EXECUTIVE SUMMARY

Rainfed agriculture accounts for 40 per cent of the total geographical area and 60 per cent of the area under agriculture. It accounts for 67 m ha. of an estimated 143 m. ha. of net cultivated area. It produces 44 per cent of the country's food requirement while supporting 40 per cent of human and 60 per cent of livestock population (NBBSSLUP 2001). The annual normal rainfall in these areas range from less than 350 to 800 mm which limits the period available for crop growth to roughly 60 to 180 days, a year. Paucity and uncertainty of rainfall is a continuous phenomena in rainfed agriculture. High rainfall uncertainty, pests and diseases attach manifests itself in yield variability which significantly conditions uncertainty in crop revenue. Besides, due to increased pressure on land and ground water resources, the risk and vulnerability are also increasing.

Addressing problems of risk and vulnerability within an agricultural production and marketing system requires an understanding of the cross cutting issues and the multiple approaches to managing and coping with it. The two coping strategies that have received scrutiny in literature are crop diversification and intercropping. But the issue is, which section of the farmers are opting for crop diversification during the period of drought. Whether the diversified small farms are earning sufficient income that have an impact on their livelihood or not is another issue that is being debated. It is therefore necessary to understand thoroughly who the vulnerable are in rainfed agriculture and particularly which section of the farmers in rainfed areas will shift towards crop diversification during the periods of drought, what is the generation of income through it and what type of institutional support mechanism is ensured for shifting, and what are the determinants for crop diversification.

The other coping mechanism perceived in drought prone, rainfed areas is crop insurance. It is a contingency contract in which participant farmers pay premiums and collect indemnities when yields fall below an insured level. It is commonly administered as crop credit insurance which has been cited as the most direct policy response to address the problem of yield risk where the insurer covers a percentage of the loan for annual cultivation expenses of the participant farmer. Findings repeatedly show that relatively few farmers demand crop insurance due to unawareness as well as linking it up with institutional credit. Keeping these points in view the following questions are pertinent.

(i) Which type of risk is more in rainfed agriculture? Physical i.e., Crop production risk or financial risk?

(ii) Which section of farmers are more vulnerable to risks in rainfed agriculture?

(iii) Which section of the farmers and what are the coping mechanisms followed by them during adverse conditions?

(iv) What is the institutional support mechanism for coping up of adverse conditions and whom does it favour?

An understanding of all these is necessary to sensitise the policy makers to incorporate risk and vulnerability reducing measures into their planning. Therefore the study was taken up with the following objectives:

1. To examine the risk and vulnerability in rainfed agriculture;

2. To examine the coping mechanisms adopted by the farmers in rainfed agriculture to sustain or improve their farm income; and

3. To identify important policy variables facilitating coping mechanism.

Study Area and Sampling

The States of Karnataka, Rajasthan and Orissa were selected for the study on the basis of extent of area under rainfed agriculture. Two districts from each State of Rajasthan and Orissa and one from Karnataka were selected on the basis of same indicator. A sample of three villages were selected from each State of Rajasthan and Orissa, two villages from one district and one village from another district, whereas in Karnataka State, all the three villages were selected from one district. Out of three villages, one village was selected as a control village or underdeveloped village and two villages were selected as progressive villages. Thus, three villages were selected from each State forming a total sample of nine villages from the selected three States.

In Rajasthan, the two best villages which implemented certain coping mechanism were selected as progressive villages. The control village which was selected is underdeveloped from the point of view of agriculture with the help of CAZRI and an NGO called Tarun Bharat Sangh. The two best villages selected for conducting the field study were Palri Mangalia {presently adopted

village under Institute Village Linkage Programme (IVLP) by CAZRI (Central Arid Zone Research Institute) and Bhawonta village adopted by Tarun Bharat Sangh (TBS), the voluntary organisation based in village Bhikampura of Alwar District, headed by Magsaysay award winner Mr. Rajendra Singh. Jhanwar village was selected from Luni district as a Control village, an village adopted under watershed programme, by CAZRI during 1992-97.

In Karnataka, the district of Chitradurga was selected which is totally a rainfed and which suffers frequently with the vagaries of monsoon. Two villages Konasagar and B.G.Kere were selected from one block as progressive villages. These villages though covered under rainfed agriculture are considered as progressive villages in terms of agriculture due to good social and economic indicators and which are utilising the services of agricultural department. Another village (control village) Sulenahalli was selected from another block as an underdeveloped village in terms of agriculture.

In Orissa, two districts Kalahandi and Bolangir were selected for the purpose of this study. The progressive villages selected were Chandrabatti and Kurlaguda from the Kalahandi district and control village Lurki was selected from the Bolangir district.

In each village, a sample of 30 farmers across all the categories i.e., 10 farmers from small, 10 farmers from medium and 10 farmers from large size category were selected. Thus, a total sample of 30 households from each village and 90 households from the three villages were selected in a State. Therefore, the total sample size from the three States for the study is 270. The data were collected during the period 2004. The secondary information were collected from the statistical abstracts, district agricultural department, district statistical handbooks and village secretaries. The primary data were collected through structured questionnaires. The data were collected for a period of two years pertaining to normal and drought year. The data for Karnataka was collected in the year 2004 which was a normal year with good monsoon. Therefore, for this State previous years data were collected. For Orissa, the data pertaining to the years 2003 and 2004 were collected which were normal and drought years respectively. Whereas, for the State of Rajasthan the data were collected during the year 2005. Since, the last five years the State consecutively faced drought and that is one of the reason why the comparitive picture of normal and drought year could not be captured in this State. This is

the limitation of this study. Therefore, the vulnerability of the farming and the coping mechanisms adopted in these areas were captured.

Simple tabular analysis using percentages and averages were used to assess relationship between various parameters. Crop diversification index was used to assess the extent of diversification taken up by all the three category of farmers.

Main Observations

- Not much variation was observed between the literacy rate of medium and large farmers. The literacy rate of small farmers was found to be less than the other two.
- The average household income of all the categories of farmers of underdeveloped villages was less than the developed villages. In the progressive villages, the income of small and medium farmers was almost on par with the large farmers. In the non progressive villages, besides agriculture the other major sources of income are from wage employment and agricultural labour, for small farmers and it is poultry and milk for medium and large farmers. Whereas, in the progressive villages, agriculture was the main source of livelihood for all the categories and livestock sector plays the second major source.
- In the progressive villages of Karnataka and Orissa, irrigated land was more among medium and small farmers and in Rajasthan it is more among small farmers.
- The phenomena of land leasing was not observed in Rajasthan State. Whereas, in the other two States the land leasing was observed more in progressive villages than in underdeveloped villages. In the progressive villages of Orissa, irrigated land was leased in and in Karnataka dryland was leased in. The land was leased mostly by the medium farmers followed by small farmers. The large farmers in both States were observed to be leasing out the land. Thus land leasing is an important instrument which proved to augment the production base and enhance income level for the small and medium farmers.

- Livestock in terms of draft, milch and small ruminant based was more in the progressive villages than in the underdeveloped villages. Though the livestock was more for large and medium compared to small farmers, not much variation was observed between the two categories of large and medium. Among the progressive villages, the village having more of irrigation facilities had more draft animals and the village having less of irrigation facilities more milch animals were there. This shows that milch animals provide income security to the farmers in areas with less irrigation facility.

- More number of implements were found in the village with more irrigation facilities and draft animals. Between the small, medium and large farmers there is a variation in the position of implements. The large farmers are having less livestock and more number of implements than medium farmers. This indicates that the large farmers are moving towards mechanisation. In the progressive villages, where the area under own irrigated landholding was more, oil engines were also found to be more in case of both large and small farmers. This has established the fact that the investment in irrigation is directly proportional to the ownership of land and irrigation facilities.

- In the progressive villages, land utilisation appears to be in favour of small and medium farmers due to more area under irrigation and cropping intensity. This is relatively due to better cropping pattern and agronomic practices taken up by the farmers in these States.

- All the three categories of farmers select the crops varieties based on high yielding and partly based on short duration and high yielding. A total ignorance about the drought resistance varieties was found among the farmers. The extension and technological support by the Government was more towards large farmers followed by medium farmers. The same by the NGOs was more for small farmers followed by medium farmers. For eg: In case of small farmers in a developed village, TBS (Rajasthan) is the major consultant for the farmers to adopt any new technology or to attend the crop related queries. In case of medium and large farmers, agricultural department is considered to be reliable source to solve their problems and provide timely and latest information.

- Crop diversification for droughts was the major coping mechanism observed in all the three States. The diversification index shows that small farmers cropping pattern was more diversified followed by medium and large farmers in the progressive villages of all the States both during normal as well as drought years. This shows large farmers were more vulnerable and their production risk was more compared to medium and small farmers.

- The determinants of crop diversification varies in different States. The determinant based on food security (For eg: Jowar and Bajra in Karnataka) or lack of irrigation (For eg: Cotton in Orissa) appeared to be more sustainable during all the periods. Whereas, the determinants based on technology induced (For eg: Jute in Orissa) or market induced (For eg: onion and vanilla in Karnataka) have led to failure.

- Lack of irrigation was the most important determinant of adoption of new crops followed by demand pattern, access to market and technology. The majority of small and medium farmers have shifted to the new crops like horticulture crops, tamarind, drumstick and sapota (with pot method of irrigation) due to inaccessibility of irrigation. Therefore, the degree of risk aversion was directly related to the category of farmers in the progressive villages.

- The large farmers focussed only on cotton during the drought years and switched back to paddy during the normal years mainly because of assured sales through public procurement. Thus, despite economic feasibility of a crop, assured market seems to be the main determinant of sowing the crop during normal season.

- The Government intervention was mainly through the introduction of new crops. This is to discourage some crops in some areas like castor in place of groundnut in Karnataka. In some areas, tomato and bengalgram in Orissa was successful and in some areas introduction of jute in Orissa and introduction of onion in Karnataka was a failure. Jute was introduced without considering the market and onion was introduced without the consideration of suitability of soils. In the underdeveloped village of Rajasthan, CAZRI has taken up Institutional village linkage programme

to avoid soil loss and to provide fodder to the small ruminants through agro-forestry system which was a failure. This is mainly because institutions are adopting the villages to test their programmes at the field level but not because the people need the technology. Therefore, to introduce a new technology, the socio-economic and marketing conditions for the technology must be considered.

- Non-market factors like pests and diseases, low productivity have been found to be detrimental factors than lack of market for discontinuation of a new crop.

- Though the share of marketed surplus has increased for small and medium farmers for some crops during the time of drought the total income was less due to relatively lesser price for their produce. This is partly due to the quality of their produce and partly due to their credit commitment to the traders. This shows that though the production risk of small and medium farmers was less during droughts, their financial risk is more when compared to the large farmers.

- Since small and medium farmers in the progressive villages were taking up land leasing activities it also augments their production base and some institutional arrangements must be made for them in the form of credit to take up land leasing also. Once the land is leased by taking up credit from the institutional source then it will be easier for them to approach other form of production support also.

- The major difference observed between underdeveloped and progressive villages was not the irrigation but the cropping pattern itself. The small and medium farmers have diversified their crops when compared to large farmers. Since their financial risk was more, the diversification appears more like due to default than market supportive. Therefore, crop diversification, which is induced need-based, technology and price supportive must be encouraged.

- **Unique Coping Mechanisms Observed**

  KARNATAKA

  - Sand, pebble mulching for the crops like sunflower, bajra and sorghum.

- Cultivation of four to five varieties of horticultural plants in a small area with pit method of irrigation.

RAJASTHAN

- Spreading plastic sheets in the water channels to reduce the percolation and leaching loss.
- Lining the irrigation channels with indigenous mixture of limestone sand : clay in a ratio of 2:2:1 to reduce the conveyance loss.
- Adopting sub-surface drainage system by some large farmers by laying the cement pipe from higher gradient to lower gradient**.**
- Promotion of agro forestry system to act as a windbreak with *Prosophis cineraria* ,fruit bearing crops like ber, pomegranate, badam and emblica officinalis all along the bunds with 4 to 5 types of vegetables in the main field.

Important policy variables for coping were found to be

- Institutional credit for land leasing and household purposes
- Fodder based production system for livestock
- Encouraging the role of NGOs in extension system
- Price support and procurement mechanism for crops grown in rainfed areas
- Need-based technology and
- Awareness about insurance.

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Chapter – 1

INTRODUCTION

Rainfed agriculture accounts for 40 per cent of the total geographical area and 60 per cent of the area under agriculture. It accounts for 67 m ha. of an estimated 143 m. ha. of net cultivated area. It produces 44 per cent of the country's food requirement while supporting 40 per cent of human and 60 per cent of livestock population (NBBSSLUP 2001). The annual normal rainfall in these areas range from less than 350 to 800 mm which limits the period available for crop growth to roughly 60 to 180 days, a year. Paucity and uncertainty of rainfall is a continuous phenomena in rainfed agriculture. High rainfall uncertainty, pests and diseases attack manifests itself in yield variability which significantly conditions uncertainty in crop revenue. Besides, due to increased pressure on land and ground water resources, risk and vulnerability are on the rise.

Risk is the likelihood of occurrence of a particular and potentially adverse shock or stress. Whereas, vulnerability is the degree of individual households or individual to shocks and stress, and their ability to prevent, mitigate or cope with the event. In rainfed farming, the risk represents the probability of a defined hazard affecting the livelihood of producers. Among the risks there is physical and financial risk.

Physical risk relates to variables such as crop yield, which vary about a long-term trend. The main source of physical risk is climatic risk: catastrophic variation in yields will usually be climate-driven. But physical performance of a single crop provides only a partial measure of the farmer's risk (*Thornton and Dent* 1990).

Whereas, financial risk relates to income variability, of which yield uncertainty is only one source. The variation in price of inputs and products, and legal and institutional factors may also contribute. For example, a drought may depress yield, but the reduced aggregate supply may lead to increased prices. Research reveals that small-scale farmers are surprisingly efficient at reducing income risk through cropping pattern practices, off-farm employment,

credit use and land leasing (e.g. Walker and Jodha 1986; Walker 1989). Anderson et al. (1987) argue that few generalities can be drawn about the relationship between yield risk for individual cases and stability of farm-family income.

An extensive literature exists on agricultural decision making or coping mechanisms under risk (e.g. Raiffa 1968; Dillon 1971; Halter and Dean 1971; Anderson et al. 1977). For example, Makeham (1974) and Harsh et al. (1981) outline a variety of management devices to reduce or cope with income variability, such as crop insurance, selection of low-risk crops, enterprise and spatial diversification, maintenance of cash reserves, contractual arrangements and hedging. The role of coping mechanisms in semi-subsistence agriculture is discussed by Anman (1988).

Addressing problems of risk and vulnerability within an agricultural production and marketing system requires an understanding of the cross cutting issues and the multiple approaches to managing and coping with it. The two coping strategies that have received the most commentary in scrutiny in literature are crop diversification and intercropping. But which section of the farmers are opting for crop diversification during the period of drought is again an issue. Some studies have observed that there is an inverse relationship between farm size and agricultural diversification (AJ Singh et. al.1985, Haque, 04). This may be attributed to a more pronounced need to reduce peak season labour requirement, exploit the better potential of location-specific production opportunities associated with holding more fields, and greater access to credit to sow land to more input intensive crops (Walker and Ryan, 1990). Some other studies on crop diversification in various States felt that small farms are relatively more diversified (Gupta and Tiwari 1985). Whether the diversified small farms are earning sufficient income that have an impact on their livelihood or not is another issue that is being debated. While a large number of studies (IJAE, 1987; IJAE 1988; Thakur, Kapila and Moorti 1985) show that small farmers too adopt multi-diversified farming, involving allocation of area under fruits, vegetables, dairy etc. which helped to earn sufficient income to make their livelihood. Some studies (Haque 1992) have also observed that small scale diversified farming by marginal and small farmers do not generate adequate income for their sustenance in most cases. Resource endowments for determining diversification also vary from State to State. This may largely

be accounted for by differences in land quality, cropping year conditions and village disparities within the region. The influence of irrigation on crop diversification is also region-specific. In many areas, widespread irrigation led to more specialisation in paddy production. In rainfed areass of Akola and Sholapur, limited well irrigation, particularly in the post rainy season, opened up opportunities to grow a wider range of crops. Draft power availability was an important explanation for variation in crop diversification across households within Mahabubnagar and Akola districts in Peninsular India (ICRISAT). It is, therefore, necessary to understand thoroughly who the vulnerable are in rainfed agriculture and which section of the farmers particularly in rainfed areas will shift towards crop diversification during the periods of drought, what is the generation of income through it and what type of institutional support mechanism is ensured for shifting, and what are the determinants for crop diversification.

Apart from crop diversification, the other coping mechanisms which are normally followed during the drought periods are asset liquidation and irrigation. But they are used only as a last resort (Walker and Ryan 1990). Several empirical studies of household response to drought have shown that food consumption declines substantially before the household parts with its assets or moves (*Dreze* 1988). The most heavily relied on means for compensating for shortfalls in income is borrowing for consumption in the informal credit markets which essentially pushes interests rates up. Drought is also usually accompanied by an increase in demand for well deepening, digging and borewell drillings which increases the demand for investment credit which also places on additional strain on the informal village credit market (*Walker and Ryan,* 1990).

The other coping mechanism perceived in drought prone, rainfed areas is crop insurance. It is a contingency contract in which participant farmers pay premiums and collect indemnities when yields fall below an insured level. It is commonly administered as crop credit insurance which has been cited as the most direct policy response to address the problem of yield risk where the insurer covers a percentage of the loan for annual cultivation expenses of the participant farmer. Repeated findings show that relatively few farmers demand crop insurance due to unawareness as well as linking it up with institutional credit. Keeping in view of all the above points the following questions are pertinent.

(i) Which type of risk is more in rainfed agriculture? Physical i.e., crop production risk or financial risk?

(ii) Which section of farmers are more vulnerable to risks in rainfed agriculture?

(iii) Which section of the farmers and what are the coping mechanisms followed by them during adverse conditions?

(iv) What is the institutional support mechanism for coping up of adverse conditions and it is in favour of whom?

An understanding of all these is necessary in the need to sensitise the policy makers to incorporate risk and vulnerability reducing measures into their planning. Hence the study was taken up with the objectives.

1. To examine the risk and vulnerability in rainfed agriculture;
2. To examine the coping mechanisms adopted by the farmers in rainfed agriculture to sustain or improve their farm income and;
3. To identify important policy variables facilitating coping mechanism.

Study Area and Sampling

The States of Karnataka, Rajasthan and Orissa were selected for the study on the basis of extent of area under rainfed agriculture. Two districts were selected from the States of Rajasthan and Orissa and one district from Karnataka again on the basis of same indicator. A sample of three villages were selected from each State of Rajasthan and Orissa, two villages from one district and one village from another district. Whereas in Karnataka State, all the three villages were selected from one district. Out of three villages, one village was selected as control village or underdeveloped village and two villages were selected as progressive villages on the basis of extent of area under irrigation and gross sown area. Thus, three villages were selected from each State which forms a total sample of nine villages from the selected three States.

In Rajasthan, two best villages which have implemented certain coping mechanism were selected as progressive villages and an underdeveloped village was also selected which is underdeveloped from the point of view of

agriculture, with the help of CAZRI and an NGO called Tarun Bharat Sangh. The two best villages selected for conducting the field study were Palri Mangalia {presently adopted village under Institute Village Linkage Programme (IVLP) by CAZRI (Central Arid Zone Research Institute) located at 25 Km from Jodhpur city on Jodhpur – Tiwari Road} and Bhawonta (village adopted by Tarun Bharat Sangh (TBS), the voluntary organisation based in village Bhikampura of Alwar district, headed by Magsaysay award winner Mr. Rajendra Singh). Jhanwar village was selected from Luni district as a control village which was an adopted village under watershed programme, by CAZRI during 1992-97. In Karnataka, the district Chitradurga was selected in which the agriculture is totally rainfed and frequently suffers with the vagaries of monsoon. Two villages Konasagar and B.G.Kere were selected from one block as progressive villages. Another village (underdeveloped village) Sulenahalli was selected from another block. In Orissa, two districts Kalahandi and Bolangir were selected for the study. The progressive villages Chandrabatti and Kurlaguda were selected from the Kalahandi district and underdeveloped village Lurki was selected from the district Bolangir.

In each village, a sample of 30 farmers across all the categories i.e., 10 farmers from small, 10 farmers from medium and 10 farmers from large size category were selected. Thus, a total sample of 30 households from each village and 90 households from the three villages in a State. Therefore, the total sample size from the three States for the study is 270. The data were collected during the period 2004. The secondary information were collected from the statistical abstracts, district agricultural department, district statistical handbooks and village secretaries. The primary data were collected through structured questionnaires. The data were collected for a period of two years pertaining to normal and drought year. The data for Karnataka were collected in the year 2004 which was a normal year. Therefore, previous years data for this State (2003, which was a drought year) was collected. For Orissa the data pertaining to the years 2003 and 2004 were collected which were normal and drought years respectively. Whereas, for the State of Rajasthan the data were collected during the year 2005. Since, the last five years were the drought years consecutively in that State, the comparitive picture of normal and drought year could not be captured in this State. This is the limitation of this study. However, the vulnerability of the farming in these areas and the coping mechanisms adopted in these areas were captured. In each village, a sample

of 30 farmers across all the categories i.e. 10 farmers from small, 10 farmers from medium and 10 farmers from large size category were selected. Thus, a total sample of 30 households from each village and 90 households from the three villages in a State were selected. However in one developed village of Rajasthan i.e. Bhowanta almost all the farmers belong to small category size. Since it was difficult to get sample from other categories in that village, it was confined to study them only. Therefore, the total sample size was 30 in that village belonging to small farmers category. Therefore, the total sample size from that State was 90 with 50 small farmers, 20 medium farmers and 20 large farmers. The total sample size from the three States for the study was 270.

Simple tabular analysis using percentages and averages was used to assess relationship between various parameters. Crop diversification index was used to assess the extent of diversification taken up by all the three category of farmers.

Crop diversification index: $= \frac{\text{Percentage of sown area under 'x' crops}}{\text{No. of x crops}}$

Where 'x' crops are those that individually occupy 10 per cent or more of the sown area in a district. The higher the value of the index, the lower the degree of diversification. The value of the crop diversification cannot be less than 10, because according to the basic assumption that if 10 crops occupy 100 per cent of sown area the index equals to 10.

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Chapter – 2

STUDY AREA AND ITS CHARACTERISTICS

Orissa

Orissa, comprises of 4.74 per cent of India's land mass and 36.80 million people (2001 Census), accounts for 3.58 per cent of the population of the country. Nearly 85 per cent of its population live in the rural areas and depend mostly on agriculture for their livelihood. According to the estimate of the Central Ground Water Board, the total groundwater resources in Orissa was 21,01,128 hecta metre in 2001. The gross annual draft for all uses in 2001 was 3,10,689 hectametre. Accordingly, 14.79 per cent of ground water resources had been harnessed till 2001. The total cultivable land of the State is nearly 65.59 lakh hectare of which only 26.89 lakh hectare has been provided with irrigation facilities by the end of 2003-04 which constitutes around 40 per cent of the cultivable land. Planned exploitation and optimum utilisation of rich natural resources like mineral, land, water and others including human resources holds the key to rapid economic development of the State.

The State can be divided into ten agro-climatic zones on the basis of soil, weather and other relevant characteristics. Its land can be classified into three categories, low (25.6 per cent), medium (33.6 per cent) and up-lands (40.8 per cent) with various types of soil like red, yellow, red-loamy, alluvial, coastal alluvial, laterite and black soil etc., with low and medium texture.

The animal resources sector plays an important role in providing and supplementing income of rural households. The total livestock population in the State was 234.59 lakh as per livestock census of 2001 of which cattle population alone accounted for 138.10 lakh, buffaloes 13.88 lakh, goats 58.80 lakh, sheep 17.79 lakh and pigs 6.02 lakh.

Agriculture in Orissa continues to be characterised by low productivity due to traditional agricultural practices, inadequate capital formation and low investment, inadequate irrigation facilities and uneconomic size of holdings. Nearly 62 per cent of the cultivable land is rainfed and exposed to the vagaries of monsoon. The per capita availability of cultivated land which was 0.39 hectare

in 1950-51 has declined to 0.15 hectare in 2003-04. Out of the total number of operational holdings of 39.66 lakh, 81.98 per cent is held by small and marginal farmers as per agricultural Census 1995-96. Most of these small and marginal farmers do not have the means to make adequate investment in agriculture due to poverty.

The agricultural Census 1995-96 shows that there were 39.66 lakh operational holdings in the State in comparison to 38.84 lakh as per the 1990-91 census registering an increase of 2.11 per cent over a period of five years. The total area of the operational holdings which was 52.08 lakh hectare in 1990-91 has marginally declined to 51.44 lakh hectare in 1995-96.

The State of Orissa presents a paradoxical picture of poverty amidst plenty. Despite being endowed with vast human and natural resources and achieving substantial progress in many areas during the past 50 years of planned development, Orissa continues to be one of the less developed States plagued by acute and persistent poverty. High dependence on the low productivity primary sector has resulted in significant fluctuations in the growth rate from year to year with a bad crop year pulling it down (Orissa- Economic survey).

Karnataka

Karnataka, located in the Southwest of the country, is the eighth largest State. The State extends about 750 km from North to South and about 400 km from East to West, and covers an area of about 1,91,791 sq. km. Karnataka has a total population of 52.73 million, with a density of 275 persons per sq. km. The State has 27 districts comprising 176 taluks, 745 hoblies, and 29,193 villages. It is a plateau, with an elevation of 600 to 900 metres above mean sea level. The agricultural census of 1995-96 indicates 62.21 lakh operational holdings, covering an area of 121.09 hectares in the State. Marginal holdings (less than 1 hectare) account for 42.0 per cent, small holdings (1-2 hectares) is 27.4 per cent, semi-medium holdings (2-4 hectares) 19.4 per cent, medium holdings (4-10 hectares) 9.5 per cent and large holdings (10 hectares and above) 1.7 per cent.

The annual normal rainfall of the State is 1139 mm, received over 55 normal rainy days. The annual rainfall varies from as low as 562 mm in the central eastern district of Bagalkot to as high as 4119 as whole indicates that,

71 per cent (806 mm) of the annual normal rainfall is received during the southwest monsoon, 17 per cent (195 mm) during northeast monsoon and the remaining 12 per cent (138 mm) is received during pre-monsoon period. More than 75 per cent of the cultivable area in the State is rainfed. Thus, most of agricultural production in the State is mainly dependent on the occurrence and distribution of rainfall. Karnataka is frequently affected by scanty and erratic rainfall. Droughts are a regular phenomenon in the State.

Rajasthan

Rajasthan is India's largest State with an estimated population of 54 million spread over its 41,588 villages covering a geographical area of about 3,42,239 sq. km. The area of Rajasthan is nearly equivalent to some of the developed countries of the Western world like Norway (3,24,200 sq. km.,) Poland (3,12,600 sq. km.) and Italy (3,01,200 sq. km.). The State is girdled by Punjab and Haryana States in the North, Uttar Pradesh in the East, Madhya Pradesh in the Southeast and Gujarat in the Southwest. The Western boundary of the State is part of the Indo-Pak international boundary, running to an extent of 1,070 km. Rajasthan has shown progress in several areas like agricultural production, harnessing of mineral resources, development of transport and communication, and the production of energy resources but the rate of progress and plans of economic development have been slowed to a large extent by a parallel growth of human population and livestock (www.rajamb.com).

Rajasthan is basically an agrarian economy. Most of its population lives in small villages and dhanies. It has a wide range of agro-climatic regions from very low rainfall in Western part to high rainfall in South and South-Eastern parts of the State. Major part of the State is covered by arid and semi-arid climatic conditions that have a characteristic low, erratic and uneven distribution of rainfall associated with lack of other water-resources for irrigated farming. There are three major reservoirs, namely Mahi Bajaj Sagar, Jhakam and Ranapratap Sagar in the State having a total storage capacity of 3.538 TMC. Out of 100 years, different districts of arid region suffer from drought in 40 to 70 years. Both animals and farmers are accustomed to grow only one rainfed crop in Kharif season that too associated with high risk that has led to dependence of village community on livestock, mining and migration to cities. Continuous drought during the past five years has forced the farming community to shift towards animal husbandry, mining and migration to cities. Due to low

capital investment capacity, lesser availability of agriculture credit and lack of adequate infrastructure facilities like roads, power, etc., farming system was more subsistence-oriented than the commercial farming.

District Profile

Among the three States, the literacy rate in the Chitradurga district of Karnataka was more with 55 per cent followed by the Alwar and Jodhpur districts of Rajasthan with 43 and 41 per cent respectively (Table 1). The literacy rate of the Kalahandi and Bolangir districts of Orissa was less when compared to the districts of other two States. The percentage of workers among the total population was slightly less in the Alwar and Jodhpur districts of Rajasthan when compared to the other States. The percentage of rural households was more for the Kalahandi and Bolangir districts of Orissa followed by Alwar district of Rajasthan and Chitradurga district of Karnataka.

Table 1 : District Profile

Category	Karnataka	Rajasthan		Orissa	
	Chitradurga	Alwar	Jodhpur	Kalahandi	Bolangir
Area (Sq.Km)	10852	8380	22850	11772	8913
Population(000 No.)	2180.44	2296.59	2153.48	1600.38	1707.75
Literacy(%)	55.48	43.09	40.69	30.05	39.74
Total Workers-000 No.	844.32	687.46	643.29	598.66	599.52
(% of total population)	(38.7)	(29.9)	(29.8)	(37.4)	(35.1)
Households-000 No.	388.10	350.55	345.11	349.66	346.94
Rural hh-000 No.	282.63	293.66	215.74	329.07	314.76
(% of total HH)	(72.8)	(83.7)	(62.5)	(94.1)	(90.7)

The average size of holding was very high in Jodhpur district followed by Chitradurga district with 3.25 ha. and 2.44 ha. respectively (Table 2). The Gross sown area was high in Alwar district with 97.99 per cent followed by Chitradurga district with 76.34 per cent of geographical area. The gross irrigated area was also high in Alwar district with 55 per cent of gross cropped area (GCA) followed by Chitradurga district with 28.8 per cent of GCA. Fertiliser consumption was high in Chitradurga district with 78.3 kg/ha followed by Alwar district with 41 kg/ha. Among the three States the fertiliser consumption was

low in the district of Orissa. The Quantum of credit availability for agriculture also was very high in Chitradurga district of Karnataka followed by Alwar district of Rajasthan. Therefore, in terms of gross irrigated area, the average size of holding, work force, fertiliser consumption and per capita availability of credit Karnataka is in a better position followed by the States of Rajasthan and Orissa.

Table 2 : Some Agricultural Indicators

Category	Karnataka	Rajasthan		Orissa	
	Chitradurga	Alwar	Jodhpur	Kalahandi	Bolangir
Av.Size of holding(ha)	2.44	1.92	3.25	1.89	1.61
NSA (% of GA)	76.34	97.99	58.24	71.07	41.33
GIA(% GCA)	23.88	54.98	11.19	14.32	9.72
Fertiliser consumption (kg/ha)	78.3	41	15.23	7.69	4.37
Credit to agriculture (Rs./Cap)	483	428	150	264	147
Value of Agrl. Prod.	4866	2157	758	1046	1195

- NSA – Net Sown Area
  GA – Geographical Area
  GIA – Gross Irrigated Area
  GCA – Gross Cropped Area

Village Profile

The total geographical area of the under-progressive villages Sulenahalli and Bawanta Kolyala of Karnataka and Rajasthan was less than the other two villages (Table 3). Whereas the geographical area of the underdeveloped village Lurki in Orissa was more (1855.3 ac) than the other two villages. Orissa was having a slightly higher male female ratio in all the three villages when compared to the other two States. The literacy rate in all the three villages of the State but Karnataka is higher, followed by the villages in Rajasthan and Orissa. Among the villages the literacy rate is less in the underdeveloped village when compared to the other two villages in all the three States. The number of BPL households in the Sulenahalli (underdeveloped) village was more than the households of other two villages in Karnataka State. Whereas, in the Orissa State the percentage of BPL household of underdeveloped village was almost on par with the other developed village.

Table 3 : Village Profile

Category	Karnataka			Orissa			Rajasthan		
	Konasagar	Sulenahalli	BG Kere	Lurki	Chandrabati	Kurlaguda	Bawanta Kolyala	Pariman-galia	Jhanwar
Area	3637.13	325.51	1583.43	2031.5	1855.3	1081.5	1321	2370	1571
Population	5668	911	3896	925	890	1250	700	1737	2495
Male	2852	484	2000	498	525	675	385	907	1461
Female	28161.01	4271.13	1896	427	365	575	315	830	1034
Literacy (% of Population	5100	363	2886	212	320	400	400	701	630
	(89.9)	(39.8)	(74)	(22.9)	(35.9)	(32)	(57.14)	(40.3)	(25.25)
No. of Households (HH)	1320	128	429	300	148	412	53	299	277
BPL HH (% of total HH)	408	84	202	98	46	196	5	9	71
	(30.9)	(65.6)	(47.0)	(32.6)	(31)	(47.5)	(9.43)	(13.01)	(25.6)
	1.01	1.13	1.05	1.16	1.14	1.17	1.2	1.09	1.4

The number of cultivators of the village Sulenahalli was less (8.9 pe rcent) than the cultivators of the villages, Konasagar and BG Kere in Karnataka (Table 4). Whereas, the number of cultivators of the village Lurki in Orissa was more with 65.8 per cent of total households than Chandrabatti and Kurlaguda. In Rajasthan State, the percentage of cultivators in the village Bawanta Kolyala a developed village was less with 58, than the villages Parimangalia and Jhanwar respectively.The agricultural labour in the villages Sulenahalli, Konasagar and BG Kere in Karnataka were 472, 1030 and 1100 respectively. Whereas for Orissa it is 36, 27 and 250, respectively for the villages Lurki, Chandrabatti and Kulaguda. In Rajasthan, the agriculture labour was less in the agriculturally less developed village of Bawanta Kolyala when compared to the other two progressive villages. In general, in all the villages of all the three States, the dependency for livelihood was more on agriculture followed by agricultural labour and trade.

Livestock

In general, the total number of livestock was more in the Karnataka State followed by Rajasthan and Orissa. In all the three States, the villages which were underdeveloped in terms of agriculture i.e. Sulenahalli in Karnataka, Lurki in Orissa and Bawanta Kolyala in Rajasthan were having less number of livestock than the other two villages in their respective States (Table 5). Though the total livestock was more in Karnataka State when compared to the other two States, the per household livestock in Orissa was more than in Karnataka (Table 5 a). Among the draft and milch livestock, the number of milch livestock was more in underdeveloped villages and draft animals were more in the developed villages. This shows that the secondary source of occupation in the underdeveloped villages can be through the sale of milk also. The small ruminants i.e. goat and sheep population was more in Karnataka State followed by Rajasthan and Orissa. The poultry population was also more in Karnataka followed by Orissa and Rajasthan.

Table 4 : Operational Profile

Category	Karnataka			Orissa			Rajasthan		
	Konasagar	Sulenahalli	BG Kere	Lurki	Chandrabati	Kurlaguda	Bawanta Kolyala	Pariman-galia	Jhanwar
Cultivation (% of total)	1232	48	429	112	121	408	43	250	189
	(33.8)	(3.26)	(11.01)	(12.00)	(13.3)	(32.64)	(6.14)	(1.43)	(7.5)
Agril. labour	1030	472	1100	36	27	250	17	29	30
HH / Cottage Industries	6	—	30	—	—	—	50	—	—
Construction works	4	14	2	—	—	—	5	4	3
Trade / Commerce	15	2	17	13	26	18	6	—	2
Service	124	—	43	9	17	19	—	15	10
Others	—	—	2275	—	—	—	—	250	—

Table 5 : Total Livestock (No.)

Category	Karnataka			Orissa			Rajasthan		
	Konasagar	Sulenahalli	BG Kere	Lurki	Chandrabati	Kurlaguda	Bawanta Kolyala	Pariman-galia	Jhanwar
Cows	1506	130	316	827	340	410	55	154	22
Bullocks	488	96	306	48	250	287	350	79	41
Buffaloes	2437	135	382	97	512	487	200	129	79
Goat/Sheep	12318	7400	4555	498	385	349	800	1245	926
Pigs	180	30	150	—	—	—	—	—	—
Poultry	20490	1080	6000	326	418	539	30	25	56
Other	—	—	—	—	—	—	—	9	—
	1320	128	429	300	148	412	53	299	277

Table 5 a : Per household Livestock (No.)

Category	Karnataka			Orissa			Rajasthan		
	Konasagar	Sulenahalli	BG Kere	Lurki	Chandrabati	Kurlaguda	Bawanta Kolyala	Pariman-galia	Jhanwar
Cows	1.14	1.01	0.7	2.09	2.2	0.9	1.03	0.5	0.07
Bullocks	0.36	0.75	0.7	0.1	1.6	0.6	6.6	0.2	0.14
Buffaloes	1.84	1.05	0.8	0.3	3.4	1.1	3.7	0.4	0.28
Goat/Sheep	9.3	57.8	10.6	1.6	2.6	0.8	15.09	4.16	3.34
Pigs	0.13	0.2	0.3	—	—	—	—	—	—
Poultry	15.5	8.4	13.9	1.08	2.8	1.3	0.5	0.08	0.20
Other	—	—	—	—	—	—	—	—	—

Agricultural Implements

The total number of agricultural implements was more in Karnataka followed by Orissa and Rajasthan (Table 6). Among the implements the number of tractors were more in Orissa State followed by Karnataka. The position of agricultural implements was very poor in Rajasthan. The total number of tractors were more in the sample household of Orissa State. The modern implements like cultivators, seed ferti drills were more in Karnataka followed by Orissa. The number of sprayers were more in Orissa followed by Karnataka, and Rajasthan. Whereas, bund farmers (soil and water conservation implement) were more in Karnataka followed by Rajasthan. There were no bund farmers in the sample villages of Orissa. This shows that the soil and water conservation practices were absolutely not there in Orissa. Also, asset structure in terms of livestock was more in Karnataka followed by Rajasthan and Orissa. Karnataka has more agricultural implements followed by Orissa and Rajasthan.

Local Institutions

The literacy rate of Orissa was poor when compared to the other two States. The primary and middle level schools were there in all the three villages. The high school was also there in two villages of Orissa and not there in underdeveloped village Lurki. There was no high school and post office facility in all the three villages of Rajasthan. Whereas, only the under-progressive villages of the Karnataka and Orissa State lack the facility of high school and post office. There was no Cooperative Society, PHC and veterinary facility in all the three villages of Orissa and Rajasthan and also in the underdeveloped village of Karnataka. There was no mandi for agricultural marketing facility in all the villages in these three States except the Kurlaguda of Orissa where a mandi was there for the procurement of cotton in the village.

The local elected institutions like gram panchayat are found in all the three villages of all the three States. Youth club has been formed in Karnataka and Orissa. The watershed association has been formed only in two villages in Karnataka and one village in Rajasthan. SHGs were the major source of credit in Karnataka and Orissa. This shows that infrastructural facilities in terms of education and post office were better in the progressive villages of Karnataka

Table 6 : Agricultural Implements

Category	Karnataka			Orissa			Rajasthan		
	Konasagar	Sulenahalli	BG Kere	Lurki	Chandrabati	Kurlaguda	Bawanta Kolyala	Pariman-galia	Jhanwar
Tractors	18 (1.17)	—	8 (2.73)	8 (4.46)	26 (8.6)	32 (9.3)	—	2 (1.26)	—
Cultivators	18 (1.17)	—	8 (2.73)	—	8 (2.64)	12 (3.48)	3 (3.8)	8 (5.06)	—
MB / Wooden Plough	780 (50.84)	80 (57.14)	148 (50.68)	89 (49.72)	146 (48.3)	158 (45.9)	50 (64.1)	93 (58.8)	49 (57.6)
Seed ferti drill	16 (1.04)	8 (5.71)	4 (1.36)	—	3 (0.99)	2 (0.58)	1 (1.28)	5 (3.16)	—
Sprayers	258 (16.81)	32 (22.85)	56 (19.17)	82 (45.81)	119 (39.4)	140 (40.69)	21 (26.9)	46 (29.11)	30 (35.2)
Bund former	444 (28.94)	20 (14.28)	68 (23.28)	—	—	—	3 (3.8)	4 (2.5)	6 (7.05)
Others	—	—	—	—	—	—	—	—	—
	1534	140	292	179	302	344	78	158	85

• Figures in parentheses indicate percentage of total.

and Orissa compared to Rajasthan. The facilities for medical care both for human beings and livestock were virtually nil in the sample villages of Orissa and Rajasthan. Soil and water conservation through watersheds was yet to take off in the villages of Orissa. Micro finance is the major source of credit in the sample villages of Karnataka and Orissa.

Land Use Pattern

Out of the total geographical area, forests was more in the sample villages of Karnataka State followed by Orissa (Table 7). Land under barren and uncultivable was more in Rajasthan sample villages together (36 per cent of geographical area) followed by Orissa and Karnataka with 31.6 and 14.3 per cent, respectively. Whereas, the area under non-agricultural use was more in case of both the sample villages in Rajasthan followed by Karnataka and Orissa. Fallow and cultivable wasteland was more in the sample villages of Orissa followed by Rajasthan and Karnataka. Though the area under cultivation as a per cent of geographical area was more in both the States of Karnataka and Orissa.

Table 7 : Land Use Pattern (ha)

Category	Karnataka			Orissa			Rajasthan		
	Konasagar	Sulenahalli	BG Kere	Lurki	Chandrabati	Kurlaguda	Bawanta Kolyala	Pariman-galia	Jhanwar
GA	3637.13	325.51	1583.43	2031.5	1855.3	1081.5	1321	2370	1571
Forests	357.90	6.07	286.06	243.7	—	—	600	—	—
	(9.8)	(1.86)	(18.06)	(12)			(52.3)		
Barren &	76.55	15.8	117.37	445.9	—	—	190	50	309
Uncultivable	(2.10)	(4.8)	(7.4)	(22)			(14.3)	(2.1)	(19.6)
Area under	40.00	35.2	92	25.7	—	—	NA	407	241
Non agri. use	(1.09)	(1.08)	(5.8)	(1.2)				(17.7)	(15.3)
Fallow & Cultivable	120	9	34.37	487.5	—	—	22	107	278
waste	(3.2)	(2.76)	(2.17)	(24)			(1.6)	(4.5)	(17.6)
Pastures	52.53	10	24	6	12	—	17	122	9
	(1.4)	(3.07)	(1.5)	(0.29)	(0.6)		(1.2)	(9.2)	(0.57)
Horticulture	140	30.92	50	—	—	—	—	—	—
	(3.8)	(9.49)	(3.15)						
Cultivated area	2850.15	218.54	980.66	822.9	1350.6	840	218	1913	516
	(78.3)	(67.13)	(61.9)	(40.51)	(72.8)	(77.6)	(16.5)	(38.5)	(32.8)

• Figures in parentheses indicate percentage of geographical area.

Chapter - 3

RISK AND VULNERABILITY IN RAINFED AGRICULTURE - ORISSA

3.1. Household Profile

As per the study design a total of 90 farmers belonging to thirty from each of the three categories, i.e., Small Farmers (SF), Medium Farmers (MF) and Large Farmers (LF) were covered for interviews based on structured questionnaire and focus group discussion in three villages of the two districts (Bolangir and Kalahandi). In each category of the farmers, 30 households (ten in each village) were contacted. A brief profile of the socio-economic characteristics of the sample households covering the demographic features, income levels, ownership of agricultural land and implements and livestock is given as follows:

3.1.1 Socio-economic Features

Table 3.1 shows significant difference in economic status of the farmers in under-developed village (Lurki) and progressive villages (Chandrabatti and Kurlaguda). The following observations may be made from the Table.

1) The literacy rate was fairly low among the small farmers in all the villages ranging between 21 per cent in Lurki and 24 per cent in Chandrabatti. Although the literacy rate among the medium and large farmers was appreciably high, the variability is also high compared to small farmers.

2) Another noticeable difference between different category of the farmers was availability of workers within the family. While on an average, four workers were available in the family of a small farmer, the number was lesser in medium and large farmers. This is explained by higher literacy rate in the latter two categories and hence larger dependent population also.

3) The difference among the underdeveloped village and progressive villages was with regard to average annual household income. The

income level of all categories of the farmers was appreciably low in Lurki. In fact, the average household income of even the large farmers in Lurki (Rs.19589) is lower when compared to even the small farmers in other two villages (Rs.33487) in Chandarbatti and (Rs.32713 in Kurlaguda).

4) Another important feature that can be noted is that the average household income was marginally higher of the small farmers in Kurlaguda when compared to medium farmers. This is mainly because of the fact that small farmers depend on livestock and wage work and these sources of income are not effective in case of medium farmers and large farmers. Similarly, the income from agriculture alone in case of medium farmers was found to be higher in Chandrabatti when compared to the large farmers in the same village. Here, again this difference is mainly because of diverse cropping structure. This aspect will be examined in detail, when cropping pattern is analysed.

3.1.2 Land Ownership

Table 3.2 shows the distribution of the cultivated land according to the irrigation and leasing status among the different categories of the farmers in the study area. The 90 farmers in three villages own 700 acres of land of which nearly twenty two per cent was irrigated land and seventy eight per cent was dryland. Of the 700 acres of land, 139 acres or nearly twenty per cent was held by the small farmers. Similarly 216 acres (31 per cent of total) in the possession of medium farmers and 345 acres or 49 per cent was with the large farmers. Out of the 345 acres of land available with the large farmers, 63 acres was leased out land. Thus, total area put to self cultivation by large farmers was 282 acres. Similarly 637 acres of land was put to cultivation by all categories of the farmers. The average landholding therefore varies from 4.6 in case of small farmers to 9.4 acres in the case of large farmers. The average land holding size in the study area is 7.1 acres which was marginally lesser than the average land holding size of the medium farmers (7.2).

Table 3.1 : Socio-economic Profile of the Sample Households

Villages	Lurki			Chandrabatti			Kurlaguda		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Average Family Size	7	6	6	7	5	5	8	6	5
Literacy (per cent)	21	37	43	24	41	57	22	44	55
Average number of workers in family	4	3	2	4	2	2	4	2	2
Average Annual Household income	12303	13863	19589	33487	44661	46572	32713	39548	53727

* Market value of the gross agricultural output is taken as income from the agriculture.

Table 3.2 : Category-wise Land Ownership (area in acres)

	Small Farmers	Medium	Large	Total
Irrigated				
Own land	19	46	44	109
Leased-in land	6	5	8	19
Leased out	0	0	23	23
Total Irrigated	25	51	75	151
	(18)	(24)	(22)	(22)
Dry				
Own	101	133	218	452
Leased-in	13	32	12	57
Leased out	0	0	40	40
Total Dry	114	165	270	549
	(82)	(76)	(78)	(78)
Total Irrigated and Dry	139	216	345	700
Net Cultivated area	139	216	282	637
Average size of holding	4.6	7.2	9.4	7.1

Figures in parentheses show the percentages to the total in the respective column.

3.1.3 LIVESTOCK

The total livestock in terms of bullocks, buffaloes and cows were found to be significantly less in case of small farmers when compared to medium and large farmers (Table 3.3). The thirty small farmers owned sixteen cows and four she-buffaloes as milch animals. The number of milk animals, especially of cows was much higher for the medium and large categories of the farmers. Whereas, the number of small ruminants i.e. goat and sheep and also poultry were more with these farmers. Large farmers possess almost all types of livestock except goat and sheep. Among the three villages, the number of small farmers who possess bullocks and buffaloes were more in Chandrabatti village followed by Kurlaguda village (Table 3.4). The number of cows among the small farmers were more in Kurlaguda village (4) followed by Chandrabatti village. Except cows, the small farmers of Lurki (under-developed) village do not possess neither milch or draught animals. The difference in the number of milch and draught animals between medium and large farmers was very less

in the three villages which indicates the fact that the large farmers were not in a position to maintain the big animals which they are supposed to maintain in terms of their land. The number of goat and sheep were more in Kurlaguda village than Chandrabatti village which indicates an inverse relationship between these and large animals.

Table 3.3 : Livestock Assets (No.)

Category	Bullocks	Buffaloes	Cows	She-buffaloes	Goats/Sheep	Poultry
Small	12	3	16	4	65	89
Medium	16	8	22	11	16	73
Large	20	14	33	6	0	120

• Figures in parentheses indicate percentages.

Table 3.4 : Village-wise Distribution of Livestock

	Lurki			Chandrabatti			Kurlaguda		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Bullocks	0	2	2	7	9	11	5	5	7
Buffaloes	0	2	3	1	2	7	2	4	4
Cows	4	2	6	5	11	10	7	9	17
She-buffaloes	0	0	1	3	5	3	1	6	5
Goat /Sheep	23	16	0	16	0	0	26	0	0
Poultry	49	28	52	21	27	41	19	18	27

3.1.4 Implements

The total number of ploughs including both MB plough and wooden plough were more for large farmers followed by small and medium farmers (Table 3.5). The small farmers of all the three villages do not possess tractors or bullock carts. Whereas, the large farmers were in possession of more number of tractors / threshers, bullock carts and oil engines compared to medium farmers. Between the medium and large farmers the difference in the number of large livestock was less and the difference in the number of other assets was more, with large farmers having more, indicates the fact that the large farmers are moving towards mechanisation.

Small farmers in the village Kurlaguda were having more number of oil engines when compared to the village Chandrabatti (Table 3.6). Because the own land holding under irrigation was more in this village when compared to the Chandrabatti village. Similar is in the case of large farmers of both the villages where the area under own irrigated land holding and oil engines was more in case of Kurlaguda village when compared to Chandrabatti village. Though the medium farmers of Kurlaguda village were having less owned irrigated land and oil engines when compared to the Chandrabatti village, the direct relationship between these two can be observed. This has been established by the fact that the investment in irrigation is directly proportional to the ownership of irrigated land.

Table 3.5 : Implements

Category	Plough	Tractors/ Threshers	Bullock Cart	Electric Motor/ Oil Engine
	No.	No.	No.	No.
Small	32	0	0	7
Medium	30	7	12	22
Large	36	13	17	27

Table 3.6 : Village-wise Distribution of Implements

	Lurki			Chandrabatti			Kurlaguda		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Ploughs	10	10	10	12	10	14	10	10	12
Tractors	0	0	1	0	4	7	0	3	5
Bullock Carts	0	2	3	0	3	8	0	7	6
Electric motor/ oil Engine	1	2	3	2	11	14	4	9	10

3.2 Agriculture-Risk, Vulnerability and Coping Mechanism

Against the above backdrop of sample following dimensions of the rainfed agriculture were examined to understand the features of rainfed agriculture and the vulnerability of the farmers and also to understand the coping mechanisms during the drought years in the three villages. The following three indicators are used to understand the risk and vulnerability in the agriculture in the selected villages in Orissa.

A) Cropping pattern and seasonal variations therein,

B) Changes in cropped area, output and yield rate during the drought year; and

C) Changes in the marketed surplus during the two years.

As indicators of coping mechanisms and institutional support systems, the following parameters were used-

A) Irrigation and land leasing,

B) Livelihood diversification and income level,

C) Marketable surplus and market dependency; and

D) Availability and dependency on institutional support system.

3.3 Cropping Pattern, Production and Productivity: Seasonal Variations

Table 3.7 shows the net and gross cultivated area in the study villages with the different category of farmers. Out of total 637 acres of net-cropped area, 139 acres or twenty per cent belongs to small farmers, 216 acres (34 per cent) to the medium farmers and 282 acres or 44 per cent belong to the large farmers. Eighty per cent of net cultivated area falls under the category of rainfed areas. Irrigation facilities-wise, medium category of the farmers were placed in a better position. Twenty four per cent of net cropped area under medium farmers was irrigated, whereas the same figures for small and large farmers was eighteen per cent. Consequently the cropping intensity was highest among the medium farmers. While the overall cropping intensity was 124 per cent , it is found to be nearly 130 in case of medium farmers followed by 122 for small farmers and 119 in case of large farmers. Thus, the land utilisation appears to be poorest in case of large farmers.

Table 3.7 : Cropped Area

	Small Farmers	Medium	Large	Total
Irrigated	25	51	52	128
	(18)	(24)	(18)	(20)
Dry	114	165	230	509
	(82)	(76)	(82)	(80)
Net Cropped Area	139	216	282	637
	(100)	(100)	(100)	(100)
Area Sown more than Once	31	64	56	151
Gross Cropped Area	170	280	338	788
Intensity of Cropping	122	130	120	124
Average Holding Size	4.63	7.2	9.4	7.1

* Figures in parentheses show irrigated land as per cent of total cultivated land.

3.3.1 Village-wise Cultivated Area

Table 3.8 shows the village-wise distribution of the cultivated area according to land categories and farmers' categories. The total net cultivated area of the village Lurki for small farmers was more when compared to the other two villages. The average size of holding of net cultivated area for the medium farmers of the village Lurki was also more with 7.5 when compared to Chandrabatti (6.8) and Kurlaguda (7.3). Similar is the case with the large farmers where the average size of holding is more for Lurki with 10.5, followed by Kurlaguda with 9.1 and Chandrabatti with 8.6.

3.3.2 Irrigation Coverage

Irrigation coverage is very poor in Lurki village where only twelve per cent of the net cultivated area with the small farmers is under irrigation. The respective proportions of irrigated land with medium and large farmers are sixteen and thirteen per cent. The irrigation coverage was best in Chandrabatti village where twenty per cent of the cultivated area of small farmers, thirty two per cent of medium farmers' and twenty two per cent of the land of the large farmers has irrigation facilities.

Table 3.8 : Category-wise and Village-wise Net Cultivated Area

	Lurki			Chandrabatti			Kurlaguda		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Irrigation									
Own	6	12	14	4	19	14	9	15	16
Leased-in	0	0	0	5	3	5	1	2	3
Net Cultivated area	6	12	14	9	22	19	10	17	19
	(12)	(16)	(13)	(20)	(32)	(22)	(23)	(23)	(21)
Dry									
Own	45	63	91	29	23	62	27	47	65
Leased-in	0	0	0	7	23	5	6	9	7
Total Dry	45	63	91	36	46	67	33	56	72
	(88)	(84)	(86)	(80)	(68)	(78)	(77)	(77)	(79)
Total Land	51	75	105	45	68	86	43	73	91
Average cultivated area	5.1	7.5	10.5	4.5	6.8	8.6	4.3	7.3	9.1

3.3.3 Cropping Pattern and Crop Coverage

Table 3.9 shows the crops grown in the study area by different categories of farmers during normal year and drought year. Paddy was the major crop in all the three villages. It is observed from the table that the crops like maize, sunflower, paddy, pulses, cow pea, kodna and linseed were taken up by the small farmers during normal year. As mentioned above, paddy was the major crop. To use the residual moisture, after harvesting paddy, farmers go for pre-rabi green gram and leave it fallow for the rabi. Irrigation is mainly through dug wells. Water is available at 15 to 25 ft. in all the three villages. If there is no rain during the initial months of kharif season the sowings are delayed and they broadcast the germinated seed due to which tilling capacity is less and yields are less. Local varieties of paddy like Setka, Dasaramatia, Borai are grown in uplands and medium lands. Whereas, the farmers were cultivating HYV of paddy in the lowlands. The high yielding varieties were Assamchudi, Mahipal, Puja, Lalat, MTV. 1001, 1010, Swarna 7029. With the introduction of cultivation of HYV, the cost of production was also increasing gradually.

Table 3.9 : Season-wise / Category-wise Crop Coverage

S.No.	Crops	Normal Year			Drought Year		
		SF	MF	LF	SF	MF	LF
1.	Maize	K +R	X	K	X	X	X
2.	Sunflower	K+R	K	K	K	K	X
3.	Paddy	K	K+R	K	K	K	K
5.	Cowpea	K	K+R	X	K	K	X
6.	Pulses	K+R	K+R	K+R	K	K	K
7.	Kodna	K	X	X	K	X	X
8.	Linseed	R	X	X	X	X	X
9.	Chillies	K	X	X	K	X	X
10.	Tomato	K	K	K+R	R	X	X
11.	Brinjal	K+R	K	K	K	X	X
12.	Onion	K	K	K+R	X	X	X
13.	Cauliflower/ cabbage	K+R	R	X	X	X	X

K= Kharif, R= Rabi, X= not grown

3.3.4 Area and Production: Farmers' Vulnerability

Table 3.10, 3.11 and 3.12 shows the farmers category-wise vulnerability as reflected in terms of changes in area, production, and marketed surplus during the normal season and drought year and yield during the drought.

3.3.5 Small Farmers Vulnerability

Table 3.10 shows the comparable figures for area, production, yield and marketable surplus for the small farmers during the normal year and drought year. The table shows that while the decline in the area under paddy during the drought year was 31 per cent, the decline in the production was 65 per cent. This is due to drastic decline in yield from six quintals in the normal year to just half in the drought year. Similar was the case with the other crop like maize, sunflower, cowpea, pulses and vegetables all of which registered drastic decline in the area under cultivation. The most significant case is that of sunflower and cowpea where decline in the area was hundred per cent. The corresponding decline in the production was 44 per cent (maize), 100 per cent (sunflower), paddy (50 per cent), cowpea (100 per cent), and pulses (36 per cent). Cotton is the only crop under which the area has increased during drought year. Though there was a slight decline in yield for this crop with an increase in the area and there was an increase in the production of this crop during drought for small farmers.

3.3.6 Decline in Marketable Surplus

Table 3.10 also shows the commodity-wise proportion of total output market by the small farmers. It may be noted from the table during the normal year 86 per cent of maize, 90 per cent of sunflower, 75 per cent of paddy, 17 per cent of cowpea, 36 per cent of pulses, 86 per cent of cotton and 96 per cent of the vegetable produce was marketed by the small farmers. These proportions decline to 55 per cent in case of maize, 100 per cent in case of sunflower and cowpea, 49 per cent in case of paddy and 89 per cent in case of vegetables. Only in case of pulses and cotton the proportion of output marketed increased during the drought year. Moreover, except for cotton the marketed quantity in absolute term has declined for all the crops. The decline in the area, production and yields of the different crops affect the marketable surplus adversely and hence farmers' income during the drought year. The decline in the marketable surplus was found to be eighty four per cent (maize), hundred per cent (sunflower), eighty two per cent (paddy), hundred per cent (cowpea), thirty six per cent (pulses) and sixty nine per cent (vegetables). The marketable surplus for cotton went up by 308 per cent.

Table 3.10 : Crop-wise Area and Production for the Small Farmers (Normal and Drought Year)

Crops	Maize	Sunflower	Paddy	Cowpea	Pulses	Cotton	Vegetables
Normal Season							
Area	18	10	59	20	22	10	24
Production (Q)	81	20	354	30	38.5	14	360
Yield (Q / acre)	4.5	2	6	1.5	1.75	1.4	15
Quantity (Q.) Marketed	70	18	265	5	14	12	360
Per cent of Output Marketed	86	90	75	17	36	86	100
Drought Season							
Area	8 (-56)	0 (-100)	41 (-31)	0 (-100)	9 (-59)	47 (+370)	13 (-41)
Production (Q)	20 (-75)	0 (-100)	123 (-65)	0 (-100)	13.5 (-65)	53 (+279)	195 (-45.8)
Yield (Q / acre)	2.5 (-44)x	0 (100)	3 (-50)	0 (-100)	1.5 (-14)	1.12 (-20)	15
Quantity (Q.) Marketed	11 (-84)	0 (-100)	49 (-82)	0 (-100)	9 (-36)	49 (+308)	185 (-45.8)
Per cent of Output Marketed	55	-	40	-	67	92	89

Note: Figures in parentheses show the per cent decrease / increase in the drought year.

The decline in the output has resulted in the decline of quantity marketed for all the crops except for the cotton where it has increased.

3.3.7 Medium Farmers' Vulnerability

Table 3.11 shows the differences in terms of above parameters for the medium farmers during the drought year from the normal year. The decline in the area under paddy for medium farmers during the drought year was 39 per cent (Table 3.11). But at the same time decline in production was 76 per cent. This is due to drastic decline in yield by 62 per cent. Similar is the case with the other crops like sunflower, cowpea, pulses and vegetables where the decline in the area during drought year was 64 per cent, 100 per cent, 10 per cent and 80 per cent, respectively. The corresponding decline in production was 73, 76, 100, 10 and 91 per cent. Cotton is the only crop production which has increased

during drought year. There was a slight decline in yield for this crop also with 33.33 per cent.

3.3.8 Decline in Marketed Surplus

As found in the case of small farmers, medium farmers also have to adjust to drastic decline in the marketable surplus during drought years due to decline in production. As proportion of total output, 73 per cent of sunflower, 79 per cent of paddy, 40 per cent of cowpea, 78 per cent of pulses, 89 per cent of cotton and 93 per cent of the vegetable production was marketed during the normal year. These proportions increased for sunflower (75 per cent), pulses (93 per cent), and cotton (93 per cent). Only in case of paddy (11 per cent) and cowpea (100 per cent) the proportion had been negative. Despite the positive trends in proportion of output marketed the quantity marketed during the drought year had been significantly lower for sunflower, paddy, cowpea and vegetables. The decline in the marketable surplus noted during drought year are 72 per cent, 97 per cent, 100 per cent and 98 per cent, respectively for sunflower, paddy, cowpea and vegetables. Cotton again is found to be the main substitute crop for the drought year. Overall however, it may be said that out of six crops grown by the medium farmers during normal, three crops have registered positive growth in terms of production and marketed quantity. Thus, the vulnerability of the medium farmers during the drought is much less when compared to small farmers.

Table 3.11 : Crop-wise Area and Production for the Medium Farmers (Normal and Drought Years)

Crops	Maize	Sunflower	Paddy	Cowpea	Pulses	Cotton	Vegetables
Normal Season							
Area	0	22	142	39	41	21	15
Production (Q)	0	44	923	58.5	82	31.5	210
Yield (Q / acre)	0	2	6.5	1.5	2	1.5	14
Quantity (Q.) Marketed	0	32	729	23.5	64	28	210
Quantity Marketed as Per cent of Total Output	-	73	79	40	78	89	100

Table 3.11 : *(Contd.)*

Drought Season							
Area	0	8	87	0	37	68	3
		(-64)	(-39)	(-100)	(-10)	(+224)	(-80)
Production (Q)	0	12	217.5	0	74	68	45
		(-73)	(-76)	(-100)	(-10)	(+116)	(-91)
Yield (Q / acre)	0	1.5	2.5	0	2	1	15
		(-25)	(-62)	(-100)	(0)	(-33)	
Quantity (Q.) Marketed	0	9	23.5		69	62	27
		(-72)	(-97)		(+8)	(+121)	(-98)
Marketed Surplus as Proportion of Output	-	75	11	-	93	91	26

Note: Figures in parentheses show the per cent decrease / increase in the drought year.

3.3.9 Large Farmers' Vulnerability

The trends in the decline in area remains to be same in case of large farmers also as witnessed in case of small and medium farmers. Decline in the area under paddy during drought year was around 28 per cent. But there was a drastic decline in yield with 57.14 which resulted in a heavy decline in the production of crop by 69.2 per cent. All the other crops have been badly effected. There was a total decline in the area of maize, sunflower and vegetables (Table 3.12). During the year under review sowings were delayed due to late onset of rainfall. The crops which were sown at the normal time were also effected due to absence of irrigation at critical stage resulting in complete loss of crops like sunflower. The only crop under which the area was not effected and in fact slightly increased was cotton. Though increase in area and production of cotton crop for large farmers was less compared to medium and small farmers, it is the only crop under which the area has been increasing at the time of drought for all the three category of farmers.

3.3.10 Decline in Marketed Surplus

The loss in area and production was accompanied by the loss in marketed surplus. During the normal year, nearly six different crops are grown by the

large farmers, despite lesser degree of crop diversification as seen later. All the six crops were marketed under normal production conditions. 81 per cent of the maize output, 87 per cent of sunflower, 84 per cent paddy, 94 per cent of paylseed, 100 per cent of cotton and 88 per cent of the vegetables produced enter the market. However, during the drought year three of the six commodities, i.e., maize, sunflower and vegetables completely disappear, where the marketed proportion of the other three commodities, paddy, cotton and pulses decline.

Table 3.12 : Crop-wise Area and Production for the Large Farmers (Normal and Drought Years)

Crops	Maize	Sunflower	Paddy	Cowpea	Pulses	Cotton	Vegetables
Normal Season							
Area	29	20	305	0	27	8	9
Production (Q)	58	30	2135	0	54	12	135
Yield (Q / acre)	2	1.5	7	0	2	1.5	15
Quantity (Q.) marketed	47	26	1793	0	51	12	135
Proportion of output marketed	81	87	84		94	100	100
Drought Season							
Area	0 (-100)	0 (-100)	219 (-28)	0	29 (+07)	36 (+350)	6 (-33.3)
Production (Q)			657 (-69)	0	58 (+07)	36 (+200)	60 (-55.5)
Yield (Q / acre)	0	0	3 (-57)	0	2 (0)	1 (-33)	10 (-33.3)
Quantity (Q.) marketed	0	0	315 (-82)	0	51 (0)	33 (+175)	60
Per cent of output marketed	-	-	48	-	88	92	-

• Figures in parentheses show per cent decrease / increase during drought year.

3.4 Cropping Pattern and Diversification Index

Paddy occupies major area as a kharif crop under small farmers with 59 acres during normal year. This is followed by vegetables with 24 acres, pulses, cow pea, maize, sunflower and cotton in terms of acreage during normal season for small farmers (Table 3.13). At the time of drought cotton was the major crop with 47 acres for small farmers followed by paddy (upland), vegetables, pulses and maize. Paddy was the major crop which is taken up both during kharif and rabi followed by pulses. The acreage was more for pulses during kharif and rabi season and during normal year followed by the acreage under cowpea, sunflower, cotton and also vegetables.

3.4.1 Drought Year

During drought year paddy was the major crop for medium farmer category followed by the area under cotton, pulses and sunflower, which were taken up only during kharif. For the large farmers paddy crop is the major crop sown during kharif followed by maize, sunflower, pulses and partly vegetables. During drought year also the major area was under paddy followed by cotton and pulses. Though paddy was the major crop in all the three categories during drought years the area under paddy is shifting gradually to cotton crop.

3.4.2 Diversification Index

We have also calculated the diversification index for the different categories of the farmers during normal year and drought years. It may be observed from Table 3.15 that by and large small farmers have achieved high degree of diversification compared to other categories. Similarly, the large farmers were having least diversified agriculture production structure. The diversification index was adversely affected during the drought thereby that the range of crops grown during the drought are lesser. However, even during the drought year the pattern of diversification among the different categories of the farmers remain the same, that is, maximum diversification in case of small farmers and least diversification in case of large farmers.

Table 3.13 : Area Under Crops and Diversification Index

Crop	Normal Year			Drought Year		
	SF	MF	LF	SF	MF	LF
Maize	18 (11)	0	29 (07)	8 (7)	0	0
Sunflower	10 (06)	22 (08)	20 (05)		8 (03)	0
Paddy	59 (35)	142 (50)	305 (76)	41 (35)	87 (42)	219 (77)
Cowpea	20 (12)	39 (13)	0	0	0	0
Pulses	22 (13)	41 (14)	27 (07)	9 (08)	37 (18)	29 (10)
Kodna	2 (01)	0	0	0	0	0
Linseed	5 (03)	0	3	0	0	0
Cotton	10 (06)	21 (08)	8 (02)	47 (39)	68 (33)	36 (13)
Vegetables	24 (14)	15 (05)	9 (02)	13 (11)	3 (01)	6 (2)
Gross Cropped Area	170 (100)	280	401	118	203	290
Diversification index	17	25.6	76	28.3	31	33.3

Figures in parentheses show per cent of the gross cropped area.

3.5 Drought and Cropping Pattern- Farmers Response and Coping Mechanism

Table 3.14 shows village and farmers category-wise cropping pattern during the normal year and drought. The shift in the cropping pattern during the drought years is captured by comparing it with the cropping pattern during

the normal years. Paddy occupies first position in cultivation in the village Lurki for the three categories of farmers, under normal year. This is followed by pulses, cotton and maize. During drought year cotton was the major crop for all the three categories of farmers. The farmers are growing HYVs of this crop like Sabila, Bunny, Tulsi, Super Bunny and initially the high yielding variety Sabita was introduced by the agricultural department. The farmers started picking up the other varieties based on the success. Though the varieties are high yielding, the farmers are growing this crop under totally rainfed condition particularly during drought times since the yield was less. The farmers still prefer this crop because the crop is fetching remunerative price in the market. Paddy was the major crop in the other two villages followed by cowpea and vegetables, for all the three categories during normal year. One major shift in area under cultivation during the drought year was with regard to cotton. During the period of drought though the area under cultivation of paddy has drastically reduced it still remained the major crop. Majority of the small and medium farmers have shifted to vegetable cultivation in these two villages. Large farmers have not taken up vegetable cultivation due to the problem of labour. For small and medium farmers it is easy to maintain because the family labour was also engaged in the vegetable cultivation. During the period of drought they could be able to sustain it partly because of their shift in the cultivation from high yielding to local varieties. Cotton was also major crop for both Chandrabatti and Kurlaguda villages during drought year, majority of the crop was being cultivated by medium farmers followed by small farmers.

Table 3.14 : Category-wise and Village-wise Gross Cropped Area

	Lurki			Chandrabatti			Kurlaguda		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Normal Season									
Crop									
Maize	6	0	9	7	0	15	5	0	5
Sunflower	0	7	10	7	7	4	3	8	6
Paddy	24	39	81	16	46	108	19	57	116

Table 3.14 : *(Contd.....)*

	Lurki			Chandrabatti			Kurlaguda		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Normal Season									
Pulses	0	0	0	0	0	0	0	0	0
Cowpea	0	8	0	11	14	0	9	17	0
Pulses	9	18	8	1	14	6	12	9	13
Kodna							2		
Linseed	3			2	0	0	0	0	0
Cotton	9	9	11	1	0	0	0	12	0
Vegetables	3	0	0	12	9	4	9	6	5
Gross Cropped Area	54	81	119	57	90	137	59	109	145
Drought Season									
Maize	2	0	0	3	0	0	3	0	0
Sunflower	0	0	0	0	0	0	0	8	0
Paddy	11	18	43	13	32	101	17	37	75
Pulses	0	0	0	0	0	0	0	0	0
Cowpea	0	0	0	0	0	0	0	0	0
Pulses	6	8	5	2	15	13	1	14	11
Kodna	0	0	0	0	0	0	0	0	0
Linseed	0	0	0	0	0	0	0	0	0
Cotton	15	22	28	15	24	3	17	22	5
Vegetables	2	0	0	6	2	0	5	1	0
Gross Cropped Area	36	48	76	39	73	117	43	82	91

3.5.1 Drought and Coping Mechanism

The farmers mainly cope up with the drought by changing the cropping pattern. During normal rainfall paddy was grown both as a kharif and rabi

crop. During drought season, paddy was taken during kharif with rabi onion or kharif paddy + prerabi greengram and rabi fallow or kharif fallow and rabi onion depending on the rainfall pattern and water availability. Table 3.10 shows the variations in the crops grown according to climatic conditions.

3.5.2 Small Farmers

Small farmers were growing paddy, cowpea, kodna, tomato and onion as pure kharif crop. Lineseed was grown as rabi crop. But maize, sunflower, pulses, brinjal and cauliflower were grown both during kharif and rabi seasons. During the drought year, the major causality was maize, linseed, onion, brinjal and cauliflower. Thus, most of the crops which were grown during both the seasons or only during the rabi season are affected adversely during the drought year.

3.5.3 Medium Farmers

The crop range grown by the medium farmers was comparatively less compared to small farmers. Maize, kodna, linseed, chillies were not grown by the medium farmers. The medium farmers grow paddy, kharif and rabi during the normal year. Similarily cowpea and pulses were also grown in both the seasons. The medium farmers were growing all the kharif vegetables during the normal season. The range of crops grown by the medium farmers during the drought year becomes much more restricted. Only sunflower, paddy, and cowpea were grown during the drought. Thus, the total number of crops grown reduces to just four from six crops during the normal year.

3.5.4 Large Farmers

Except for kodna, cowpea, chillies, and linseed large farmers grow all the crops during the normal year. Of eight crops grown during the normal year, pulses, tomato, onion and cauliflower were grown during both rabi and kharif. During the drought year, the production range was confined to the crops-paddy, and pulses.

3.5.5 Government Intervention

Government's intervention is mainly through the introduction of crops by giving minikit trails. The crop Bengal gram was introduced through minikit trials and later the farmers themselves are multiplying the seeds and growing. Similarly jute crop was also introduced through minikit trials in the villages Chandrabatti and Kurlaguda. Since there is no immediate market for this crop, the crop failed. Therefore, to introduce a new technology, the socio-economic and marketing conditions for the technology must be considered.

3.5.6 Selection of Seed Varieties

The reduction in the cropped area from normal year crops during the drought year is one important mechanism of risk aversion and selection of appropriate seed varieties according to agricultural conditions is another very important dimension to explore not only to assess the coping mechanism but also to assess the presence of the institutional support system, especially the strength of the extension services and availability of sources of the inputs. Majority of the farmers in all the three villages depend on previously grown crops for their seed. The Table 3.15 reveals some very interesting sources of seed selection, depending on the category of the farmers. While, majority of the small farmers depend on previously grown seeds and on the advice of shop keepers, in case of medium and large farmers, government advice was also available, though not a sizeable proportion as only three per cent of small farmers and five per cent of large farmers are dependent on them. Thus, whatever little government services are confined to medium and large farmers and small farmers were practically untouched by them. Another important finding is that a good number of farmers of all the three categories were unaware about the seed varieties and selection. This is largely because of failure of agricultural extension to cater these people particularly the small farmers.

Table 3.15 : Selection of Seed Varieties: Source-wise and Category-wise Distribution of Farmers

	Small Farmers	Medium Farmers	Large Farmers
Using previously grown seeds	19 (63)	24 (80)	21 (70)
Consulting agriculture department	0	3 (10)	5 (17)
Consulting neighbouring farmers	9 (30)	5 (17)	3 (10)
Advice of shopkeepers/Others	18 (60)	4 (13)	7 (23)
Do not know anything about seed varieties	5 (17)	6 (20)	4 (13)
Total responses (All Sources)	51	42	40
Total number of farmers	30	30	30
Number of farmers resorting to more than one source	21 (70)	12 (40)	10 (33)

• Figures in parentheses indicate percentage to total number of farmers.

Basis of Seed Selection

Table 3.16 shows the basis for selecting the seed varieties. All the three categories select the crops varieties based on high yielding and partly based on short duration and high yielding (Table 3.16). A total ignorance about the drought resistance varieties was found among the farmers.

Table 3.16 : Basis of Selection of Seed Variety

Category	Small	Medium	Large
Short duration	0	0	0
Drought resistant	0	0	0
High yielding	27 (90)	24 (80)	28 (93)
Short duration and high yielding	3 (10)	6 (20)	2 (27)
Short duration, drought resistant and high yielding	0	0	0

• Figures in parentheses indicate percentage to total.

3.6 New Crops

Apart from change in cropping pattern and selection of the seed varieties, another very important mechanism for reduction of risks involved in growing traditional crops under rainfed conditions is introduction of the new crops made available through research and development or market induced initiatives. The following aspects were explored from this point of view:

a) Introduction of new crops during last five years,

b) Reasons for growing new crops; and

c) Economic feasibility of the crops and continuation with the new crop.

3.6.1 Introduction of New Crops

Table 3.17 shows the number and percentage of the different categories of the farmers who have gone for new crops during the last five years. The table 3.18 shows that by and large small farmers have been most enterprising as far as trying of new crops are concerned. Only 20 per cent of the large farmers and 38 per cent of the medium farmers have tried new crops. Thus, the degree of risk aversion was directly related to the category of farmers. The assertion is corroborated by the fact that the range of new crops tried were also larger for the small farmers. Seven new crops were introduced by the small farmers during last five years compared to four in case of medium farmers and just one (cotton) in case of large farmers (Table 3.18).

Table 3.17 : Number and Percentages of Farmers Growing New Crops During Last 5 Years

Category	New crops
SF	14 (45)
MF	11 (37)
LF	6 (20)

• Figures in parentheses Indicate percentage to sample farmers.

Table 3.18 : Year of Introduction of Crops

Category	Year of introduction (crop)				
	2000	2001	2002	2003	2004
SF	Cotton	Sunflower	Maize, Paul seed	Paddy	Tomato, Cabbage
MF	Cotton		Tomato, Brinjal		Cowpea
LF			Cotton		

3.6.2 Reasons for Growing New Crops

The response pattern of the farmers to this particular question has been most interesting. Small farmers capacity and willingness to respond to new situations or factors was much more when compared to large and medium farmers. Whereas access to lack of irrigation was the most important determinant of new crops, in case of small farmers demand pattern and market access was also equally important. Table 3.19 reveals that the distribution of farmers in different categories according to factor inducing the introduction to the new crops. Only in case of large farmers drought (no access to irrigation) had been the sole factor causing introduction of the new crop (cotton).

Table 3.19 : Reasons for Growing New Crops

Category	Demand	Market Access	Irrigation (Access/ Inaccess)	Access to Technology	Total Number of Respon-dents
SF	11	8	13	7	14
MF	5	9	11	3	11
LF	0	0	6	0	6

3.6.3 Economic Viability of the New Crop and Continuation

Table 3.20 shows the distribution of small, medium and large farmers which is economically feasible with new crops. Of the seven new crops tested during last five years, opinion about economic feasibility was positive in case of three crops. All the farmers who tried maize, cotton and vegetables (all the three new crops were tried only in the case of small and medium farmers) new crops believed these crops were economically feasible of one crop or the other. Large farmers tried only cotton during the drought years and switch back to paddy during the normal years mainly because of assured sales through public procurement and similar was the case with medium farmers. Thus, despite economic feasibility of a crop, assured market seems to be the main determinant of sowing that crop. Table 3.21 shows the distribution of the farmers who tried with the new crops but discontinued later due to some reasons.

Table 3.20 : Crop-wise and Group-wise Distribution of Farmers according to Feasibility of New Crops

Economically Feasible	Small Farmers	Medium Farmers	Large Farmers
Maize	7	5	0
Cotton	12	6	6
Vegetables	10	9	0
Total Number of Respondents	14	11	6

3.6.4 Discontinuation with the New Crop

During the last five years, seven new crops were tried by the three categories of the farmers. Of the seven, however, only three crops, i. e., cotton, maize and some of the vegetables like pottal etc., are still grown. The non-market factors have been found to be detrimental than lack of market. In the case of sunflowers usually the bird attack and lack of irrigation facilities at appropriate stages of plant growth are two major factors behind discontinuation as the crop turns out to be non-remunerative. Similarly, in case of tomato and brinjal insects are the major problems. Besides, tomatoes are subject to highly volatile market fluctuations in prices. Moreover, lack of quality seeds and non-

availability of timely extension services are some of the factors which make these crops non-feasible.

Table 3.21 : Percentages of Farmers Discontinuing with Crops due to various reasons

Name of the Crop and Reasons for Discontinuation	Small Farmers	Middle Farmers	Large Farmers
Sunflower			
Lack of Market	20	25	No response
Not feasible	35	35	No response
Not viable	45	40	No response
Tomato/ Brinjal			
Lack of Market	27	21	
Not feasible	63	44	
Not viable	0		

3.7 Land Leasing and Irrigation Status

3.7.1 Land leasing is a very important source of land for cultivation and for enhancement of the production base. Although tenancy in Orissa is illegal and land leasing is not officially reported, yet significant proportion of land was leased-in by all categories of the farmers, especially by the small farmers. Enhancing productive capacity by leasing-in land was an important function of irrigation also. The Table 3.22 shows the distribution of total land, both irrigated and dry and the proportion of leased-in land to the total. While only 18 per cent of the total land under the possession of the small farmers was irrigated, the same is twenty four per cent and twenty two per cent respectively, for medium and large farmers. Of the twenty five acres of irrigated land under the possession of the small farmers, six acres or twenty four per cent of the total land was actually leased-in land. This proportion is comparatively smaller for medium farmers (both in absolute terms as well as percentage terms). Similarly the dependence of the large farmers on leased in land (irrigated) was also lower in

percentage terms. Thus, the leasing of irrigated land was found to be more prevalent among the small (6 acres) and large farmers (8 acres) when compared to medium farmers (5 acres). Overall, twenty two per cent of the irrigated land under the disposal of the three category of the farmers comes from leasing-in.

3.7.2. Category-wise Distribution of Land

Within the sample size, the small and marginal farmers having irrigated land were found to be leasing-in and not leasing-out. However, in case of large farmers both leasing-in and leasing-out of land was found. Thirty one per cent of irrigated area with the large farmers had been leased out to others. Eleven per cent of the total rainfed areas area with the small farmers was leased-in land. Similarly, 19 per cent of the cropped area (rainfed areas) with the medium farmers comes from leasing-in. Overall, it is found that while small farmers were engaged in leasing-in of land to augment their productive capacity, the same was more prevalent among the medium farmers. The large farmers are least dependent on the leased-in land.

Table 3.22 : Category-wise Land by Owner and Leasing Status (Area in acres)

	Small Farmers	Medium	Large	Total
Irrigated				
Own land	19	46	44	109
Leased-in land	6	5	8	19
Leased-in (irrigated) land as	24	10	11	13
Per cent to total irrigated land				
Leased-out	0	0	23	23
Leased-out land (irrigated)	0	0	31	15
as per cent to total irrigated land				
Total Irrigated	25	51	75	151
	(18)	(24)	(22)	(22)

Table 3.22 : *(Contd.....)*

	Small Farmers	Medium	Large	Total
Dry				
Own	101	133	218	452
Leased-in	13	32	12	57
Leased-in (dry) land as	11	19	04	10
Per cent of total rainfed areas				
Leased-out	0	0	40	40
Leased-out land (dry) as	0	0	15	07
per cent to total rainfed areas				
Total dry	114	165	270	549
	(82)	(76)	(78)	(78)
Total irrigated and dry	139	216	345	700
Total leased-in land	19	37	20	76
Leased-in land as percent of total area	14	17	06	11
Total leased-out land	0	0	71	71
Leased-out land as per cent to total land	0	0	21	10

*Figures in parentheses show the percentages to total in the respective column.

3.7.3 Village-wise Status of Land

Table 3.23 shows village-wise and farmers category-wise area under holding, irrigation status and leasing practices for the three categories of the farmers at the micro level. The phenomena of land leasing was absent in the backward village (Lurki), whereas, small farmers and medium farmers were leasing-in the other two villages (Chandrabatti and Kurlaguda) though the leasing-in was more for drylands when compared to the irrigated land. The leased-in land was more for medium farmers of Chandrabatti village when compared to Kurlaguda village. Though the large farmers were also leasing-in the land in all the three villages, the percentage in terms of leasing-out the land was more than the leasing-in land.

Table 3.23 : **Category-wise and Village-wise Distribution of Land Holdings (in acres)**

	Lurki			Chandrabatti			Kurlaguda		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Irrigation									
Leased-in	0	0	0	5	3	5	1	2	3
				(56)	(14)	(08)	(10)	(12)	(12)
Leased-out	0	0	0	0	0	16	0	0	7
						(46)			(27)
Total Irri.	6	12	14	9	22	35	10	17	26
(% to total) dry									
Own	45	63	91	29	23	62	27	47	65
Leased-in	0	0	0	7	23	5	6	9	7
				(19)	(50)	(05)	(18)	(16)	(08)
Leased-out	0	0	0	0	0	28	0	0	12
						(29)			(14)
Total dry	45	63	91	36	46	95	33	56	84
(% to total)	(88)	(84)	(87)	(80)	(68)	(75)	(77)	(77)	(76)
Total Leased -	0	0	0	12	26	10	7	11	10
in land				(27)	(38)				
Total leased -	0	0	0	0	0	44	0	0	19
out land									
Total Land	51	75	105	45	68	140	43	73	110

3.7.3 Farmers' Practicing in Leasing-in

Similarly Table 3.24 shows the distribution of the farmers according to land holdings under different categories and their distribution according to leasing-in and leasing-out status. None of the small and medium farmers having irrigated land are leasing-out land as seen from table. Only six out of thirty farmers belonging to the category of large farmers are leasing out land. A glance at the distribution of the farmers according to leasing-in status, the number was marginally higher for the category of small farmers (four out of

thirty) compared to medium (three out of thirty) and large farmers (two out of thirty). The leasing-in of dryland was found to be prevalent among the medium farmers (seven out of thirty) and small farmers (five out of thirty). Overall, it can be concluded that while the small farmers were more interested in leasing-in of irrigated land (of the total nine farmers who are found to be leasing-in land, four belong to the category of small farmers). Leasing-out of land was exclusive to the large farmers only and none of the small and medium farmers were found to be leasing-out. Thus, land leasing is an important instrument to augment the productive base and enhance income level for the small farmers and also to some extent in case of medium farmers.

Table 3.24 : Number and Percentages of Farmers Leasing-in and Leasing-out

	Small Farmers	Medium	Large
Irrigated			
Own land	7 (23.33)	24 (80.00)	26 (86.66)
Leased-in land	4 (13.33)	3 (10)	2 (6.66)
Leased-out	0	0	6 (20)
Total Irrigated	7 (23.33)	24 (80)	26 (86.66)
Dry			
Own	30 (100)	30 (100)	30 (100)
Leased-in	5 (16.66)	7 (23.33)	3 (10)
Leased-out	0	0	9 (30)
Total Dry	30 (100)	30 (100)	30 (100)
Total Irrigated and Dry	30 (100)	30 (100)	30 (100)

- Figures in parentheses indicate percentage to total

3.8 Livelihood Diversification and Source-wise Income

An attempt was made to collect data on income sources and livelihood patterns during the normal agriculture year and drought years. However, due to lack of precise information supplied by the farmers income sources during the two seasons could not be worked out. Yet the source-wise distribution of income in case of different categories of the farmers under near non-irrigated agriculture (under-developed village) and better agriculture conditions

(progressive villages) focusses on the different livelihood options available to the farmers as sources in income.

3.8.1 Sources-wise Distribution of Annual Household Income

Table 3.25 shows the source-wise average household income for different categories of farmers in under-developed and progressive villages. The following observations are made from the Table 3.25.

3.8.2 In all the three villages, agriculture remains to be the major source of income. Eighty eight per cent of the total income of the small farmers is from the agriculture in village Lurki. For the other two villages, i.e., Chandrabatti and Kurlaguda the income generated is nearly ninety five per cent. Thus, reliance on agriculture as the main source of income of small farmers was more in the progressive villages. This is mainly because of two factors, i) higher productivity due to irrigation facilities and b) greater degree of diversification, in the area of vegetables. This also reflects that farmers under adverse conditions adopt multiple livelihoods rather than being dependent on only one source for income generation .

3.8.3 The other major sources of income of the small farmers were wage employment (5.45 per cent) and agricultural labour (3.41 per cent) in case of the backward and totally rain dependent village (Lurki) followed by livestock as a second main source of income. The agricultural labour and wage works together contribute less than three per cent of the total income of the small farmers in each of the two progressive villages. Thus, not much variations is found in the source-wise distribution of the total income of the small farmers in the progressive villages. Considering the different sources of income for small farmers, it may be concluded that wage employment and agricultural labour taken together were important sources of livelihood in terms of income generation, besides agriculture in the underdeveloped villages whereas in the progressive or developed villages, agriculture was the main source of livelihood for small farmers and other sources, where the livestock sector plays the secondary role.

3.8.4 While the overall household income was more or less comparable within the two progressive villages and are nearly at the same level, income levels of all the categories of the farmers were found to be appreciably low in the underdeveloped villages. The average household income of large farmers in underdeveloped villages (Rs.19589) was appreciably lower than the average household income of even the small farmers in progressive villages and about

Table 3.25 : Source-wise Distribution of Farmers Income

	Lurki			Chandrabatti			Kurlaguda		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Agriculture	108338 (88)	128061 (92.38)	185287 (94.59)	317068 (94.69)	434459 (92.28)	445222 (95.60)	307679 (94.05)	384183 (97.14)	519870 (96.76)
Rent from land	0	0	0	0	0	6000 (1.29)	0	0	5000 (0.93)
Livestock	2000 (1.6)	4600 (3.32)	8300 (4.24)	7600 (2.27)	10500 (2.35)	8200 (1.76)	9100 (2.78)	8500 (2.15)	7900 (1.47)
Agricultural labour	4200 (3.41)	0	0	5800 (1.73)	0	0	5500 (1.68)	0	0
Wages works	6700 (5.45)	3400 (2.45)	0	3200 (0.95)	0	0	2900 (0.89)	0	0
Remittances	1800 (1.46)	2470 (1.78)	2300 (1.17)	1200 (0.36)	1650 (0.37)	6300 (1.35)	1950 (0.60)	2800 (0.71)	4500 (0.84)
Total	123038 (100)	138631 (100)	195887 (100)	334868 (100)	446609 (100)	465722 (100)	327129 (100)	395483	537270 (100)
AHI	12303	13863	19589	33487	44661	46572	32713	39548	53727

- Figures in parentheses indicate percentage to total.

one third of the income of the large farmers in progressive villages. Not much difference was found in the income levels of small and medium farmers in the underdeveloped village. However, though the average household income of large farmers in Lurki was even less than the small farmers' income in the progressive villages, it is still more than double the average income of the small farmers and marginally less than that of the medium farmers. Thus, even at this low level of income, disparities between large farmers and other categories of farmers are pronounced. For the progressive villages, the income levels of the different categories of farmers are comparable though inter class income differences within the village are found. But income level of all the category of farmers in Lurki was much lower when compared to the same category in the progressive villages. The income of small farmers, medium farmers and large farmers in Lurki was 37 per cent, 31 per cent and 42 per cent of the household income, respectively, in Chandabatti and 38 per cent, 35 per cent and 36 per cent, respectively, of the farmers in Kurlaguda.

3.9 Marketable Surplus and Marketing

The reduction in the quantity marketed for all crops during the drought except for the cotton and pulses shot up during the drought (Tables 3.10, 3.11 and 3.12). In this section, an assessment has been made of the relative proportion of the three categories of farmers in total marketed surplus and the decline in the marketed surplus for each of the category during the drought. Table 3.26 sums up commodity-wise and crop-wise sale of marketable surplus.

3.9.1 Category-wise Share in Marketed Produce

Table 3.26 shows the total marketed quantity for each of the product, category-wise farmers share in the marketed quantity and change in the drought year. Maize was marketed only by the small and large farmers. Of the total quantity marketed (70 quintals) small farmers account for sixty per cent. whereas rest of the forty per cent was the share of the large farmers during the normal year. Similarly, the share of small farmers was 24 per cent, 10 per cent, 17 per cent, 11 per cent, 23 per cent and 58 per cent for sunflower, paddy, cowpea, pulses, cotton and vegetables, respectively. The share of medium farmers was huge as far as sunflower, cowpea, pulses and cotton are concerned. Large farmers account for maximum share of market in paddy (64 per cent). Small farmers share was largest in maize (60 per cent) and vegetables (58 per cent). Only ten per cent of the total marketed paddy was contributed by the small farmers during the normal year. However, during the drought year when the marketed quantity reduces drastically, maize was sold only by the

small farmers. Similarly their share in vegetable also increases from 58 per cent in the normal year to 96 per cent during the drought years. On the other hand, the share of large farmers goes up in case of paddy during the drought year up to 81 per cent compared to 64 per cent during the normal year. There was a 100 per cent reduction in marketable surplus of cowpea for all the three categories. During both normal and drought years the medium farmers marketable surplus was more when compared to large and small farmers. Both large and small farmers contribute almost the same amount during normal years, whereas, during drought years small farmers marketable surplus of cotton crop was more than the large farmers. The marketable surplus of small farmers was to the extent of 58 per cent during normal year which increased to the extent of 97 per cent during drought year since the contribution of large farmers is nil during drought year.

Table 3.26 : Category-wise Sale of Marketable Surplus (Normal Year)

	Normal Year (quantity in quintals)						
Category	Maize	Sunflower	Paddy	Cowpea	Pulses	Cotton	Vegetables
SF	70	18	265	5	14	12	360
	(60)	(24)	(10)	(17)	(11)	(23)	(51)
MF	0	32	729	24	64	28	210
		(42)	(26)	(83)	(50)	(54)	(30)
LF	47	26	1793	0	51	12	135
	(40)	(34)	(64)		(39)	(23)	(19)
Total	117	76	2787	29	129	52	705
	(100)		(100)	(100)	(100)	(100)	(100)
Drought Year							
Category	Maize	Sunflower	Paddy	Cowpea	Pulses	Cotton	Vegetables
SF	11	0	49		9	49	185
	(100)		(13)		(7)	(34)	(96)
MF	0	9	24		69	62	45
		(100)	(06)		(53)	(43)	(4)
LF	0	0	315	0	51	33	60
			(81)		(40)	(23)	(20.6)
Total	11	9	388	0	129	144	290
	(100)	(100)	(100)		(100)	(100)	(100)
Change in Drought year	-91	-88	-86	-100	0	+177	-81

Note: Figures in parentheses show per cent share in total marketed for that crop.

3.9.2 Financial Risks

The financial risks of the farmers during the drought year are governed by two factors- (a) Decline in the quantity marketed during drought when compared with the normal year. (b) The price variations during the drought affect the small and medium farmers more adversely as they usually receive lower prices compared to large farmers, hence the decline in income due to drought is felt more acutely by these two categories of the farmers even though the decline in marketed output may be the same for all the categories of the farmers.

Table 3.27 shows that the income received by the different categories of the farmers during normal year and drought year. It can be observed that decline in the income of the small farmers during the drought year is due to decline in marketed surplus which is nearly seventy four per cent. Similarly, the income of the medium farmers declines by sixty seven per cent as against sixty one per cent decline in the income of the large farmers. The overall decline for all the three categories taken together is sixty four per cent. Three significant facts may be noted from the above analysis-

1) The decline in the income from the marketed produce was inversely related to the size of land holding (as represented by the different categories of the farmers).

2) Apparently the proportionate decline in the income of the small and medium farmers was higher but in absolute terms the decline in the income of the large farmers is much higher.

3) Commodity-wise analysis shows that income loss was nearly hundred per cent in case of cowpea, ninety five per cent in case of maize and sunflower, eighty six per cent in case of paddy and around fifty per cent in case of vegetables. The loss in case of pulses was just about eleven per cent. Thus relatively, pulses are most resistant to drought though the scale of production was fairly low. Vegetables were also comparatively safer options during the drought year as compared to food crops like paddy. Cotton is only drought year crop and compensates the farmers to some extent from the financial risks arising out of drought.

Table 3.27 : Gross Value of Marketed Produce : Normal Year and Drought Year

Category	Maize	Sun Flower	Paddy	Cowpea	Pulses	Cotton	Veg	Total
SF	28000	25200	132500	16800	19600	19200	180000	421300
MF	0	51200	364500	21600	89600	56000	126000	708900
LF	21150	41600	896500	0	71400	24000	135000	1189650
Total	49150	118000	1393500	38400	180600	99200	441000	2257850
SF	2150	0	17500	0	6700	46550	38684	111584
MF	0	6705	12000	0	72405	99200	45000	235310
LF	0	0	173250	0	81600	79200	135000	469050
Total	2150	6750	202750	0	160705	224950	218684	815989
SF	-92.32	-100.00	-86.79	-100.00	-65.82	142.45	-78.51	-73.51
MF	0.00	-86.90	-96.71	-100.00	-19.19	77.14	-64.29	-66.81
LF	-100.00	-100.00	-80.67	0.00	14.29	230.00	0.00	-60.57
Total	-95.63	-94.28	-85.45	-100.00	-11.02	126.76	-50.41	-63.86

3.9.3 Source-wise Marketing/Sales

Table 3.28 shows the marketing outlet for the farmers. Marketing arrangements are one of the most important support systems for the development of agriculture. Most of the produce is being marketed by the outside from nearby villages and mandal. Mandal is the most important source of marketing, especially through the weekly marketing system. Mandis are located in two of the villages. Traders from outside visit the villages at the time of harvesting and procuring maize and sunflower directly from the farmers. The price at which these crops were procured was far less than the minimum support price announced by the government. Farmers dependency on government is confined to paddy only and the price of procurement is also not fixed. The price varies from village to village. All the farmers in Lurki village were selling to outside traders. In Kurlaguda village they were selling it in APMC in nearby town. The procurement system was also followed in Chandrabatti village, where, farmers were getting better price when compared to other

villages. In this village, the paddy was being purchased by miller in the village itself @Rs. 380/bag or Rs.506/Q. The procurement price was fixed by the Collector in consultation with some progressive farmers and officials. The millers send it to the mandi and the FCI procures it from the millers. The target was fixed by the government before giving it to small farmers followed by medium and large farmers.

3.9.3 Not much variation is found among farmers group in terms of outlet sources, except for pulses where large farmers were selling it to outside traders exclusively, whereas in case of small amd marginal farmers good proportion of the output was sold inside the village. Similarly, small farmers dependency on village traders in respect of vegetables was much more on the village traders (41 per cent) compared to medium farmers (15 per cent) and large farmers (11 per cent). Since small farmers alone account for 58 per cent of the total vegetables marketed form the three villages, this difference in outlet source is important and indicative of the fact that due to poor holding capacity and infrastructure, they usually do not get good price.

Table 3.28 : Per cent Distribution of Farmers according to Source of Marketing of Agricultural Produce

Crop-wise Marketing Outlet/Number of Farmers Using Outlets	SF	MF	LF
Maize (Total Number of Farmers Selling)	*19 (100)*	*0*	*12*
Outside Traders	16 (84)	0	10
Village Traders	3 (16)	0	2
Government Procurement	0	0	0
Others	0	0	0
Sunflower (No. of Farmers Selling)	*7 (100)*	*13 (100)*	*9 (100)*
Outside Traders	7 (100)	13 (100)	9 (100)
Village Traders	0	0	0
Government Procurement	0	0	0

Table 3.28 : *(Contd.....)*

Crop-wise Marketing Outlet/Number of Farmers Using Outlets	SF	MF	LF
Others	0	0	0
Paddy	*22 (100)*	*27 (100)*	*30 (100)*
Outside Traders	2 (09)	0	0
Village Traders	4 (18)	6 (22)	7 (23)
Government Procurement	16 (73)	21 (78)	23 (77)
Others	0	0	0
Cow pea	*7 (100)*	*6 (100)*	*0*
Outside Traders	3 (43)	4 (67)	0
Village Traders	4 (57)	2 (33)	0
Government Procurement	0	0	0
Others	0	0	0
Pulses	*12 (100)*	*22 (100)*	*14 (100)*
Outside Traders	4 (33)	9 (41)	14 (100)
Village Traders	8 (67)	13 (59)	0
Government Procurement	0	0	0
Others	0	0	0
Cotton	*17 (100)*	*19 (100)*	*14 (100)*
Outside Traders	17 (100)	19 (100)	14 (100)
Village Traders	0	0	0
Government Procurement	0	0	0
Others	0	0	0
Vegetables	*22 (100)*	*13 (100)*	*9 (100)*
Outside Traders	10 (45)	7 (54)	5 (56)
Village Traders	9 (41)	2 (15)	1 (11)
Government Procurement	0	0	0
Others	3 (14)	4 (31)	3 (33)

3.10 Credit

Credit is an important institutional support to the farmers both under normal conditions and drought conditions. Institutionally, credit is taken from mixed sources like bank, moneylenders, friends and relatives. While credit from institutional sources is considered to be a positive feature, dependency on non-institutional sources like moneylenders is considered to be a sign of backwardness and lack of access to cheaper credit. It also means an exploitative credit market. Twenty five households belonging to small farmers category, twenty four belonging to medium category and twenty five belonging to large farmers category were found to have taken loan from one source or the other. In majority of the cases, the sources were either bank or money-lenders or both. The Table 3.29 shows the dependency of the farmers on different sources of the credit. It may be noted that out of twenty five small farmers, 14 or fifty six per cent are dependent on non-institutional sources for credit. Another twelve per cent of the farmers in this category are dependent on both institutional and non-institutional sources. Here, it may be mentioned by institutional source means bank as a source and non-institutional source means-money lender or even friends and relatives who extend financial support based on interest. In case of small farmers only, 32 per cent of those who avail of credit are dependent on bank solely and another twelve per cent are partially dependent. Sixty eight per cent of the farmers were dependent on non-institutional sources of credit and the interest paid by them was highest among the three categories. Forty six per cent of the medium farmers who avail credit are dependent on institutional sources. Twenty seven per cent of the farmers of this category depend on non-institutional sources and another twenty five per cent depend on both the sources. When compared to small farmers the higher percentage of dependency of the medium farmers on both institutional and non-institutional sources, suggests that access to banking services are gradually improving. The proportion of the non-institutional credit was just twelve per cent in case of large farmers with another twenty per cent depending on both the sources. Consequently, the interest cost for the large farmers is lowest among all the three categories.

Table 3.29 : Credit Facility

Category	Small	Medium	Large
No. of Farmers Availing Credit	25 (100)	24 (100)	25 (100)
No. of Farmers Availing Institutional Credit	8 (32)	11(46)	17 (68)
No. of Farmers Availing Non-Institutional Credit	14 (56)	7 (29)	3 (12)
No. of Farmers Availing Credit form Both Sources	3 (12)	6 (25)	5 (20)
Interest Charges	41.86	34.88	26.26

Note: Figures in parentheses indicate percentages

3.10.1 Purpose for Credit

Table 3.30 indicates the distribution of the farmers who have taken credit according to the purpose of the credit. There is significant variation in the purpose for which credit was taken by different categories of the farmers. To satisfy the household needs (36 per cent) in times of need followed by crop loans (24 per cent) were two important reasons for taking credit for small farmers. Thus, sixty per cent of the small farmers who have taken loan belonged to these two categories. Thirty eight per cent of the medium farmers took credit as crop loans followed by poultry (29 per cent). Thus, the table shows that medium farmers give preference to agriculture as well as diversification for availing of credit. The distribution of the large farmers according to the purpose of credit shows much more diverse pattern. Only twelve per cent of the large farmers took loan for crops. Overall, forty eight per cent farmers took loan to meet the requirements of agricultural implements (12 per cent), capital assets like purchase of tractors (12 per cent) and purchase of submersible pumps etc. 24 per cent). Thus, source-wise distribution of large farmers shows that irrigation was the top priority for them. The interest rate for institutional credit is12 per cent. The credit disbursement is taken care by Kalahandi Ancholika Grameena Bank.

Table 3.30 : Distribution of Farmers Availing Credit According to Purpose

Purpose of Credit	Small Farmers	Medium Farmers	Large Farmers
Crop loan	6 (24)	9 (38)	3 (12)
To purchase tiller/tractor	-	3 (13)	3 (12)
To purchase cart	3 (12)	1 (04)	-
To purchase submersible pump/dig well /pipe	2 (08)	4 (17)	6 (24)
To purchase agricultural equipment	-	-	3 (12)
For poultry	1 (04)	7 (29)	5 (20)
To purchase bullock	4 (16)	-	2 (08)
For household needs	9 (36)	-	3 (12)
For hospital	-	-	-
Total number of farmers availing credit	25 (100)	24	25

Insurance

At present the insurance is fixed for two crops only i.e., paddy and cotton. The premium rate for paddy was 6.45 per cent and for cotton it is 2.65 per cent. Revenue Inspector of the village prepares a crop damage report during the drought period. The insurance fixed for 100 per cent threshold yield value for paddy was Rs.4937 and Rs.12,342 for 150 per cent threshold yield value. Similarly for cotton it was Rs.7847 at 100 per cent threshold yield value and Rs.19,618 at 150 per cent threshold yield value . 15.4 per cent of small farmers, 30.76 per cent and 53.74 per cent of medium and large farmers were aware about the crop insurance. Paddy is the only crop for which the farmers availed insurance till date and 26.6 per cent of large farmers and 10 per cent of medium farmers have availed the insurance.

Table 31 : Awareness About and Utilisation of Insurance

Farmers	Awareness	Availed
SF	15.4	0
MF	30.76	10
LF	53.74	26.6

Chapter - 4

RISK AND VULNERABILITY IN RAINFED AGRICULTURE - KARNATAKA

4.1 Household Profile

As per the study design out of 90 farmers, 30 from each category, Small Farmers (SF), Medium Farmers (MF) and Large Farmers (LF) were covered based on structured questionnaire and focus group discussions in three villages in the district of Chitradurga in Karnataka. In each category of farmers, 30 households (ten in each village) were covered. A brief profile of the socio-economic characteristics of the sample households covering the demographic features, income levels, ownership of agricultural land and implements and livestock are given below.

4.1.1 Socio-economic Features

In the Table 4.1 a significant difference is being observed in the economic status of the farmers in underdeveloped village (Sulenahalli) and progressive villages (Konasagar and B.G. Kere).

Table 4.1 : Socio-economic Profile of the Sample Households

Category	Sulenhalli			Konasagar			B.G. Kere		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Average family size	8	6	5	9	7	6	8	7	7
Literacy (Percentage)	48	64	66	55	64	61	58	63	59
Annual household income (From all sources)	28500	26700	32900	51650	57650	95410	46100	55580	98250
Annual household income from agriculture	14000	19500	24000	30500	48000	85000	25800	50000	88500

1. The literacy rate was generally lower for small farmers in all the three villages and between the medium and large farmers it was almost same. The difference in literacy rate was almost high between small and medium farmers.

2. The total annual household income for medium and large farmers was almost same for progressive villages (Konasagar and B.G.Kere). The total income of small farmers of the village Konasagar is higher compared to the farmers in village B.G.Kere. (Progressive villages). Whereas, the total income of all the categories of farmers of the underdeveloped village and Sulenahalli was fairly less than progressive villages.

3. Similar type of observations are seen in all the categories of farmers for annual household income from agriculture in the underdeveloped village as well as in progressive villages.

4. Among the progressive villages the income from agriculture was higher in the village B.G.Kere for medium and large farmers whereas, it was higher for small farmers in the other village Konasagar

5. For all the three category of farmers the income from agriculture in developed village was more than twice than the income from agriculture in underprogressive villages.

4.1.2. Land Ownership

It is observed from the Table 4.2 that the total dryland occupies 76.3 per cent of total land owned for small farmers. Whereas, it was 71.5 and 72.75 per cent for medium and large farmers. The irrigated land of small farmers was 23.6 per cent of total land owned. Whereas, the same was 26.4 per cent and 27.25 per cent for medium and large farmers. The average land holding therefore varies from 2.56 in case of small farmers to 5.4 acres for medium and 13.3 acres for large farmers. The average landholding size in the study area was 7.09 acres, which was closer to average landholding size of the medium farmers (5.4 acres).

Table 4.2 : Category-wise Land Ownership (Area in Acres)

	Small Farmers	Medium Farmers	Large Farmers	Total
Irrigated				
Own land	14.2	46	109	169.2
Leased-in land	0	0	0	0
Leased-out	4	0	0	4
Total irrigated	18.2 (23.6)	46 (26.4)	109 (27.25)	173.2 (27.10)
Dry				
Own	53.7	125.83	284	451.53
Leased-in	4	2	6	12
Leased-out	1	0	1	2
Total Dry	58.7 (76.3)	127.83 (71.5)	291 (72.75)	465.53 (72.86)
Total Irrigated and Dry	76.9	173.8	400	638.9
Average size of holding	2.56	5.4	13.3	7.09

* Figures in parentheses indicate average holding size in that category.

4.1.3 Livestock

The total number of draught and milch animals was more for large farmers followed by medium and small farmers (Table 4.3). The small ruminant-based livestock was more for small farmers followed by medium farmers. The number of bullocks, buffaloes, cows and she-buffaloes for all the three category of farmers was less in the under-developed village than the other two progressive villages Konasagar and B.G.Kere (Table 4.4). Among the two progressive villages for large farmers the number of draught animals were more in B.G.Kere than Konasagar and the number of milch animals were more in Konasagar than in B.G.Kere. Whereas, for medium farmers bullocks and buffalo population was more in BG kere village, cows and she-buffalo population was more in Konasagar village. Among the three villages, goat and sheep population was more in Konasagar village followed by B.G.Kere. That is not only draught and milch-based, small ruminant livestock was also more in progressive villages than the under-developed village.

Table 4.3 : Livestock Assets (No.)

Category	Bullocks	Buffaloes	Cows	She-buffaloes	Goats/Sheep
Small	6	4	10	5	56
Medium	18	6	16	11	32
Large	26	13	24	12	0
	50	22	50	28	88

Table 4.4 : Village-wise Distribution of Livestock

	Sulenahalli			Konasagar			B.G. Kere		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Bullocks	1	3	2	2	7	10	3	8	14
Buffalos	0	1	1	2	2	6	2	3	6
Cows	2	1	3	4	8	13	4	7	8
She-buffalos	0	1	2	2	6	4	3	4	6
Goat / sheep	13	10	0	25	12	0	18	10	0

4.1.4 Implements

The total number of implements were more for large farmers followed by medium and small farmers (Table 4.5).There is not much variation in the position of implements by small and medium farmers except oil engines and electric motors. Whereas between the small, medium and large farmers the variation in the position of implements was very high. Small farmers of the sample households do not possess any tractor at all. Another significant observation is that the number of oil engines of small farmer was slightly higher than medium farmers.

Table 4.5 : Implements

Category	Plough	Tractors/ Threshers	Bullock Cart	Electric Motor/Oil Engine
	No	No	No	No
Small	30	0	8	7
Medium	34	4	6	28
Large	47	11	13	47

Table 4.6 : Village-wise Distribution of Implements

	Sulenahalli			Konasagar			B.G. Kere		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Ploughs	10	10	14	10	10	16	10	14	17
Tractors	0	1	2	0	3	6	0	1	5
Bullock carts	2	1	2	3	2	5	3	3	6
Electric motor / Oil Engine	1	3	7	2	12	19	4	13	21

The asset position of the under-developed village (Sulenahalli) was comparatively weaker than the other two progressive villages Konasagar and B.G.Kere (Table 4.6). Among the two progressive villages, Konasagar and B.G.Kere, the number of ploughs and bullock carts for all the category of farmers were more for B.G.Kere than Konasagar. The number of electric motors or oil engines was more in B.G.Kere followed by Konasagar and Sulenahalli for all the category of farmers. This may be due to the fact that the total area under irrigation was more in B.G.Kere followed by Konasagar and Sulenahalli.

4.2 Agriculture - Risk, Vulnerability and Coping Mechanism

Against the above backdrop of sample, the following dimensions of the rainfed agriculture were examined to understand the features of rainfed agriculture and the vulnerability of the farmers and also to understand the coping mechanisms followed by them during the drought years in the three villages. The following three indicators were used to understand the risk and vulnerability in the agriculture in the selected villages in Karnataka:

a. Cropping pattern and seasonal variations therein;

b. Changes in cropped area, output and yield rate during the drought year and normal year; and

c. Changes in the marketed surplus during the two years.

As indicators of coping mechanisms and institutional support systems, the following parameters were used:

d. Irrigation and land leasing,

e. Livelihood diversification and income level,

f. Marketable surplus and market dependency; and

g. Availability and dependency on institutional support system.

4.3 Cropping Pattern, Production and Productivity: Seasonal Variations

The net and gross cultivated area in the study villages of the different category of farmers is shown in Table 4.7. Out of the total 638.73 acres of net-cropped area, 76.9 acres or 12 per cent belong to small farmers, 162 acres or 25.3 per cent belong to medium farmers and 400 acres or 62.6 per cent belong to large farmers. Area sown more than once was more for medium farmers with 43.6 per cent of gross cropped area followed by large and small farmers with 38.46 per cent and 35.5 per cent, respectively. Because of this, the cropping intensity was more for medium farmers with 177 per cent followed by large and small farmers with 163 per cent and 155 per cent, respectively.

Table 4.7 : Cropped Area

Category	Small Farmers	Medium	Large	Total
Irrigated	18.2	46	109	173.2
Dry	58.7	115.83	291	465.53
Net cropped area	76.9	161.83	400	638.73
Area sown more than once	42.5 (35.5)	125.5 (43.6)	250 (38.46)	418
Gross cropped area (GCA)	119.4	287.3	650	1056.7
Cropping intensity (%)	155	177	163	165

* Figures in parentheses indicate per cent of GCA.

4.3.1 Village-wise Cultivated Area

The village-wise distribution of the cultivated area according to land category and farmer's category is given in Table 4.8. The total net cultivated area of small farmers for the under-developed village Sulenahalli was more than the small farmers of the other two villages. As a result, the average size of holding of small farmers of Sulenahalli village was (2.7) more than the small farmers Konasagar (2.01) and B.G.Kere (2.46), whereas,the net cultivated area of medium farmers and large farmers of under-developed (Sulenahalli) village was less than the medium and large farmers of the other two progressive villages.

Irrigation Coverage

In general, the irrigation coverage ranges around 29 per cent of the total net cultivated area for large farmers of progressive villages-Konasagar and B.G.Kere. It was almost the same for medium farmers of Konasagar.Whereas; it was more with around 33 per cent for medium farmers and 28.4 per cent for small farmers of B.G.Kere when compared to Konasagar. Therefore, between the two progressive villages, the irrigation coverage was more in the village of B.G.Kere for all the three category of farmers. Whereas, in the under-developed village, the variation in irrigation coverage as a percentage of net cultivated area was less between medium and large farmers, but it is more between small and medium farmers.

Table 4.8 : Category-wise and Village-wise Net Cultivated Area

	Sulenahalli			Konasagar			B.G. Kere		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Irrigation									
Own	2.03	7.5	18.5	4.9	18.5	41	7	20	49.5
Leased in	0	0	0	0	0	0	0	0	0
Net cultivated	2.03	7.5	18.5	4.9	18.5	41	7	20	49.5
irrigated area	(7.5)	(19.7)	(20.7)	(24.3)	(29.3)	(28.7)	(28.4)	(32.8)	(29.5)
Dry									
Own	24.97	30.5	70.5	12.2	44.5	98.5	16.6	38.8	114
Leased in	0	0	0	3	0	3	1	2	4
Net cultivated	24.97	30.5	70.5	15.2	44.5	101.5	17.6	40.8	118
dry area	(92.4)	(80.26)	(79.2)	(75.6)	(70.6)	(71.2)	(71.5)	(67.1)	(70.4)
Total net cultivated area	27	38	89	20.1	63	142.5	24.6	60.8	167.5
Average cultivated area	2.7	3.8	8.9	2.01	6.3	14.25	2046	6.08	16.75

- Figures in parentheses indicate per cent of Net Cultivated Area.

4.3.3 Cropping Pattern and Crop Coverage

Table 4.9 : Season-wise / Category-wise Crop Coverage

S.No.	Crops	Normal Year			Drought Year		
		SF	MF	LF	SF	MF	LF
1.	Groundnut	K	K	K, R	K	K	K
2.	Sunflower	K	K, R	K, R	-	-	-
3.	Paddy	K	K, R	K, R	-	K	K, R
4.	Maize	K, R	K, R	K, R	-	-	-
5.	Red gram	K, R	K	K	K	K	K
6.	Castor	-	K	K	-	-	K
7.	Onion	R	R	R	-	-	-
8.	Cowpea	K	K	K	K	K	K
9.	Jowar	K	K	K	K	K	K
10.	Bajra	K	K	K	K	K	K
11.	Ragi	K	K	K	-	-	-

The different crops grown in the study area by different categories of farmers during normal year and drought year is given in Table 4.9. Groundnut was the major crop in all the three villages. The table indicates that the crops that were taken by all the farmers during normal year were groundnut, sunflower, paddy, maize, redgram, castor, onion, cowpea, jowar, bajra and ragi. Irrigation was mainly through borewells. Groundwater is available at 600 to 800 ft depth. Almost all the crops were covered with HYVs including minor millets like jowar, bajra and ragi.

4.3.4 Area and Production – Farmers Vulnerability

The farmers category-wise vulnerability as reflected in terms of changes in area production and marketed surplus during the normal and drought year is given below:

Small Farmers Vulnerability

The comparable figures for area, production, yield and marketed surplus for the small farmers during the normal year and the drought year is given in Table 4.10. There was a drastic reduction in the area of maize, sunflower, paddy, groundnut and redgram to an extent of 38.3, 30, 61.5, 50.7 and 31.2 respectively, during drought year from the normal year. The crops like maize, sunflower, groundnut and redgram have more yield reduction. The area under cultivation has increased for some of the crops like cowpea, castor, jowar, and bajra during drought period. But the yield of these crops was also effected to an extent of 50, 57.1, 20 and 14.2 per cent, respectively. The marketable surplus of the crops like maize, sunflower and castor was 100 per cent of the total production during the normal year. Whereas, the marketable surplus of paddy, groundnut, redgram and onion was to the extent of 70.2, 84.9, 27.3 and 84.8 per cent of production, respectively. The marketable surplus of all the crops except castor has declined during the drought period.

Table 4.10 : Crop-wise Area and Production for the Small Farmers (Normal and Drought Year)

Crops	Maize	Sunflower	Paddy	Cowpea	Groun-dnut	Redgram	Castor	Onion	Jowar	Bajra
Area	15.4	10	6.5	3	27.6	13.1	6.6	5	5	4
Production (Q)	277.2	60	168.75	3	165.6	78.6	46.2	12.5	12.5	14
Yield (Q / acre)	18	6	22.5	1	6	6	7	25	2.5	3.5
Quantity (Q.) marketed	277.2	60	118.5	0	140.6	21.5	46.2	106	0	0
Drought Season										
Area	9.5	7	2.5	8	13.6	9	26.6	0	6	8
	(-38.3)	(-30)	(-61.5)	(166.6)	(-50.7)	(-31.2)	(30.3)		(20)	(100)
Production (Q)	61.75	24.5	40	4	34	25.2	79.8	0	12	24
	(-77.7)	(-59.1)	(-76.2)	(33.3)	(-79.4)	(-67.9)	(72.7)		(-4)	(71.4)
Yield (Q / acre)	6.5	3.5	16	0.5	2.5	2.8	3	0	2	3
	(-63.8)	(-41.6)	(-28.8)	(-50)	(-58.3)	(-53.3)	(-57.1)		(-20)	(-14.2)
Quantity (Q.) marketed	61.75	24.5	0	0	25.1	0	79.8	0	0	0
	(-77.7)	(-59.1)	(-100)	(0)	(-82.1)	(-100)	(72.7)	(0)	(0)	(0)

Figures in parentheses indicate percentage decline from the normal year.

Medium Farmers Vulnerability

The comparable figures for area , production ,yield and marketable surplus for the medium farmers during the normal year and the drought year is given in Table 4.11.There was a drastic reduction in the area of crops like maize, sunflower, paddy, cowpea, redgram, jowar and bajra during drought time. The yield of the crops has also reduced. The yield of the crops like groundnut and castor for which the area increased has also reduced to an extent of 60 and 68.7 per cent, respectively. The marketable surplus of medium farmers for the crops sunflower and castor was 100 per cent of production during the normal years. Whereas, for the crops maize , paddy , cowpea, groundnut, redgram and onion was 96.1, 81.3 , 27.6, 90.0, 21.31 and 97.1 per cent of production respectively, during the normal years. For the crops like jowar and bajra there was no marketable surplus during normal years. Whereas, at the time of drought the marketable surplus of all the crops has declined ranging from 50 to 100 per cent from the normal year. The crops for which there was an increase in the area also, the marketable surplus has declined with decline in yield.

Large Farmers Vulnerability

The comparable figures for area, production, yield and marketable surplus for the large farmers during the normal year and the drought year is given in Table 4.12. Except the crop castor the area under cultivation of all the other crops have suffered during the drought year. The area under maize and sunflower has declined considerably to an extent of 57.3 and 66.6 per cent from the normal year. Only for the crops castor and bajra the area has increased during drought year to an extent of 124 and 15 per cent respectively. The yield of all the crops including castor except bajra has declined much during drought year. The marketable surplus of crops like sunflower and castor was 100 per cent during normal year, whereas for maize, paddy, groundnut, redgram, onion and bajra it is 96.5, 88.1, 94.1, 65.1, 96.9 and 27.5 per cent of the total production, respectively. During the drought year the marketable surplus of crops has further declined to 91.9, 48.9, 77.1, 100, 50 per cent of production for the crops maize, paddy, groundnut, redgram and bajra, respectively.

Table 4.11 : Crop-wise Area and Production for the Medium Farmers (Normal and Drought Years)

Crops	Maize	Sunflower	Paddy	Cowpea	Groundnut	Redgram	Castor	Onion	Jowar	Bajra
Normal Season										
Area	27.5	31	22.5	6.5	34	11.5	27	29	10	8.8
Production (Q)	440	186	472.5	16.25	255	69	216	870	25	35.2
Yield (Q / acre)	16	6	21	2.5	7.5	6	8	30	2.5	4
Quantity (Q.) marketed	42.3	186	384.5	4.5	232	8.5	216	845	0	0
Drought Season										
Area	17.5	16	20.5	5	42	9.5	48	0	8.5	6.5
	(-36.3)	(-48.3)	(-8.8)	(-23.05)	(23.5)	(-17.3)	(77.7)		(-15)	(-26.1)
Production (Q)	122.5	64	287	10	126	19	120	0	17	13
	(-72.1)	(-65.5)	(-39.01)	(-38.4)	(-50.5)	(-72.4)	(-44.4)		(-32)	(-63.06)
Yield (Q / acre)	7	4	14	2	3	2	2.5	0	2.0	2
	(- 56.25)	(-33.3)	(-33.3)	(-20)	(-60)	(-66.6)	(-68.7)	(-100)	(-20)	(-50)
Quantity (Q.) marketed	105.5	64	199	0	103	0	120	0	0	0
	(-75.05)	(-75.05)	(-48.2)	(-100)	(-55.6)	(-100)	(-44.4)	(-100)	(0)	(0)

- Figures in parentheses indicate percentage decrease / increase from the normal year.

Table 4.12 : Crop-wise Area and Production for the Large Farmers (Normal and Drought Years)

Crops	Maize	Sunflower	Paddy	Cowpea	Groundnut	Redgram	Castor	Onion	Jowar	Bajra
Normal Season										
Area	61	48	48	11	96.5	23	43	41.5	7	20
Production (Q)	732	192	1056	22	712	172.5	365.5	1328	17.5	80
Yield (Q / acre)	12	4	22	2	8	7.5	8.5	32	2.5	4
Quantity (Q.) marketed	707	192	931	0	727	112	365.5	1288	0	22
	(96.5)	(100)	(88.1)	(0)	(94.1)	(65.1)	(100)	(96.9)	(0)	(27.5)
Drought Season										
Area	39	32	37.5	37.5	84.5	16	96	0	7	23
	(-36.06)	(-33.3)	(-21.8)	(21.8)	(-12.4)	(-30.4)	(23.2)		(0)	(15)
Production (Q)	312	64		600	211.25	40	288	0	21	69
	(-57.3)	(-66.6)		(-43.18)	(-72.6)	(-76.8)	(-21.2)		(20)	(-24.8)
Yield (Q / acre)	8	2	16	2.5	2.5	2.5	3	0	3	3
Quantity (Q.) marketed	287	64	475	0	166.25	0	288	0	0	11
	(-59.4)	(-66.6)	(-48.9)		(-77.1)	(-100)	(-21.2)			(-50)

- Figures in perantheses indicate percentage decrease / increase from the normal year.

For small farmers the only crop that has an increase in area during drought year was castor. Though there was a decrease in yield, with an increase in area, the overall production of the crop has increased during drought period. The area under crops like cowpea, jowar and bajra has increased during drought period. But their production was not sufficient enough to market these crops. Hence, there is no marketable surplus. All the other crops, have suffered in area and yield. There was an increase in area under groundnut and castor during drought year for medium farmers. For all the other crops, the area has declined. Though there was an increase in area under these crops, there was a decline in yield and thereby production. For large farmers, the area under cultivation during drought period has increased only for castor. But with a decline in yield, the production of this crop was also affected. Therefore, small and medium farmers tend to diversify more during drought periods, becoming more vulnerable to the climatic aberrations.

4.4 Cropping Pattern and Diversification Index

Groundnut occupies major area for all the category of farmers which was grown as kharif crop by large farmers (Table 4.13). Maize and redgram and sunflower are the major crops grown by small farmers after groundnut. Groundnut was the major crop for medium and large farmers followed by sunflower and paddy. Castor and onion were other major crops grown by medium and large farmers in the recent past to an extent of 27 and 19 acres by medium farmers and 43 and 41.5 acres by large farmers respectively, during normal year.

During drought year, the major crop that suffered in terms of area, under the small farmers category was paddy by 61.5 per cent from the normal year followed by a set back in the area under groundnut, maize, sunflower, redgram and onion with 50.7, 38.3 and 31.2 and 100 per cent, respectively. Whereas the area under cowpea, bajra, castor and jowar increased by 166.6, 100, 303.3 and 20 per cent, respectively. The crops that suffered a major set back in terms of area under medium farmers category due to drought were sunflower, paddy, redgram, jowar, bajra and onion with a decline in percentage of 50, 47.5, 8.8, 17.3, 15, 26.1 and 100, respectively. Whereas, the crops groundnut, maize and castor have increased during drought period. The crops that suffered a set back in area under large farmers category during drought period were groundnut, sunflower, paddy redgram, cowpea and onion with a decline in percentage of 50.2, 36.6, 21.8, 30.4, 27.2 and 100 from the normal

year, respectively, whereas, the crops under which the area has increased during drought period were bajra, maize and castor with an increase in percentage of 27.7, 69.5 and 123.2 respectively, from the normal year. Therefore, it can be concluded from the above observations that small farmers tend to diversify more during normal years, whereas medium and large farmers tend to diversify more during drought periods.

That is during the period of droughts there is a category-wise variation in the decline or increase in the certain crops.

4.4.2 : Diversification Index

Table 4.13 : Area Under Crops and Diversification Index

Crop	Normal Year			Drought Year		
	SF	MF	LF	SF	MF	LF
Groundnut	27.6 (29.9)	80 (35.2)	170 (39.08)	13.6 (15.07)	42 (24.2)	84.5 (24.6)
Sunflower	10 (10.84)	31 (13.6)	50.5 (11.6)	7 (7.7)	16 (9.2)	32 (9.3)
Paddy	6.53 (7.08)	22.5 (9.98)	48 (11.03)	2.5 (2.7)	20.5 (11.8)	37.5 (10.9)
Maize	15.4 (16.69)	11.5 (5.07)	23 (5.2)	9.5 (10.5)	17.5 (10.08)	39 (11.3)
Redgram	13.1 (14.20)	11.5 (5.07)	23 (5.2)	9 (9.97)	9.5 (5.4)	16 (4.6)
Cowpea	3 (3.25)	5.5 (2.42)	11	8	5	8
Jowar	5 (5.42)	10	7	6	8.5 (4.8)	7
Bajra	4 (4.33)	8.8	18	8	6.5	23 (6.7)
Castor	6.6 (7.15)	27 (11.9)	43 (9.8)	26.6 (29.4)	48 (276)	96 (27.9)
Onion	5 (5.42)	19 (8.37)	41.5 (9.5)	0	0	0
Gross cropped	92.23	226.8	435	90.2	173.5	343
Diversification Index	17.9	20.2	20.5	18.3	18.4	18.6

- Figures in parentheses indicate per cent of gross cropped area

The diversification index for the different categories of farmers during normal and drought year is presented in Table 4.13. It is observed from the table that small farmers have achieved greater degree of diversification compared to other categories during normal year. The degree of diversification for medium and large category farmers during normal year is more or less similar whereas, during the period of drought there was not much variation in the degree of diversification between the three categories of farmers. However, during the drought period the degree of diversification is more for medium and large farmers compared to normal year.

4.5 Drought and Cropping Pattern – Farmers Response and Coping Mechanism

The farmers category-wise cropping pattern during the normal year and drought year is given in Table 4.13. Farmers response to droughts, the terms of change in cropping pattern is captured by comparing it with normal year cropping pattern. Groundnut was the major crop for small farmers in underdeveloped (Sulenahalli) village followed by castor and paddy during normal year. Whereas, in the progressive villages, in Konasagar maize was the major crop. Part of the area under irrigation was shifted from the cultivation of paddy to onion. Sunflower and redgram are the other major crops cultivated. Whereas in BG Kere for small farmers during normal year, redgram was the major crop followed by maize, sunflower, groundnut, paddy and onion. That is, during normal year, for small farmers the cropping pattern in a underdeveloped village or in a developed village was decided by the extent of availability of irrigation. Castor and onion are relatively new crops in that area. During normal year, castor was taken up by the small farmers in the underdeveloped village where the irrigation availability was less and onion was taken up by the small farmers in developed village where the irrigation availability was relatively more. During drought period the area under castor has considerably increased for small farmers in underdeveloped as well as in progressive villages. Onion was not grown by the small farmers in progressive villages during drought year. One interesting observation is that gross cropped area of small farmers in progressive villages has increased during drought year, whereas it declined for medium and large farmers. This is mostly due to increase in area under crops like cowpea, castor, jowar and bajra by small farmers to cope up with the deficiency in yield of other crops.

4.5.1. Drought and Coping Mechanism

Not much variation is observed in the cropping pattern mainly to cope up with drought during normal season and drought season. But variation is observed in the cropping pattern of underdeveloped and progressive villages. In the underdeveloped village (Sulenahalli), groundnut was the major crop and the other crops were also growing as sole crops. Whereas, in the progressive villages Konasagar and BG Kere groundnut was the major crop grown and other crops were grown mostly as mixed crops. Moisture conservation measures like pebble mulching were also seen in small farmer holdings and in some medium farmer holdings. Therefore, with the cultivation of different crops in a small holding with soil and moisture conservation practices , the land productivity was more in these villages.

The category-wise variations in the cropping patterns owing to climatic and agronomic conditions are as follows:

(i) *Small farmers:* Most of the crops taken up by small farmers were kharif crops. Groundnut, sunflower, paddy, cowpea etc., were grown exclusively during kharif. Maize, redgram and onion were grown during kharif and rabi seasons. During the drought year, the major casualty was sunflower, paddy, maize, castor, onion and ragi. Thus, most of the crops which are grown during both the seasons or only during kharif season are affected adversely during the drought year. However, most of the small farmers have now shifted to planting horticulture crops. They were growing a mixed plantation with mango, sapota , drumstick,and pomegranate in their small holdings with pot method of irrigation.

(ii) *Medium farmers:* The crop range grown by medium farmers was almost similar to the small farmers. Castor is the new crop introduced in this area which was adopted mostly by the medium and large farmers and to a little extent by small farmers. The crops were introduced by agricultural department in order to discourage

groundnut crop in this area. This is because groundnut crop yield is decreasing in this area due to bud necrosis problem. Since this is related to viral problem which is soil borne, the entire area in the surrounding block was suffering as a result of which the yield of the crop is decreasing. The crops that were grown exclusively during kharif by the medium farmers were groundnut, castor and minor millets. The crops that were grown during both kharif and rabi were sunflower, paddy, maize and redgram. All these crops were adversely affected during drought season. Their production range during kharif of normal season was around 10 crops, whereas, during drought season it was confined to 5 crops. Similarly, their production range during rabi of normal season is around 5 crops, whereas, during rabi drought season all the crops were affected.

(iii) *Large Farmers:* The cropping pattern of large farmers is similar to that of medium farmers during normal season, with a production range of around 10 crops during kharif and 5 crops during rabi. The crops like sunflower, maize, castor, onion and ragi were badly hit during drought season. The production range during rabi crop is confined to one crop i.e. paddy to a limited extent.

4.5.5 Government Intervention

Government intervention is mainly through the introduction of crops like castor and onion. Castor is introduced mainly to discourage the groundnut crop. Onion is introduced through minikit trials. Though this crop was introduced initially on a small scale, the farmers found this crop to be profitable, hence, almost all the category of farmers have taken up this crop on a large scale which has resulted in market glut. The basic structure of the soil was loose in this area which is not suitable for the cultivation of this crop due to which the yield of the crop was less than average yield. The large scale cultivation of this crop by many farmers has resulted in market glut as a result of which the price of the crop has declined from Rs.460 per q to Rs.40 q resulting in the cultivation of the crop becoming highly unremunerative.

Selection of Seed Varieties

Farmers response to drought coping through cropping pattern has been assessed as mentioned above. The rationale behind the selection of seed varieties by the farmers is also assessed in order to find out the awareness about the drought resistant varieties on one hand and institutional support services received by them on the other hand which is observed from the Table 4.14.

4.14 : Selection of Seed Varieties : Source-wise and Category-wise Distribution of Farmers

		Small Farmers	Marginal Farmers	Large Farmers
1.	Using previously grown seed	12	13	10
2.	Consulting agricultural department	2	6	16
3.	Consulting neighbouring farmers	10	7	9
4.	Advice of shopkeepers/others	5	6	10
5.	Total number of farmers	30	30	30
6.	Total response	39	34	45
7.	Total number of farmers	30	30	30
8.	Number of farmers resorting for more than one source	9	4	15

The majority of small and medium farmers (12 and 13) utilise the crop produce stored from their previous crop as the seed. This is followed by agricultural department which is a key source of information for large farmers (16) followed by medium farmers (6) and small farmers (2). Neighbouring farmers and shopkeepers advice also plays a major role in the selection of varieties. Large section of the small farmers (33.33 per cent) and to some extent medium farmers (6.6 per cent) are unaware about the varieties. This shows that agricultural extension department is still not catering to the needs of majority of farmers particularly belonging to small and medium category.

Basis of Seed Selection

All the three category of farmers select the crop varieties based on high yielding and partly based on short duration and high yielding and the basis for selection of seed varieties is given in Table 4.15. A total ignorance about drought resistant varieties was found among all category of farmers.

Table 4.15 : Farmers Awareness About Variety

		Small Farmers	Marginal Farmers	Large Farmers
1.	Short Duration	0	0	0
2.	Drought Resistance	0	0	0
3.	High Yielding	26	27	20
4.	1 & 3	2	6	8
5.	1, 2 & 3	0	0	0

Introduction of New Crops

Another important mechanism for reduction of risk in growing crops which are more susceptible to drought is introduction of the new crops which may be more remunerative in terms of market or which may be more resistant to pests and diseases. The following aspects were explored from this point of view.

a) Introduction of new crops during last five years.

b) Reasons for growing new crops.

c) Economic feasibility of the crops and continuation with the new crop.

Introduction of New Crops

Table 4.16 : No. and Percentages of Farmers Growing New Crops During Last 5 Years

Category	New Crops
Small Farmers	16 (53.3)
Marginal Farmers	18 (60)
Large Farmers	22 (73.3)

• Figures in parentheses indicate percentage from sample.

The number and percentage of farmers growing new crops during last 5 years is given in Table 4.16. The table shows that more number of large farmers (72.3 per cent) have shown interest in the introduction of new crops in the last 5 years followed by medium farmers category who have introduced new crops. The range of crops introduced by all the category of farmers was almost same.

While small farmers have shown interest in the seasonal crops except drumstick, medium and large farmers were more interested in the horticulture crops.

Reasons for Growing New Crops

Majority of small farmers shifted to the new crops horticulture crops like Tamarind and drumstick mainly due to inaccessibility of irrigation. The medium farmers also shifted to these horticulture crops in addition to castor and onion. The small and medium farmers particularly in the progressive villages were raising 4 to 5 types of horticultural crops in the same plot with the help of an NGO. They are irrigating their plants through pot/pitcher method of irrigation which is a low cost drip irrigation method. In the main land, they are raising sapota, mango, drumstick and pomegranate and on the bunds of the plots in which they are cultivating seasonal crops and are raising tamarind and subabul. In some fields along the entire border of the field farmers have grown bamboo also. This process began since two to three years and the impact of these crops could not be captured. Some large farmers have gone for sapota crop but that is a sole crop. Since it is difficult for the large farmers to irrigate the large areas through pot system they have not adopted it. Some large farmers have shifted to the banana cultivation. Later they found that there is no immediate market (market access) for that crop and they cut the entire crop and planted sapota instead of it.

Table 4.17 : Crop-wise and Group-wise Distribution of Farmers according to Viability of New Crops

Crop	SF	MF	LF
Economically viable			
1. Castor	3 (33.3)	8 (66.6)	9 (60)
2. Drumstick	6 (66.6)	4 (33.3)	-
Economically unviable			
3. Castor	0	0	6
4. Drumstick	0	0	0
Total no. of respondents	9	12	15

• Figures in parentheses indicate per cent of total number of respondents.

The crop-wise and group-wise distribution of farmers observation according to the viability of new crops is given in Table 4.18. Though drumstick is a relatively new crop which is just two years old, majority of the small farmers (66.6 per cent) and some medium farmers (33.3 per cent) felt that it will give them good net returns followed by drumstick (66.6 per cent) and small farmers observed that castor is economically viable, whereas majority of the medium farmers (66.6 per cent) observed that castor crop is more remunerative. Among the large farmers there was some difference in opinion regarding the viability of castor crop. While 60 per cent opined that it is remunerative, 40 per cent opined that it is un-remunerative. The reason for un-remunerativeness being the price of castor is declining in the market to around Rs. 800 –1000 per quintal from Rs.1400 and Rs.1500 per quintal.

While all the category of farmers started growing castor crop as an alternative to groundnut crop, small and medium farmers felt that it is more viable compared to groundnut because of the increasing cost of cultivation of groundnut due to bud necrosis problem and decreasing yield and also due to inability to do irrigation during critical stages also. Groundnut crop needs 4 to 5 irrigations during its critical stages whereas for castor one irrigation or rainfall is enough to germinate and in later stages with or without rainfall it will give some minimum yield.

4.2.2 Land Leasing and Irrigation Status

Village-wise Status of Land

It is observed from the Table 4.18 that the total rainfed areas as a percentage of total land is more for small farmers with 73.6 followed by large farmers and medium farmers with 72.75 and 71.5, respectively. The total irrigated land as a percentage of total land was more for large farmers (27.25) followed by medium and small farmers with 26.4 and 23.6, respectively. There is no leased in land in case of irrigated land category. Whereas, large farmers have leased in more land (6 acres) followed by small farmers (4 acres) and medium farmers (2 acres) under rainfed areas category. Small farmers have leased out land of around 4 acres (21.9 per cent) from their total irrigated land. Whereas, medium and large farmers have not leased out any land under irrigated land category. Both large and small farmers have leased out land of one acre each under rainfed areas category, whereas, medium farmers have not leased out any rainfed areas.

Table 4.18 : Category-wise and Village-wise Distribution of Land Holdings (in Acres)

	Sulenahalli			Konasagar			B.G.Kere		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
				Irrigation					
Own	2.03	7.5	18.5	5.17	18.5	41	7	20	49.5
Leased-in	0	0	0	0	0	0	0	0	0
Leased-out	0	0	0	3 (36.7)	0	0	1 (12.5)	0	0
Total irrigation	2.03 (7.25)	7.5 (19.7)	18.5 (20.7)	8.17 (35.06)	18.5 (30.3)	41 (28.5)	8 (30)	20 (33.3)	49.5 (29.5)
				Dry					
Own	24.97	42.5	70.5	12.2	44.5	98.5	16.6	38.8	114
Leased-in	0	0	0	3	0	3	1	2	4
Leased-out	0	0	0	0	0	1	1	0	0
Total dry	24.97 (89.1)	42.5 (80.2)	70.5 (79.2)	15.2 (6.52)	44.5 (72.9)	102.5 (71.4)	18.6 (169.9)	40.83 (67.12)	118 (70.4)
Total land	27	50	89	23.3	61.63	143.5	26.6	60.83	167.5
Avg.size of holding	2.8	5.0	8.9	2.3	6.1	14.3	2.5	6.3	16.7

- Figures in parentheses indicate percentage from total.

Table 4.18 shows village-wise and farmers category-wise area under owned holding and leased-in land status. The phenomena of leasing-in and leasing-out of both irrigated and rainfed areas was completely absent in the underdeveloped (Sulenahalli) village. Whereas, in the progressive villages leasing-in of irrigated land was also absent in all the category of farmers. Wheras, leasing-in of rainfed areas is seen in all the three category of farmers in both the progressive villages of Konasagar and B.G.Kere, except medium farmers of the village Konasagar. Small farmers of the Konasagar village have leased out around 37 per cent of irrigated land, whereas the same category in B.G.Kere village have leased out around 13 per cent of irrigated land. The average size of holding of all the three category of farmers in the under-developed village (Sulenahalli) was less than the other two progressive villages Konasagar and B.G.Kere.

Table 4.19 : Number and Percentage of Farmers having Different Categories of Land

	Small Farmers	Medium	Large
Own Land	8 (26.6)	22 (73.3)	28
Leased-in Land	0	0	0
Leased-out	2 (6.6)	0	0
Total Irrigated	10	22 (73.3)	28 (93.3)
Own	30 (100)	30	30
Leased-in	0	0	0
Leased-out	0	0	0
Total Dry	30 (100)	30	30
Total Irrigated and Dry	40	52	58

- Figures in parentheses indicate percentage from total.

Table 4.20 : Distribution of Households according to Different Categories of Land (No.)

	Sulenahalli			Konasagar			B.G.Kere		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Own	1	6	6	4	7	10	3	9	12
Leased-in	0	0	0	0	0	0	0	0	0
Leased-out	0	0	0	2	0	0	0	0	0
Total irrigated land	1	6	6	4	7	10	3	9	12
Dry									
Own	10	10	10	10	10	10	10	10	10
Leased-in		0	0	0	0	0	0	0	0
Leased-out		0	0	0	0	0	0	0	0
Total dry	10	10	10	10	10	10	10	10	10
Total land	11	16	16	14	17	20	13	19	22

It is seen from the Tables 4.18,4.19,and 4.20 that a total of 8 small farmers possess the irrigated land of around 18.2 acres. Among the 8 farmers, 2 farmers have leased out 4 acres of land. In B.G.Kere, all the 30 sample households of small farmers possess the dry land of around 58.7 acres. The medium and large farmers possess the dryland of around 127.83 and 291 acres, respectively. The 30 sample households of medium and large farmers possess irrigated land of around 46 acres and 109 acres, respectively. Out of the 8 small farmers who possess the irrigated land, the farmers of the progressive villages Konasagar and B.G.Kere possess more irrigated land than the village Sulenahalli. Between the two progressive villages, more number of medium and large farmers of B.G.Kere possess irrigated land than the farmers of Konasagar village.

4.2.1 Livelihood Diversification and Sources of Income

An attempt was made to collect the data regarding various sources of income for all the three category of farmers, in order to capture the ways of coping during drought.

Table 4.21 shows the source-wise average household income for different categories of farmers in underdeveloped and developed village. In all the three villages agriculture remains to be the major source of income. A very significant difference was found in the income levels of the different categories of farmers in all the three villages and also in the sources of income.

One important observation is that there was not much difference in the total income of small, medium and large farmers in the underdeveloped (Sulenahalli) village. Though the total income of all the category farmers in progressive villages was higher than the underdeveloped village, the difference in income between small and large farmers was substantially large. Eighty-nine per cent of the total income of the small farmers comes from the agriculture in village Sulenahalli. The same figures for the other two villages, i.e., Konasagar and B.G.Kere are nearly ninety-two per cent. Thus reliance on agriculture as the main source of income of small farmers is more in the progressive villages. The other major source of income of the small farmers were wage employment (3.6 per cent) and agricultural labour (4 per cent) in case of the underdeveloped village (Sulenahalli). Under more developed conditions, livestock emerged as a second main source of income though its relative contribution is less than even two per cent. Large farmers in these villages mostly depend on poultry as a source of income. Some large and medium farmers also depend on the sale of milk as a secondary source of income. This also reflects that farmers under adverse conditions adopt multiple livelihoods rather than being dependent on just one source.

Overall, considering the different sources of income for small farmers, it may be concluded that wage employment and agricultural labour taken together were important sources of livelihood in terms of income generation, besides agriculture, in the underprogressive villages. Whereas, in the progressive villages, agriculture was the main source of livelihood for small farmers and other sources, especially the livestock sector plays the secondary role. While the overall household total income of all the three category of farmers of progressive villages was more or less comparable, there is a large variation in the income of these farmers with that of farmers in underdeveloped (Sulenahalli) village.

Table 4.21 : Source-wise Distribution of Average Income Distribution of Households according to Different Categories of Land (No.)

	Sulenahalli			Konasagar			B.G. Kere		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Agri	121309	313153	418919	263955	774343	1482597	223112	806607	1544659
	(89.3)	(97.7)	(97.9)	(92.5)	(98.1)	(98.6)	(91.6)	(98.7)	(98.7)
Rent	0	0	0	1500	0	0	1000	0	0
			(2.9)			(2.16)			
Livestock	3000	1650	6000	5400	9300	17500	6700	8900	17900
	(2.2)	(0.5)	(1.4)	(1.8)	(1.1)	(1.1)	(2.7)	(1)	(1.14)
Agri Lab	5500	0	0	6000	0	0	5000	0	0
	(3.6)			(2.1)			(2)		
Wages	5000	4500	0	5600	3400	0	6100	0	0
	(3.6)	(1.4)		(1.9)	(0.4)		(2.5)		
Others	1000	1050	2900	2650	1950	2910	1500	1680	1850
	(0.7)	(0.3)	(0.6)	(0.9)	0	(0.1)	(0.6)	(0.2)	(0.1)
Total	135805	320353	427819	285105	788993	1503007	243412	817187	1564405
	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)

• Figures in parenthesis indicate per cent from total.

Marketable Surplus and Marketing

An assessment of the relative proportion of the three categories of farmers in total marketed surplus and the decline in the marketed surplus for each of the category during the drought is made. Table 4.22 (a and b) and 4.23 sums up commodity-wise and crop-wise.

Category-wise Share in Marketed Produce

Table 4.22 : (a) Category-wise Sale of Marketable Surplus (Normal Year)

Cate-gory	Maize	Sunfl-ower	Paddy	Cow-pea	Groun-dnut	Red-gram	Castor	Onion	Jowar	Bajra
SF	277.2	60	118.5	0	140.6	21.5	46.2	106	0	0
MF	423	186	384.5	4.5	232	8.5	216	845	0	0
LF	707	192	931	0	727	112	365.5	128.8	0	22

Table 4.22 : (b) Category-wise Sale of Marketable Surplus (Drought Year)

Cate-gory	Maize	Sunfl-ower	Paddy	Cow-pea	Groun-dnut	Red-gram	Castor	Onion	Jowar	Bajra
SF	61.75 (-77)	60 (0)	0 (-100)	0 (0)	25.1 (-82.1)	0 (-100)	79.8 (72.7)	0 (-100)	0 (0)	0 (0)
MF	105.5 (-75)	0 (-65.5)	64199 (-48.2)	0 (0)	103	0 (-100)	0	0 (0)	0 (0)	0 (0)
LF	287 (-59.4)	64 (-66.6)	475 (-48.9)	0 (0)	166.25 (-77.1)	0 (-100)		0 (-100)	0 (-100)	11 (-50)

- Figures in parentheses indicate per cent decline from the normal year.

Table 4.23 : Relative Share of Different Category of Farmers in Total Marketed Surplus

Normal Year (Quantity in Quintals)								
Category	Maize	Sunflower	Paddy	Cowpea	Groundnut	Redgram	Castor	Onion
SF	19.6	13.6	8.2	0	12.7	15.1	7.3	4.7
MF	30.05	42.4	26.8	100	21.09	5.9	34.4	37.7
LF	50.2	43.8	64.9	0	66.1	78.8	58.2	57.5
Total	100	100	100	100	100	100	100	100

Table 4.23 : *(Contd.....)*

Drought Year (Quantity in Quintals)								
SF	13.5	31.90	0	0	8.5	0	16.3	0
MF	23.2	34.04	29.5	0	34.9	0	24.6	0
LF	63.1	3	70.4	0	56.4	0	59	0
Total	100	100	100	100	100		100	0

During the normal year though the share of large farmers was more for many commodities like maize, paddy, groundnut, redgram, castor and onion (Table 4.23). The share of small and medium farmers together was also on par with the share of large farmers. An interesting phenomena was during the period of drought the share of large farmers has decreased and small farmers has increased for certain commodities like sunflower, castor etc.i.e the marketed surplus of large farmers has declined more than the small and medium farmers for these crops. Whereas, the share of small and medium farmers has further decreased for some commodities like maize, groundnut etc with a decline in marketed surplus to –77.7 and – 82.1 per cent. The share of small farmers was almost absent for the crops like paddy during drought period.

Financial Risk

Table 4.24 : Income from Agriculture (Rs./Q)

Category	Maize	Sunflower	Paddy	Groundnut	Redgram	Castor	Onion	Total
Normal Year								
SF	133056	60000	59250	154660	21500	64680	42400	535546
MF	203040	186000	192250	232000	9350	216000	211250	1249890
LF	339360	230400	558600	799700	112000	511700	32200	2583960
Total	675456	476400	810100	1186360	142850	792380	285850	4369396
Drought year								
SF	29640	60000	-	35140	-	95760	-	220540 (-58)
MF	52750	89600	159200	164800	-	140000	-	606350 (-51)
LF	143500	83200	380000	266000	-	460800	-	1333500(-48)
Total	225890(-66.5)	232800 (-36)	539200(-33.4)	465940 (-60.7)		696560(-12.09)		2160390(-50.5)

The financial risk by the farmers at the time of drought depends on the factors; a) Quantity of the produce marketed, b) Price received for the product. In general it was observed that the source of marketed surplus for small and medium farmers has decreased for some crops like maize, groundnut and paddy and increased for some other crops like sunflower and castor during the drought year. The price variations during the drought affect the small and medium farmers more adversely as they received less prices compared to large farmers, hence the decline in income due to drought is felt more acutely by these two categories of the farmers. The Table 4.24 shows the income received by the different categories of farmers during the normal year and drought year. It can be observed that decline in income of the small farmers during the drought year due to decline in marketed surplus was high to other categories with 58 per cent. Similarly the income of the medium farmers declined by 51 per cent as against 48 per cent decline in the income of the large farmers. Commodity-wise analysis shows that the income loss was more for maize crop followed by groundnut and sunflower. The loss in castor was less with around 12 per cent. Thus relatively castor crop was more resistant to financial risk in times of drought.

Source-wise Marketing / Sales

Almost all the category of farmers were selling their produce to the outside traders in the nearby town .Though majority of all the small and medium farmers (11 out of 17) have sold their maize produce to outside traders, 6 farmers have sold their produce at agricultural produce market yard being procured by MARKFED at minimum support price (Table 4.25). While the MSP of maize at that time was Rs.440./Q.The small and medium farmers have sold their produce to outside traders at an average price of Rs.390 to 400 per quintal. Whereas, majority of large farmers (35.2 per cent) have sold their produce at government market yard. This is largely due to quality of their produce, while the small and medium farmers are unaware about the maintenance of quality of the produce. Hence, their maize produce was not procured to an extent like that of large farmers. Though paddy was procured by FCI for all the three category of farmers some small (2) and medium (6) farmers have sold it at outside market also. Outside traders in nearby town are the major institution purchasing some produces in the village itself but that too at a minor instance. Since the number of marketing channels is less, a large number of traders are exploiting.

Table 4.25 : Sale / marketing of Agricultural Produce

Crop	SF	MF	LF
Maize			
1.	5	6	4
2.	0	0	0
3.	2	4	8
4	0	0	0
Total	7	10	12
Sunflower			
1.	5	13	14
2.	0	0	0
3.	0	0	0
4.	0	0	0
Total	5	13	14
Paddy			
1.	2	6	0
2.	0	0	0
3.	4	22	30
4	0	0	0
Total	6	28	30
Cowpea			
1.	12	6	7
2.	0	2	0
3.	0	0	0
4.	0	0	0
Total	12	8	7
Groundnut			
1.	27	26	17
2.	3	4	4
3.	0	0	13
4.	0	0	0
Total	30	30	0

Table 4.25 : *(Contd.....)*

Crop	SF	MF	LF
Redgram			
1.	4	9	2
2.	2	4	0
3.	0	0	3
4.	0	0	0
Total	6	13	5
Castor			
1.	6	5	2
2.	0	0	0
3.	0	3	4
4.	0	0	0
Total	6	8	6

Credit and Insurance

Table 4.26 : Category-wise Farmers Availing Credit

	Small	Medium	Large
Institutional	11 (36.6)	18 (60)	30 (100)
Non-Institutional	19 (63.3)	12 (40)	-
Interest charges	38.8	28.5	12.15

- Figures in parentheses indicate percentage total.

It is observed from the Table 4.26 that 63.3 per cent of small farmers were availing non-institutional credit and 36.6 per cent were availing institutional credit, whereas 60 per cent and 40 per cent of medium farmers were availing institutional and non-institutional credit, respectively. Almost all the sample households of large farmers were availing institutional credit since majority of small farmers were availing non-institutional credit, the average interest rate charged for them was 38.8 per cent whereas for medium and small farmers it was 28.5 per cent and 12.15 per cent respectively.

Table 4.27 : Purpose for which Credit is taken

	Purpose	Small	Medium	Large
1.	Crop loan	7 (23.3)	11 (36.6)	14 (46.6)
2.	To purchase tractor/tiller	0	1 (3.3)	4 (13.3)
3.	To purchase cart	1 (3.3)	2 (6.6)	0
4.	To purchase submersible pump	1 (3.3)	3 (10)	9 (30)
5.	Agricultual equipment	3 (10)	1 (3.3)	3 (10)
6.	Bullock	2 (6.6)	2 (6.6)	0
7.	Household consumption	16 (53.3)	10 (33.3)	0

- Figures in parentheses indicate percentage to the sample.

Purpose of Credit

Household consumption was the major purpose (53.3 per cent)for which loan was availed by small farmers both from institutional as well as non-institutional. 23.3 per cent of the small farmers avail the loans for crops (4.27), whereas majority of large farmers (46.6 per cent) and medium farmers (36.6 per cent) avail the loans for crops. Other than crop loans, household consumption was a major purpose of availing the credit for medium farmers. Whereas other than crop loans, large farmers avail the credit for enlarging their irrigation base as well as for agricultural equipment. Therefore, household consumption was the major purpose for which the credit was being availed by small and medium farmers. Therefore, some provision must be made to provide institutional credit for households consumption to small and medium farmers.

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Chapter - 5

RISK AND VULNERABILITY IN RAINFED AGRICULTURE–RAJASTHAN

5.1 Household Profile

As per the study design totally 90 respondents (farmers) were interviewed covering 30 farmers from each category *viz.,* Small Farmers (SF), Medium Farmers (MF) and Large Farmers (LF), using pre-structured questionnaire and Focus Group Discussions (FGD) in three villages in Jodhpur and Alwar districts of Rajasthan. In this chapter, the primary information collected in the sampled villages were analysed and discussed under various sub-headings.

5.1.1 Socio-economic Features

In pursuance of Table 5.1, it was evident that the literacy rate among the three categories was dominated by large farmers followed by medium and small farmers. In all the three villages, small farmers have recorded lower literacy rate as compared to the other two categories. It was noticed that the literacy rate considerably varied between small, medium and large farmers. Among the three study villages, progressive villages have recorded better annual household income compared to the control village (Jhanwar). Among the three villages, small farmers of Bhawonta were able to produce good yields due to better irrigation facilities because of Johads (or SMC works) as compared to the other two villages.

The total annual household income in progressive villages was considerably higher compared to the controlled villages. It is also noticed that there was significant difference in the annual household income among the three categories of farmers. The total annual household income of small farmers of Bhawonta village was Rs. 35,850 as compared to the other two study villages. This was mainly due to high crop productivity because of protective irrigation facilities and soil and moisture conservation (SMC) works.

The agricultural household income is affected in all the villages due to severe successive droughts for the last five years and lack of ground water for protective irrigation. Hence, the productivity of all the crops was affected in the entire State.

Table 5.1 : Socio-economic Profile of Sample Households

Villages	Bhawonta			Palri Mangalia			Jhanwar		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Average Family Size	5	0	0	7	7	11	6	7	12
Literacy (Per cent)	45	0	0	51	57	62	48	59	61
Average Number of Workers in Family	3	0	0	4	4	6	3	4	6
Annual Household Income (From all Sources)	35850	0	0	17700	22000	54500	15000	17100	20600
Annual Household Income (From Agriculture*)	25000	0	0	9500	11000	28500	9600	12000	17000
Average land holding (Acres)	4.8	6.1	10.9	5.8	4.8	6.1	10.9	5.8	4.8

* Market value of the gross agricultural output is taken as income from the agriculture.

5.1.2 Land Ownership

In pursuance of Table 5.2, the total area under rainfed areas cultivation was maximum with 412.64 acres as compared to that of total irrigated land (168.36). As the study villages fall under the arid and semi-arid regions of the State, maximum landholdings are under the rainfed areas cultivation and minimum land under the irrigated conditions. Among the three study villages, land holding under the categories of leased-in and leased-out were not noticed. Among the three categories of farming communities, small farmers have recorded maximum landholdings both under irrigated land and rainfed areas with 100.36 acres and 140.64 acres, respectively. While among medium and large farmers, large farmers have higher land holdings as compared to the medium farmers by the virtue of their average land holdings.

The overall average land holding in the study villages was only 5.8 acres. However, the small farmers are holding an average land of 4.8 acres, medium with 6.1 acres and large farmers with 10.9 acres, respectively.

Table 5.2 : Category Land Ownership (area in acres)

	Small (50)	Medium (20)	Large (20)	Total
Irrigated				
Own Land	100.36	25	43	168.36
Leased-in Land	0	0	0	0
Leased-out	0	0	0	0
Total irrigated	100.36 (41.4)	25 (20.0)	43 (19.72)	168.36 (29.0)
Dry				
Own	140.64	97	43	280.64
Leased-in	0	0	0	0
Leased-out	0	0	0	0
Total dry	140.64 (58.6)	97 (80.0)	175 (80.28)	412.64 (71.0)
Total irrigated and dry	240	122	218	580
Average size of holding	4.8	6.1	10.9	5.8

* Figures in parentheses indicate average holding size in each category.

Livestock

From the Table 5.3, it is noticed that the number of livestock noticed in small farmers category was maximum as compared with the medium and large farmers. This is basically due to high number of respondents in the category of small farmers when compared to the other two categories. On an average per household of buffaloes (1.36), cows (2.8), she-buffaloes (2.7) are more in number with the small farmers as compared to that of medium and large farmers. This was basically because the small farmers were dependent on the farming activities as well as livestock for their livelihood.

Among the progressive villages, Palari Mangalia recorded more number of livestock than the Bhawonta. On an average the small ruminants per household are more in Palari Mangalia as compared to other two study villages (Table 5.4). In all the three study villages ploughing operation was carried out utilising the tractor facilities (@300 per hour per acre). Hence, less emphasis was given for maintenance of bullocks and buffaloes as compared to the cows, she-buffaloes and small ruminants.

Table 5.3 : Livestock Assets (No.)

Category	Bullocks	Buffaloes	Cows	She-buffaloes	Goats/Sheep
Small (50)	34 (0.68)	68 (1.36)	140 (2.8)	135 (2.7)	238 (4.76)
Medium(20)	19 (0.95)	21 (1.05)	34 (1.7)	38 (1.9)	120 (6.00)
Large(20)	10 (0.50)	14 (0.70)	42 (2.1)	50 (2.5)	187 (9.35)

- Figures in parentheses indicate average livestock in particular category.

Table 5.4 : Village-wise Distribution of Livestock

	Bhawonta			Palri Mangalia			Jhanwar		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Bullocks	18	0	0	10	13	6	6	6	4
	(0.36)			(0.2)	(0.65)	(0.3)	(0.12)	(0.30)	(0.20)
Buffaloes	26	0	0	26	13	8	16	8	6
	(0.52)			(0.52)	(0.65)	(0.4)	(0.32)	(0.40)	(0.30)
Cows	64	0	0	55	21	30	21	13	12
	(1.28)			(1.1)	(1.05)	(1.5)	(0.42)	(0.65)	(0.60)
She-buffaloes	56	0	0	46	23	31	33	15	19
	(1.12)			(0.9)	(1.15)	(1.55)	(0.66)	(0.75)	(0.95)
Goat/ sheep	128	0	0	68	73	106	42	47	81
	(2.56)			(1.36)	(3.65)	(5.3)	(0.84)	(2.35)	(4.05)

- Figures in parentheses indicate average livestock in particular category.

5.1.3 Implements

Most of the small farmers were not maintaining their own wooden ploughs which were not used under present day conditions, as most of the farmers utilise the tractor-drawn implements for land preparation. Intercultural practices are carried out with bullock/buffalo-drawn implements. Apart from these implements, every farmer of Bhawonta village owns an electric motor or oil engines. Among the three categories of farming communities, small farmers and large farmers possess more of bullock drawn implements compared to the medium farmers (Tables 5.5 and 5.6). It is also noticed that the small farmers

Table 5.5 : Implements

Category	Plough	Tractors/ Threshers	Bullock Cart	Electric Motor/ Oil Engine
Small (50)	56 (1.12)	0	50 (1.0)	54 (1.08)
Medium (20)	18 (0.9)	2 (0.1)	17 (0.85)	6 (0.12)
Large(20)	23 (1.15)	5 (0.25)	24 (1.2)	18 (0.9)

- Figures in parentheses indicate average livestock in particular category.

were not in a position to own any tractor. The tractors are more in number with large farmers when compared to medium and small farmers because they utilise tractors not only for agricultural purposes but also for mining (drilling and transportation).

Table 5.6 : Village-wise Distribution of Implements

	Bhawonta			Palri Mangalia			Jhanwar		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Ploughs	28 (0.56)	0	0	19 (0.38)	11 (0.55)	15 (0.75)	9 (0.18)	7 (0.35)	8 (0.40)
Tractors	0	0	0	0	2 (0.10)	3 (0.15)	0	0	2 (0.10)
Bullock carts	24 (0.48)	0	0	16 (0.32)	10 (0.5)	16 (0.8)	10 (0.2)	7 (0.35)	8 (0.40)
Electric motor /Oil Engine	38 (0.76)	0	0	14 (0.28)	4 (0.2)	13 (0.65)	2 (0.04)	2 (0.10)	5 (0.25)

- Figures in parentheses indicate average in that category.

Among the study villages, the control village possesses less number of implements compared to the progressive villages. Due to severe drought conditions, farmers of control villages have lost their interest in agriculture and slowly shifting towards the wage employment in the adjoining Jodhpur city. While, in Palari Mangalia the small farmers are involved in mining as labourers with the wage ranging from Rs.60–120 based on their nature of job.

5.2 Agriculture – Risk, Vulnerability and Coping Mechanism

Rajasthan State was severely affected by drought for the sixth consecutive year. The study villages, which were falling under the arid and semi-arid regions of Rajasthan, are considerably affected by the drought. In view of the prevailing situation, to understand the risk and vulnerability of drought on the agriculture sector, few indicators are used to understand the risk faced by the agriculturists.

i. Change in cropping system and cropping pattern

ii. Change in cropped area, output and yield

As indicators of coping mechanism and institutional support systems, the following parameters were used:

a. Selection of varieties

b. Input management

c. Adoption of soil and moisture works

d. Irrigation management

e. Livelihood diversification

f. Market surplus and market dependency

g. Availability and dependency on institutional support system.

5.2.1 Cropping Pattern, Production and Productivity

The details of net cropped area, areas sown more than once and gross cropped area are presented in Table 5.7. The total irrigated area of the three villages is 168.36 acres, of which 59.6 per cent fall under the category of small farmers followed by 25.5 per cent under medium farmers and 15 per cent under large farmers, respectively. A similar trend is noticed in case of rainfed areas. Out of the total 580 acres of net cropped area, 41.1, 21.0 and 37.9 per cent falls under small farmer, medium farmer and large farmer category, respectively.

Table 5.7 : Cropped Area

	Small	Medium	Large	Total
Irrigated	100.36	25	43	168.36
Dry	140.64	97	175	412.64
Net Cropped Area	241	122	218	581
Area sown more than once	78.5 (24.7)	9 (6.9)	14 (6.0)	101.5 (15.0)
Gross Cropped Area	318.5	131	232	681.5
Intensity of cropping	132.7	107.4	94	117.5
Average holding size	4.7	6.1	13.05	-

- Figures in parentheses indicate average in that category.

The area sown more than once was highest in case of small farmers with 24.7 per cent of gross cropped area followed by medium farmers with 6.9 per cent and large farmers with 6.0 per cent which has resulted in high cropping intensity in case of small farmers with 132.7 per cent followed by medium and large farmers with 107.4 and 94 per cent, respectively.

5.2.2 Irrigation Coverage

The selected study village falls under the arid and semi-arid regions, hence a meager area of 29 per cent of the total net cropped area falls under irrigated area. Nearly 71 per cent of the total cropped area was under rainfed areas condition. 41.6 per cent of netcropped area of small farmers was under the irrigated conditions (Table 5.8).

The maximum area under irrigation condition was noticed in Bhawonta village under small farmers category followed by large farmers and medium farmers of Palari Mangalia village. The soil and moisture conservation such as internal bunding and Johad (traditional percolation pond) across the Aravalli valley has resulted in improving the ground water table in Bhawonta village from >1000 feet to 600 - 800 feet. This has resulted in better irrigation facilities

Table 5.8 : Category-wise and Village-wise Net Cultivated Area

	Bhawonta			Palri Mangalia			Jhanwar		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Irrigation									
Own	70.5	0	0	15.5	19.5	25	14.36	5.5	18
Leased-in	0	0	0	0	0	0	0	0	0
Net cultivated area	70.5	0	0	15.5	19.5	25	14.36	5.5	18
Dry									
Own	76.5	0	0	34	50	76	29.5	47	142
Leased-in	0	0	0	0	0	0	0	0	0
Total dry	76.5	0	0	34	50	76	29.5	47	142
Total land	147	0	0	49.5	69.5	101	43.86	52.5	160
Avg. cultivated area	4.9	0	0	4.9	6.9	10.1	4.3	5.2	16.0

in Bhawonta village. Available irrigation facilities have influenced the farmers to adopt different cropping systems. The crops adopted by the farmers based on irrigation facilities and moisture availability for the crop period, different crops cultivated in Kharif and Rabi seasons by different categories farmers is presented in Table 5.9.

It is evident from the Table 5.9 that bajra, wheat, barley and mustard were the major crops cultivated in all the three villages, which can meet their food security. Maize and Bengal gram were also cultivated during Kharif to meet their domestic requirements. CAZARI and TBS have conducted various awareness creation and capacity building programmes to convince farmers to adopt high yielding and drought-resistant varieties in order to reduce the crop growth period and complete the crop cycle within the available moisture. These programmes have created a lot of awareness for the farming communities. Hence, the farmers of all the three villages have adopted sowing of HYV, drought-resistant and short duration varieties for cultivation of crops during the aberrant weather conditions.

5.2.3. Area and Production – Farmers Vulnerability

Small Farmers Vulnerability

The details of cropped area, production, yield and marketed surplus for the small farmers during the present drought year is given in Table 5.10. There is drastic yield reduction due to delay, abrupt ending and failure of monsoons during tillering, flowering and grain filling stage accompanied with low moisture holding capacity and high temperatures. As drought has become the common phenomenon, farmers have lost their interest in agriculture and are trying to reduce the cost of cultivation by avoiding high cost inputs. During Kharif, farmers

Table 5.9 : Season-wise / Category-wise Crop Coverage

Crop	Normal Year		
	SF	MF	LF
Bajra	K, R	K, R	K, R
Bengal gram	K	K	K
Cumin	R	R	R
Moong	R	R	R
Moth	K,R	K	K
Wheat	K, R	K, R	K, R
Barley	K, R	K, R	K, R
Mustard	K, R	K, R	K, R
Gaur	R	R	R
Maize	K	K	K
Castor	K	K	K

are able to harvest enough produce for their domestic purposes, while during rabi, farmers are not able to harvest the crops due to above mentioned reasons. Due to low yields, except mustard and castor the small farmers are not able to market any other crop produce as the yields are self-sufficient for their consumption for the entire year as well certain part of the grain yield is stored for seed purpose. The marketable surplus of most of the crops has declined during the past five years due to drought.

Table 5.10 : Crop-wise Area and Production for the Small Farmers

Crops	Bajra	Moong	Moth	Wheat	Barley	Mustard	Gaur	Maize	Castor
Area	57	51	34.4	62.7	26.7	33.5	5.5	35.5	12.2
Production (Q)	256.5	25.5	13.76	1881	1068	536	1.65	335	6.1
Yield (Q / acre)	4.5	0.5	0.4	30	40	16	0.3	10	0.5
Quantity (Q.) marketed	0	0	0	0	0	536	0	0	6.1

Medium Farmers Vulnerability

Crop-wise area and production of the medium farmers is presented in Table 5.11. Due to irrigation facilities and large area under cultivation, the medium farmers were able to produce, a negligible quantity of produce was marketed though there was a drastic reduction in yield levels due to insufficient moisture during the high growth period of the crops. Sowing of crops such as gaur, maize and castor would not produce any produce due to moisture stress. The medium farmers were able to market the bajra, wheat and mustard crop produce to the extent possible due to decline in yield and potential yields were not harvested. They were not able to harvest the sown rabi crops due to severe drought.

Table 5.11 : Crop-wise Area and Production for Medium Farmers

Crops	Bajra	Moong	Moth	Wheat	Barley	Mustard	Gaur	Maize	Castor
Area	70.5	18	12.5	22.7	4	3.3	0	0	0
Production (Q)	282	9	6.25	635.6	160	49.5	0	0	0
Yield (Q/ acre)	4	0.5	28	40	15	0	0	0	0
Quantity (Q.) marketed	162	0	0	127	0	49.5	0	0	0

Large Farmers Vulnerability

Similar trends were noticed in case of large farmers as observed in medium farmers. They would not harvest the potential yields of moong bean, moth bean, gaur and maize crops. The surplus yields of the crops such as

bajra, wheat, barley, mustard and castor crop were marketed after meeting their domestic requirements. The crop-wise area and production for the large farmers is given in Table 5.12. Reduction in crop yields has not resulted in marketable surplus. In anticipation of drought, farmers take up sowing in the entire cultivable area with diversified crops in order to harness better quantity in spite of yield reduction.

Table 5.12 : Crop-wise Area and Production for the Large Farmers

Crops	Bajra	Moong	Moth	Wheat	Barley	Mustard	Gaur	Maize	Castor
Area	91	22.5	37	21	17.5	15	0	13	15
Production (Q)	318.5	11.25	27.75	525	612.5	150	0	156	11.25
Yield (Q/acre)	3.5	0.5	0.75	25	35	10	0	12	0.75
Quantity (Q.) marketed	197	0	0	138	192	150	0	0	11.25

5.2.4 Cropping pattern and diversification index

Among the various crops raised in the study villages, only nine important crops are grown in all the study villages. Due to severe drought during 2004–2005, certain crops like moth bean, barley, maize, gaur and castor were not cultivated. Among the important food crops, bajra and wheat are the two major crops cultivated in all the study areas (Table 5.13). Due to drought, the crops suffered in areas under small farmers category are barley, moong, moth, castor and gaur crops. While in case of medium farmers, crops such as maize, gaur and castor were severely affected. In case of large farmers, crops such as barley, maize, castor and gaur were not able to produce any yield due to the effect of drought.

The diversification index indicated that the medium farmers have wider diversification of crops with 28.2 followed by large farmers with 27.5 and small farmers with 14.3. The cropping pattern and diversification index is presented in Table 5.14. However, the diversification index indicates that the crop diversity is more in case of medium and large farmers compared to small farmers.

Table 5.13 : Category -wise and Village-wise Gross Cropped Area

Gross Cropped Area	Bhawonta			Palri Mangalia			Jhanwar		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Bajra	18	0	0	17	34.5	36	22	36	55
Moong	0	0	0	26	9	19	25	9	3.5
Moth	0	0	0	15	6.5	8	19.4	6	29
Wheat	39.2	0	0	14.5	15.27	13	9	7.5	8
Barley	26	0	0	0	2.5	17.5	0	1.5	0
Mustard	15.9	0	0	12.8	1.8	8.5	4.8	1.5	6.5
Maize	33	0	0	0	0	13	2.5	0	0
Gaur	0	0	0	5.5	0	0	0	0	0
Castor	9	0	0	3.2	0	15	0	0	0
Gross Cropped Area	141	0	0	94	69.5	116	82.7	61.5	102

Table 5.14 : Cropping Pattern and Diversification Index

Crop	SF	MF	LF
Bajra	57 (17.8)	70.5 (53.8)	91 (39.2)
Moong	51 (16)	18 (13.7)	22.5 (9.6)
Moth	34.4 (10.8)	12.5 (9.5)	37 (15.9)
Wheat	62.7 (19.6)	22.7 (17.3)	21 (9.05)
Barley	26.7(8.3)	4 (3.05)	17.5 (7.5)
Mustard	33.5 (10.5)	3.3 (2.5)	15 (6.4)
Gaur	5.5 (1.7)	0	0
Maize	35.5 (11.1)	0	13 (5.6)
Castor	12.2 (3.8)	0	15 (6.4)
Gross Cropped Area	318.5	131	232
Diversification index	14.3	28.2	27.5

5.2.5 Drought and Cropping Pattern – Farmers Response and Coping Mechanism

The coping mechanisms adopted by the farmers to overcome drought are adopting HYV with drought resistance and short duration characteristics, providing protective irrigation, raising less water requirement crops, cultivation of hardy crops. Further, farmers opined that they avoid sowing of crops in the rabi seasons based on the weather forecast given by the CAZARI and TBS. If they have sufficient ground water for protective irrigation, farmers are cultivating rabi crops. In Bhawonta village, small farmers follow the cropping system of barley / wheat followed by maize or bajra. Further, the farmers have adopted mixed cropping system of wheat and barley in a ratio 4 : 2 in order to meet their requirements. While, in Palari Managalia, farmers have adopted bajra followed by moth bean / guar, or barley/wheat followed by moong bean / pearl millet. While in case of control village (Jhanwar) farmers have adopted tree-based cropping system that is agro-forestry system along with ber or Prosophis cineraria, bajra followed by moth bean is adopted. Presently. CAZARI has taken up farmer field demonstration castor with neem cake and few varietal trails of mustard crop with neem cake. The farmers were showing good response for the adoption of these practices in their fields.

To avoid conveyance loss, farmers of Palari Mangalia were spreading plastic sheets on the channels and later the water is allowed to flow on the plastic sheets to reduce the percolation and leaching loss. Few farmers plasted the irrigation channels with a indigenous mixture of lime stone : sand : clay in a ratio of 2:2:1 which, will reduce the conveyance loss. Further, few large farmers adopted sub-surface drainage system by laying the cement pipe from higher gradient to lower gradient to reduce electricity charges as well as conveyance losses.

Farmers have adopted the HYV with short duration and drought resistance varieties to overcome the drought and with an intention to complete the crop cycle with the available soil moisture. Farmers add lot of organic matter to the soil to increase the water holding capacity of the soils, due to high temperatures and the organic matter gets degraded at a faster rate.

Farmers develop sub-plots in the main fields during land preparation, which act as a soil and moisture conservation structures and allow rainwater to stagnate in the sub-plots for a longer period.

5.2.5 Government Interventions

The agriculture department and CAZRI had worked together in order to promote the adoption of HYV with short duration and drought resistance characters and adoption of INM in order to bring down the cultivation cost. The principle behind these technologies is to curb the cost of production in agriculture so as to increase the cost benefit ratio. The basic soil structure is fragile and loose hence, the soil loose is very high during summer and winter seasons. To avoid soil loss and to provide fodder to the small ruminants, CAZRI has promoted the agro-forestry system to act as a windbreak in all adopted villages under the institutional village linkage programme.

Table 5.15 : Selection of Seed Varieties : Source-wise and Category-wise Distribution of Farmers

	Small farmers	Medium farmers	Large farmer
Using previously grown seed	16	12	13
Consulting agricultural department	15	4	8
Consulting CAZRI	10	10	15
Consulting Tarun Bharath Sangh (TBS)	26	0	0
Advice of shopkeepers / others	0	0	0
Total number of farmers	50	26	29
Total response	67	20	20
No. of farmers resorting for more than one source	17	6	16

In case of small farmers of Bhawonta village, TBS is the major consultant for the farmers to adopt any new technology or to attend the crop related queries. They have also consulted the agriculture department for any of their queries.

In case of medium and large farmers, CAZRI is considered to be the reliable source to solve the farmers problems and provide timely information of the latest information etc. However, the function of agriculture department is not to the satisfaction of the farming communities. Only few medium and large farmers have sought the services of the agriculture department. It is also evident from the Table 5.15 that farmers do not rely on one source to meet their requirement, they have accessed all the available resources to solve their problems.

Table 5.16 indicates that majority of the farmers have adopted the variety, which have the characteristics of short duration, drought resistance and high yielding in nature.

Table 5.16 : Basis for the Selection of Seed Variety

	Small Farmers	Medium Farmers	Large Farmer
Short duration	0	0	0
Drought resistance	0	0	0
High yielding	0	0	0
1&3	15	3	7
1,2 & 3	35	17	13

Introduction of New crops

The concept of introduction of new crops is to encourage farmers to cultivate the crops which are more resistant to drought and can withstand the moisture for a longer period. In view of this, CAZRI and TBS conducted several exposure trips for the benefit of the farming communities to adopt the proven technologies, in the adjoining villages. Looking into the feasibility of the technologies and cropping systems adopted by the farmers, the visiting farmers had adopted certain technologies and cropping systems. Few of the farmers adopted new crops like brinjal, tomato, onion, fruit tree crops, roses, castor and mustard with neem cake and bio-fertilisers (Tables 5.17 & 5.18). It was the large farmers who adopted new crops on large scale as compared to

medium and small farmers. Presently, except the castor and mustard with neem cake and bio-fertiliser technologies and cropping system, none other new crops are being cultivated in the farmers field due to severe drought and lack of irrigation facilities. Fruit bearing tree crops such as ber pomegranate, badam and Emblica officinalis were cultivated all along the bunds of the main field. Prosophis cineraria were cultivated for the fodder purpose in order to avoid grazing of weeds, which cover the top soil and restrict the soil erosion.

Table 5.17 : No. and percentages of Farmers Growing New Crops During Last 5 Years

	Category	New Crops
	Small Farmers	8 (21)
	Marginal Farmers	13 (34)
	Large Farmers	17 (45)

Table 5.18 : Year of Introduction of Crops

Category	Year of Introduction (Crop)					
	1992	2001	2002	2003	2004	2005
Small Farmers	-	-	Castor with Bio-fertilisers	-	-	-
Marginal Farmers	Roses	-	-	-	-	-
Large Farmers	Vegetable Crops	-	Vegetable Crops	-	-	-

Reasons for Growing New Crops

Majority of farmers adopted new crops based on the availability of irrigation facilities and ground water. The next reason for adoption of new crops is the access to the technology through CAZRI and TBS. Vegetable and fruit crops were grown looking into their demand and market access. The large farmers

were able to cultivate 4-5 varieties of vegetable crops. Further, the fruit tree crops such as ber, Emblica officinalis, pomegranate and badam were cultivated by medium and large farmers all along the borders of the field. In progressive villages, farmers gave importance to the vegetable crops in order to meet the growing demand of vegetables. Lack of irrigation and continuous drought for the last five years resulted in stepping back by the farmers in cultivation of vegetable crops.

Table 5.19 : Reasons for Growing New Crops

Category	Demand	Market Access	Irrigation (Access/ Inaccess)	Access to technology	Total no. of Respondents
Small Farmers	0	0	5	3	8
Marginal Farmers	2	1	8	2	13
Large Farmers	1	1	8	7	17

The crop-wise and group-wise distribution of farmer's observation according to the viability of new crops is presented in Table 5.20. The farmers were able to analyse the economic viability of the seasonal horticulture crops and castor (oilseed crop), however, they were not in a position to analyse the fruit tree crops, as they have just introduced them four to five years back. Due to drought the plants were in poor conditions. 62.5 per cent of large farmers have accepted castor as economically viable crop, 50 per cent of medium farmers accepted tomatoes and 55.5 per cent of small farmers felt that castor is an economically viable crop, respectively. As castor being the hardy crop, it is still being accepted by all categories of farmers.

Table 5.20 : Crop-wise and Group-wise Distribution of Farmers According to Feasibility of New Crops

	Economically Viable	Small Farmers	Marginal Farmers	Large Farmer
1.	Castor	3	1	5
2.	Tomato	1	4	2
3.	Onion	5	2	1
4.	Roses	0	1	0
	Total no. of respondents	9	8	8

Due to subsequent droughts for the past five years, the farmers were finding it difficult to cultivate the vegetable and fruit crops. The fruit tree crops were able to survive because of exploiting the nourishment provided to the main crops during the kharif seasons. Due to lack of irrigation facilities, the vegetable crops were not being cultivated.

70-95 per cent of the farmers discontinued cultivation of new crops due to drought.

Table 5.21 : Percentages of Farmers Discontinuing with Crops due to Various Reasons

Name of the Crop and Reasons for Discontinuation		Small Farmers	Marginal Farmers	Large Farmers
1.	Drought (for last 5 years)	7	9	11
2.	Lack of Irrigation	1	4	6
	Total Respondents	8	13	17

5.2.6 Livelihood Diversification and Sources of Income

In pursuance of Table 5.22, it is noticed that there was much variation in the income between small, marginal and large farmers. In control villages, the other sources of income are from livestock, agriculture labour and wage employments in the adjoining Jodhpur city. The tree crop farming system promoted by CAZRI helps farmers to meet the requirement of fodder for their animals. In fact, this agro-forestry system is fetching better returns through the cattle / livestock management. The progressive villages were earning more from the livestock management when compared to the control villages, as fodder was one of the major issues in control villages.

In case of Palri Mangalia, apart from agriculture, livestock, agriculture labour and wage employment, the farmers have additional income from the mining. Most of the large farmers were owning mines and wholesale / retails shops for the sale of the chatrasal slabs. Because of this additional source of income, small and marginal farmers were able to earn Rs.80-120 per day based on the nature of job. During rainy season, the farmers were involved in agriculture, livestock management and agriculture labour activities, as the mines

get filled up by the rainwater. Hence, the income from mining during rainy season will be nil.

In Bhawonta village, farmers have an additional income from the carpet weaving and per month a family of 4-5 members were able to generate a carpet of size 10 X 10 feet that fetches them 7,000 to 10,000 based on the type of carpet. The raw material is obtained from the dealers and the finished product needs to be handed over within the prescribed time. The livestock management was going on in a big way hence, the farmers sell their excess manure @ Rs.500 per ton.

Table 5.22 : Source-wise Distribution of Average Income Distribution of Households According to Different Categories of Land (No.)

	Bhawonta			Palri Mangalia			Jhanwar		
	SF	MF	LF	SF	MF	LF	SF	MF	LF
Agri	25000	0	0	9500	11000	28500	9600	12000	17000
Livestock	3250	0	0	2000	3000	6000	1400	1600	3600
Agri Lab	3000	0	0	1700	2700	0	2000	1000	0
Wages	4000	0	0	1500	2800	0	2000	2500	0
Mining	0	0	0	3000	2500	20000	0	0	0
Others	600	0	0	0	0	0	0	0	0
Total	35850	0	0	17700	22000	54500	15000	17100	20600

Market Surplus and Marketing

An assessment of the relative proportion of the total marketed surplus and the decline in the marketed surplus for each of the category is presented in Table 5.23. This clearly indicates that in case of small farmers except mustard and castor no other crop is being sold, as the produce obtained from food crops is self-sufficient for their family requirements. While medium farmers were able to market bajra, wheat, barley, mustard crops and the large farmers were able to sell the bajra, wheat, barley, mustard, cumin and castor. However, the sale of certain crops such as moong, moth bean and maize has considerably reduced.

Table 5.23 : Category-wise Sale of Marketable Surplus

Category	Bajra	Moong	Moth	Wheat	Barley	Mustard	Gaur	Maize	Castor
Small Farmers	0	0	0	0	0	536	0	0	6.1
Marginal Farmers	162	0	0	127	0	49.5	0	0	0
Large Farmers	197	0	0	138	192	150	142	0	11.25

Source-wise Marketing / Sales

The farmers of all the three categories have sold their produce to either the outside traders visiting the village at the time of harvesting period or to the inside traders who had given credit for the crop production. Apart from these two options farmers have not sold their produce to any of the other sources. Due to severe drought, available produce for sale per farmer would be meagre and to avoid transportation charges they sell their produce to the traders visiting their villages.

The outside traders are the major institution purchasing farmers produces in the village itself. As mentioned earlier, due to less produce for sale and poor infrastructure such as road and transport facilities, the farmers are reluctant to take their produce to the wholesale markets or APMC yards.

Table 5.24 : Sale / Marketing of Agricultural Produce

Crop	Small Farmers	Marginal Farmers	Large Farmers
Bajra			
Outside Traders	0	12	16
Inside Traders	0	8	4
Villagers (directly)	0	0	0
Wheat			
Outside Traders	0	19	14
Inside Traders	0	1	6
Villagers (directly)	0	0	0

Table 5.24 : *(Contd.....)*

Crop	Small Farmers	Marginal Farmers	Large Farmers
Barley			
Outside Traders	0	0	15
Inside traders	0	0	5
Villagers (directly)	0	0	0
Mustard			
Outside Traders	37	8	18
Inside Traders	13	12	2
Villagers (directly)	0	0	0
Castor			
Outside Traders	32	0	12
Inside Traders	18	0	8
Villagers (directly)	0	0	0
Cumin			
Outside Traders	0	0	17
Inside Traders	0	0	3
Villagers (directly)	0	0	0

Credit Facilities

Among the three categories of farmers, only 10 per cent of small farmers had availed the institutional credit and the rest of the farmers had availed the non-institutional credit. The farmers are at a opinion that it is easy to get the non-institutional loans as compared to the institutional loans (Table 5.25).

Most of the farmers are not aware of the Kisan Credit Cards and crop insurance (Table 5.26). When discussed about the same with the agriculture department, they have displayed the pamphlets and paper advertisements made during 2004-05. The emphasis for the crop insurance is initiated only during

Table 5.25 : Credit Facility

Purpose	Small	Medium	Large
Institutional	5 (10)	0	0
Non-institutional	45 (90)	20 (100)	20 (100)
Interest charges	10	15	15

kharif 2004. Hence, agriculture department has taken up wide publicity of the crop insurance. The agriculture department is yet to dispose the crop insurance amount for the kharif season, 2004. If any of their relative or the villager gets benefited by the crop insurance, the entire village would be going for crop insurance and institutional credits.

Table 5.26 : Awareness about and utilisation of Insurance

Category	Aware	Unaware	Availed	Unavailed
Small Farmer	14	36	5	45
Medium Farmer	9	11	0	20
Large Farmer	16	4	0	20

Purpose for Credit

Among the three categories of farming communities, about 45 to 60 per cent of farmers availed the credit for the crop loans. The detailed purpose of credit as per the requirement of the small, medium and large farmers is presented in Table 5.27. The small farmers availed the credit for purchase of cart (28 per cent), purchase of submersible pump (14 per cent) and agricultural equipment (12 per cent). The medium farmers availed the credit to meet their requirements such as purchase of cart (20 per cent), purchase of tractor/tiller (15 per cent) and purchase of submersible pump (10 per cent). While large farmers had availed the credit for the purchase of tractor/tiller (25 per cent) and submersible pump (10 per cent). This clearly indicates that the farming community had availed the loan only for the agriculture purposes but not to meet their basic amenities.

Table 5.27 : Purpose for Credit

Purpose	Small	Medium	Large
Crop Loan	23 (46)	9 (45)	12 (60)
Purchase of Tractor/Tiller	0	3 (15)	5 (25)
Purchase of Cart	14 (28)	4 (20)	0
Purchase of Submersible Pump	7 (14)	2 (10)	2 (10)
Agricultural Equipment	6 (12)	1 (5)	1 (5)
Purchase of Bullock	0	1(5)	0

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Chapter - 6

MAIN OBSERVATIONS AND POLICY IMPLICATIONS

Effects of Drought

State	S.No.	Small Farmer	Medium Farmer	Large Farmer
Orissa	1.	Discontinuation of new crops	Discontinuation of new crops	-
	2.	Decline in the area under vegetables, pulses paddy sunflower, maize and cowpea	Decline in the area under sunflower, paddy, cowpea, vegetables and pulses	Decline in the area under maize, sunflower, paddy and vegetables
	3.	Decline in marketed output	Decline in marketed output	Decline in marketed output
	4.	Effect of price variation	Effect of price variation	-
	5.	-	-	Leasing-out the land
Karnataka	1.	-	Production range of crops has reduced from 10 to 5.	Production range of crops has reduced from 10 to 5.
	2.	Major casualty is for the crops sunflower,paddy, castor,onion ragi and maize	Major casualty is for the crops groundnut, sunflower, paddy, castor and maize	Major casualty is for the crops sunflower,castor, maize, onion and ragi.
	3.	Effect of price variation	Effect of price variation	-
	4.	Decline in marketed output	Decline in marketed output	Decline in marketed output

State	S.No.	Small Farmer	Medium Farmer	Large Farmer
Rajasthan	1.	Major casualty is for the crops barley, moong, mothbean, castor and guar crops	Major casualty is for the crops maize, guar,and castor	Major casualty is for the crops barley,maize,castor and guar.
	2.	Reduction in the application of inputs	Reduction in the application of inputs	-
	3.	Shifting to wage employment	Shifting to wage employment	Shifting to alternate livelihoods like mining
	4.	-	-	Reduction in the number of draft animals

Drought Coping Mechanisms

State	S.No.	Small Farmer	Medium Farmer	Large Farmer
Orissa	1.	Leasing-in the land	Leasing-in the land	-
	2.	Crop diversification	Crop diversification	Livelihood diversification
	3.	Migration	Migration	-
	4.	Increase in the area under rainfed cotton	Increase in the area under rainfed cotton	Increase in the area under cotton and pulses
Karnataka	1.	Mixed cropping and intercropping	Mixed cropping and intercropping	Horticulture and plantation crops
	2.	Crop mulching with sand and pebbles	Crop mulching with sand and pebbles	-

State	S.No.	Small Farmer	Medium Farmer	Large Farmer
	3.	Different types of horticultural plants in the same piece of land.	Different types of horticultural plants in the same piece of land.	-
	4.	Pot method of irrigation for horticultural plants	Pot method of irrigation for horticultural plants	-
	5.	Leasing-in the land	Leasing-in the land	-
Rajasthan	1.	Adopting HYV with drought resistant and short duration	Adopting HYV with drought resistant and short duration	Adopting HYV with drought resistant and short duration
	2.	Increase in the number of small ruminants	Increase in the number of small ruminants	-
	3.	Mixed cropping of wheat and barley in the ratio of 4 : 2	Inter cropping of bajra followed by moth bean/guar or barley/wheat followed by moong bean / pearl millet	Tree based cropping system with ber or prosophis ,bajra, followed by moth bean
	4.	-	-	Purchasing tractor so that they can use it for other purpose like mining.

- Not much variation was observed between the literacy rate of medium and large farmers. The literacy rate of small farmers was generally less than the other two categories.
- The average household income of all the categories of farmers of underdeveloped village was less than the developed village. In the

progressive villages the income of small and medium farmers was almost on par with the large farmers. In the under-progressive villages besides agriculture the other major sources of income are from wage employment and agricultural labour for small farmers and poultry and milk for medium and large farmers. Whereas, in the progressive villages, agriculture was the main source of livelihood for all the categories and livestock sector plays the second major source.

- In the progressive villages of Karnataka and Orissa irrigated land was more for medium and small farmers and in Rajasthan it was more for small farmers.

- The phenomena of land leasing was not observed in Rajasthan State, whereas, in the other two States the land leasing was more in progressive villages than in underdeveloped villages. In the progressive villages of Orissa, irrigated land was leased-in and in Karnataka dryland was leased in. The land was leased in mostly by the medium farmers followed by small farmers. Large farmers in both States were observed to be leasing out the land. Thus, land leasing is an important instrument proved to augment the production base and enhance income level for the small and medium farmers.

- Livestock in terms of draft, milch and small ruminant-based was more in the progressive villages than in the underdeveloped village. Though, the livestock was more for large and medium compared to small farmers, not much variation was observed between the two categories of large and medium farmers. Among the progressive villages, the village which is having more of irrigation facilities, draft animals were more and the village which is having less of irrigation facilities milch animals were more. This shows that milch animals provide income security to the farmers in areas with less irrigation facility.

- More number of implements was in the village with more irrigation facilities and draft animals. Between the small, medium and large farmers there is variation in the position of implements. The large farmers were having slightly less livestock but more number of implements than medium

farmers. This indicates the fact that the large farmers are moving towards mechanisation. In the progressive villages, the village where the area under own irrigated land holding was more, oil engines were also more in case of both large and small farmers. This established the fact that the investment in irrigation is directly proportional to the ownership of land and irrigation facilities.

- In the progressive villages, land utilisation appears to be in favour of small and medium farmers due to more area under irrigation and cropping intensity. This is due to relatively better cropping pattern and agronomic practices taken up by these farmers in these States.

- All the three categories select the crops varieties based on high yielding and partly based on short duration and high yielding. A total ignorance about the drought resistance varieties was found among the farmers. The extension and technological support by the government was more towards large farmers followed by medium farmers. The same by the NGOs was more for small farmers followed by medium farmers. For eg: In case of small farmers in a developed village, TBS (Rajasthan) is the major consultant for the farmers to adopt any new technology or to attend the crop related queries. In case of medium and large farmers agricultural department is considered to be the reliable source to solve their problems and provide timely and latest information.

- Crop diversification was the major coping mechanism observed in all the three States for droughts. The diversification index shows that small farmers cropping pattern was more diversified followed by medium and large farmers in the progressive villages of all the States both during normal as well as drought years. This shows that the large farmers were more vulnerable and their production risk was more compared to medium and small farmers.

- The determinants of crop diversification were different in different States. The determinant based on food security (For eg: Jowar and Bajra in Karnataka) or lack of irrigation (For eg: Cotton in Orissa) appeared to be more sustainable during all the periods, whereas, the determinants based

on technology induced (For eg: Jute in Orissa) or market induced (For eg: Onion and Vanilla in Karnataka) have led to failure.

- Lack of irrigation was the most important determinant of adoption of new crops followed by demand pattern, market access and access to technology. Majority of small and medium farmers shifted to the new crops mainly due to inaccessibility of irrigation. They have shifted to the horticulture crops like tamarind, drumstick and sapota (with pot method of irrigation). Therefore, the degree of risk aversion was directly related to the category of farmers in the progressive villages.

- Large farmers tried only cotton during the drought years and switched back to paddy during the normal years is mainly because of assured sales through public procurement. Thus, despite economic feasibility of a crop, assured market seems to be the main determinant of sowing the crop during normal season.

- The Government intervention was mainly through the introduction of new crops. This is to discourage some crops in some areas like castor in place of groundnut in Karnataka. In some areas like Orissa tomato and bengalgram were successful and jute was a failure and introduction of onion in Karnataka was a failure too. Jute was introduced without considering the market and onion was introduced without the consideration of suitability of soils. In the underdeveloped village of Rajasthan, CAZRI has taken up institutional village linkage programme to avoid soil loss and to provide fodder to the small ruminants through agro-forestry system which was a failure. This is mainly because institutions are adopting the villages to test their programmes at the field levels but not because the people need the technology. Therefore, to introduce a new technology, the socio-economic and marketing conditions for the technology must be considered.

- Non-market factors like pests and diseases, low productivity have been found to be more important detrimental factors than lack of market for discontinuation of a new crop.

- Though the share of marketed surplus has increased for small and medium farmers for some crops during the time of drought the total income was less for them due to relatively lesser price for their produce. This is partly due to the quality of their produce and partly due to their credit commitment to the traders. This shows that though the production risk of small and medium farmers was less during droughts, their financial risk is more when compared to the large farmers.

- Since small and medium farmers in the progressive villages were taking up land leasing activities to augment their production base some institutional arrangements need to be made in the form of credit for them to take up land leasing also. Once the land is leased by taking up credit from the institutional source then it will be easier for them to approach for other form of production support also.

- The major difference observed between underdeveloped and progressive villages was not the irrigation but the cropping pattern itself. The small and medium farmers have diversified their crops more when compared to large farmers. Since their financial risk was more, the diversification appears more due to default than market support. Therefore, crop diversification, must be encouraged which is need-based, technology-induced and price supportive.

Unique Coping Mechanisms Observed

KARNATAKA

- Sand, pebble mulching for the crops like sunflower, bajra and sorghum.

- Cultivation of four to five varieties of horticultural plants in a small area with pot method of irrigation.

RAJASTHAN

- Spreading plastic sheets in the water channels to reduce the percolation and leaching loss.

- Lining the irrigation channels with indigenous mixture of limestone: sand : clay in a ratio of 2:2:1 to reduce the conveyance loss.
- Adopting sub-surface drainage system by some large farmers by laying the cement pipe from higher gradient to lower gradient.
- Promotion of agro forestry system to act as a windbreak with Prosophis cineraria ,fruit bearing crops like ber, pomegranate, badam and emblica officinalis all along the bunds with 4 to 5 types of vegetables in the main field.

Important Policy Variables for Coping were found to be

- Institutional credit for land leasing and household purposes;
- Fodder based production system for livestock;
- Encouraging the role of NGOs in extension system;
- Price support and procurement mechanism for crops grown in rainfed areas;
- Need-based technology; and
- Awareness about insurance.

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RISK, VULNERABILITY AND COPING MECHANISMS IN RAINFED AGRICULTURE
A Study in Three States

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