrains etc., for enhancing production and productivity. Watershed was usually employed as an umbrella term describing a whole range of methods of collecting and conserving various forms of runoff water from different sources, particularly for dryland agriculture, It was a collection of excess runoff water in a storage tank and using it for better crop production. Though the basic simultaneously objective of watersheds was soil and moisture conservation, it influences the cropping pattern, yield rate of crops cultivated and consequently livelihood sustainability and food security of the people.
The study is based on primary data collected from a random sample of 200 households selected from four villages—two from the project area and another two outside the project area of Kashipur Block in Rayagada district during January 2005. Analysis of survey data indicated that the impact of watersheds on dryland agriculture was favourable in terms of changes in cropping pattern and its intensity, less in was not favourable in food security and the incidence and intensity of poverty in the project area compared to adjoining non-project areas. These areas acted as a surrogate for the project area when the IWDP project was not implemented. Even though the impact of watershed on dryland agriculture was encouraging; there was still very large-scale food insecurity to the extent of 84 per cent in the project area and 100 per cent in the non-project area.

Ch. Radika Rani and P. Praveena Sri’s (2008)\textsuperscript{70} study aims to examine the risk and vulnerability in rainfed agriculture, and the coping mechanisms adopted by the farmers in rainfed agriculture to sustain or improve their farm income. From the results it is evident that for small farmers, the production risk of crops like maize, sunflower, groundnut and redgram is more than the area risk. But for medium and large farmers, the production risk is more in the case of oilseed crops like groundnut and castor. The financial risk in terms of decrease in marketed surplus is also observed in the case of all crops. Land leasing proved to be an important instrument to augment the production base and enhance the income level for the small and medium farmers. Further, the diversification index shows that small farmers' cropping pattern is more diversified, followed by medium and large farmers, in the developed villages during normal as well as drought years.

M. Srinivasa Reddy, Sanjit Kumar Rout and E.B. Uday Bhaskar Reddy (2008)\textsuperscript{71} in their study made an attempt to assess the impact of drought situation in Ananthapur district in a wider context of rural livelihood, particularly in the year 2002 – 03 with respect to crop failure depletion of ground water, indebtedness,
migration, suicides etc. It further evaluated the relief measures as well as the cropping strategies adopted by the government and people during this crisis. This study brings out clearly about the inefficacy of the short-term measures to mitigate the drought and finally suggested that the area under assured irrigation was to be increased to atleast 33 percent of cultivated area as per the recommendation of the Second Irrigation Commission, 1972. Increasing practice of drip and sprinkler irrigation technologies would enhance water use efficiency. Deep ploughing must be discouraged in drought prone area to pressure moisture content in the soil and an application of deep-rooted local varieties will succeed in dryland and drought prone areas. Moreover, implementation of crop rotation, diversification of cropping pattern and mixed farming will help protect the crop during drought. In dryland areas agro-forestry should be encouraged in addition to seasonal and annual crops to maintain the farming system during stress.

Ramesh Chand and S.S. Raju’s (2008) study has estimated instability in major crops before and after the initiation of economic reforms at the state and district levels in Andhra Pradesh. It has revealed that in a large state like Andhra Pradesh and which is the case for most states of India, the instability status as perceived through the state level data may be vastly different from that experienced at the disaggregate level. The study concludes that the state level analysis does not reflect complete picture of shocks in agriculture production, and further shocks in production underestimate shocks in farm income. It has suggested the need for addressing risk in farm income by devising area-specific crop insurance or other suitable mechanisms.

T. Ponnarasi and K. Sita Devi (2008), made “An enquiry into the Socio-Economic Status of Rainfed communities – Logit Model Approach”. The study made an attempt to examine the socio-economic status of the rural households in rainfed areas. The study utilised a logistic regression model to empirical quantity. The relative influence of various factors influencing a household to be poor or
non-poor. It showed that the level of court R2 was 0.87, which indicated the good predictive ability of model. The estimation yields the expected signs for the coefficients of all the independent variable except social status. Dryland farming is found to be more deprived and poor. The planners could encourage the establishment of employment generating activities in rainfed areas through diversified farming enterprise. The level of living of rural sector was found to be very low especially among the rainfed farmers due to the lack of rural infrastructure. Hence the government might redouble the efforts to strengthen the rural infrastructure facilities through various welfare schemes.

R. Rama Krishna and D. Tata Rao (2008) in their study, “Strengthening Indian Agriculture through Dryland Farming: Need for Reforms”, have stated that the dryland agriculture plays an important role in the progress of agriculture in Indian economy. In India, 68 per cent of total net sown area (136.8 mha) comes under dryland, which spread over 177 districts. Dryland crops account for 48 per cent area is under food crops and 68 per cent area is under non-food crops. In general the economic policies of developing countries in past years had negative effects on development in dryland region. Development strategies have shifted resource way from dryland to irrigated production and from rural to urban also, since dryland farmers are poor and politically less influential. In this context the prevailing policy instruments need to be re-looked at, redefined, rewritten and efficiently implemented to take care of the dryland farming. There is a need to motivate more private instruments into agriculture sector an intention like tax concession or benefits can be proposed to them. There is also a strong need for public-private partnership, not only to start new projects but also to support and maintain the existing public structure.

D.Kumaracharyulu and K.P.C.Rao(2009) assess the risk attitudes of the farmers, which are important in understanding their decision making process. They had carried out a study on the risk attitudes of 80 farmers from four villages
in Mahabubnagar district of Andhra Pradesh. The authors assessed the risk attitudes of the sample by using experimental methods involving trivial but real payoffs to them. In their study they used Mean-Variance (E-V) utility function to calculate the risk aversion coefficients based on the alternative outcomes chosen by the sample farmers. The study found that slight to moderate risk aversion exists in most of the sample farmers. The slight reduction in risk attitudes between 2004 and 2006 was found to be associated with higher rainfall, better access to credit and insurance and improved levels of yields and income age of household head and family size were noted to increase risk aversion significantly.

S.C.Pramanik (2009)\(^{76}\) suggests certain techniques to manage rainwater for successful production of pulses in rainfed areas. In the paper titled “Rain water Management Techniques”, the rainfed agro-ecosystem of pulses growing areas represent wide variation in rainfall which ranges between 500mm and 700mm, soil type, i.e. light red soil to heavy black soil and the length of growing period ranging between 90 days and 180 days. The author opines that though the total rainfall is sufficient to meet the water requirement of the crops, weather extremities such as delayed onset or early withdrawal and uneven distribution make the pulses suffer either from water logging at seedling stage or severe drought yield. In this regard, the author suggests that there is urgent need to operationalise the efficient rainwater harvesting and management technologies specific for successful production of pulses.

V.M.Rao (2009)\(^{77}\) in his study discussed the nature of the crisis with particular reference to rainfed agricultural locates in the emerging societal context and considers the underlaying process. The crisis is a creeping crisis in the sense that it has gradually grown into a menace. It is now owing to indifferent policies. It is pointed out that the policies now on the anvil hardly reflect the concern felt at the highest level in the government. This study argues greater transparency and
accountability in the working of policies and their effectiveness in achieving the goals on which they are focused. Practicable institutional mechanism are suggested to improve policy making at top tire in the government which is seen to be responsible for the poor functioning of the government system despite its vast pool of experts and administrators and a departmental structural reaching down to the ground level. The crisis places a special responsibility on the agricultural economic persons as a think thank on the issue relating to agriculture development and farmer welfare. The study concludes with observation on the role of that the profession can play in helping the government in reining in the crisis and in realising the substantial development potential which rainfed agriculture has.

The review does reveal that though lots of studies have been taken up in India and in other countries with a view to explore the impact of Govt. Policies on the performance of dryland agriculture, the opinion on researching the performance of dryland agriculture is divided.

There had been no sufficient effort to develop input-output coefficients for various sizes of farms under different agro climatic regions. This would provide necessary information for national decision making in matter of mechanisation both for individual farms. The review does also reveal that area of study in most cases is so small and it can be considered for different agro climatic conditions in India factors responsible for the growth of dryland agriculture varies from region to region over time due to initial differences in resources and varying degree of resource development followed by technological changes.

To sum up, various studies discussed in this chapter carried out by a number of scholars and research institutions have proved that the economic policies of developing countries during past years had limited effects on
development in the dryland regions, despite the prominent role of the dryland agriculture in the economics. The studies find that the development strategies have shifted resources away from dryland to irrigated production and from rural to urban areas. Besides, the fruits of Green Revolution have not reached the poor farmers in dryland areas. Since dryland farmers are poorer and are without any political influence, the adverse effects of macro economic policies fall disproportionately on them, in spite of the fact that they are often the primary producers of food crops. Further the reviewers have felt that crop productivity in dryland is low and unstable due to vagaries of weather. So traditionally, mixed cropping is the hallmark of dry farming and intercropping provides a certain insurance against uncertain weather. Integrating the dryland crop yields with watershed management programmes would improve and stabilize crop yields. In spite of large number of studies on dry land agriculture, they are confind to one or other regions. There is no comprehensive study covering all the dry land regions. The development strategies had their impact differently in different regions. So far there is no comprehensive study on the distress conditions of dryland farmers in Andhra Pradesh.
REFERENCES


59. P. Kumaresan, G.Srinivasa and N.B.Vijaya Prakash (2005), “Production and Profitability in Rainfed Sericulture –A Study in the District of


