Chapter -II
Review of Literature
Review of earlier research studies on performance of dryland and wetland agriculture were presented in this chapter. This review throws light on conceptual issues relating to the assessment of crop production, farm income and employment in dryland and wetland regions. This will be guiding us to know the problems faced by the farmers in the earlier studies and to concentrate on particular aspects which need more and more closer examination. The research of various studies on irrigation in dry and wetland in different areas, indepth analysis and observations are helpful to understand the agricultural status in the study regions. The available literature will help to broaden the scope and nature and of immense use to successive research.

An attempt has been made in this chapter to analyse the conclusions of earlier studies on the economic analysis of irrigation in dry and wetland cultivation. Where ever available relevant studies were also analysed and briefly discussed to facilitate the comparison between dry and wetland cultivation in the country.

“The Cropping pattern and the Related Profitability under irrigated Conditions” in Firozpur District (Punjab) was a study by A.S. Khlon, S.S.Miglani and Harwanth Singh (1971)

In a cross sectional data on cropping pattern, yield cost and return for the year 1969-70 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 Dryfarming conditions in Maharashtra” in selected districts concluded that the average yield per acre under dryfarming conditions is very low resulting in poor incomes to the farmers and are unable to bear the risk of crop failure. The average risk to the unirrigated crop of Rabi, Jowar is nearly 46 per cent greater than the irrigated one. As the chances of crop failure is always greater under dryfarming they finally suggested that crop insurance as a safeguard against crop yield instability.

M.V.Nadkarni (1971), in his study “Yield uncertainty in Maharashtra Agriculture” calculated the coefficient of variation for different crops in Maharashtra to measure their yield uncertainty. He concludes that irrigation is not a major determinant 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
will not only increase the average yield but also would reduce the year to year variation.

Paramatma Singh and D.D. Gupta (1971) in their study “Economics of Dryfarming in Haryana State” observed that the average input-output returns of crops were very low in the dryfarming areas with the result that the economic condition of the farmers remained precarious. The study suggests that immediate steps should be taken to increase the irrigation facilities in the areas and also to establish small scale industries to utilize the labour potential which was underutilized. It further suggests that there is ample scope to increase agricultural production in these areas with proper channelization of available resources.

“Economic Evaluation of Dryfarming in Punjab” is the study made by S.S. Kahlon and H.S. Sandhu (1971). In their study to identify dryfarming zones in Punjab they made an interesting study of the Zonal characteristics, moisture conservation methods, pattern of input use and net profits from crops grown in these zones. Groundnut is found to be remunerative in the north and central zones sesamum (mustard) in southern zone. The cultivation of wheat in southern zone resulted in a loss to 124 rupees per acre. From this they are of the conclusion that production potential of dry farm land is extremely low in Punjab. To overcome these lacunae they suggested expansion of irrigation facilities and till then possible moisture conservation measures might be developed to render dryfarming useful particularly in the southern and central zones.

Saroj Kanti Chaudhuri (1971) in his study “Semi Arid Agriculture in west Bengal” found that the cultivators in the semi-arid zones are no less enterprising than those in irrigated zones. He is of the opinion that scarcity of water preventing them from the adoption of improved agricultural practices. Ultimately he suggests that drought resistant varieties of crops which are suitable for the arid-region such as high yielding Bajra, Maize etc., may be encouraged. Cultivators strongly feel that by constructing dams over the rivers that flow in the area will result in sufficient water for growing high yielding varieties of crops and can well raise some rabi crops even.

“Income Raising potential on Rainfed farms in Jabalpur District, Madhya Pradesh was a study undertaken by V.P. Shukla (1971). In this study he examined a
sample of farms in Jabalpur district for assessing the economics of present resource use under rainfed conditions and advanced technology that should achieve net income over a given range of resource. The author found that that the use of fertilizers and improved seeds increased farm incomes by 32 percent and 48 percent on unirrigated and irrigated farms respectively.

Patel R.K. and A.C Gangwar (1983)\textsuperscript{8} in a study on “Estimation of potential for farm income and employment in Dryfarming Areas of Haryana” examined the income and compliment effects of dryfarming technology. Finally they conclude that the introduction of technology risk in the income of small farmers were higher than that of in medium and large farmers.

K.P.C. Rao and R.P. Singh in their study (1968)\textsuperscript{9} are of the opinion that the poor resources base of dryland farmers and under developed institutional facilities in these areas is responsible for backwardness of agriculture. Besides, there are no proper incentives to these farmers to produce more. A strong input supply is needed to facilitate the adoption of new technologies and a strong extension support to enhance the skills and capabilities of dryland farmers. To take risks and innovations it is suggested to provide crop insurance. In addition to these they suggested heavy investments, subsidies and preferential treatment to these farmers as was done in the case of irrigated farming.

N.S. Jodha (1986)\textsuperscript{10} in his study examined the specific implications of new technologies and detailed projections about future demand and supply of major inputs like fertilizers, power and crop output etc. He came to the conclusion that small size of the holding, ecological limitations of dryland agriculture etc., are standing in the way of increased incomes despite the introduction of new technologies. He suggested to combine non-farm activities along with new farm technology for better results.

Ananth S.Rao and M.N. Dandekar (1989)\textsuperscript{11} examined the improvement of income with limited resources of the farms by adopting improved dryland area technology on income and employment of the farm families. The authors found that the net farm income increased by 330, 568 and 470 percent under plan IV compared to that of under plan I. With the use of improved technology and adequate credit facilities, potential for optimum utilization of resources in all farm size groups was
greater. Even the adoption of improved technology is labour-intensive than increasing the scope for the employment of more human labour.

V.M. Rao’s (1991) study “Dryland agriculture in Karnataka” based on the reports of the Government of Karnataka analysed the growth potential of new dryland technology and characteristics of market environment. He concludes that the data and contextual evidence suggested that dryland agriculture in Karnataka is capped by a combination of three unfavourable factors; harsh physical conditions, indifferent policies and competition from more productive parts of agriculture which are having an adverse impact on the thrust for growth of the new dryland technology and on the market environment for dryland.

S.P. Singh and C. Prasad (1992) in their study “Second phase of green Revolution; Rainfed Agriculture” examined the availability and application of resources and technologies to improve rainfed farming in the context of ushering in the second phase of green revolution. The study has revealed that there has been a marked positive relationship between increase in productivity and concomitant increase in production. In contrary, production of crops has been lagging far behind in the rainfed areas where irrigation facility has not increased appreciably.

K.N. Nihan and Chandrasekhar (1993) analyzed the growth experience of Indian agriculture and its implications on growth and sustainability in their study “Green Revolution; Dryland Agriculture and sustainability”. The study analysed the relation between growth and instability and factors behind yield instability using crop wise and disaggregated time series data. In their study on the cost economics of Indian agriculture covering several crops and regions, they observed that irrigated crops with modern technology had tremendous growth in some areas where as in drought prone regions like Karnataka dry crops have shared the gains of agricultural growth. Most significant aspect of this growth is associated with instability in yields and increasing cost of cultivation. Thus the strategies for promoting sustained growth will have to keep in view the diverse environment and constraints under which agricultural growth is taking place.

C.J. Intnal, M.I. Belguami, V.P. Badanur, V.S. Surkod and Q.C. Sajjan (1994) in their study on productivity levels of different crops in dryland areas come
to the conclusion that productivity is not encouraging because of scanty and erratic rainfall, poor fertility of the soils and non-adoption of improved land, water and crop management practices.

Singh’s (1994)\textsuperscript{16} analysis of impact of new technology in the rural areas of semi-arid tropics indicated that the rural households are enjoying very little income, whereas the people in the villages with plenty of rainfall were having higher levels of income with the adoption of new technology. Here the mean levels of the villages were higher when compared to the villages having little use of fertilizers and limited irrigation facilities.

T.M. Gajanana and B.M. Sharma (1994)\textsuperscript{17} analysed the instability in dryland agriculture with respect to yields and product prices in Tumkur district of Karnataka State. Using the time series data from 1968-69 to 1985-86 their results indicated that there was very high incidence of instability and high magnitude of risk in all the enterprises except dairying. All the pulses and millets besides paddy were found to be more unstable in yields particularly during drought periods. They made an important observation that the normal rainfall alone cannot affect yields. They concluded that crop enterprises with higher risk shall be combined with crop cultivation to come out to the vagaries of drought.

S.M. More and S.P. Muck, and J.D. Patil’s (1994)\textsuperscript{18} study on watersheds indicated that by adopting soil conservation measures, the recharge levels of dug wells in the watersheds increased phenomenally. The area under seasonal irrigation also increased from 1 to 15 hectares. Compartmental bunding increased the gain and fodder production of rabi sorghum by 38 and 50 percent respectively. By using improved seeds over local seed of crops improved the production ranging between 25 and 125 percent. Due to cultivation on deep soil as compared to medium soil there is an increase in grain and fodder yield of rabi sorghum by 72 and 75 percent respectively. Judicious use of available water for life saving irrigation also proved to be a boon and it increased cropping intensity from 95 percent to 134 percent. Though there are fluctuations in the rainfall over the five years of study, the improved crop production technologies increased the overall crop productivity by 200-300 percent. They suggested to remove constraints in technology transfer and feedback
mechanisms for future developmental needs of dryland areas taken up for improvement on a watershed basis.

J.B. Singh and C.R. Hazra (1998) studied rainfall pattern of Jhansi for three decades to analyze the relationship between rainfall and suitable crops. Rainfall is the most dominant factor that controls the crop production in rainfed areas. Their analysis indicated that there is a possible shift of pattern of rainy season over the year. They concluded that the short duration of rainy season will affect productivity of traditional Khariff crops in the region. Hence they suggested an alternative short period growing crops when there is short duration of rainy season for successful crop production in rainfed areas of Jhansi.

Rajesh and Kombairaju (1998) studied the impact of mechanization in the rainfed areas. They are of the opinion that the level of mechanization in the rainfed agriculture is very low because of its prohibitive cost to small and marginal farmers. Their study proved that the use of tractor drawn implements like basin, lister, boar bed, fertilizer-cum-seed drill will help the cultivator to save operation time and conserve the rainwater in site resulting in better germination, crop growth and yield. The use of improved tractor drawn implements resulted in increased energy use and cost, the additional income realized from higher yield were more compensated than the additional cost generated and more profit as compared to non-using farms. Farmers are not resorting to mechanization because investment required on agriculture machinery is quite high and these can be used only for a few days in a year, the farmers accord low priority for mechanization in dryfarming in comparison to other inputs. The authors suggest that the use of machinery and contractual field operations have to be popularized through proper extension of education.

There has been an increase in the productivity of almost all crops as a result of watershed development programmes across all land holdings irrespective of sizes. But, the study carried out by S. Erappa (1998) on “Sustainability of watershed Development programmes to Dryland agriculture in Karnataka” reports that there has been a decline in yields of few crops like ragi and maize. In another study on Gulbarga it is found that there has been an increase in the productivity of crops like thur, hybrid jowar and bajra.
Scientific watershed management was beneficial both to the individual farmer and the total area by reducing the inherent instability in agricultural production. Manoranjan Sharma (1998)\textsuperscript{22} in his article “Sustainable Agriculture growth: Accent on dryland farming” felt that watershed management projects in Kerala used a combination of engineering and agronomic measures like peutorican type contour terrace wall, contour trenches and embankment, gully plugging and landslide stabilization. These projects in Punjab emphasized drainage and watershed canalization works like earthen embankment, gabion structure like sturs, spurs, revetment etc.,

“Poverty and income Distribution in rainfed and irrigated eco system: village studies in Chattisgarh” was a study made by A. Janaiah, Manik, L. Bose, A.G. Agarwal (2000)\textsuperscript{23}. In this study they found that Rice is the basic source of household income in the study villages contributing for about 46 percent of total income. They pointed out that the distribution of total income was relatively less unequal in the rainfed ecosystem than that of in the irrigated ecosystem. Income inequalities in rainfed ecosystem could minimize the creation of productive non-farm employment opportunities so that disguised unemployment may be minimized. They conclude that the incidence, depth and severity of poverty were substantially lower in the irrigated eco system. Hence, they suggest the expansion of reliable irrigation and adoption of modern rice technology to eradicate rural poverty in Chattisgharh.

M.A. Khan (2001)\textsuperscript{24} in his article, Rain harvesting technology for sustainable water management examined the preservation of available water. As there is more and more demand for domestic consumption and for biomass production, there is urgent need to manage the rain-run off involved in harvesting of excess rain falling on surface land by creating a storage facility either in the field or in a constructed structure.

“Development of dryland agriculture through Gabion structure (A device for water conservation) is the study made by D.H. Velmale and P.B. Paranjape (2002)\textsuperscript{25} in Amaravathi District. They are of the opinion that judicious use of available water will increase agriculture production. As there are serious fluctuations in monsoon, available scarce water must be conserved by using various water conservation devices. The authors use Gabion structure for the development of dryland agriculture
which is a water conservation device. They concluded that the cropping intensity was higher on beneficiary farmers than on non-beneficiary farmers. Production on beneficiary was higher than non-beneficiary due to water conservation.

“Temporal analysis of rainfed agriculture in Telangana region of Andhra Pradesh” is a study made by Md. Alibaba, D. Kumaracharyulu, D. Anil Kishore and Y. Eswaraprasad (2002)\textsuperscript{26}. They carried out a study on the temporal variation in source of irrigation and the impact on the rainfed agriculture in the region. Based on secondary data for a period of twenty years, the simple statistical technique compound annual growth rates were used. They observed that there is marginal increase in the total irrigated area in the study period. They are also of the opinion that a high positive growth rate in the area by tubewells led to over exploitation of ground water resulting in the further fall in the water tables. Hence they suggested that the government shall take appropriate and drastic measures to check over exploitation of ground water. To increase the irrigated area desilting of canals and tanks should be taken up to increase the water storage and to utilize maximum capacity.

L.S. Gangwar (2002)\textsuperscript{27} made a study on sugar mill command area in Central Uttar Pradesh. His study is based on primary data by using multi-stage random sampling technique. His results revealed that there was one percent increase in expenditure on irrigation in canal irrigation where as returns per hectare from sugarcane ratoon fell by 0.15 percent. From this it is clear that there is over use of canal water in sugarcane ratoon. The regression coefficient 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 farms. He concludes that awareness is to be created among farmers regarding the adoption of new technology, HYV seeds, extension works etc through media, exhibitions, demonstrations etc. Besides he suggested crop diversification with live stock, poultry and other similar ancillary activities to bring down the risk and generating additional income even in adverse climatic conditions.

The cost, output and other estimates of crops of Northern dry zone Karnataka was studied with the help of published reports by A. Maharajan, G.K. Hiremath and B.L. Patil (2003)\textsuperscript{28}. The study indicated that breakeven yield found to be relatively
stable in the case of HYV paddy, sunflower and cotton in Kharif season, Bengalgram and sunflower in Rabi season, groundnut in summer season and sugarcane were found to be profitable as the actual yield was more than the breakeven yield for these crops over the year.

“Reshaping of Dryland agriculture watershed management programs in different areas of India” was a study undertaken by G. Sastry, Y.V.R. Reddy, Om Prakash and H.P. Singh (2003)\(^2\). They stated that community approach is best for augmentation of ground water through surface water resources. Water resource development is key to watershed development programmes in India. Supplemental irrigation along with fertilizer use increased productivity levels by 60 to 100 percent. Productivity of dry crops responded positively when integrated with watershed management coupled with water resources development and fertilizer consumption.

R.L. Shiyani, B.H. Kakadia and V.D.Tarpara (2003)\(^3\) studied the problem of drought on Saurasthra agriculture. They suggested proper management of natural resource and watershed approach to develop dryland agriculture in Saurasthra. Besides they argued for the establishment of more number of fodder banks and distribution of fodder at reasonable rate to the affected farmers to save the livestock economy in the region. The government shall accord high priority to the relief works pertaining to the development of dryland irrigation regions.

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 respectively. Hanish Kumar Sinha and Chandra Sen (2004)\(^4\) in their study drawn the inference that due to drought the cost of cultivation of all crops on all sizes of farms decreased to a small extent but there was a drastic decrease in total returns obtained through cropping activities on the sample farms.

Livestock provides supportive income, employment and nutrition to the households in the drought prone areas. Most of the households sell larger quantities of milk and milk products to meet their cash requirements. It is also observed in the study of Jai Singh Rathore (2004)\(^5\) that the better-off households took the advantage of situation and purchased assets sold by poor households under distress.
In another interesting study by K.P.C. Rao (2004) undertake in the villages of Mahaboobnagar, Kurnool and Nalgonda districts during 2001-02 found that crop and livestock rearing activities in dryland areas of Andhra Pradesh are not remunerative. It is observed in the study that investments in water exploration is infructuous and labourforce is migrating to greener pastures in search of livelihood. The study argues for greater public investment for land and water development and for the development of relevant technologies to benefit the dryland farmers.

“State of the Indian Farmer: A millennium study-Rainfed Agriculture” is a study undertaken by V.M. Rao (2004). In this study he felt that the major constraint in the farmer’s progress is policy constraints rather than non availability of resources and technology.

In his article “Water Harvesting and Conservation for increasing production in Dry Watershed Basis”, R.K. Sivanappan (2004) suggested that public participation was very much essential for success of watershed management. It is due to human apathy the problem is being aggravated. Hence, he concluded that the people’s participation was very essential in soil land conservation and water harvesting and also to increase production from the rainfed lands.

“Unlocking the potential of rainfed through integrated watershed management” is the study made by S.P.Wani, A.Ramakrishna and T.K.Sreedevi (2004). They are of the opinion that integrated watershed management allowed in-site conservation of soil nutrients which gradually offered the opportunity to harvest several crops in a given year through supplementary irrigation.

In his study on drylands Y.V.R.Reddy (2004) stated that dryland farmers are always at disadvantage position compared to irrigated farmers due to delayed and erratic monsoons, prolonged droughts, non availability of certified seeds, genuine supply of plant products, lack of risk aversion mechanism during monsoon failure or drought. He discussed technologies on watershed development programme, inter cropping, sequence cropping, agro forestry system suitable farm implements, bio pesticides and fertilizer application. He concluded that 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{38} in their study “Economic evaluation of National Watershed Development Programme for Rainfed Agriculture in Indore District, Madhya Pradesh” suggested measures like adoption of land soil and water conservation practices by the farmers, better coordination among government functionaries and better coordination between development activities for effective implementation of National Watershed Development Programme for Rainfed Agriculture.

S.N. Sudhakara Babu and T. Vishnu Murthy (2005)\textsuperscript{39} in their study on sustainable development of dryland regions of the state (particularly Telangana and Rayalaseema regions) laid stress for judicious exploitation of the resources. They are of the opinion that to some extent macro level characterization of resources has been somewhat better by attaining breakthrough whereas micro level assessment of natural resources and their utilization or exploitation as per the availability are essential. Further they stated that soil conservation and adoption of improved crop management technologies will result in dividends in terms of profitability even under vagaries and uncertainties of monsoons. They concluded that the crop 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 fertilization as per capability is essential.

Shaik Haffis and Y.V.R. Reddy (2005)\textsuperscript{40} in their study on groundnut in Ananthapur and Chittoor districts of A.P. under rainfed conditions they concluded that under varying situations, different factors influenced productivity at different levels. However they strongly felt that manures and fertilizers play a vital role in influencing productivity.

As against the general belief that the crop income dominating household incomes, it is observed that non-farm income dominates household income. Based on primary data collected from 193 cultivators, P. Samuel, B.C. Barah and Pandey (2006)\textsuperscript{41} in their study on the livelihood systems of farm households in Coastal Orissa found that the incomes of the households are quite diversified. The income share from livestock has been comparatively high for large farmers. Their non-farm income is three times higher than that of non-farm incomes for the small farmers and two times in case of the larger category. They conclude that the creation of more nonfarm
employment avenues, increasing in investment of human resource development, development of newer varieties of rice through R & D and more and more provision of tube well irrigation is need of the hour to increase and sustain the household income in coastal Orissa.

Ch. Radhika Rani (2006)\(^\text{42}\) in her paper entitled “Environmental and Sustainable Agriculture in Drought prone Areas”- A case study of Andhra Pradesh examined the linkages between agriculture, environment and means for their growth and sustainability without competing with each other. The depletion of soil moisture occurrence of drought, reduction in the bio-mass availability, extension of cropping to sub-marginal areas to meet production deficits, enhanced weed growth are the causes for the degradation of soil and water leading towards environmental degradation in drought prone areas. She concludes that the decline in rainfall and depletion of vegetative cover due to over grazing by goats, improper agricultural facilities added fuel to the fire by accelerating degradation of land in under developed villages whereas community decision regarding controlling the livestock grassing has exerted influence on the rejuvenation of green cover in the developed village. She observed that there is a mismatch between water availability and cropping pattern in the village resulting in apparent drought situation.

B.K. Panda, R.K. Panda and P. Sarangi (2007)\(^\text{43}\) studied “The Impact of Watershed Development on Dryland farming in K.B.K. Districts of Orissa”. They are of the opinion that there is a need to initiate soil and water conservation to develop watersheds and to provide protective and supplementary irrigation particularly to waste lands, drylands, hill terrains etc. for enhancing production and productivity. Besides soil and moisture conservation watersheds influences the cropping pattern, yield rate of crops cultivated and consequently livelihood sustainability and food security of the people.

The small farmers are at production risk of crops like maize, sunflower, groundnut and red gram is more than the area risk. Whereas the production risk is more in case of oil seed crops like groundnut and castor for medium and large farmers. The financial risk in terms of decrease in marketed surplus is also observed in the case of all crops in their study by Ch. Radhika Rani and P. Praveena (2008)\(^\text{44}\). They are of the opinion that 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, Sarjit Kumar Rout and E.B. Uday Bhaskar Reddy (2008) made an attempt to assess the impact of drought situation in Anantapur District in a wider context with respect to crop failure, depletion of ground water, indebtedness, migration, suicides etc. in the year 2002 – 03. They are of the opinion that short measures are no way useful for the mitigation of situation. Increasing cultivated area, increased practice of drip and sprinkler irrigation technologies would enhance water use efficiency. Deep ploughing is to be discouraged in drought prone areas to preserve moisture content in the soil and application of deep-rooted local varieties are suggested in dryland. Besides crop rotation, diversification of cropping pattern and mixed farming will help protect the crop during drought. Agro forestry seasonal and annual crops during stress were recommended.

“An enquiry into socio economic status of rainfed communities – logit model approach” is the study made by T. Ponnarasi and K. Sitadevi (2008). The study utilized a logistic regression model to empirical quantity. They felt that farming is found to be more deprived and poor. They suggested more and more employment generating activities in rainfed areas through diversified farming. Further, suggested to increase the government’s efforts to strengthen the rural infrastructure through various welfare and development schemes.

“Strengthening Indian agriculture through dryland farming: Need for reforms” is the study undertaken by R. Ramakrishna and D. Tata Rao (2008). They are of the opinion that development strategies have shifted resources away from dryland to irrigated production and from rural to urban as dryland farmers are poor and politically less influential. Hence they suggested to recast the existing policies towards dryland farming and for the strict implementation of the same.

Lalitha, A (1980) examined the cropping pattern in Andhra Pradesh during the period 1957-1977 and concluded that highest growth rates were recorded by rice in Coastal Andhra, Sugarcane and tobacco in Telegana and tobacco in Rayalaseema
region. Irrigation and rainfall have impact on wet crops like rice, sugarcane in all the three regions.

Grewal, S.S and Rangi, P S (1983) made an attempt to estimate the growth of Punjab agriculture in relation to productivity increase and response to the use of fertilizers and observed that productivity increase was largely the outcome of increased irrigation and fertilizer use.

Mahendra Dev (1987) in his article “Growth and Instability in Foodgrain Production” observed that the inclusion of rainfall index in the trend equation has improved the value of coefficient of multiple determination in most of the states which indicates that rainfall was able to explain the major part of the variation in food grain production. It was shown that differences in quantity and quality of irrigation might be the major factor that influenced inter-state variations in growth and instability in food production.

Hanumantha Rao et al (1988) in their study “Unstable Agriculture and Drought” felt that the instability in agricultural production has increased in the post-green revolution period due to rise in the sensitivity of output due to variations in rainfall. The rising vulnerability of agricultural output, especially of food grain output to drought is traceable to the high complementarity of new seed, fertiliser technology with water and inadequate expansion of irrigation facilities. Although area under irrigation has increased from about 17 percent of cultivated area in early 1950s, a good part of this irrigation is itself dependent on rainfall.

Bandyopadhay (1989) while conducting a study on “Growth and instability in the production of Main Cereal Crops in West Bengal Punjab-Haryana” reported that the elaborate network of irrigation in Punjab-Haryana, independence of vagaries of monsoon/rainfall along with the development of private tubewell irrigation on substantial scale particularly during post-green revolution period may have effectively narrowed down the year-to-year fluctuations in the production of wheat. Rice crop has also been introduced in the states which grew at a much faster rate compared to that in West Bengal. It is heartening to know that the colonial rule in Bengal damaged ancient irrigation network and it has not been repaired or compensated by the development of irrigation during the era of planned development since
independence in West Bengal. Irrigation has been the main technological constraint for agricultural production in West Bengal.

Bhall and Tyagi (1989)\textsuperscript{53} in their study confined that the growth performance of rainfed areas was characterized by the persistence of very large inter year and inter period disparities. The rainfed areas which had shown poor performance during the period 1962-65 to 1970-73 recorded very high growth during 1970-73 to 1980-83 as a result of good monsoons.

Narla Ramakrishna Reddy (1990)\textsuperscript{54} in his study stated that the irrigation and rainfall contribute to stabilize fluctuations in the production and yields. The study also supported the view that irrigation and rainfall contribute to stabilize the albeit to a limited extent as signs of the regression coefficients are negative even though do not fully account for the variations in both production and yields.

Chattopadhyaya (1991)\textsuperscript{55} in his study broadly suggested that during the last three decades West Bengal rice economy was subjected to technological changes with positive effects on area, yield and production of rice. He concludes that the yield variability seems to be related positively to rainfall variation and negatively to increase in irrigation and fertilizer application, however the relation is not clear.

Deshpande R S (1991)\textsuperscript{56} studied the growth instability nexus in Maharashtra found a strong negative relationship between growth and industry in pre-new technology period. Region-wise analysis over the three decades revealed that the relationship emerged stronger in the case of non-drought prone districts than that of drought prone districts. The results showed instability as a companion of growth for drought prone districts and not so in the case of non-drought prone districts. The low instability – high growth combination was observed in case of drought prone districts whereas a high instability – low growth combination was found for non-drought prone districts.

Jha (1994)\textsuperscript{57} conducted study on growth and instability in agriculture in post green revolution period. His study proved that the decline in instability in crops, viz., paddy and wheat was brought about with increased area under irrigation over the years. He concluded that with new technology, instability in agricultural income reduced with adequate irrigation facilities and consistent price policy.
Pochanna, K (2000)\(^5\) in his study observed a positive relation between yield growth and instability in Punjab, Haryana, Andhra Pradesh, Karnataka, Orissa and West Bengal. He concluded that the use of fertilizers and extension of irrigation are important factors not only to yield growth but also to reduce the fluctuations and ensure stability in the yield growth.

Patnaik’s (2005)\(^5\) studies on changing agrarian situation after reforms concluded that neo liberal policies affected peasant community most adversely. Fund allocation to rural development which improves irrigation and other heads of agriculture has come down from 4% of NNP to 1.9% of NNP by 2001-02. He stated further that shift in cropping pattern towards non food grains has led to food security problem.

Vamsi Vakulambaranam(2005)\(^6\) in his paper “Growth and distress in a South Indian Peasant Economy during the era of Economic Liberalization” argued that the reduction of domestic support in terms of subsidy and credit on the one hand and drastic price fall of agriculture commodities in the international market on the other hand led to distress in farming class.

Suri (2006)\(^6\) in his paper “ Political Economy of Agrarian Distress” probed the factors that led to agrarian distress in the country. While analyzing various causes he highlights that lack of remunerative prices, indebtedness, neglect of agriculture by the government, decline of public investment have contributed to agrarian crisis.

Chand et al (2007)\(^6\) listed main factors that are responsible for slow growth of Indian agriculture. They are of the opinion that a) decline in the area under cultivation which seems to be a result of expanding urbanization and industrialization b) deteriorating the terms of trade for agriculture c) stagnant crop intensity d) poor progress of irrigation and fertilizer e)decline in supply of electricity to agriculture and finally slow down in diversification.

Mishra Srijit (2007)\(^6\) also expressed similar views in his study that economic reforms of 1990’s deepened the agriculture crisis particularly inadequate or excessive water, lack of irrigation facilities, market related uncertainties such as increasing input costs and output price shocks, poor availability of credit from institutional sources or
excessive reliance on informal sources with a great interest burdens and new technology among others.

Narayamoorthy (2007)\(^6\) A in his study “Deceleration in Agricultural Growth Technology fatigue or policy fatigue” concludes that lack of allocation of funds to irrigation development after liberalization led to stagnation in the net area irrigated. As surface water is not available in plenty farmers resorted to groundwater irrigation heavily this resulted in the increase in the cost of cultivation and depletion of ground water resources. Adding fuel to the fire non-availability of farm credit put the farmer in further crisis.

R. Maria Saleth (2011)\(^6\) felt that water scarcity has emerged as a major constraint for agriculture production, farm and rural employment. He is of the opinion that local level water scarcity does motivate farmers not only to improve on-farm water use efficiency but also to evolve new and informal institutional arrangements for inter-farm water sharing. His paper lists to provide an insight into magnitude of water trade in India. It outlines the technical and institutional environment with which Indian water markets are operating and evaluates their efficiency equity and sustainability implications. Finally he suggests the legal and institutional framework that is needed to make water marketing as an efficient institutional option for water management in India.

Radhika Rani ch (2011)\(^6\) in their article “Climate Change and Rainfed Agriculture: Rural Development Perspectives” observed that erratic monsoon precipitation would adversely affect the lives of majority of population in the study area. Vertical expansion that has to come mainly from rainfed region with sustainable and eco friendly agriculture practices are seen as sink for GHG emissions is the alternative left to make the production viable and to meet the food security in the long run. The paper attempted to analyze the impact of climate change on agriculture with particular reference to rainfed agriculture and suggested the strategies to be adopted with inbuilt climate change mitigation measures in the context of rural development.

Venkat Naidu. G and Ramappa. P (2012)\(^6\) in their article “Problems and Prospects of Dryland Farming” narrated the problems of dryland agriculture which is spread over 6510 million hectares in about 48 countries of the world. Out of this 60%
of land under rainfed is in developing countries. India ranks first among the dryland agricultural countries in terms of both size and value to produce. Their study reveals that the dryland agriculture is not at all remunerative in the study area. To mitigate the sufferings of agriculturists in these areas, they suggested that government shall undertake long term policies like linking of rivers to solve inter-state water disputes and provide employment. If this does not happen there is every possibility that the farming community may leave the agriculture

Govindaraju, M.S, Raju Gowda H. N and G.B Panduranga Naik (2012) in their article “Agrarian Crisis, Farmers Suicides in India Trends and Issues” suggested effective water management techniques should be popularized so that effective water management of the scarce water to prevent suicides.

Rainfed agriculture, where crop production is exclusively dependent upon rainfall covers about 80% of the world crop land and produces world cereal grains (more than 60%) but also generates livelihood in rural areas. Out of 143 m h of cultivated area in India, 67% is rainfed. Rainfed agriculture extends over 97 million hectares of which nearly 67 m h falls in the mean annual precipitation range of 500-1000 mm in India. About 91% area of coarse grains, 91% pulses, 80% oilseeds, 60% cotton, 50% rice and 19% wheat in India produced solely from rainfed lands of which 43% share is through dryland. Hence rainfed areas will have to be focus of India’s future agriculture revival with a different paradigm of development and upgrading rainfed agriculture promises large social, economic and environmental paybacks, particularly in poverty reduction and development. This is the opinion of Dasharath Prasad and Heerendra Prasad in their article “Increasing Agriculture Productivity in Rainfed Areas”.

They suggested Mulching is a useful practice in rainfed areas for controlling erosion, weed growth, reducing runoff and conserving moisture as well as improving soil properties like increased porosity, available water content, soil aggregation, moisture content at field capacity improvement in bulk density, also increase the soil organic carbon and beneficial soil microbes that result increase soil fertility, water use efficiency and crop productivity. Legume mulching is a highly beneficial practice for enhanced moisture and nutrient conservation, leading to increased productivity and soil health.
The above review of literature brought various factors that are responsible for the miserable plight of the farmers. The most striking feature of the distress of the farmers are indebtedness, which is cause and consequently leading them to debt trap and ultimately farmers are leaving agriculture or forced to live as agriculture labourers. However the reasons for the borrowing of the farmers differ from place to place but the notable feature is predominance of non institutional sources particularly moneylenders are fleecing them like leeches thus resulting in perpetual poverty. Another major cause leading to distress is the illiteracy of the farmers which is speaking volumes in the selection of crops, indiscriminate use of fertilizers and pesticides. These people are easily cheated by gullible traders and commission agents who are supplying spurious seeds, ineffective pesticides. Adding fuel to the fire recurring droughts or cyclones are also major causes that are throwing farmers into distress. Finally it is the market players who corner major chunk of profits then offering most unremunerative prices to the farmers. Their exploitation coupled with mounting debts some of the farmers are resorting to the extreme step of committing suicides.

On the whole, there are diversified causes that are responsible for distress among the farmers. The review of literature of earlier studies thrown much light on the miserable plight of farming community in our country. Taking cue from the results of earlier researchers, a sincere effort is made in this study to deliberate upon the issues of distress in agriculture in the state of Andhra Pradesh. The following are the main objectives of the study.
REFERENCES


