

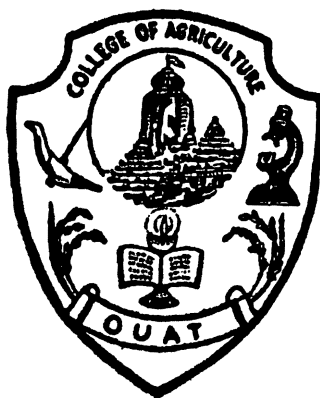
FARMERS' PERCEPTION OF DROUGHT SITUATION AND THEIR MANAGEMENT STRATEGY IN NUAPADA DISTRICT OF ORISSA

**A THESIS SUBMITTED TO
THE ORISSA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, BHUBANESWAR
IN PARTIAL FULFILMENT OF THE REQUIREMENTS**

**FOR THE DEGREE OF
MASTER OF SCIENCE IN AGRICULTURE
(EXTENSION EDUCATION)**

BY

Kishor Kumar Behera



**Department of Extension Education
COLLEGE OF AGRICULTURE
Orissa University of Agriculture & Technology
BHUBANESWAR
1997**

THESIS ADVISOR

Mr. B. K. MAHAPATRA

Dedicated to
my
Beloved Parents


Mr. B. K. Mahapatra,
Associate Professor,
Department of Extension Education,
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CERTIFICATE

Certified that the thesis entitled “**FARMERS’ PERCEPTION OF DROUGHT SITUATION AND THEIR MANAGEMENT STRATEGY**”, submitted in partial fulfilment for the award of the degree of **MASTER OF SCIENCE IN AGRICULTURE (EXTENSION EDUCATION)** of the Orissa University of Agriculture and Technology, Bhubaneswar, is a faithful record of *bonafide* research work carried out by **SRI KISHOR KUMAR BEHERA** under my guidance and supervision.

This research is original and no part of this thesis has been submitted for any other degree or diploma. The assistance received during the course of investigation has been duly acknowledged.

Bhubaneswar
The ~~8~~² October, 1998


(**Mr. B. K. Mahapatra**)
Chairman
Advisory Committee

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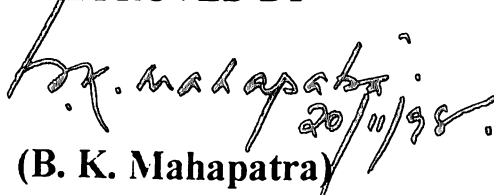
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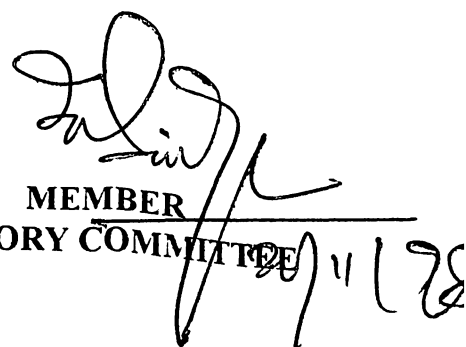
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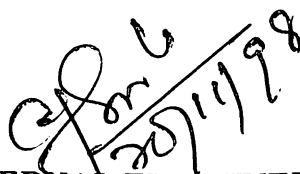
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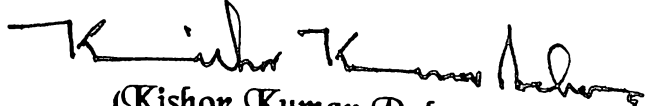
I also thankful to BCS Computer Centre, Ganganagar, Bhubaneswar for their endless service during my thesis work.

At the nib but not the neptide, I bow down my head before my adorable parents, whose blissful blessings, unfathomable love and inspiration which made me so steady.

I solicit the benediction of "MAA SARALA" for my progress and prosperity.

Bhubaneswar

Dated, the 12th October, 1998


(Kishor Kumar Behera)

ABSTRACT

Name of the student	:	Kishor Kumar Behera
Adm. No.	:	202 EE/95
Title of the thesis	:	Farmers' perception of drought situation and their management strategy
Degree for which thesis is submitted	:	M.Sc. (Ag) in Extension Education
Advisor's name	:	Mr. B. K. Mahapatra Associate Professor
Year of submission	:	1997

"Farmers' Perception of Drought Situation and Their Management Strategy. A study" was undertaken to study the socio-economic profile and farming condition, knowledge and perception related to various components of drought, different management strategies and suggestions of the farmers' to overcome drought. The study was conducted in four villages of Komna block of Nuapada district. Eighty number of respondents were selected randomly from each village for the purpose of the study. The major findings of the study were :

Majority of the respondents were from marginal and small farming community as well as most of them were illiterate. It was observed that most of the respondents belonged to katcha house, possessed country plough and 2-3 number of draught animals. It was revealed from the analysis that most of the farmers had more acreage of non-irrigated land. It was found from farming perception that inadequate rain is the prime cause leading to drought. Majority of the farmers opined that crop loss of more than 50 percent and drought situation could be managed by the adoption of mixed intercropping and exploitation of ground water for irrigation. Also majority of the farmers opined that their social life being disturbed due to drought and they are migrating to different places on a seasonal basis. Some farmer were forced to go for distress sale of the products during drought situation. It was also observed for the entire analysis soil moisture conservation measures should be intensively taken up to mitigate disaster like drought. The top ranked suggestions as perceived by the farmers to overcome drought was "development of irrigation facilities.

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CHAPTER - I

Introduction

INTRODUCTION

Drought is commonly understood to be a continuous period of dry weather resulting in acute shortage of water. It is generally assumed to be a natural phenomenon over which human beings have little or no control. But how far this assumption is true? Analysis of data from different regions of this country reveals that scarcity of water, food and fodder has been occurring systematically over a longer time span and even during years of normal rainfall. Therefore it would be too much of a simplification if we consider drought as just another natural disaster which recurs periodically. Drought is the consequence of the imbalances created by human beings on nature, on environment and ecology. And the people who are the hardest hit by drought are the poor and marginalised people who don't have the means to tide over it. Hence one has to look at the problems of drought both from ecological-environmental and societal standpoints to really understand it in all its enormity.

Indian Agriculture has made remarkable strides during the "Green Revolution" phase of its growth but experience during post green revolution phase has cast doubts about its capacity to feed the growing population, besides, green revolution has been largely crop specific and region specific and the benefits have largely accrued to irrigated wheat growing areas, leaving vast areas of the country outside the development process. This leads to development duality and class inequity between irrigated and rainfed areas.

Out of total geographical area of the country i.e. 328.75 m ha. of which only 143.7 m ha. (43.71%) is under cultivation, from that 70 percent of cultivated area i.e. 100.6 m ha. under rainfed condition contributing 42 percent of total production.

A wide variety of horticultural crops & more than 82 percent of pulses grown in dryland. About 2/3rd of rice, rape seed mustard and 1/3rd of wheat and 3/4 of cotton is grown in these areas, besides more than 70 percent of raw materials of oil seeds and cotton needed for agro-based industries is produced from drylands.

India is blessed with abundant water resources and rain, yet demand of water for agricultural, industrial and civil needs is increasing day by day. However, just 25 percent of rain water is being utilised for irrigation now. Even after full exploitation of irrigation potential about 50 percent of cultivated land will still continue to depend on erratic rainfall for production. The country will have to depend for most of its requirement of coarse cereals, pulses, oil seeds and cotton upon these land. It is estimated that if estimated requirements are to be met, the productivity of land has to be increased by at least 72 percent.

Again in 1925, the Royal Commission on Indian Agriculture described the Indian economy as a "gamble on the monsoon". Even today, in the non-irrigated areas of India, the harvest of coarse grain remains a gamble on the monsoon. High rainfall variability and drought are common phenomenon as much as two-thirds of the cultivated area in India is subjected to drought (Rao et al. 1988).

Scientists' perception of drought situation:

Drought can be defined in many ways and each of these definition can also become very subjective. But according to Dr. Meher, Homjir to identify drought-prone areas, the criteria that can be employed are the amount of rainfall received and the no. of rainy days. And the degree of drought-proneness can be decided on the basis of climatic condition, agricultural pattern, use of water and irrigation facilities etc.

Drought is a slow onset natural hazard and it offers time and opportunity to mitigate its impact. The drought can be grouped on the basis of physical characteristics and their impact on socio-economic system both in time and space.

Meteorological drought :

A situation arising from inadequate and mal distribution of rainfall.

Hydrological drought :

Condition denote reduced stream flow and inadequate filling of reservoirs, tanks or drying up of water in the surface water storage structure.

Soil moisture drought :

Inadequate soil moisture particularly rainfed areas which may not support crop growth.

Agricultural drought :

Characterised by low soil moisture levels and shortage of water resulting in crop failures.

Socio-economic drought :

The reduction of availability of food and income loss on account of crop failures endangering food and social security of the people in the affected areas.

Famine :

When large scale collapse of access to food occurs which without intervention, can lead to mass starvation, and

Ecological Drought :

When the productivity of natural ecosystem fails significantly as a consequences of distress induced environmental damage.

HISTORICAL ACCOUNT OF DROUGHT IN ORISSA

Sl. No.	Year of occurrence	Affected districts	Causes
1.	1866	All	Failure of monsoon in 1885 (Naanka Durvikhya)
2.	1920	Puri & Other	Failure of monsoon in 1981 & Severe floods of 1919
3.	1954-56	13 districts	Failure of monsoon
4.	1966(ND)	whole Orissa Parts of Koraput, Bolangir, Sundergarh, Sambalpur, Phulbani	Failure of shower
5.	1879--80	13 districts	Erratic late monsoon & with or no premonsoon rain
6.	1982-83	All districts	Cyclone induced floods
7.	1987	All districts	Erratic behaviour of rain
8.	1992-93	11 old & new districts	Hail storm, cyclone, Heavy rain & Flood, Late monsoon

SOURCE: STATE ENVIRONMENT OF ORISSA, CPDW, BBSR, ORISSA.

DROUGHT - 1996

DISTRICT	AFFECTED BLOCKS	AFFECTED GRAMPANCHAYATS	AFFECTED VILLAGES
Bolangir	14	--	1088
Dhenkanal	--	143	--
Gajapati	--	60	400
Kalahandi	13	--	2205
Kendrapara	--	--	1264
Khurda	--	113	1054
Nayagarh	--	142	1600
Nuapara	4	30	125
Puri	--	175	1177
Cuttack	--	84	410

SOURCE: STATE ENVIRONMENT OF ORISSA, CPDW, BBSR, ORISSA.

TOTAL AREA & POPULATION COVERED UNDER DPAP AREA

SL. NO.	DISTRICT	AREA	POPULATION
1.	Phulbani	10,026.59 km ²	5,94,000
2.	Kalahandi	4,825 km ²	7,36,266
3.	Bolangir	3,467.66 km ²	6,31,032
4.	Sambalpur	3,173.25 km ²	4,34,634

Drought mitigation programmes in general

1. Drought prone areas should incorporate short-term and long-term development projects such as fodder bank, pasture development/rangeland management as disaster mitigation practice.
2. An area specific watershed model development plan should be prepared for arid, semi-arid and sub-humid regions of the country.
3. In rainfed agricultural zones (having less rainfall and frequent droughts), considerable stress should be placed on development of khadi and village industries/cottage and handicrafts industries projects to provide gainful employment to the local people and check peoples migration towards cities.
4. The development programmes such as National Watershed Development Programme (NWDP) for rainfed areas, DPAP, Desert Development Programme (DPP) , drinking water programme and poverty alleviation programmes should be integrated to for a comprehensive drought mitigation programme.
5. Public participation and use of traditional practices for disaster mitigation should be given proper attention.

Purpose of this farmers perception of drought situation and their management strategies can illustrate many findings as their traditional management practices for crop production which were already vanished and some are in the process of degradation.

Nuapada that carved out of erstwhile Kalahandi district is among one of the poorest and drought stricken district of the state, with only 9 percent of cultivated land under irrigation.

SPECIFIC OBJECTIVE OF THE STUDY

Objective set up for this study were as follows :

1. To study the socio-economic levels of the farmers and farming condition in drought stricken areas.
2. To analyse the perception of the farmers with respect to
 - a) Weather leading to drought
 - b) Crops in drought situation.
 - (i) Tolerant
 - (ii) Non-tolerent
 - c) Extent of crop loss in drought situation.
 - d) Government programmers to counter the drought situation.
 - e) Social pathology in drought situation.
3. To examine the various management strategies, they have adopted to mitigate drought situation and extent of farmers' perception on their effectiveness.
4. To seek suggestions of the farmers to overcome drought situation.

SCOPE AND IMPORTANCE OF THE STUDY

This study was undertaken to study the influence of different traditional drought management practices basically on the small and marginal farmers for whom it is meant for. Findings of the programme would reveal the knowledge, perception of farmers and strategies for managing the drought situation at their own level. with the modern technologies meant for drought mitigation. This would be helpful for researches understanding the close relationship of traditional and modern practices meant for management of drought situation. This investigation is expected to be a worthwhile reference for implementing agencies at grass root level for better implementation.

LIMITATION OF THE STUDY

This study has been taken as partial fulfilment for the post graduate degree in extension education. The resources of the author such as funds, time and mobility were very much limited. Although it was desirable to take up an adequate number of respondents from different places in order to get fairly reliable data. But in the present case, very little time was available for the study for which and eighty number of respondents were included. All the study was limited to only one block of one district (Nuapada) of Orissa. Hence, this study may be considered as explorative. However, the research worker will definitely get valuable information from this study which will help them in large scale investigation.

CHAPTER - II

Review of Literature

REVIEW OF LITERATURE

The review of literature is of utmost importance to formulate the theoretical framework of research and to know the area in which further research is needed. Review also provides an insight into the methods and procedures followed in such types of studies. It suggests operational definition of major concepts and provides basis for interpretation of the findings.

In this chapter an attempt has been made to present some literature related to different aspects of drought. These are presented under the following headings.

1. To study the socio-economic levels of the farmers' and farming condition in drought stricken areas.
2. To analyse the perception of the farmers' with respect to
 - a. Weather leading to drought
 - b. Crops in drought situation
 - i. Tolerant, ii. Non tolerant
 - c. Extent of crop loss in drought situation
 - d. Government programmes to counter the drought situation
 - e. Social pathology in drought situation
3. To examine the various management strategies, they have adopted to mitigate drought situation and extent of farmers' perception on their effectiveness.
4. To seek suggestions of the farmers' to overcome drought situation.

DROUGHT

Ponkeshe (1979) reported that there are several definition of drought and most of them are provided by the physical or natural sciences. Sociologists have studied droughts and according to some, the designation of certain changes in an

area's weather as a "drought" is a social act and droughts are relative to human standards. Sociological drought is defined as the meteorological-hydrological condition under which there is less water available than is anticipated and relied on for the normal level of socio-economic activity of the region.

Singh and Rao (1988) stated that drought is universally acknowledged as a phenomenon associated with scarcity of water. Meteorological drought indicates the deficiency of rainfall compared to normal rainfall in a given region. Hydrological drought indicates the scarcity of water in the surface and underground resources. Agricultural drought is a situation when the rainfall and soil moisture are inadequate to meet the water requirement of crops for their healthy growth and maturity.

Annerose (1991) stated that the agricultural drought forms affecting groundnuts in Senegal were analysed using crop development and water requirement simulation. With the cement widely available cultivars, 3 major zones were defined in the Senegalese groundnut basin depending on the useful length of the growing season and risks of inter during the growing cycle.

Vogel and Drummond (1993) found that the dimensions of drought in South Africa including the bio-physical and socio-economic factors, are outlined. Issues such as *land use management, drought planning and relief* are discussed with specific reference to case studies of past and present drought initiatives in South Africa.

Tardieu and Belhassen (1995) viewed that cells of droughted plants do not necessarily experience dehydration, leaf water potential and cell turgor are frequently maintained at high values in spite of decreasing soil water status.

Soule and Yin (1995) revealed that moisture trends were examined for the contiguous USA for recent 15, 30, 50 and 95 year periods of the Palmer Hydrologic Drought Index. Linear trend slopes and corresponding P-values from Spearman rank correlation were mapped from a series of regression to examine the spatial patterns of trends and how they change through time. For each mapped time series there are distinct core regions with strong positive and negative trends.

SOCIO-ECONOMIC PROFILE

Bharara (1980) revealed that desert rural folk in Rajasthan, India perceive drought as a multi-dimensional phenomenon varying from meteorological to bio-physical to socio-religious in nature. Among various notions concerning the causes of drought, 77% of the responses were meteorological, existing climatic changes 49% bio-physical bringing devastation of natural vegetation and 33% socio-religious with supernatural beliefs.

Bils Borrow (1982), Chopra *et al.* (1990), Khosla (1991), revealed that integrate the principle of ecological sustainability with those of economic efficiency and social equality in the development and dissemination of rural technologies.

Bentley (1984) has estimated that 200 m ha of land in India are partly degraded in terms of short term productivity.

Santakki and Sundaraswamy (1989) revealed a positively significant relationship between the farm power and socio-economic character like education, size of holding, extension contact and extension participation and annual income.

Regi Thomas (1993) revealed from his case study found out that transition from modern to ecological agriculture yielded more, in 1st year yield were low, second year crop yield and soil began to improve and third year showing significant improvement and coconut yield showed 240% increase along with increased yield of 480% from intercropping.

Chattopadhyay (1993) revealed that analysis of survey data on community perceptions of the so called natural environment ; particularly of hazards and disasters and responses and strategies of the rural communities to the environmental challenges they face an analysis of survey data as community perceptionson the 'social' dimensions of the environment.

Singh and Bhattacharya (1994) Pointed that through organic farming, the only way for sustainable agriculture by N. Margasaguyam and Dr. T. Selvin Sebaraj. Hroman Kurukhetra Journal Jan-Feb-1997, pp. 114.

PERCEPTIONS

Weather leading to drought

Capinera and Horton (1989) stated that effect of weather on infestation levels of grasshopper assembles in the short grass prairie regions of Montana, Wyoming, Colorado and New Mexico were examined during correlation and multiple regression analysis. Regressions and correlations indicated that effect of weather varied with latitude. There was little evidence that grasshopper suppression activities interfered with the preparation of weather population relationship.

Mbogoh *et al.* (1991) presented a production profile of Machakos district, Kenya, as part of a larger study of long term environmental change and dry land management in this region. This paper contains two studies, focussing on crop production and livestock production respectively.

Raman and Swaminathan (1993) reported that rainfall and especially the annual South West monsoon is crucial for crop growth in south peninsula India. The international variation in monsoon performance for over a century in Karnakata is analysed The weather service to the farmer and drought management is described. Expansion and standardisation of the existing rain gauge network will provide data, via a satellite link to the state Government's Drought Monitoring Cell. Weekly rainfall distribution at the micro level projection of anomalies could be supplemented by assessments of agricultural stress evaluated with regard to soil types, soil texture and crop status are to be monitored by field and remote sensing techniques. Prediction of the monsoon's behaviour enabled the company to plan its production of fertilizers and pesticides better.

Chattopadhyay (1993) revealed that (1) the long run pattern of rainfall variability in Eastern India in terms of trends and harmonics and Markov chains of spells of dry and wet weather within the main monsoon season. (2) the problem of increasing frequency of floods as well as drought along with the failure of major river valley projects; (3 and 4) investigation of block level data in two of the worst drought affected districts, Kalahandi in Orissa and Purulia in West Bengal.

Ryder (1994) examined the farmer perceptions of soils in Las Cuevas, a mountainous region in the Central Cordillera of the Dominican Republic. A discussion of soil erosion and local soil taxonomy is followed by comparison of opinion held by framers and scientists on the importance of selected climatic-edaphic criteria for agriculture. The paper compares farmer and scientist opinion for soil depth and stoniness in the Dominican Republic.

Chapman and Auge (1994) reveals that understanding physiological drought resistance mechanism in ornamental may help growers and land seapen minimize

plant water stress after wholesale production. They measured the stomatal conductance of leaves of drying plants, lethal water potential and relative water content and leaf osmotic adjustment during the lethal drying period. Maintenance of stomatal opening as leaves dry, low lethal water status values and ability to osmotically adjust indicate relative drought tolerance with the reverse indicating drought avoidance.

Kiome and stocking (1995) found that farmer perceptions of the dangers of soil erosion is increasingly recognised as having a rational basis. However, little confirmation exists in the literature that farmers' decisions are any more or less rational than recommendations based upon professional advice. Five conservation treatments were assessed for their performance at these sites in semi-arid and Kenya and compared with farmers' views of the need for conservation and their bench terraces, tied ridging contour conservation measures.

Crops in drought situation

Martiniello (1987) revealed that of 5 physiological tests applied to 15 genotypes at different stages of the growth cycle 2 (dry matter accumulation in seedlings after heat treatment and stability of the cell membrane) were correlated with yield, suggesting that the tests may be of use in a breeding programme. The genotypes selected with these 2 tests have been introduced into a recurrent selection programme for the development of synthetic populations.

Chakresh *et al.* (1989) found that early-maturing (drought-escaping) and high-yielding strains of *Brassica juncea* were developed together with material segregating for epicuticular wax on the leaves (which reduced water loss). Strain RN57, from the cross Varuna x TM4. Shows leaf senescence at the siliqua completion stage which reduces transpiration and improves drought tolerance.

Fraser and Hewson (1994) stated that sixty paddocks were direct drilled during autumn 1990 in a field trial in different area of the North Otago area. Sited selection criteria included land with a potential for wind or flood water erosion, steep land with up to 22% slope and land with a sunny aspect i.e. land of low quality. The aim was to give vegetative persistence and ground cover, pasture quality was a secondary consideration. The farmers' involved in the project were questioned five years after drilling as to their perception of the success or failure of their pastures, their attitude to direct drilling and their use of alternative pasture species. The success of the programme was reflected in the fact that 50% of those farmers' involved have established new pasture by direct drilling since the programme was implimated, 93% intend establishing pastures by direct drilling in the future and 98% have sown or intend to sow, pastures using alternative species to L. Perenne.

Lamaze *et al.* (1995-96) reported that physiological mechanisms involved in the drought resistance of plants discusses the definition of water stress early, effects (hormonal balance, gene expression, cellular elongation and stomatal conductance), mid-term effects (osmotic adjustment) and longer term effects of water stress, the stress syndrome, mechanisms of drought resistance and the improvement of resistance to drought in plants (covering physiological indicators, molecular markers and the creation of transgenic plants).

Extent of crops loss in drought situation

Mustafa (1993) reported that an approach of Maerz (1987) and simulates random yield values which confirm to the underlying parameters for high land Balochistan in Pakistan. A total picture of farmer's yield distribution over time in the Southern parts of Khuzdar and Kalat and northern parts of Loralai in Balochistan was constructed. The yields of wheat and barley in the last 10 years

were ranked for each crop and farmer accordingly. It was a rapid, inexpensive and objective way to measure the gaps between actual and potential yields. Further improvement can be made by incorporating meteorological and other crop-yield data in the model. There is a need to develop a model which can simulate joint non-normal distribution.

Government programmes to counter drought situation

Bhaskaran and Praveena (1982) reported that over two-third of respondents had adopted the recommended general dry land agricultural practices viz. off season tillage, soil mulching and mid-season correction.

Mohiuddin (1983) revealed that 64.2% farmers' had showed average adoption whereas 20% had shown high rate of adoption and only 15.5% had showed low adoption of improved dry land agricultural technology practices.

Kunnal *et al.* (1984) found that on the whole only 48% of the sample farmer adopted the soil and water conservation practices, 56% of farmer used improved varieties of Sorghum only 2.44% of sample farmers'.

Jaiswal *et al.* (1985) reported that only small farmers' worked as labourers in contour bunding and many of them did not bother about the maintenance of bunds. They also observed that adoption of improved dry land farming practices was confined only to big farmers'.

Vijayaraghava *et al.* (1990) found that majority of dry land farmers' in study area had adopted variety, fertiliser and plant protection measures as against their earlier practices of cultivation of local desi cotton varieties with no pesticide or fertiliser application dispel the myth that dry land farmers are generally averse to new technologies because of risk and other factors.

Bavalalti *et al.* (1990) found that the adoption of dry land farming practices like crop rotation (90%), application of FYM (85%), fall ploughing (83%) were followed by majority of farmer. The practices of deep ploughing was adopted by 75% of the respondents followed by contour cultivation (67%), ridge and furrow cultivation (57%). The higher adoption of these practice might be due to simplicity of these practices which could be practiced by making use of their own knowledge and resource without reliance on any external agency.

Garg (1993) stated that the utility of National Remote Sensing Agency data in monitoring drought in India and then analysis these problems of drought based on suggestion for drought management including the handing over of state tube wells to the farmers' themselves. To increase the managerial resources of the direct administration, it is recommended that expert analysis of rainfall patterns and information by the National Remote Sensing Agency is provided. It is also suggested that the Reserve Bank of India should formulate guidelines to give rescheduling benefits to the farmers' for agricultural dues during drought as a standing policy and not as an ad hoc measure. All such policies should be so formulated that relief measures are introduced in a coordinated manner under the leadership and direction of the district collector.

O' Sullivan (1993) found that the common wealth National Drought Policy Review conducted in 1989-90 indicated that primary procedures should become more self-reliant in preparing for and managing during periods of climatic stress. The core concept of the drought policy is management for self-reliance together with adoption of a transitions period during which appropriate incentives will be offered to encourage the more to self reliance in drought.

Letts (1993) reported that the national property management planning campaign seeks to further improve the land, business and drought management skills of Australia's primary producers. It will achieve this principally by ensuring that existing planning activities are made comprehensive, recognising that land holder are the principal decision makers on land and management and assisting them to acquire the knowledge and skill necessary to manage their assets on sustainably drawing on the large amount information on an sustainable land management already contained within the farming community and facilitating the exchange of this information in a workshop environment.

Bhardwaj (1994) showed that run-off was 52% of the rainfall and soil loss 54 t/ha in cultivated fallow against 43% run-off and 21 t/ha soil loss in maize grown in counter. Both were quite effective in reducing soil loss over contour cultivation.

Bhan, Uttam and Radheshyam (1995) revealed that among moisture conservation practices (MCP), furrowing was found to be most effective in reducing water-use increasing water-use efficiency root development and yield.

Goyal, Ojasviu and Bhati (1995) studied that water harvesting by means of farm pond coupled with Ber in adjoining area could sustain the system even in very low rainfall situation.

Social pathology in drought situation

Tennakoon (1986) reported that dissertation analysis Sri Lankan farmers' perception of and adjustment to drought by providing a detailed care study of agricultural adjustment in the Dry Zone of Sri Lanka. It deals with agricultural practices in drought prone areas : coping with a disturbed agricultural calendar : crop loss and its consequences as conditioners of drought perception of farmers:

reasons for drought as seen by the farmers. The study also examines the perceptions and attitudes of local and regional level Sri Lankan officials whose responsibilities involve them in adjustments to drought.

Ashton (1996) reported that an estimated 5500 Australian dairy farmer were directly affected by the drought while a further 5100 were indirectly affected, primarily through higher fodder prices. The most frequently used dairy herd management responses to the drought were more cattle than normal, drying cows off earlier than normal and reducing the number of cows milked. Approximately 28% of dairy farmers' experienced a loss in milk production/ cow in 1994/95 as a result of the drought and 16% indicated that they had reduced the number of cows milked. These reductions accounted for an estimated loss of production of >420 million litres. The net cost to the dairy industry in 1994/95 as a result of the drought was estimated to be > A 200 million dollar.

MANAGEMENT STRATEGIES

Swaminathan (1982) revealed that collection of lectures presents a comprehensive view of integrated rural development and offers suggestions on specific areas in which development programmes can be implemented. 13 chapters examine issues such as irrigation, rainfall and dryland agriculture, adult education and agricultural progress, drought management and the scientific utilisation of natural resources.

Litsinger *et al.* (1982) found that awareness and control of pests of rice by farmers' in the Philippines were determined in Solana in northern., Luzon, where traditional photoperiod sensitive rice varieties were still grown extensively and both drought and flooding occurred. The major pests reported by the farmers' were *Leptocorisa oratoria*, *Nymphula depunctalis* (Gn) and *Mythimna separate* (wlk).

followed by rats, birds and *Scirpophaga incertulas* (wlk). Insecticides were applied by 47% of the farmers, but at doses over 10 times too low. The only cultural control measures reported was removal of infested rice plant pests and infested weeds. Spiders were cited as natural enemies of rice puts by 80% of the farmers' and resistant rice varieties were named by 49%.

Stone and Willis (1983) reported that the book is No. 12 in the series Development in Agricultural and managed-forest Ecology and contains the papers presented at a symposium held at Tulsa, Oklahoma in October 1982. The papers have previously been published in Agricultural Water Management 7 (1/3) and relevant items have already been abstracted.

Framji (1986) reported that drought results from a combination of climatic and human factors and the latter are the prime causes. The drought situation, its causes and measures to alleviate it in Africa, Australia, Brazil, China, India and the USSR are described. Provision of well managed irrigation facilities are the most important means of protection against drought. Structural measures that would increase water availability or reduce water losses droughty areas are discussed. Research needs for improving drought management are suggested and recommendations made to aid drought alleviation.

Sharpin *et al.* (1989) found that a study of the long-range forecasting of water supply was commenced in response to fears of demand exceeding the safe yield of the water system. A computer simulation model was developed to evaluate the safe yield of the system. This model was utilised to evaluate drought management actions such as demand reduction actions and supply alternatives and to develop an acceptable Drought Management Programme.

Gupta and Mehrotra (1990) reported that optimal use of water resources for irrigation planning in drought-prone regions can be worked by multiset programming model, technique. The model generates a record of all the input data used, including the time perspective of water year, cost of irrigation, drainage water profile etc.

Jodha (1990) revealed that in the search for innovativeness in drought management, public policies have by passed an important source of insight, namely the coping strategies of farmers'. Drought management is examined in arid and semi arid tropical areas of India, where high rainfall variability and droughts are a common phenomenon. Dry land farmers and partoralists in drought prone tropical areas) do not manage drought in isolation from the overall farming system. In keeping with the environmental complexity of the dry region, farmer have developed their own coping strategies. These are under severe strain due to rapid change in demographic, technological and institutional factors in dry region. The major policy implications are there is a need to revitalize farmers' strategies through technological and other means; learning from farmers' on drought manager, public policies should not artificially isolate drought management from the overall development strategy for dry areas and the rationale of farmer strategies should be made the explicit concern of integrated development and drought management intemention.

Jodha (1991) revealed that farmers' have adopted a variety of survival strategies to fight the hazards of natural disasters like drought and floods. This article draws attention to such strategies arguing that government policies in India to minimize the impact of drought in dry land areas have failed as a result of over looking indigenous knowledge and its value. The ways in which farmer and agricultural households cushion themselves against calamities are described and incorporated into policy recommendations for the government.

Agrawal and Mehrotra (1991) revealed that a drought management strategy is described mathematically in terms of short and long-term profiles. The factors considered include ground water availability storage of storm run-off, artificial groundnut recharge, improved water-lifting technology and better education.

Raman *et al.* (1992) revealed that water management under drought condition is important in tropical regions such as India. Where one-third of the cropped area is affected by frequent droughts. A linear programming model was used to generate optimal cropping patterns from past drought experiences and from synthetic drought occurrences. An expert system incorporating these policies was developed to identify the similarity between a current drought and known drought events and to guide strategic response by management.

Mohan (1992) reported that factor affecting the incidence of drought and the effectiveness of cultural measures to alleviate stress in tea are discussed, based on surveys of several estates in South India. Data are included, from trials on the following, the effects of soil moisture conservation measures on soil moisture status, the yields of several drought-tolerant clones or composite plants during drought years, the effects of kaolin application supplemented with subsoil irrigation the effects of artificial shade on microclimate and yield. The effects of shade provided by pollarded or unpollarded trees of *Grevillea robusta* on yield, and the effects of sprinkler irrigation on yield.

Narayanan (1993) reported that N, P, K and Ca nutrition under drought conditions is reviewed with reference to several crops including sorghum, rice, cotton, potatoes, wheat, barley, maize, white clover (*Trifolium repens*), cowpeas and groundnuts.

Reddy (1994) found that drought management practices for groundnut were compared on shallow (15cm depth) sandy loam soil with a loamy subsoil in 1991-92. Mean pod yield was 1.36 t/ha in control plots and among drought management practices ranged from 1.53 t with a 5% Kaolin spray during mid season stress to 1.68 t when mulched with 5t groundnut shells/ha. 10d. after sowing. Other treatments assessed were application of 20 t sand /ha before sowing (40 t, in 1992) a 1% lime spray during mid season stress, a 2% area spray the day after rainfall following mid-season stress, soil application of 20 kg urea/ha after the dry spell and a 5 cm supplemented irrigation during mid-season dry stress.

Lourduraj *et al.* (1996) found that in a field trial in kharif (monsoon) 1992 at Aliyarnagar, Tamil Nadu, groundnut CV. CO. 2 seeds were treated with 0.5% CaCl_2 , 0.5% KCl or no seed treatment was given and the crop was given 12.5 t compost coir pith, enriched farm yard manure/ha. or no manure (10 kg N+10 kg p + 45 kg k/ha only) and foliar application of 3% Kaolin rice gruel spray, liquid paraffin or no foliar spray. Dry pod yield was increased by seed treatment with CaCl_2 but was unaffected by seed treatment with KCl. Enriched farm yard manure gave the highest yield and no manure (N PK only) the lowest. Foliar application of Kaolin or liquid paraffin gave higher yields than rice gruel spray or no foliar application.

Stephenson (1996) found that instead of planning water resource projects to yield a constant maximum rate, it is advocated that reservoirs be operated in a variable draft basis that is when water levels drop to predefined levels the supply rate is decreased accordingly. The level of water restrictions during drought should be sensitive to the economic consequences. If possible the tariff should be adjusted to reduce consumption to the desirable level of supply.

Durai (1996) reported the drought management in sugarcane with reference to the effects of water stress on crop growth, yield and quality and management factors including planting systems, foliar N or K application, mulching, irrigation and soil amendments.

Wilhite (1997) stated that the state drought planning is discussed to illustrate the significant increase in the number of states that have prepared response plans from three states in 1982 to 27 in 1997. Mitigative actions adopted by states provide an unique archive that may be transferable to other states. Incorporating these actions into a more anticipatory risk management approach to drought management will help states move away from the traditional crisis management approach.

Reddy (1997) reported that role of remote sensing applications carried out by the Andhra Pradesh State Remote Sensing Applications Centre (APSRAC India, to equip the state for better disaster preparedness and administrative response through technology utilisation.

EI-Mourid and Moussaoui (1997) reported that in the last 20 years most countries of WANA have implemented drought management instruments that concern mainly emergency relief programmes. These programmes consist of purchase of concentrate feed, imports of food and feed grains. Livestock watering, rural drinking water and credit debt relief. These actions are often considered as a response to drought through crisis management but do not provide the basis of long term strategic plan for managing future droughts in a risk management manner.

SUGGESTIONS

Mohiuddin (1983) found that 64.4% of farmers' had average attitude about improved Dry-land Agricultural Technology (DDT) while 25.6% had high attitude and 10% had low attitude.

Sinha *et al.* (1984) revealed that majority of farmers' (80%) had medium level of attitude and the rest were distributed under high (12%) and low (8%) attitude categories towards soil conservation programme.

Padaria and Singh (1990) opined that identification of scientifically sound traditional practices will be helpful to the scientists in technology blending programme and in generation of law.

Reddy *et al.* (1990) opined that the farmers' are backed by their own experience prefer to select known, stable and profitable crop and varieties instead of switching over to unknown crops or varieties to avoid risk in Mittermari watershed area.

CHAPTER - III

Research Methodology

RESEARCH METHODOLOGY

In this chapter, a brief account of agricultural situation and other information of the study area having relevance to this topic along with investigation and analytical procedure used in the study area are presented.

DESCRIPTION OF STUDY AREA

THE DISTRICT

The newly reorganised district of Nuapada carved out of Kalahandi district between 20° 67' N to 20° - 24' N latitudes and 82-26° E and 82°-33' E longitudes. It is land locked with districts of Bargarh, Bolangir, Kalahandi and states of Madhya Pradesh and Andhra Pradesh.

Nuapada comes under central table land in Orissa geographical characterisation and under Western undulating zone in Orissa agroclimatic characterisation. The district extends over an area of 3407.5 square kilometres, with population of 4.69 lakh; according to 1991 census, sex ratio is 1002 females per 1000 male. The population density is 138 per square kms. The district has one subdivision with 2 Tahsils, 5 Blocks, 93 Panchayats and 659 villages. Of the total populations 35.95 percent are scheduled tribes and 13.09 percent are scheduled castes. Average decennial growth rate of population is 19.58 percent. Literacy rate is 27.52 percent of with male literacy rate is 42.31 percent and that of female is 12.78 percent. The district is a tribal dominated area and 86.32 percent of people are found to be below poverty line according to 1991 census.

Table 3.1 Climate of Nuapada district

Months	Rainfall in mm.				No. of rainy days	Temperature		Relative humidity
	1993	1994	1995	Normal		Max.	Min.	
Jan.	--	2.4	1.4	11.4	0.8	30.1	11.56	70
Feb.	--	12.5	11.8	15.4	1.2	33.1	10.7	77
Mar.	3.9	2.3	5.7	13.6	1.2	37.0	17.7	48
Apr.	26.3	12.7	20.4	23.7	1.9	40.96	19.9	39
May	14.5	28.5	30.5	33.7	2.5	42.96	20.2	41
June	172.4	313.2	297.4	228.3	9.8	42.7	20.3	75
July	267.0	29.8	310.8	343.5	16.1	43.4	18.4	86
Aug.	215.0	459.5	390.6	284.6	16.1	33.8	21.3	87
Sept.	219.2	216.6	210.5	220.9	10.5	31.8	19.5	82
Oct.	32.9	19.8	59.0	81.9	4.1	30.5	18.7	81
Nov.	--	3.0	19.8	17.9	1.0	29.9	16.1	80
Dec.	--	--	4.2	3.2	0.2	29.2	12.4	63
Total	--	951.2	1366.3	1361.2	1378.2	65.4	--	--

Source : Directorate of Agriculture and Food Production, 1995-96.

CLIMATE AND RAINFALL OF NUAPADA DISTRICT

Nuapada experiences tropical climate predominantly effected by south-west monsoon. Climate is characterised by an apprehensive hot summer followed by humid monsoon for four months and cold winter for 3 months. Actual monsoon starts from middle of June and continues upto September end. Average annual rainfall is 1378.2 mm. Around 85 percent of total rain and 80 percent of rainy days occur during four monsoonic month from June to September. Summer months are almost without rain and atmosphere become extremely dry. Entire district has undulating topography. Traditional forest area is now devoid of vegetation cover due to deforestation. This causes massive soil erosion and flood during rainy season. Average annual maximum and minimum temperature is 42.5°C and 42.5° C

respectively. This climate has not been supportive for productive agriculture as evident from characteristic dry land agriculture. There are a few small river like Jonk, Sunder which are seasonal in nature. After the rainy season the rivers become almost dry.

LAND UTILISATION PATTERN OF THE DISTRICT

Nuapada district is one of the smallest district of the state. It extends over total geographical area of 341 thousand hectares Table 3.2 indicates the land use pattern of the district.

Total forest cover is 112 thousand hectares which is 32.84 percent to total geographical area. Miscellaneous tree crops and grooves, permanent pasture and grazing land, culturable wastes, cultivable land and barren, current fallows which is not put under any productive use occupy respectively 4, 10, 12, 13, 9, 2 and 3 thousand hectares and in percentage to total geographical areas, it is 1.17, 2.93, 3.51, 3.81, 2.63, 0.85 and 0.87 respectively. Net sown area amounts to 176 thousand hectares, it is 51.61 percent of total geographical area.

Table 3.2 Land utilisation pattern of Nuapada district

Sl. No.	Items	Magnitude in '000 ha.	Percentage to total geographical area
1.	Total geographical area	341	100
2.	Forest area	112	32.84
3.	Miscellaneous tree crops and grooves not included in net sown area	4	1.17
4.	Permanent Pasture and other grazing lands	10	2.93
5.	Culturable waste	12	3.93
6.	Land put to non agricultural uses	13	3.81
7.	Barren and cultivable land	9	2.63
8.	Current fallows	2	0.58
9.	Other fallows	3	0.87
10.	Net area sown	176	51.61

Source : Directorate of Agriculture and Food Production – 1995-96.

IRRIGATION SOURCES OF THE DISTRICT

Irrigation Potential is not adequately developed in the district. Table 3.3 indicates the irrigation sources of the district.

Table-3.3 Irrigation sources of Nuapada district (Area in hectares)

Sl.No.	Items	Kharif	Rabi
1	Major and Medium irrigation project	5980	2164
2	Minor irrigation project	5571	1342
3	Lift irrigation project	3595	2157
4	Other sources	14874	2277
5	Total	30020	7940

Source : Directorate of Economics and Statistics – 1995-96.

In kharif 30.020 and in rabi 7.940 hectares only which constitute 17 percent and 4.51 percent respectively of total cultivated area. This shows that nature of agriculture is rainfed agriculture. It is dependent upon monsoon. This is one of important causes for frequent dry spell and drought in the area.

LAND HOLDING PATTERN OF THE DISTRICT

Table-3.4 Land holding pattern of Nuapada district

Sl.No.	Category of farmer (ha.)	No of farm family	Percentage to total land holder	Land in ha.	Percentage to total land
1	Marginal (0.02-1.0)	28956	38.82	16807	12.72
2	Small(1.0-2.0)	23046	30.89	32164	24.34
3	Small medium(2.0-4.0)	16324	21.88	44211	33.46
4	Medium(4.0-10.0)	5853	7.84	32590	24.66
5	Large(>10)	406	0.54	6334	4.79
6	Total	74586	100.00	132106	100.00

Source : Directorate of Economics and Statistics – 1996-97.

As indicated by table 3.4 total number of farm house hold is 74, 586 which is 76.94 percent of total household of the district. Out of the total, 22348 households are land less (23.05 percent of total households). Average operational land holding size is 1.77 hectares, more than that of state (1.34 hectares). Land

distribution pattern is very inequitable with 71 percent of farm households own, land size, less than that of district average. Small and marginal farmers own mostly marginal and sub marginal land having less productive capacity, whereas big farmers occupy better lands. Absentee landlordism is a predominant phenomena, inequitable land distribution is one of the major contributory factor for it. Total number of owning SC and ST households is 11.038 and 26.193 respectively. They own land area of 11, 284 and 51, 297 hectares respectively. The operational size of holding is 1.02 and 1.95 hectares for SC and ST communities respectively.

Table-3.5 Cropping pattern of Nuapada district

Sl.No.	Name of the crop	Area in '000 hectares	Percentage to gross cropped area
1	Rice	107.21	49.50
2	Wheat	0.33	0.13
3	Maize	2.16	0.91
4	Jowar	0.85	0.36
5	Bajra	0.04	0.02
6	Other cereals	5.79	2.45
	Total cereals	126.38	53.37
7	Red gram	8.43	3.56
8	Green gram	19.50	8.26
9	Black gram	15.06	6.36
10	Horse gram	15.69	6.64
11	Gram	1.43	0.60
12	Other pulses	20.96	8.88
	Total Pulses	81.07	34.23
	Total foodgrains	207.45	87.71
13	Groundnut	10.54	4.45
14	Mustard	1.73	0.74
15	Other oilseeds	14.89	6.28
	Total oilseeds	27.1	11.47
16	Mesta	1.1	0.49
17	Cotton	0.03	0.01
18	Potato	0.04	0.02
19	Sugarcane	0.61	0.03
20	Tobacco	0.31	0.13
	Others total	2.16	12.29
	Gross cropped area	236.77	100.00

Sources :- Directorate of Agriculture and food production -1995-96

Table 3.5 indicates the cropping patterns of the district. Total cereals occupy largest area of 126.38 thousand hectares. Among cereals rice is the single largest crop occupying 107.21 thousand hectares. Pulses are the second important category occupying 81.07 thousand hectares. Total food grain occupy 207.45 thousand hectares which is 87.71 percent of gross cropped area and rest 12.29 percent of gross cropped area is occupied by crop like oil seeds, cotton, mesta, potato, sugarcane and tobacco. Cropping intensity of the district is 134.52.

PRODUCTIVITY OF CROPS OF THE DISTRICT

Table-3.6 Productivity of crops of Nuapada district (kg/ha)

Sl.No.	Crops	Nuapada	Orissa	India
1	Rice	1029	1452	1879
2	Wheat	1240	1695	2373
3	Jowar	224	685	894
4	Bajra	210	578	527
5	Maize	1019	1100	1583
6	Ragi	654	889	925
7	Gram	548	587	761
8	Red gram	480	763	754
9	Green gram	397	492	436
10	Black gram	428	526	456
11	Horse gram	445	502	437
12	Oilseeds	742	769	801
13	Groundnut	1495	1464	936
14	Mustard	445	484	856
15	Sesamum	425	469	558
16	Potato	7719	11228	16696
17	Onion	6783	7330	11382
18	Sugarcane	7500	67290	67062

Sources :- Directorate of Agriculture and food production -1995-96

Table 3.6 indicates the productivity of crops of Nuapada district along with that of State and country. It shows consistent low productivity in all crops except groundnut yield gap is very large for rice which is the major crop of the district.

POVERTY OF THE DISTRICT

Table 3.7 Poverty of the district

Sl.No.	Category	Magnitude No of families	Percentage to total household
1	Up to Rs 4000	21651	23.80
2	Rs 4001 to Rs 6000	29354	32.26
3	Rs 6001 to Rs 8500	19680	21.63
4	Rs 8501 to 11000	7845	8.62
5	Total household poverty line	78530	86.32
6	Above Rs 11000	12436	13.67
7	Total household	90966	100.00

Source : DRDA Nuapada 1992

Table 3.8 An economic over view of Nuapada district

1.	Geographical area (lakhs ha)	3.407
2.	Density of population per sq. km	138
3.	Population served by a bank office	16767
4.	Total number of workers	214314
5.	Literacy rate (percent)	27.52
6.	Total agricultural labourer	53000
7.	Fertilise consumption (Metric tonne)	1473
8.	No. of co-operative society	27
9.	Working capital of co-operative (Rs. in lakh)	364.78
10.	Loan advance (Rs. in lakh)	46.69
11.	Fish production (Metric tonne)	497

12. Per capita fish production (kg.)	1.06
13. Total food grain production (qtls.)	953899
14. Per capita availability of food grain per annum (kg.)	205.58
15. Total no. of cattle	195099
16. Buffaloes (nos.)	32382
17. Sheeps (nos.)	16921
18. Goats (nos.)	36526
19. Pigs (nos.)	815
20. Fowls (nos.)	75651
21. Number of Bank branches	105
22. Deposits in Bank (Rs. in lakh)	5899.81
23. Credit (Rs. in lakh)	6189.59

Table 3.7 gives information on poverty of the district. It shows 86.32 percent people living below poverty line. 56.06 percent of the household of the district had family income less than Rs. 500 per month, only 13.67 percent were not counted as poor.

METHODOLOGY

This methodology deals with the procedure along with their plan for statistical analysis and interpretation of findings followed by the investigator in preparation of this manuscript. These have been outlined under the following major headings.

1. Selection of the problem.
2. Research design.
3. Location of the study.

4. Sampling procedure.
 - a) Selection of the district.
 - b) Selection of the block.
 - c) Selection of the villages.
 - d) Selection of the respondents.
5. Collection of information.
 - a) Development of the interview schedule
 - b) Pre-testing the interview schedule
 - c) Interviewing
6. Operationalization and measurement of variables.
7. Statistical measures.

1. SELECTION OF THE PROBLEM

Selection and conceptualisation of the research problem is one of the most important factors of social science research. The generalised concept indicates that proper formulation of a problem is often more essential than its solution. The problem has been selected keeping in view to improve the socio-economic condition of the rural poor through different drought management programmes in drought prone areas those who are below poverty-line. Both central as well as state Governments are giving a lot of importance on drought management to achieve the stated objectives. But it has been observed that drought management measures have not been able to create an impact on the socio-economic status of its beneficiaries upto the satisfaction of the Government. This could be the resultant effect of so many factors such as less rapport among the community, the lack of technological gap and the political interference at the time of drought proofing measures in areas and lack of follow-up activities after the implementation. The present study aims at revealing the real picture of different management activities taken up by farmers' to mitigate drought, their perception in their effectiveness, extent of socio-economic change and the suggestions by the beneficiaries to overcome drought.

2. RESEARCH DESIGN

According to Lindquist (1956), research design is the plan, structure and strategy of investigation, conceived so as to obtain answers to the research questions and to control variance. In this study attempt has been made to define the problem, writing down the operational procedure, collecting relevant information and finally analysing them to get specific results. The present investigation comes within the purview of survey research design mainly of Ex-post-facto in nature. According to Kerlinger (1964), Ex-post-facto research is a systematic empirical enquiry in which the researcher does not have direct control of independent variables because their manifestation have already occurred or because they are inherently not manipulable. In Ex-post-facto research, the investigator starts with observation of the dependent variables to trace out the effects of independent variables.

3. LOCATION OF THE STUDY

The study was conducted in four different villages located in Komna Block of Nuapada district. The villages covered under the study were Babupalli, Sukulimundi, Shemelpalli and Thikpalli.

4. SAMPLING PROCEDURE

The district and the block were selected purposively whereas random sampling procedure was followed for selecting the villages and the respondents.

a) Selection of the district

Nuapada district was purposively selected because this was the first district in the state where the intensity and number of drought commencement were recorded as highest in Orissa.

b) Selection of the block

The Komna block of Nuapada district was purposively selected because the researcher came to know from government officials such as District Agriculture Officer (DAO), Block Development Officer (BDO) and Agriculture Extension Officer (AEO) as well as local people that this block has been consecutively affected by droughts and the farmers have been suffering much.

c) Selection of the villages

After selection of the block, four villages were selected at random for the purpose of present investigation. Those were Babupalli, Sukulimundi, Shemelpalli and Thikpalli.

d) Selection of the respondents

The respondents were selected randomly from four villages. A sample consisting of eighty respondents was selected following the principle of random sampling technique. Out of the eighty respondents, 30, 20, 15 and 15 were from the villages of Babupalli, Sukulimundi, Shemelpalli and Thikpalli, respectively.

5. COLLECTION OF INFORMATION

(a) Development of interview schedule

An interview schedule was developed keeping in view the objective of the study for the purpose of collecting information. The schedule was broadly divided into 4 parts based on 4 objectives of the study. The first part was devoted for collection of information about personal and socio-economic profile of the respondents such as age, education, family type, farming condition, etc. The second part of the schedule was devoted for collecting information about perception of farmers' regarding weather leading to drought, crops in drought situation, crop loss, government programmes to encounter drought situation and

social pathology. The third part of the schedule was devoted to questions related to different management strategies adopted by the respondents to mitigate drought situation and the fourth part of the schedule was meant to study the suggestions by the respondents to overcome drought.

(b) Pre-testing the interview schedule

After the development of the schedule, it was pre-tested with 10% respondents of the sample selected for the interview. On the basis of observation made during pre-testing, some minor modifications were done. Thus the schedule was finalised for collection of information.

(c) Interviewing

The interview was carried out by the author by personal contact. A good rapport was created which helped to ask questions and discuss any matter pertaining to the study and to record information received from the respondents.

6. OPERATIONALISATION AND MEASUREMENT OF VARIABLES

- (i) Age:** The age has been operationally defined as the number of years completed by the respondent at the time of enquiry.
- (ii) Education :** Education has been operationalised as the extent of literacy or no. of years of formal education attained by the respondents. In the present study, the scale developed by Trivedi (1963) was used with a little modification.
- (iii) Family type :** Family type has been defined operationally as nuclear or joint on the basis of either separate or common kitchen respectively. In the present study, the scale developed by Trivedi (1963) was used.
- (iv) Family size :** Family size denotes to the no. of members in the family as the family staying in common kitchen.

- (v) **Size of operational holding** : The farm size has been operationalised as the total land (irrigated or unirrigated) owned by the respondents.
- (vi) **Cropping intensity** : It is the ratio of total cropped area to total cultivated area expressed in percentage.
- (vii) **Occupation** : Occupation has been operationally defined as the relatively continuous pattern of activity that provides respondent a livelihood and define his/her general social status.

The other variables such as farming conditions, perception of the farmers', crops and sustainability, extent of crop loss, government programmes to counter the drought situation, social pathology, different management strategies adopted and farmers' perception in their effectiveness and suggestions of the respondents to overcome drought were measured by the schedules developed for the study.

7. STATISTICAL MEASURES

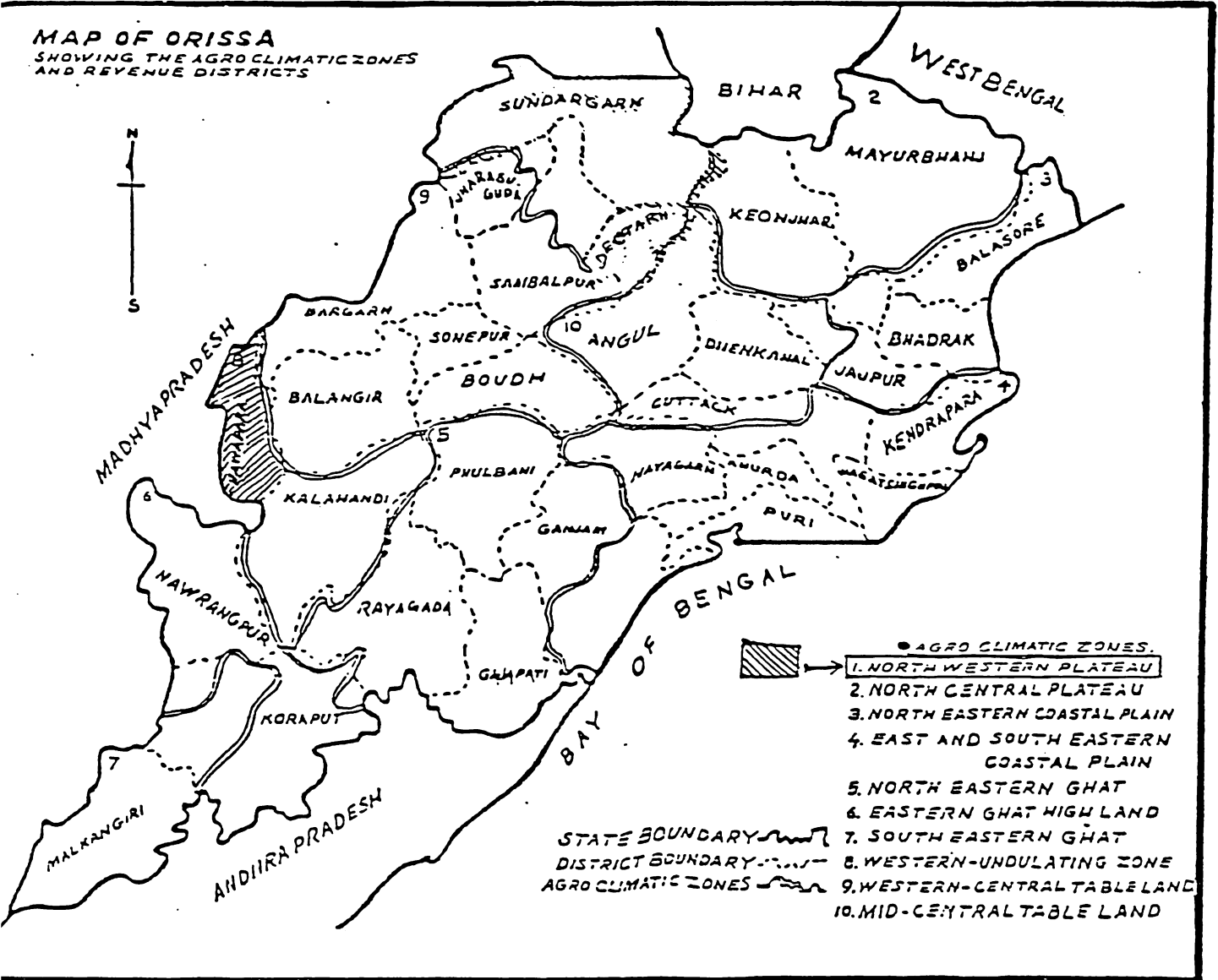
The following statistical measures were used in the study for analysis of data.

- (i) **Percentage** : Percentage was used in descriptive analysis for making simple comparisons. For drawing percentage, the frequency of a particular cell was multiplied by 80 and divided by the total number of respondents in that particular category to which cell they belong.
- (ii) **Mean score** : It is also another simple comparison which is calculated by using the formula.

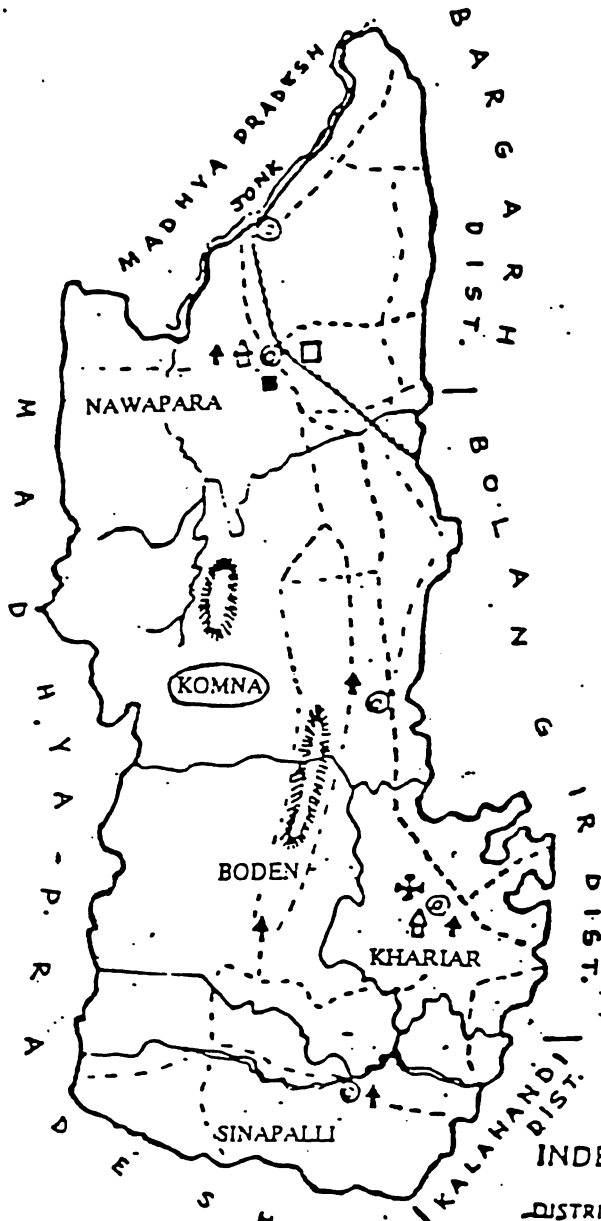
$$M.S. = \frac{f.x}{N}$$

Where, f.x. = Sum of total score obtained by the individual
 N = Number of respondents.

MAP OF ORISSA
 SHOWING THE AGRO CLIMATIC ZONES
 AND REVENUE DISTRICTS



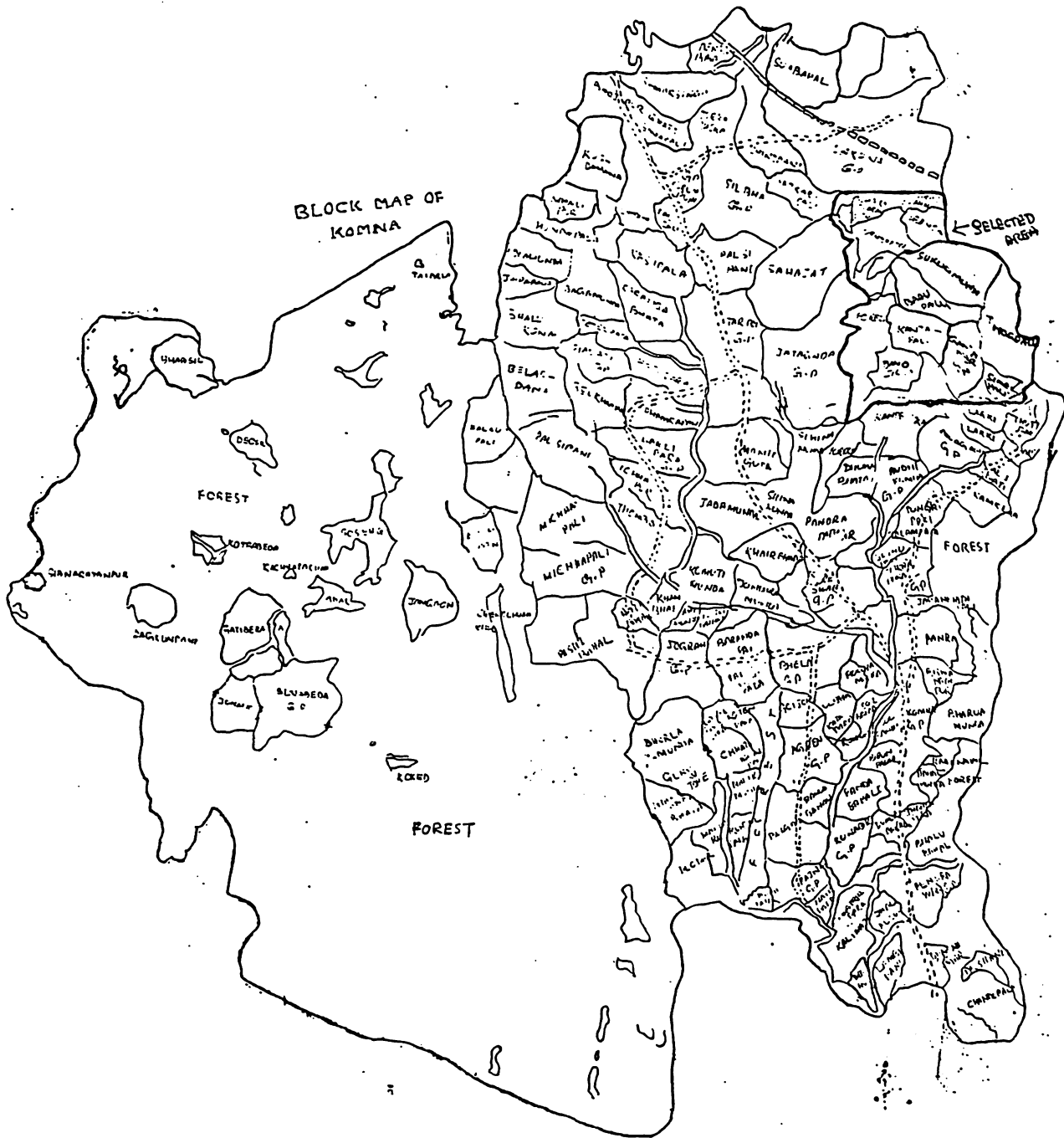
MAP OF NUA P A D A DISTRICT



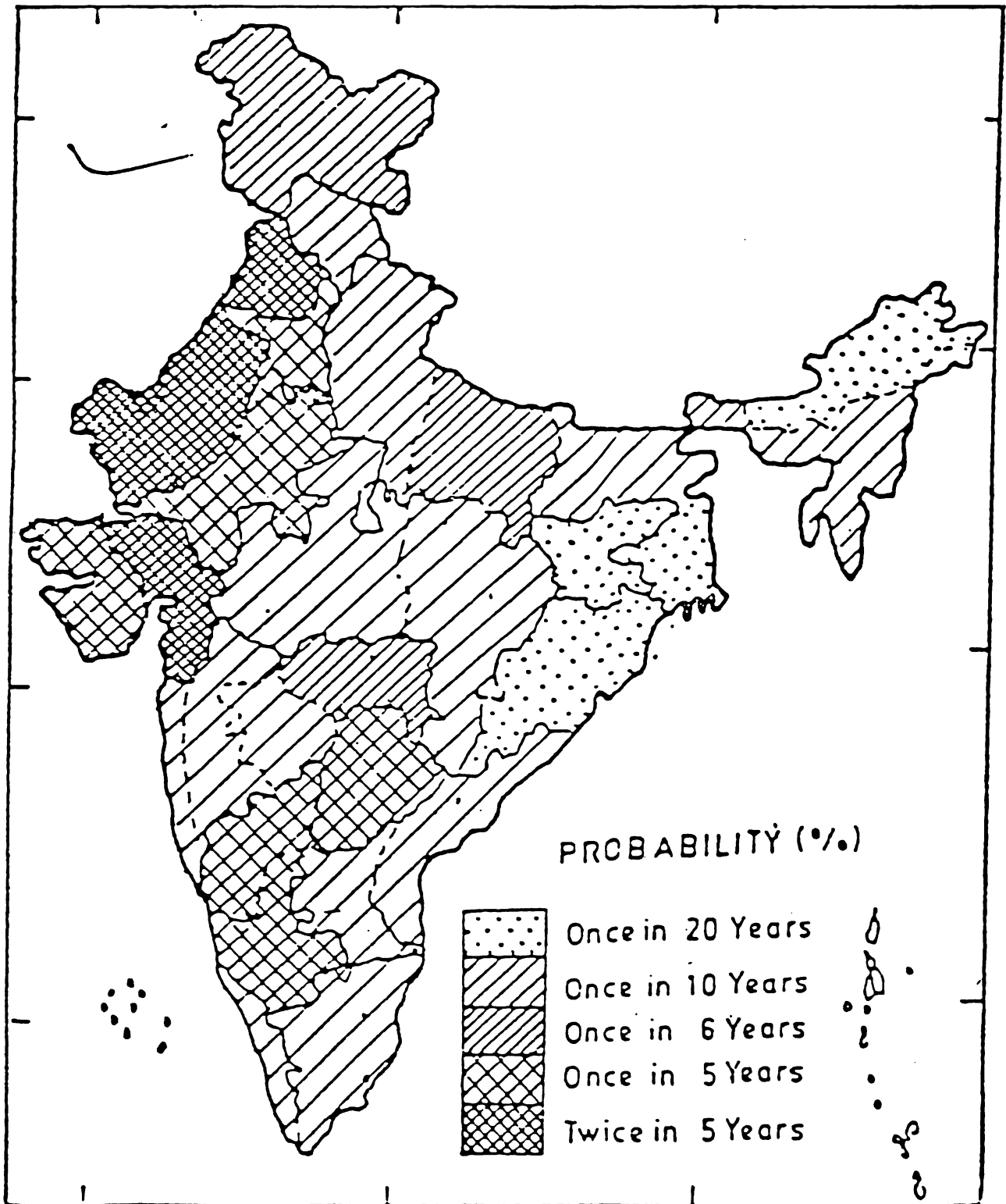
INDEX

- DISTRICT BOUNDARY
- BLOCK BOUNDARY
- DISTRICT HQRS.
- BLOCK HQRS.
- P.S. HQRS.
- TAHSIL HQRS.
- NAC
- ROAD
- RAILWAY
- RIVER
- HILL

BLOCK MAP OF KOMNA



PROBABILITY OF DROUGHT IN INDIA



CHAPTER - IV

Results and Discussion

RESULTS AND DISCUSSION

The study was mainly conducted to analyse the information perceived by the farmers perception of drought situation and their management strategy. The study conducted and obtained data during investigation were processed, analysed statistically and presented with the help of tables, graphs with systematic under the following specific problem.

OBJECTIVE -I

TO STUDY THE SOCIO-ECONOMIC PROFILES OF THE FARMERS

The followings are the main ingredient of socio-economic profile (1) Age (2) Education (3) Family type (4) Family size (5) House type (6) Total cultivated area (7) total irrigated area (8) Non-irrigated area (9) Agricultural implements (10) Annual family income (11) Farm power (12) material possession (13) Occupation (14) Farming condition.

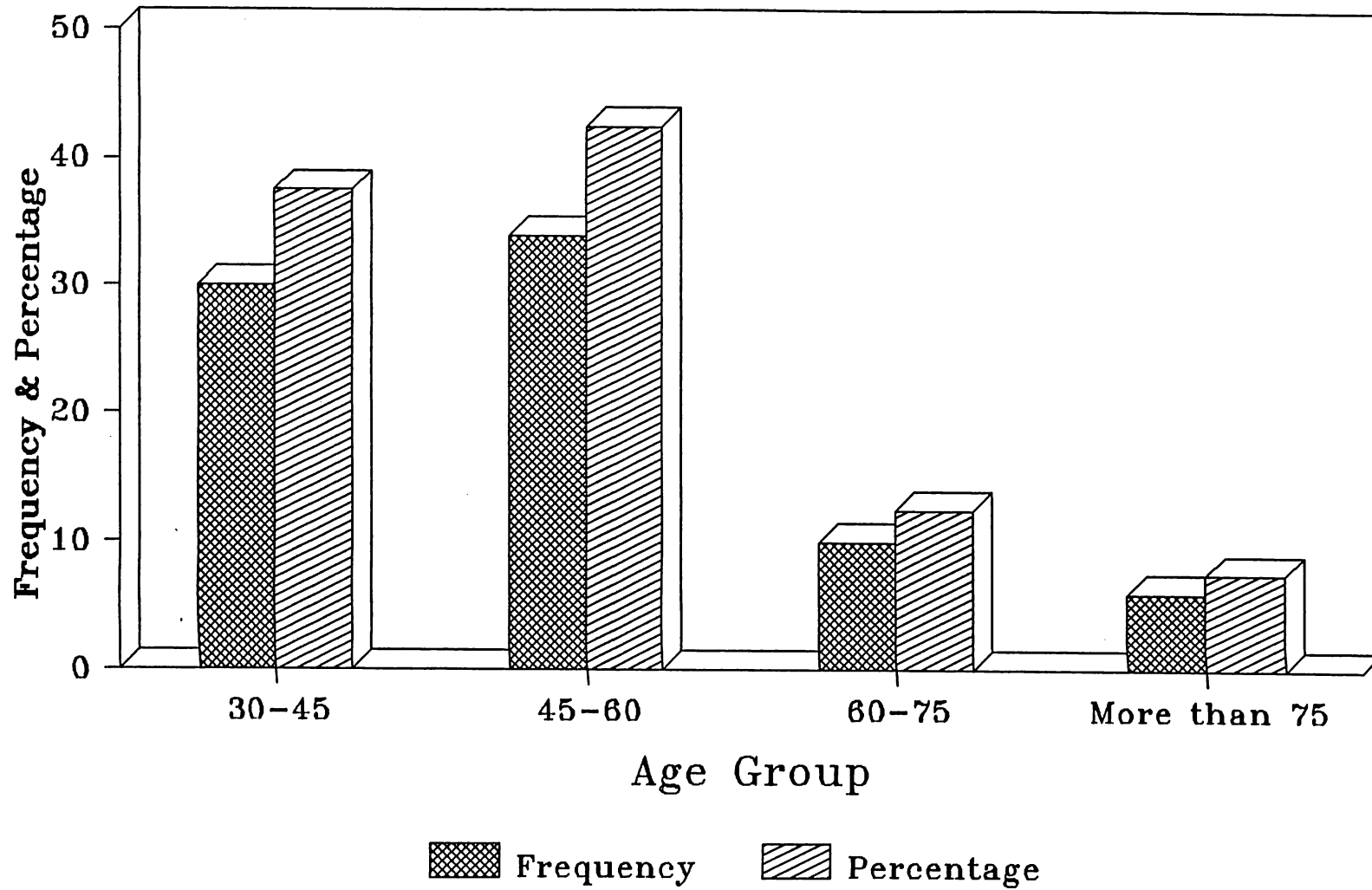
AGE(X_1)

Table-4.1.1 Distribution of respondent farmers on the basis of their age

Characteristic	Category	Frequency (N=80)	Percentage
Age	30-45	30	37.5
	45-60	34	42.5
	60-75	10	12.5
	> 75	6	7.5

It is evident from table 4.11 that, out of 80 respondents 37.5 percent of them are of 30-45 age group, 42.5 percent belonged to 45-60 age group, 12.5 percent of 60-75 age group and 7.5 percent belonged to above 75 age group.

Fig.5 Age of Respondents



It is found that more no. of the respondents/farmers belong to the category of 45-60. The reason might be due to the fact that the farmers coming in this category are actively involved in the farming process in comparison to other groups. The age group of 30-45 are also involved in the farming process but these are not so familiar with this above category because of the farmers coming in this group are little young & due to unemployment problems they are involved and having little experience but not stable with farming system. The next category coming is 60-75, this category is having more experienced & presently they are less involved due to age factor. The last category is more than >75 age group. This category is also more experienced than other categories but presently less active in farming system. So if the drought management practices should be taught to first two categories, then it will be more effective.

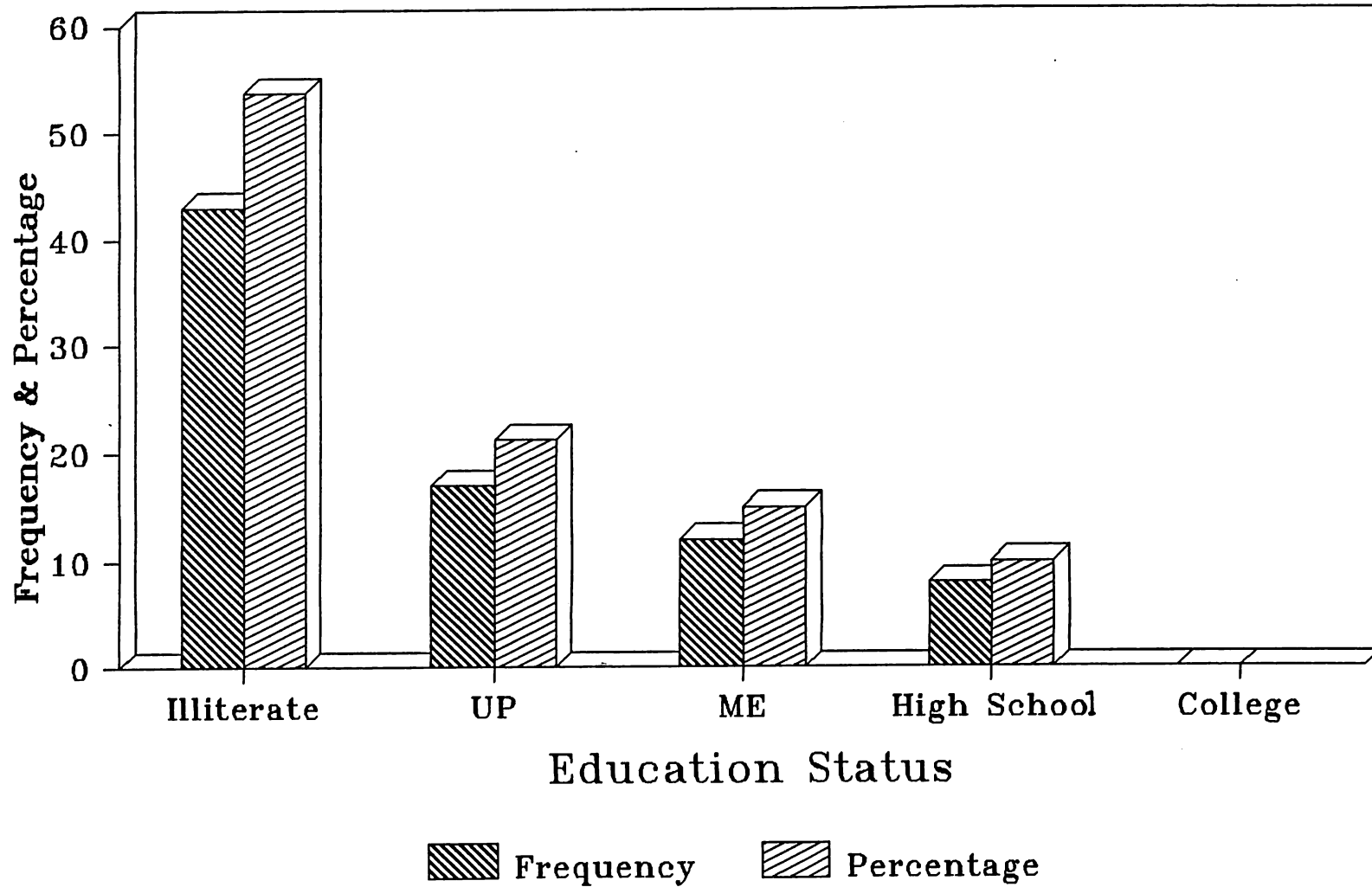
EDUCATION(X₂)

Table-4.12 Distribution of respondent farmers on the basis of their education

Characteristic	Category	Frequency(N=80)	Percentage
Education	Illiterate	43	53.75
	UP	17	21.25
	ME	12	15.00
	High school	8	10.00
	College education	Nil	--

Education plays a vital role for the development of an individual. The data analysed in the table 4.1.2. indicated the distribution of educational categories of the respondents, out of the total respondents under the study 53.75 were found to be illiterate, whereas 21.25 , 15 and 10 percent received primary, middle school and high school education respectively. No body had got the opportunity for higher education i.e. college education.

Fig.6 Education of Respondents



The government has launched various programmes to eliminate illiteracy & to make the illiterate functional literates. It has been seen during investigation most of the farmers are adopting drought management practices in their traditional way but they don't know exactly the practices. But the literate masses are little bit aware of some modern practices.

FAMILY TYPE (X₃)

Table-4.1.3 Distribution of respondent on the basis of their family type

Characteristic	Family type	Frequency(N=80)	Percentage
Family type	Nuclear	68	85
	Joint	12	15

A look at the table 4.1.3 reveals that majority of the respondents were staying with nuclear family (68 percent) and very little number of respondents were staying with joint family. This is due to the fact that most of the family of the respondents were already divided & was maintaining individual family system. Incase of joint family, respondents were staying together with other families & that had not been divided into single type.

FAMILY SIZE(X₄)

Table 4.1.4 Distribution of respondent on the basis of their family size

Characteristic	Family size	Frequency(N=80)	Percentage
Family size	Up to 5 members	56	70
	5-10 members	14	17.5
	> 10 members	10	12.5

A glance at table 4.1.4 indicates that most of the families are coming under the category having less than five members (70%). The family size having 5-10 members & more than 10 members are coming to 17.5 and 12.5 respectively. It is due to the fact that majority of the families are of single family type i.e. small family size. Rest of the family includes single type as well as joint family type.

Fig.7 Family type of Respondents

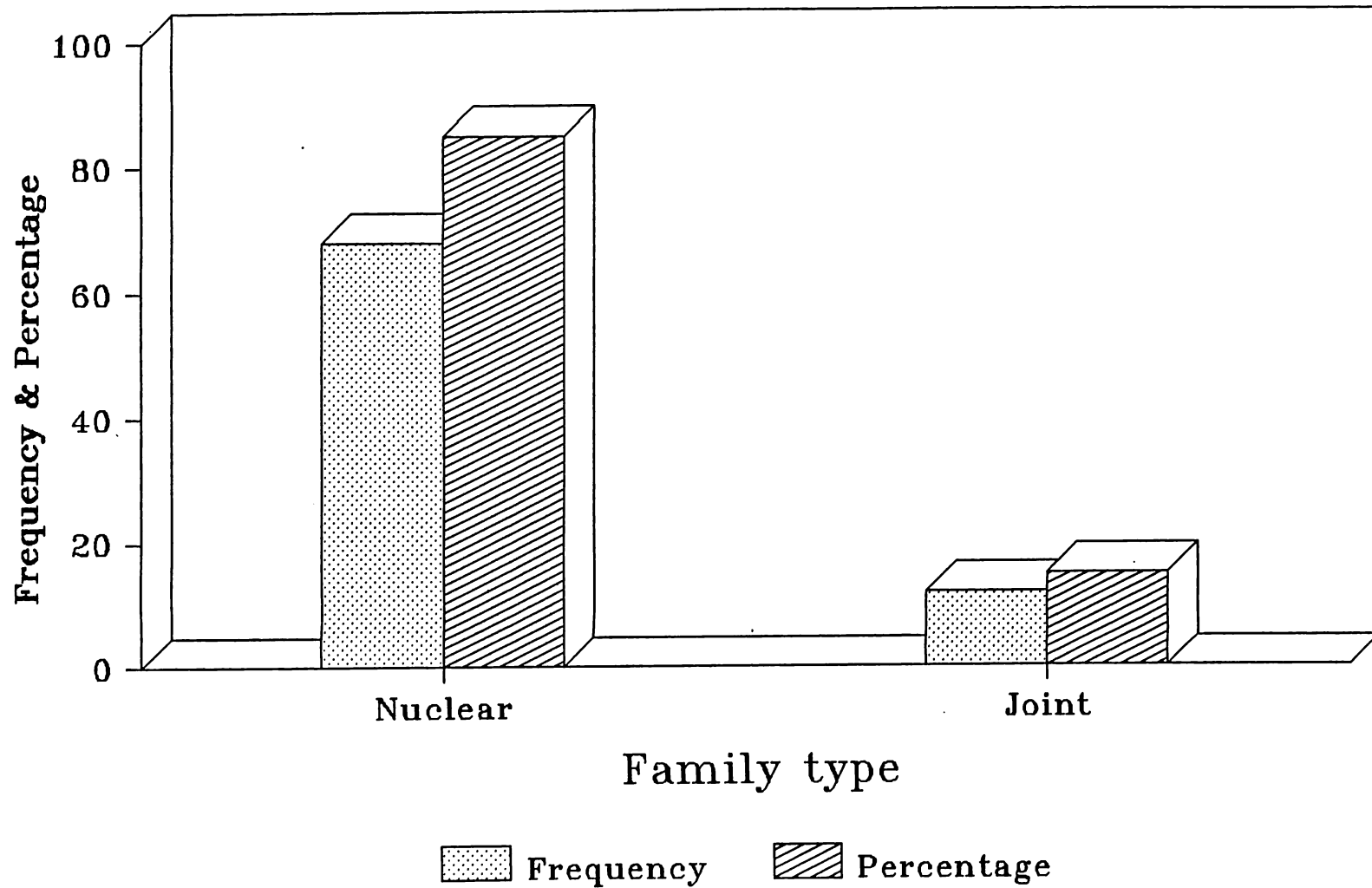
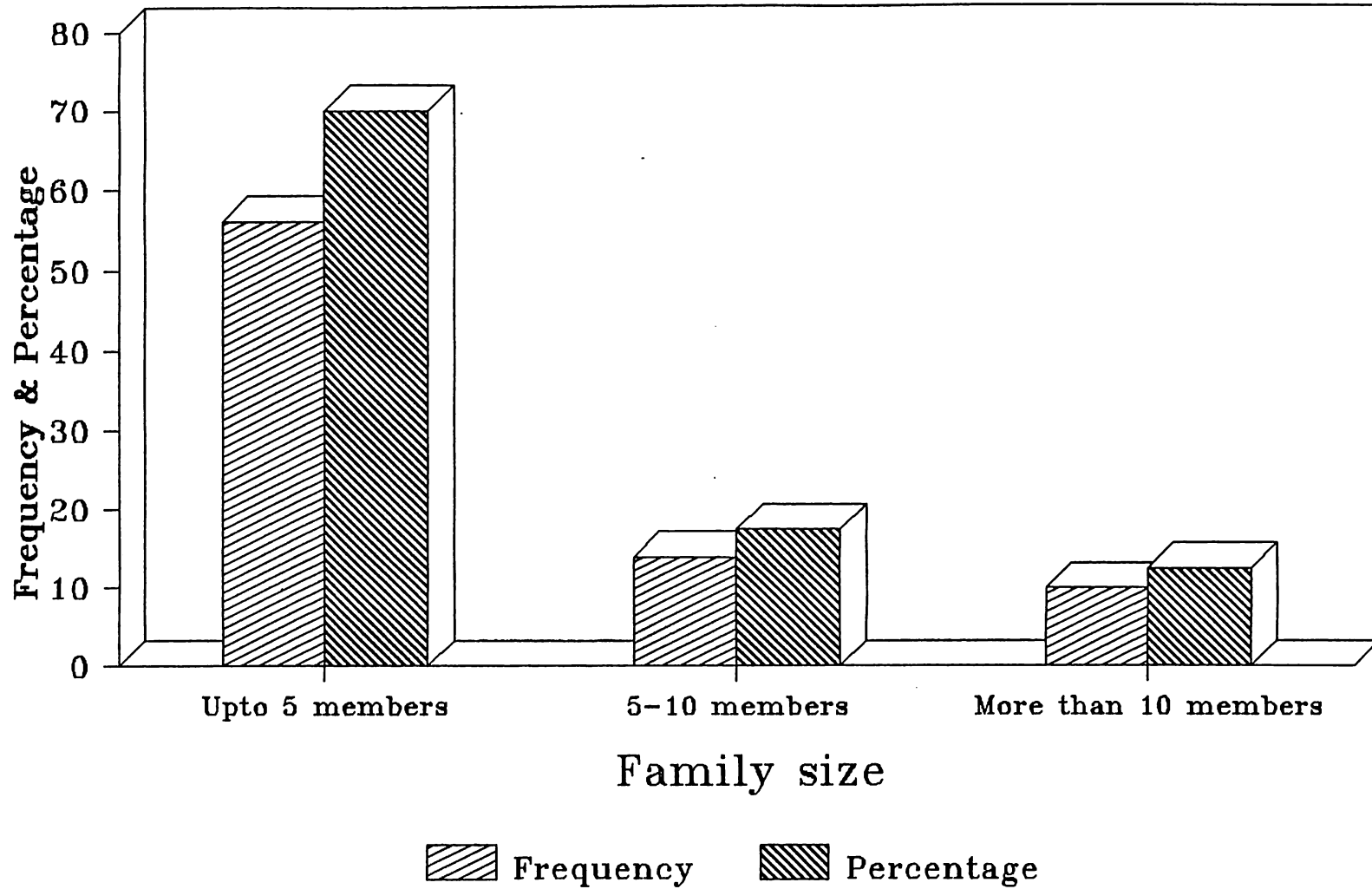


Fig.8 Family size of Respondents



HOUSE TYPE (X₅)

Table 4.1.5 Distribution of respondent on the basis of their house type

Characteristic	House type	Frequency(N=80)	Percentage
House type	Katcha	72	90
	Pucca	3	3.75
	Mixed	5	6.25
	Building	nil	--

From the table 4.1.5 it was observed that 90 percent of the respondents were living in Kutch house and 6.25 percent of the same were living in mixed house where as only 3.75 percent of the respondent had pucca house. For this the reason is that the majority of the respondents had poor economic condition & very few had little sound economic status.

AGRICULTURAL IMPLEMENTS (X₆)

Table 4.1.6 Distribution of respondent on the basis of their agricultural implements

Characteristic	Category	Frequency(N=80)	Percentage
Agricultural implements	Country plough	77	96.25
	Sprayer	1	1.25
	Duster	--	--
	Fert. seed drill	--	--
	Thresher	1	1.25
	Tractor	1	1.25
	Power tiller	--	--

The possession of major agricultural implements by the respondents have been presented in table 4.1.6 . It was observed from the table that majority of the respondents (above 96%) possessed country plough and very least percentage of

Fig.9 House type of Respondents

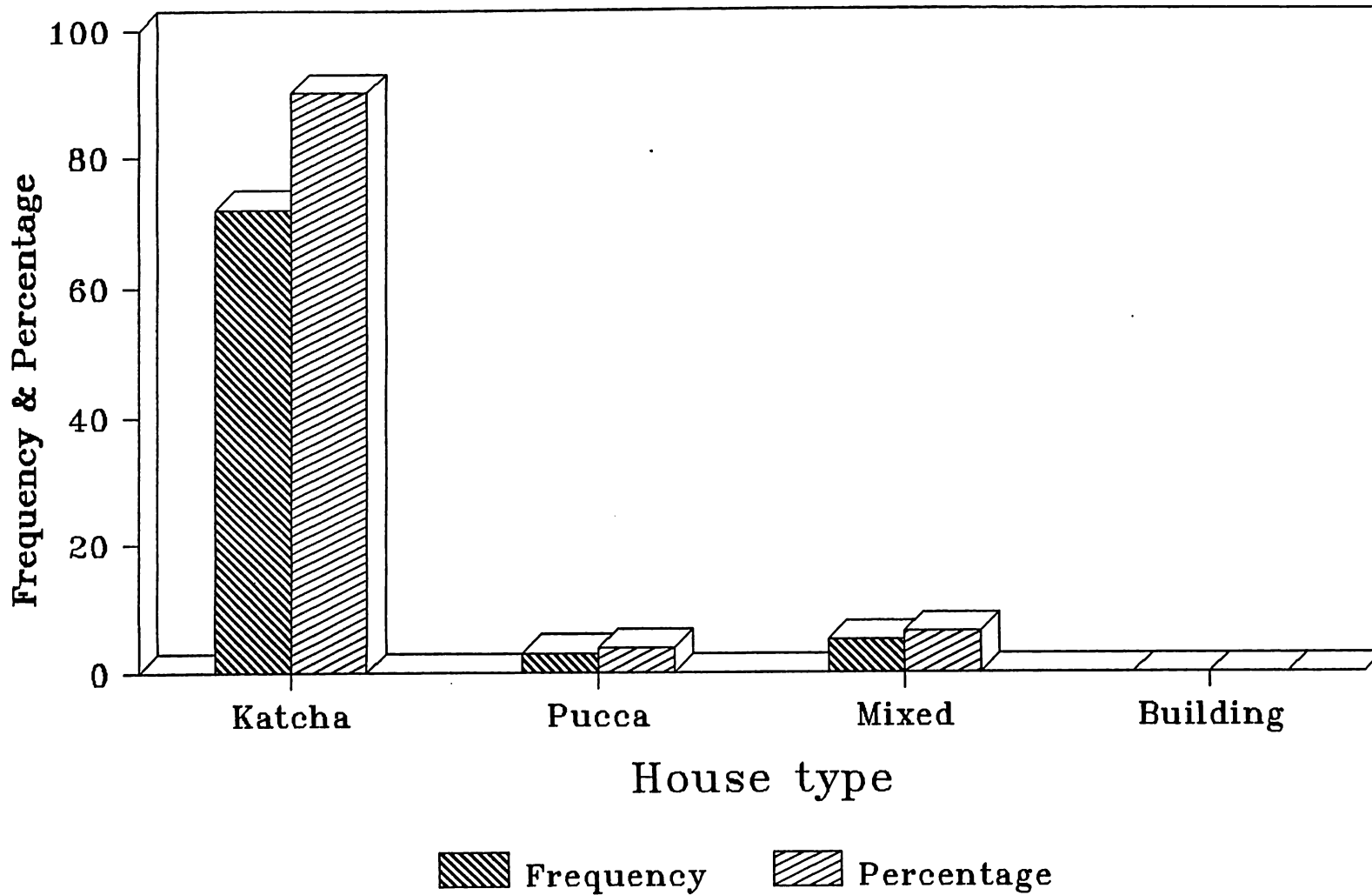
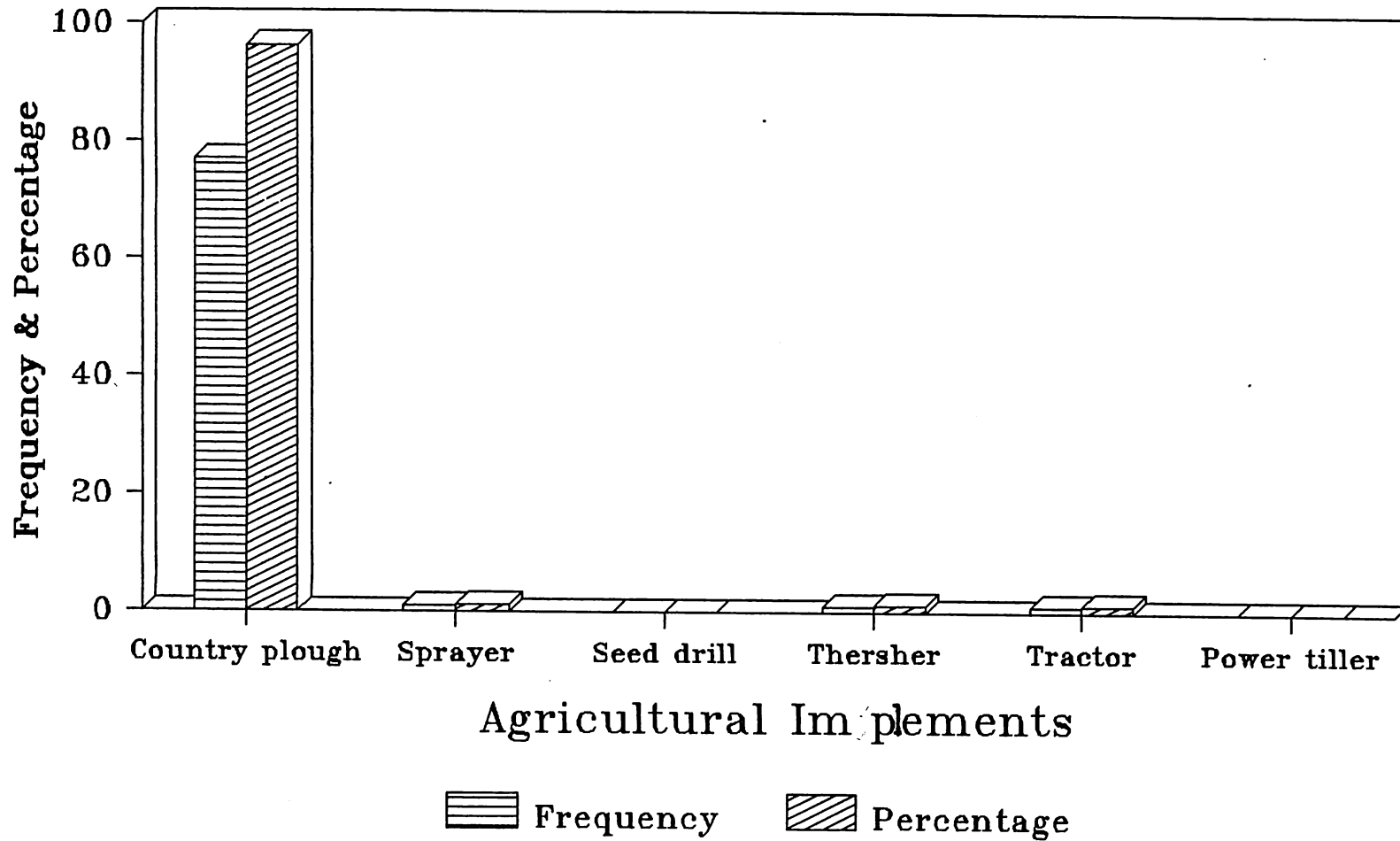


Fig.10 Possession of Agricultural Implements



the farmers (1.25%) possessed sprayer, thresher and tractor. The reason is that majority of the respondents belonged to small and marginal farmers. They can't afford for sprayer, thresher or power tiller and other modern agricultural implements. So they had only country plough for their ploughing activities. Few medium & high farmers had possessed threshers and sprayer because their (medium and big farmers) economic condition is good in comparison to other groups. The tractor was only possessed by a few big farmer whose economic condition was better in the society. Also it was observed that majority of the farmers were not using different modern agricultural implements those which add more value to agricultural productions which could have helped in mitigating drought to some extent.

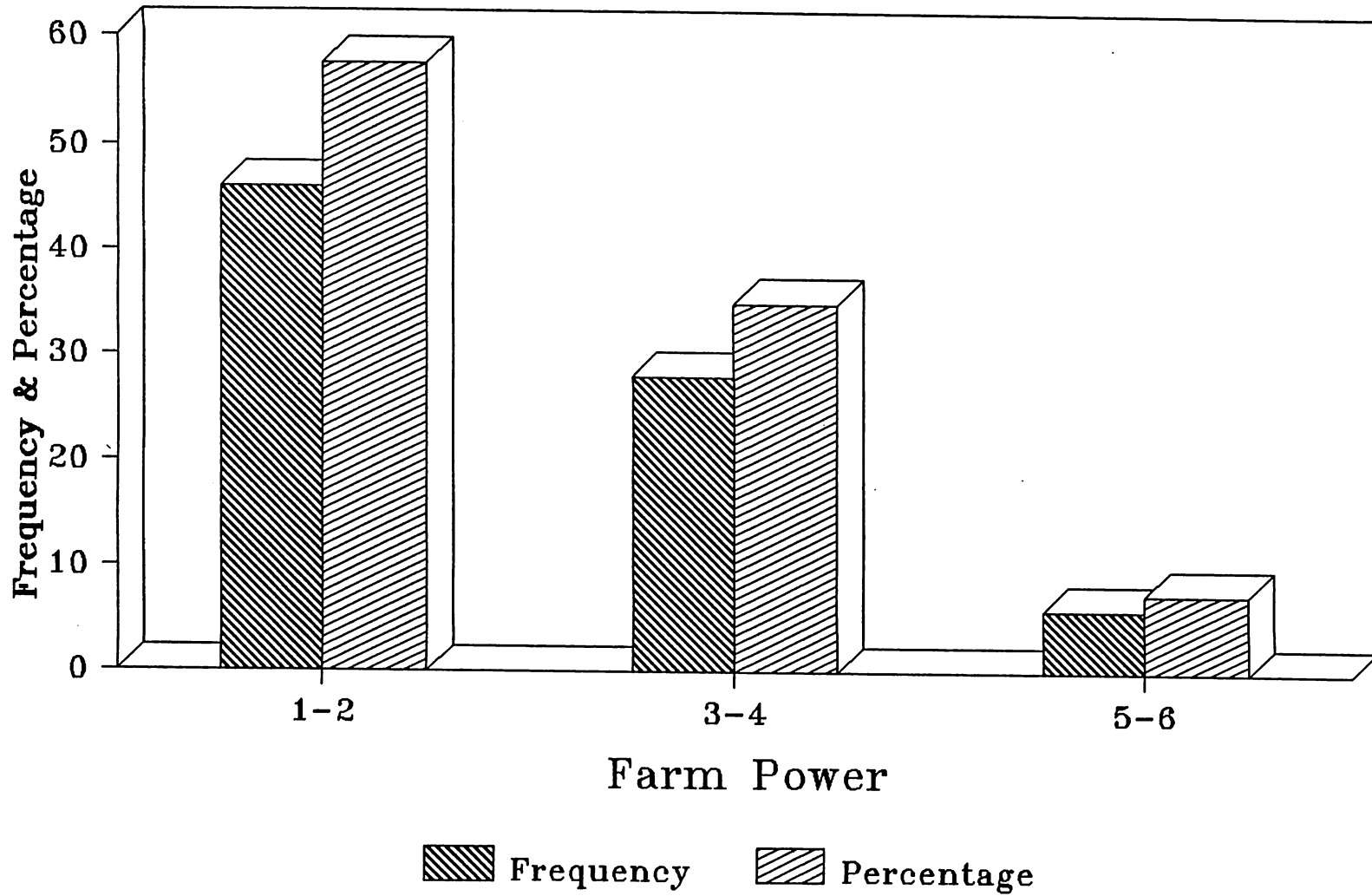
FARM POWER(X₇)

Table 4.1.7 Distribution of the respondents on the basis of their farm power

Characteristic	Category	Frequency	Percentage
	0	Nil	--
Farm power	1-2	46	57.5
	3-4	28	35
	5-6	06	7.5

It was revealed from the table 4.1.7 that 57.5 percent and 35 percent of the respondents had 1-2 draught animals and 3-4 draught animals respectively. The very less number of big farmers (7.5%) had 5-6 number of draught animals because of the more land holding & they had the capacity to feed them. Most of the medium farmers had 3-4 no. of less no. of small & marginal farmers had a of possession of 1-2 draught animals due to their less amount of land holding.

Fig.11 Farm power



ANNUAL INCOME (X₈)

Table 4.1.8 Distribution of the respondents on the basis of their annual income

Characteristic	Category	Frequency	Percentage
Annual income	< Rs.5,000	8	10
	Rs.5,000- 10,000	57	71.25
	Rs.10,000-15,000	12	15
	Rs.15,000-20,000	3	3.75
	Rs.>20,000	--	--

Table 4.1.8 revealed that 10 percent of the respondents were having upto rupees five thousand where as 75.25 percent of the respondents had the annual income of rupees five thousand to ten thousand. Again 15 percent and 3.75 percent of the respondents were having the annual income level of ten thousand to fifteen thousand and fifteen thousand to twenty thousand respectively. It was observed that majority of the income from agricultural source. Incase of small & marginal farmers, they didn't have more agricultural land holding, so their income were confined to a very small and limited amount i.e. five thousand to ten thousand. But incase of big and medium farmers they had other incomes apart from farming. During drought period the small & marginal farmers suffer much in general.

MATERIAL POSSESSION (X₉)

Table 4.1.9 Distribution of the respondents on the basis of their material possession

Characteristic	Category	Frequency	Percentage
Material possession	Chair	5	6.25
	Table	5	6.25
	Sofaset	6	7.5
	Watch	17	21.25
	Radio	12	15
	Cycle	25	31.25
	Scooter	02	2.5
	TV	03	3.75
	Bullock cart	05	6.25

Fig.12 Annual Family Income of Respondents

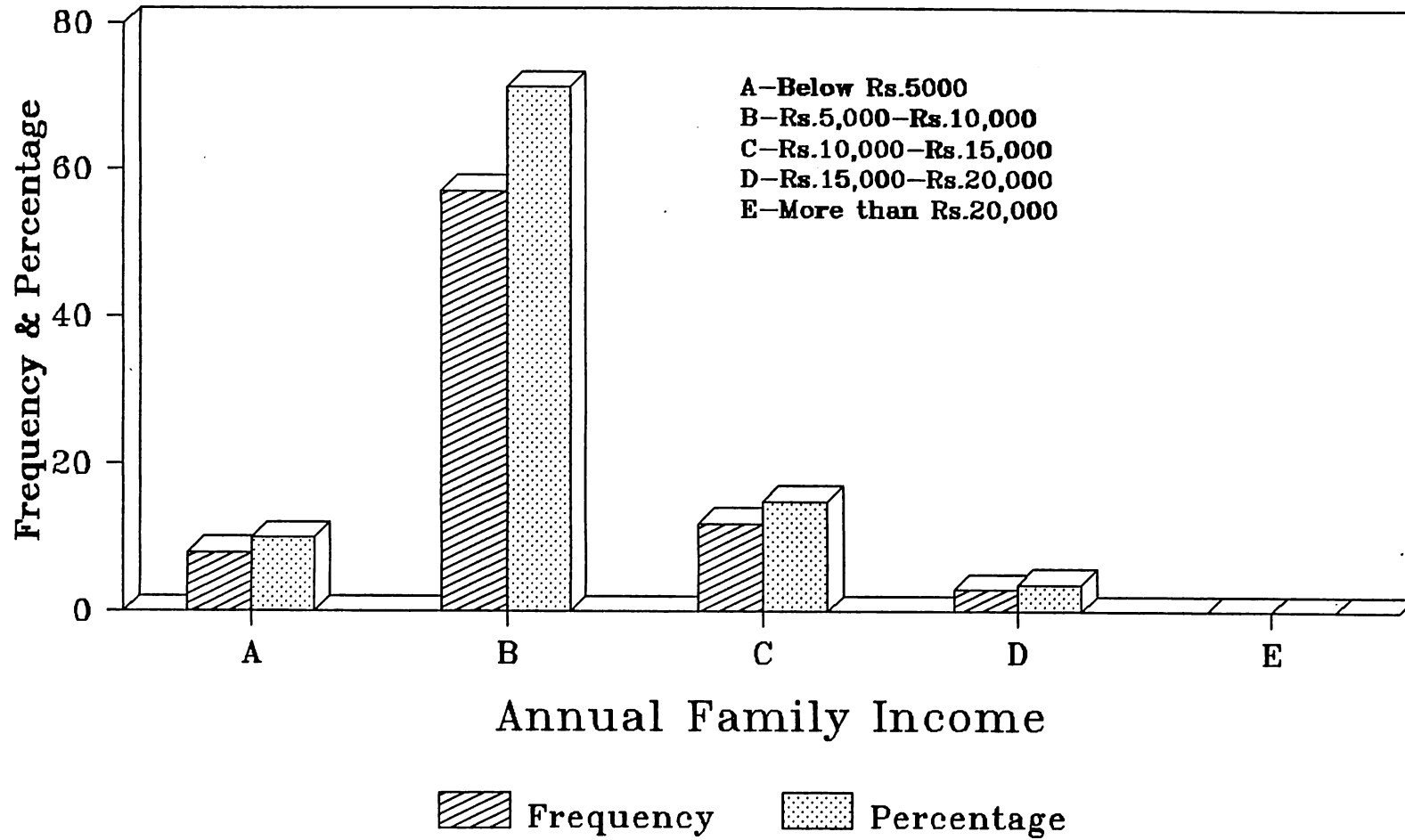
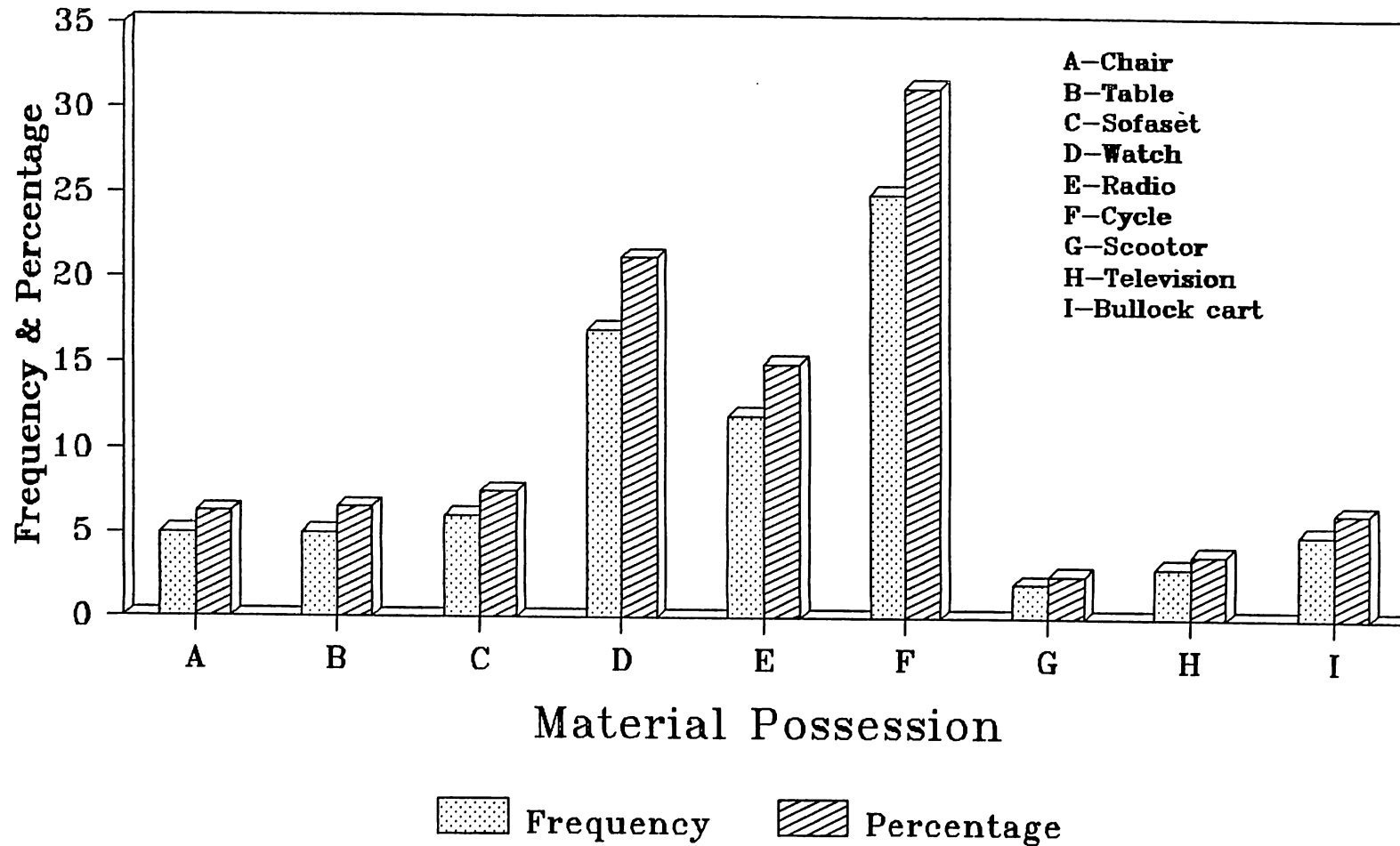


Fig.13 Material Possession of Respondents



It was revealed from table 4.1.9 that 6.25 percent of the respondents had the material possession of chair, 6.25 percent possessed table, 7.5 percent of them possessed so asset , 21.25 percent had watch, 15 percent had radio, 31.25 percent had TV and 6.25 percent possessed bullock cart. The reason was that materials like scooter costs heavily for which only big farmers could afford money, on the other hand cycle was essential for transportation of low amount of goods for which marginal & medium farmers could afford. Thus percentage of cycle was more due to more number of small & marginal farmers. Regarding other category the farmers didn't need it essentially.

OCCUPATION (X_{10})

Table 4.1.10 Distribution of the respondents on the basis of their occupation

Characteristic	Category	Frequency	Percentage
Occupation	Farming	66	82.5
	Business	6	7.5
	Service	8	10.0

The table 4.1.10 revealed that majority of the respondents (82.5 percent) were coming under farming type of occupation. The rest of the respondents i.e 7.5 percent and 10 percent were from business and service respectively. This was so because of less member of alternative income sources were available apart from agriculture, again it was due to low literacy rate. Most of the respondents coming under highest category were from marginal and small farmers.

LAND HOLDING (X_{11})

Table 4.1.11 Distribution of the respondents on the basis of their land holding

Characteristic	Category	Frequency	Percentage
Land Holding	0-5 acre	52	65
	5-10 acre	18	22.5
	10-15 acre	8	10
	>15 acre	2	2.5

Fig.14 Land Holding

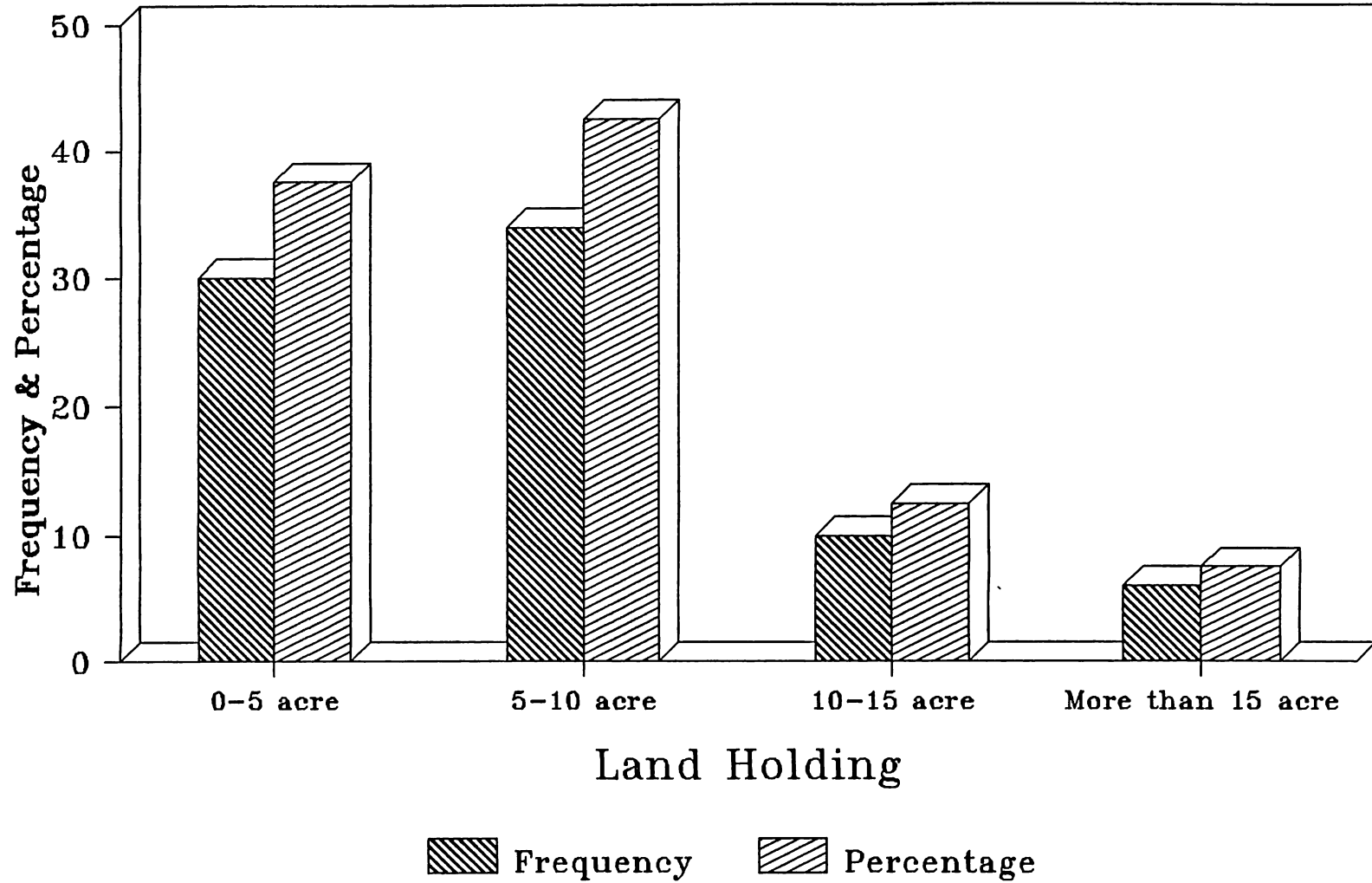


Table 4.1.11 reveals that 65 percent of the respondents were coming under marginal and small farmers. Again 22.5 percent and 10 percent farmers had 5-10 acres and 10-15 acres of land respectively, those are considered as medium and big farmers. Whereas only 2.5 percent farmers were coming under very big farmers who were having more than 15 acres of land holding. This was due to the fact that more number of respondents were having very less acerages of land and they were the most sufferers during the period of drought due to more amount of uplands.

IRRIGATED AREA (X_{12})

Table 4.1.12 Distribution of the respondents on the basis of their irrigated area

Characteristic	Irrigated area	Frequency	Percentage
Irrigated area	0-5 acre	23	28.75
	5-10 acre	3	3.75
	10-15 acre	1	1.25
	> 15 acre	--	--

From this table it was observed that 28.75 percentage of farmers coming under 0-5 as followed by 3.75 percentage, 1.25 percentage of farmers belonged to 5-10 as and 10-15 ac. of lands respectively. Because of the fact that the majority of the marginal and small farmers had better irrigation facilities in comparison to other category farmers.

NON IRRIGATED AREA (X_{13})

Table 4.1.14 Distribution of the respondents on the basis of their non-irrigated area

Characteristic	Irrigated area	Frequency	Percentage
Non-Irrigated Area	0-5 acre	40	50
	5-10 acre	10	12.5
	10-15 acre	3	3.75
	> 15 acre	--	--

This table revealed that 50 percent of the farmers having 0-5 ac. of lands were coming under non-irrigated category, followed by 12.5 percent and 3.75 percent of farmers belonged to 5-10 and 10-15 ac. and had no irrigation facilities respectively. This was due to the fact that small and marginal farmers had small acres of land and out of that few acres were irrigated. But in comparison to the percentage of irrigation of small and marginal farmers were very less incomparision to medium and big farmers. Basically the big farmers had more number of irrigation facilities. They had more acerages of land under irrigation.

CROPPING INTENSITY (X₁₄)

Table 4.1.14

Characteristic	Category	Frequency	Percentage
	50-70	19	23.75
Cropping Intensity	70-90	35	43.75
	>90	26	32.5

The table indicated that majority of the farmers coming under 43.75% of cropping intensity where as others were under 32.5 and 23.75 percentage. This was so because of the fact that more number of big and medium farmers coming under the highest percentage category to some extent. The small and marginal farmers coming under other categories.

PART-II

PERCEPTION OF THE FARMERS

Farmers are the real victims in the drought prone areas in comparison to other areas. Drought affects the entire livelihood leading to a great disastrous condition. It has different impacts on socio as well as on economic condition of the

farmers. Many farmers view the cause of drought, crop sustainability, impact on social lives and different programmes to mitigate drought situation from different angles. The present agricultural scientists working on this field should take farmers' perception into consideration while planning for drought management. The followings are some of the statements relating to different aspect of drought, analysed to get the exact perception of farmers'.

Table 4.2.1 Weather leading to drought

Sl. No.	Statement	Total Score	Mean Score	Rank
1.	Inadequate rain is the prime cause leading to drought	366	4.57	I
2.	Dry spell in the begining of cropping season may cause drought	210	2.62	VII
3.	Low indetermittent rain may also cause drought	216	4.35	V
4.	Erratic ad sporadic rainfall may cause drought	343	2.50	II
5.	Defforestation may cause drought	334	4.17	III
6.	Even after giving life saving irrigation drought condition prevails	220	2.75	IV
7.	In drought year the temperature is generally higher than the normal year	200	2.50	VIII
8.	Loss of faith on God cause drought	213	2.66	VI

Weather leading to drought is one of the important aspect of frequent occurrence of drought. The analysed above table showed that inadequate rain is the prime cause leading to drought was perceived as a major factor with mean score 4.57 followed by "erratic and sporadic rainfall may cause drought" (4.35) and "defforestation may cause drought" (4.17) and "even after life saving irrigation drought condition prevails" (2.75), "low intermittent rain may also cause drought" (2.70); "lose of faith on God may cause drought" (2.50); "dry spell in the beginning of the cropping season may cause drought" (2.62); and " in drought year the temperature is generally higher than normal " (2.50). These were ranked as I, II, III, IV, V, VI, VII and VIII respectively.

The mean score rank (4.57) of inadequate rain is the prime cause of drought leading to drought was placed at the top among other perceptions of weather leading to drought.

This was so because, the majority of the respondents basically depending on natural rains to have the agricultural productions. They didn't have other irrigation facilities except few. If there would be no adequate rainfall, it would have become difficult to get the normal yield from a plot.

Erratic and sporadic rainfall may cause drought ranked second in order of importance because sometimes there was adequate rainfall but due to the erratic & sporadic nature all the patches could not be able to receive the uniform amount of rainfall so also it was not at the time of requirement & it was very haphazard in nature which leads the crop towards drought situation just making an injustice to crop production.

Third among other perception is "deforestation may cause drought" because now people had realised that due to destruction and degradation of forest coverage we (respondents) already lost our humus from the soil, and not getting the rain at right time which is primarily and indirectly related to commencement of drought so consecutively in the district of Nuapada so also in the state of Orissa.

Table 4.2.2 CROP AND SUSTAINABILITY

Sl. No.	Statement	Total Score	Mean Score	Rank
1.	No crop can tolerate drought situation	240	3.0	III
2.	Resistance varieties are not tolerant to drought	201	2.51	VI
3.	Crop after vegetative stage may tolerate drought	208	2.60	V
4.	Mixed and inter cropping are always good to counteract drought situation	271	3.38	I
5.	Crop planning is an important activity in drought situation	265	3.31	II
6.	In kharif, non-paddy crops can give normal yield in drought situation	232	2.90	IV

The above specific perception relating to crop and sustainability were analysed and has shown in descending order of importance were a mixed and inter cropping are always good to counteract drought situation" (3.38), "Crop planning is an important activity in drought situation (3.31), "No crops can tolerate drought situation"(3.0), "In Kharif, non-paddy crops can give normal yield in drought situation" (2.90), "Crops after vegetative stage may tolerate drought" (2.60) and "resistance varieties are not tolerant to drought" (2.51).

From the above table it was observed that "mixed & intercropping are always good to counteract drought situation which ranked at top. District Nuapada, (undivided Kalahandi) is nationally famous for drought prone area. The operational villages taken up by the researcher were affected consecutively due to concurrent drought. No preventive measures can be taken to escape from drought but some management practices as well as contingency planning can be made to mitigate drought situation. From the agricultural point of view, if one goes for mixed farming with anticipation of getting drought, can get a better return in comparison to monocropping when there is drought. Crop planning marked in second in order of importance because in a drought prone area before going to have a specific crop in the field, one should have proper planning aiming at different hazards so that crop will be less affected. Again in the rank of third, "no resistance varieties can tolerate drought" is coming. It is fact that if there will be no rain, nothing will be possible in the field of agriculture. So this should be taken into consideration of management strategy to mitigate drought situation.

EXTENT OF CROP LOSS

During drought year crop production generally got a set back like anything. The extent of crop loss was analysed at below when there is drought.

Table 4.2.3

Sl. No.	Crop loss	Frequency	Percentage
1.	>50 %	69	86.25
2.	50 %	8	10
3.	<50 %	3	3.75

The table revealed that majority of the yield loss coming under the category of >50 of 86.25 percent farmers, followed by 10 percent and 3.75 percent which represents yield loss of 50 percent and less than 50 percent respectively. Because during drought year majority of farmers didn't get even if sown seeds also. These were basically small as well as marginal farmers.

Table 4.2.4 GOVERNMENT PROGRAMMES TO COUNTER DROUGHT SITUATION

Sl. No.	Statement	Total Score	Mean Score	Rank
1.	Integrated and judicious management of natural resources is useful in mitigating drought situation	244	3.05	IV
2.	Drought condition can be managed through exploitation of ground water	326	4.07	I
3.	Alternative land use system such as alley cropping, agro horticulture, agroforestry and silvipasture system are very useful to mitigate drought	287	3.58	III
4.	Financial assistance in the shape of subsidy will help in mitigating drought	200	2.50	VI
5.	Afforestation will check the occurrence of drought	317	3.96	II
6.	Technical know-how and timely supply of input can counter the drought situation	203	2.53	V

It was revealed from the above analysed that "drought condition can be managed through exploitation of ground water" was marked first ranked with an average mean score (4.07), followed by "afforestation will check the occurrence of drought" (3.96), "alternative land use system such as alley cropping agro-horticulture, agroforestry and silvipasture system are very useful to mitigate drought" (3.58), "integrated and judicious management of natural resources is useful in mitigating drought situation" (3.05), "technical know-how and timely supply of input can counter the drought situation" (2.53) and "financial assistance in the shape of subsidy will help in mitigating drought" (2.50).

From this table it was observed that the drought can be managed through exploitation of ground water & it was marked first in order of importance. The farmer of that locality were fully familiar with the disastrous condition of drought. They (farmers) have been observing since last long what are the factors responsible for it and how but it could be managed at their own level. Ground water is yet not exploited which could be helpful in mitigating this disastrous situation to some extent. The next immediate second perception comes "due to massive rate of forest degradation", this drought comes in consecutive year & it is indirectly related. So to manage this, the immediate measure comes an afforestation or regeneration of new forest which will help in climatic changes and other factor as ranked comes in next.

SOCIAL PATHOLOGY

Drought is a natural phenomena and it is common to almost all people of Nuapada (undivided Kalahandi) district. It has number of impacts on society which lead the farmers into different unsocial activities such as migration, bonded labourer, distress sale etc. These were analysed at below according to their perception.

Table 4.2.5

Sl. No.	Category	Yes		No	
		F	%	F	%
1.	Social life being disturbed due to drought	80	100	--	--
2.	Migration in the village	66	82.5	14	17.5

This table revealed that there was 82.5 percent of migration of respondents to different areas to earn money for the survival of their family. Rest 17.5 percent of the respondents didn't go in migration. These percentage was very less and under this big farmers and government employees were basically confined. But due to drought the life of cent percent of the respondents got disturbed. This was only due to chronic occurrence of drought which did lead to a greater loss to crop field and down fall of the economic status.

NATURE OF MIGRATION

Table 4.2.6

Sl. No.	Category	Frequency	Percentage
1.	Seasonal	64	96.96
2.	Permanent	2	3.03

From this table it was observed that the majority of the respondents (96.96%) coming under seasonal migration and less number of respondents (3.03) coming under permanent migration. Because of the fact that the most of the small and marginal farmers did go in seasonal migration. They had their land in their own villages so they went in migration when there was drought and crop loss in their lands. Only few respondents went for permanent migration those who had not more acerages of landed property in their own villages and go for getting better income by migrating to some other places. Finally they sold their landed property and established in some other places.

Table 4.2.7

Sl. No.	Category	Frequency	Percentage
1.	Beggary	--	--
2.	Starvation	8	10
3.	Child selling	--	--
4.	Selling of livestock	42	52.5
5.	Distress sale of products	53	66.25
6.	Bonded labourer	21	26.25
7.	Change of occupation	7	8.75
8.	Unemployment	11	13.75
9.	Problem of theft, anger and groupism in the villages	--	--

This table indicated that 66.25% of the respondents were coming under the category of "distress sale of the products" followed by "selling of livestock" (52.5%), "bonded labourer" (26.25%), "unemployment" (13.75%), "starvation" (10%) and "change of occupation" (8.75%).

This was so , the reason is that farmers had no money or commodities for selling to have some money for their survival but by that time there is crop in the field. Generally farmers get it sold immediately after harvesting. It happened to majority of the small and marginal farmers. Also during drought situation the next effect of drought came as selling of livestock because farmers had already lost their standing crop in majority of areas. So they did go for selling of livestock for their survival and then other effects come in next.

PART-III

VARIOUS MANAGEMENT STRATEGIES ADOPTED TO MITIGATE DROUGHT SITUATION AND EXTENT OF FARMERS PERCEPTION ON THEIR EFFECTIVENESS

Farmers are the real inhabitant of their locality and they have been practising farming as the prime occupation since long. The agriculture sector have becoming more vulnerable towards drought from year to year. The farmers were

the real victims of these calamities. They have their own perception regarding drought and developed also some measures at their level to mitigate drought situation to some extent of their effectiveness.

Here below, one analysis was made to get their management strategies as well as perception of the different measures.

Table 4.3.1

Sl. No.	Statement	Total Score	Mean Score	Rank
1.	Soil and tillage management	257	3.21	IV
2.	Selection of crops	222	2.27	IX
3.	Selection of varieties	274	3.42	III
4.	Seed treatment	226	2.82	V
5.	Fertilizer management	216	2.70	VII
6.	Weed control	209	2.61	VIII
7.	Conservation of rain water and it's use	369	4.61	I
8.	Soil moisture conservation	353	4.41	II
9.	Intercultural operation	218	2.72	VI

The table predicated that "conservation of rain water and it's use" was placed at the top was first ranked with mean score 4.61, followed by "soil moisture conservation" (4.41), "selection of varieties" (3.42), "soil and tillage management" (3.21), "seed treatment" (2.82), "intercultural operation" (2.72), "fertilizer management" (2.7), "weed control" (2.61) and "selection of crops" (2.27).

From this analysis it was observed that conservation of rain water and its use was placed at the top in order of importance because the blocks affected due to drought generally receives rains on an average a normal rainfall which was also sufficient for taking up two crops in a year but even if farmers were not able to take-up one crop in a year at least. Sometimes whatever farmers sow, they were not getting it back. This was only due to the topographical situation of land and

poor soil quality. So for better utilisation of rain water, first it should be conserved. Then next comes soil moisture conservation. It can be only increased when there is conservation of rainwater which increases the fertility status of the soil gradually for better crop production and helps in crops to get escaped when there is drought. Then other categories come such as selection of varieties etc. From this analysis also it could be observed that farmers had right perception about the root cause of drought and they were trying at their level to mitigate this situation.

PART-IV

SUGGESTIONS OF FARMERS TO OVERCOME DROUGHT

Looking into the regional need and so frequent occurrence of drought in Nuapada (undivided Kalahandi) district, farmers had their own suggestion how to overcome drought. These suggestions were analysed below.

Table 4.4.1

Sl. No.	Category	Frequency	Percentage
1.	Development of irrigation facilities	68	85.0
2.	Financial assistance in the shape of subsidies	24	30.0
3.	Technical know-how and timely supply of inputs	8	10.0
4.	Early loan through Banks and co-operatives	12	15.0
5.	Crop insurance	34	42.50
6.	Measures to check defforestation	38	47.50
7.	Introduction of social forestry	21	26.25
8.	Better cropping pattern	27	33.75
9.	Selection of resistance variety	25	31.25
10.	Better land management	14	17.50
11.	Different agriculture and allied training to farmers	11	13.75
12.	Adoption of mixed farming like poultry, diary, goatery, bee keeping and sericulture	23	28.75

This table revealed that majority of the respondents were coming under the category of development of irrigation facilities (85%) and followed by a Measures to check defforestation (47.5%), "crop insurance" (42.5%), "better cropping pattern" (33.75%) "selection resistant varieties" (31.25%), "Financial assistance in the shape of subsidies (30%), "adoption of mixed farming like poultry, dairy, goatery, bee keeping, sericulture" (28.75%), "introduction of social forestry" (26.25%), "better land management" (17.5%), "early loans through banks and co-operatives" (15%), "different agriculture and allied training to farmers" (13.75%), "technical know-how and timely supply of inputs" (10%).

From this table it was observed that majority of the farmers need to have irrigation facilities as the top most priority. Though there had been occurrence of frequent drought but ground water potential is very good. Exploitation of ground water for the purpose of irrigation has yet not been given attention seriously. So this was the suggestion of majority of the farmers.

The second one coming was "measures to check defforestation" from this it can be easily understood that now the farmers have realised that the destruction of forest is indirectly related to occurrence of drought. So massive plantation activities and plans to have the more regenerated forest should be carried out to over come drought.

The crop insurance was coming in third as felt by the farmers in giving their suggestions. Farmers felt that inspite of different measures, there was occurrence of diseases attack, climatic hazards like flood, cyclone etc. So whatever crops grown by the farmers, that should be covered under insurance scheme at least to get their investment backed. The other suggestions came as less important gradually.

CHAPTER - V

Summary and Conclusion

SUMMARY

There was a tremendous change in Indian agriculture during the 'green revolution' phase of growth. But the experience during the post green revolution phase has cast doubts about its capacity to feed the growing population. The rainfed upland areas constitute 70 percent of the cultivable land contributing about 42 percent of the total food grain production in the country. Realising the urgent need for increased food production to meet the food demand of teeming million, strategies at national level have laid great emphasis in development of drought prone area through different programmes such as DPAP, DDP, NWDP, IWDP etc. Until recently all the above said programmes attempted various activities for development of drought objected areas in piece-meal approach, with isolated effort and there was no co-ordination among developmental departments. Realising this Govt. introduced dry land farming programme for rainfed upland areas. The dryland farming focusses on intercropping instead of mono-cropping, only to escape drought situation. In Nupada districts different programmes like watershed projects have been implemented since last ten years throughout the district. However, farmers of drought prone areas hardly avail the opportunities meant for drought mitigation. There is very reason to believe that the farmers are not deprived from this, also they are gradually leaving their traditional practices of mitigating drought. So far, no systematic study has been under-taken in this direction. The present investigation therefore is an attempt to fill the lacuna in this area. The specific objectives of the study,

1. To study the socio-economic levels of the farmers and farming condition in drought stricken areas.

2. To analyse the perception of the farmers with respect to
 - a. Weather leading to drought.
 - b. Crops in drought situation.
 - (i) Tolerant (ii) Non tolerant
 - c. Extent of crop loss in drought situation.
 - d. Government programmes to counter the drought situation.
 - e. Social pathology in drought situation.
3. To examine the various management strategies, they have adopted to mitigate drought situation and extent of farmers perception an their effectiveness.
4. To seek suggestions of the farmers to overcome drought situation.

THE IMPORTANT FINDINGS OF THE STUDY EPITOMISED AS FOLLOWS

1. Majority of the respondents belonged to middle and upper middle age group.
2. Majority of the respondents were illiterate.
3. Majority of the respondents were coming under nuclear family type.
4. Most of the respondents belonged to the family size of up to five members.
5. It was also observed that majority of the respondents live in Katcha house. Their financial condition was not so good as 15 percent of the respondents under the category which have a annual income of Rs 10,000 to Rs 15,000.
6. Most of the respondents had country plough & very few respondents had sprayer, thresher and tractor.
7. It was observed that majority of the respondents had 1-2 draught animals.
8. It was found that majority of the respondents had possessed cycle.

9. Majority of the respondents were found that they were from farming occupation.
10. Majority of the respondents were from small and marginal category of farmers.
11. It was observed that most of the small and marginal farmers had non-irrigated lands.
12. It was found that majority of the respondents had 70-90% cropping intensity.
13. It was observed that inadequate rain was the prime cause leading to drought.
14. Majority of the respondents had opined that mixed and intercropping are always good to counteract drought situation.
15. Majority of the respondents had also opined that crop loss was more than 50 percent during drought.
16. It was found that "drought condition can be managed through exploitation of ground water" was the first activities to counter act drought situation.
17. Cent percent of the respondents opined that social life was being disturbed due to drought and majority of the respondents were seasonally migrating.
18. It was found that majority of the respondents were forced for distress selling of the products.
19. It was observed that majority of the respondents had opined that conservation of rainwater is the prime drought management strategy can mitigate drought in their effectiveness.
20. Majority of the respondents opined that "development of irrigation facilities" is the top most suggestion to over come drought.

SUGGESTION

In view of the findings of the study the following suggestions can be made.

- (a) As the study was confined to Nuapada district only, similar studies may be undertaken to cover other drought affected districts of the state, so as to confirm or reject the findings of the study.
- (b) This study was limited to the respondents of one block, for future it can be conducted by taking the respondents from more than one block.
- (c) In this study, some variables measured by the developed schedule. For further study, some reliable and valid scale may be used for measuring the variable.
- (d) The traditional practices, the respondents have been adopting for drought mitigation should be promoted.
- (e) Agricultural extension officers, village agricultural workers and other higher officials should take interest in promoting the valuable drought management practices and encouraging the farmers to keep it up.
- (f) More number of NGOs or officials should be employed for more diffusion of the technologies which can add value with the existing practices of the farmers.
- (g) The state government department of soil conservation should look into this drought management practices seriously for a better mitigation.

CONCLUSION

This study is expected to help government officials and research scholars to conduct the research work in different parts of drought affected area of Orissa. The socio-economic condition of the rural poor can be improved by proper drought mitigation & different contingency planning with proper monitoring system. Thrust should be given to soil moisture conservation aspect of the land science, optimum utilisation of different natural resources, managing the entire eco-system in such an integrated manner that it will increase the production, productivity & to escape the drought situation as well as erratic behaviour of monsoon.

The result will be useful for the farmers belonging to rainfed upland and dryland areas of Orissa.

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Appendices

APPENDIX - I

FARMERS' PERCEPTION OF DROUGHT SITUATION AND THEIR MANAGEMENT STRATEGY IN NUAPADA DISTRICT OF ORISSA

INTERVIEW SCHEDULE

Name of the respondent : Sl. No. :
Village : Date :

GP : Block : Dist :

SOCIO-ECONOMIC STATUS

A. Social Status

1. Age (Date)

2. Education

a. Illiterate

b. Up to UP School

c. Up to ME School

d. UP to High School

e. College education

3. Family type

a. Joint

b. Single

4. Family size

a. Male

b. Female

c. Children

d. Total

5. Economic Status

1. Family size and tenure of status

Particulars of land holding

Areas in acres
Irrigated Non-irrigated

Total

i) Land owned Marginal
(less than. 0.5 ac.)

ii) Small (0.5-2. 5 ac.)

iii) Medium (2.5- 8 ac.)

iv) Big (More than 8 ac.)

2. Total cultivated areas in acres : -----

3. House type

a. Katcha

b. Pucca

c. Mixed

d. Building

4. **Agricultural Implements**

a. Country Plough

b. M. B. Plough

c. Sprayer/ Duster

d. Fertilizer cum seed drill

e. Thresher

f. Tractor

g. Power tiller

h. Specify if any other

5. Annual income from all sources (in Rs.) -----

6. Farm income (in Rs.)

i) Crop -----

ii) Poultry -----

iii) Dairy -----

iv) Piggery -----

v) Duckery -----

vi) Bee keeping -----

vii) Goatery -----

viii) Mushroom -----

ix) Pisciculture -----

x) Forest product -----

xi) If any other specification

7. **Non-farm income (in Rs.)**

i) Service -----

ii) Agril. labourer -----

iii) Artisan -----

iv) Non agril labourers -----

v) Any other specification -----

8. **No. of draught animal**

i) No

ii) 1-2 nos.

iii) 3-4 nos.

iv) 5-6 nos.

9. Material possession

- i) Chair
- ii) Table
- iii) Sofaset
- iv) Almirah
- v) Watch
- vi) Radio
- vii) Cycle
- viii) Scooter
- ix) T. V.
- x) Bullock cart

FARMING CONDITION

1. Occupation

- I) Primary occupation Agril.
- ii) Secondary occupation Labour.
- iii) Any other subsidiary occupation specify

2. Major cropping pattern

Sl. No.	Kharif	Rabi	Summer
I)			
ii)			
iii)			

3. Cropping Intensity (in % age)

4. Irrigation status (Ac.)

- a. Area under irrigation throughout the year -----
- b. Area under partial irrigation which can be used for providing critical irrigation at the time of emergency -----

PART - II

PERCEPTION OF THE FARMERS

Many farmers view the cause of drought and crop sustainability in drought stricken area from different angles. Some statements are given below which indicates your response in 5 pt. scale.

A. Weather leading to drought

<u>Sl. No.</u>	<u>Statement</u>	<u>SA</u>	<u>A</u>	<u>UD</u>	<u>DA</u>	<u>SDA</u>
i)	Inadequate rain is the prime cause leading to drought					
ii)	Dry spell in the beginning of cropping season many cause drought.					
iii)	Low intermittent rain may also cause drought.					
iv)	Erratic and sporadic rainfall may cause drought.					
v)	Defforestation may cause drought.					
vi)	Even after giving life saving irrigation drought condition prevails.					
vii)	In drought year the temperature is generally higher than the normal year.					
viii)	Loss of faith on God may cause drought					

B. Crops & Sustainability

- i) No crops can tolerate drought situation
- ii) Resistance varieties are not tolerant to drought
- iii) Crops after vegetative stage may tolerate drought
- iv) Mixed & inter-cropping are always good to counteract drought situation
- v) Crop planning is an important activity in drought situation
- vi) In Kharif, non-paddy crop can give normal yield in drought situation

C. Extent of crop loss

- i) Crop loss in drought situation may extend upto
- a) More than 50 %
 - b) 50 %
 - c) Less than 50 %

D. Govt. programmes to counter the drought situation

<u>Sl. No.</u>	<u>Statement</u>	<u>SA</u>	<u>A</u>	<u>UD</u>	<u>DA</u>	<u>SDA</u>
i)	Integrated & judicious management of natural resources is useful in mitigating drought situation					
ii)	Drought condition can be managed through exploitation of ground water					
iii)	Alternate land use system such as alley cropping, agro-horticulture, agroforestry and silvipastural system are very useful to mitigate drought					
iv)	Financial assistance in the shape of subsidy will help in mitigating drought					
v)	Afforestation will check the occurrence of drought					
vi)	Technical know how & timely supply of input can counter the drought situation					

E. Social pathology

- i) Are your social life being disturbed due to drought ? Yes. No
- ii) Is there migration in your village ? Yes / No
- If yes, whether it is permanent or seasonal ?

iii) What are the other effects of drought ?

- a) Beggary
- b) Starvation
- c) Child selling
- d) Selling of gold
- e) Selling of livestock
- f) Distress sale of products of crop
- g) Bonded labour
- h) Change of occupation
- I) Unemployment
- j) Problems of theft, anger and groupsim in the village
- k) If any other specify

PART - III

MANAGEMENT STRATEGY ADOPTED AND FARMERS' PERCEPTION IN THEIR EFFECTIVENESS TO MITIGATE DROUGHT

Give your response in 5 pt. scale as per your performance & observation

Sl. No.	Statement	Very Effective	Some what Effective	Undecided	Ineffective	Harmful
i)	Soil & tillage management					
ii)	Selection of crops					
iii)	Selection of varieties					
iv)	Seed treatment					
v)	Fertilizer management					
vi)	Weed control					
vii)	Conservation of rain water and its use					
viii)	Soil moisture conservation					
ix)	Intercultural operation					
x)	If any other strategy being adopted, specify					

PART - IV

3. SUGGESTIONS OF FARMERS TO OVERCOME DROUGHT (Put only '✓' Marks)

- i) Development of irrigation facilities
- ii) Financial assistance in the shape of subsidies
- iii) Technical know how & timely supply of inputs
- iv) Early loan through banks & co-operatives
- v) Crop insurance
- vi) Measures to check deforestation
- vii) Introduction of social forestry
- viii) Better cropping pattern
- ix) Selection of resistance variety
- x) Better land management
- xi) Different agriculture & allied trainings to farmers
- xii) Adoption of mixed farming like poultry, dairy, goatery, bee keeping and sericulture etc.
- xiii) If any other, specify

APPENDIX - II

SCORING KEY FOR INSTRUMENTS USED

01	EDUCATION	Illiterate	0
		UP	1
		ME	2
		High School	3
		College Education	4
02	FAMILY TYPE	Nuclear	1
		Joint	2
03	FAMILY SIZE	Up to 5 member	1
		5-10 member	2
		> 10 member	3
04	HOUSE TYPE	Katcha	1
		Pucca	2
		Mixed	3
		Building	4
05	ANNUAL INCOME	Rs.	
		<5,000	1
		5,000 - 10,000	2
		10,000 - 15,000	3
		15,000 - 20,000	4
		> 20,000	5
06	DRAUGHT ANIMALS	No	0
		1-2 nos.	1
		3-4 nos.	2
		5-6 nos.	3
06	PERCEPTION OF FARMERS	Strongly Agree (SA)	5
		Agree (A)	4
		Undecided (UD)	3
		Disagree (DA)	2
		Strongly Disagree (SDA)	1
07	MANAGEMENT STRATEGY	Very Effective (VE)	5
		Somewhat Effective (SE)	4
		Undecided (UD)	3
		Ineffective (IE)	2
		Harmful (HF)	1