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FARMERS' RISK COPING STRATEGIES IN RAIN-FED AGRICULTURAL REGIONS: AN EMPIRICAL STUDY FROM INDIA

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ABSTRACT

Drought is as natural as climate and its variability. We are motivated to conduct the present research study with a special focus on risk coping strategies of farmers in rain-fed agricultural States of Karnataka, Maharashtra, and Madhya Pradesh – in three out of the 'Big Five' States in India.

Through primary data, we found that there is a substantial decline of 71.8 per cent in the total income of the respondents in the three study regions during the drought period. The extent of inequality in the incomes in the sample households is also high at 0.87 (Gini-coefficient) during the normal rainfall year and this declined to 0.25 during the drought period indicating that the inequality in the income distribution of the sample group is relatively lower during the drought period. While large and medium farmers households are the worst affected due to occurrence of drought, small and marginal farmers are relatively unscathed as they might have depended on other sources of income during the drought period.

Most of the farmers could not repay the loans as they are unable to receive remunerative prices for their agricultural produce and some of them are expecting loan waivers from the government. Our results showed that adopting crop saving irrigation followed by cultivating long duration crops, and using family labour to reduce cost of cultivation are the most preferred strategies embraced by the farmers when they face early drought situation.

Keywords: *Risk Coping Strategies, Rain-fed Agriculture, Drought, Farmers, India, Karnataka, Maharashtra, Madhya Pradesh.*

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Introduction

There have been widespread debates as droughts had an adverse impact on 2,55,923 villages located across 10 States in India in 2016. Around 16 per cent of India's geographic area is drought-prone (Reserve Bank of India, 2013). In India, rain-fed agriculture accounts for 57 per cent of the total cropped area. Approximately 85 per cent of land holdings in India belong to small and marginal farmers who possess less than two hectares of land. As such, rain-fed agriculture hits the small and marginal farmers to the maximum; in fact, drought co-exists with the farmers, the society and the economy in India (Choudhury and Sindhi, 2017).

According to a study conducted by the Centre for the Study of Developing Societies, about 76 per cent of the farmers in India are ready to quit agriculture for better jobs, mainly due to the lack of proper inputs, inadequate extension services and non-remunerative prices, mounting debt, poor rural infrastructure and absence of proper market linkages. For every 43 minutes, a farmer commits suicide in India according to the annual report of National Crime Records Bureau, 2014; the highest number of farmer suicides was reported in Maharashtra, followed by Telangana, Madhya Pradesh, Chhattisgarh and Karnataka, which are referred to as the 'Big-Five' in India (Kaur & Kaur, 2016). A research study from Odisha State confirmed that 30 per cent of farmers commit suicide due to the loss of crops and 87 per cent of this loss is on account of droughts (Choudhury and Sindhi, 2017).

Though the small farmers are operating only on 44 per cent of the land under cultivation in India, they provide food and nutritional security to the nation; however, they have limited access to institutional credit, inputs, technology, and markets (Singh, 2016). The progressive fragmentation of landholdings, degradation of natural resource base and emerging concerns of climate change have been putting escalating pressure on the natural resources; hence, these natural resources are rapidly shrinking due to unsustainable use at an alarming rate, coupled with frequent occurrence of floods and droughts (Wilhite et al., 2014).

Drought causes enormous socio-economic and environmental problems and endangers the farmers' livelihoods and incomes, and undermines the viability of the agricultural sector's emergence as a solution to the problem of endemic poverty of farmers. To address these issues, farmers adopt various alternatives in their production, consumption and livelihood practices by following conservative measures. Over the centuries, farmers have developed indigenous techniques that have the potential to face any drought or natural disaster in the climate change regime; hence, the small and marginal farmers mastered the art of small farming to meet their subsistence needs without relying much on modern agricultural technologies (Denevan, 1995).

Of late, there has been a surge of interest in new market-based and traditional risk management instruments and approaches to manage the drought. It is also noticed that there is a shift from conventional cropping systems to commercial cropping systems. Institutional support for drought relief is largely available in India through community-based organisations, self-help groups, farmers' clubs, farmers' cooperatives, farmer producer organisations (FPOs), apart from the government agencies.

While there are many new instruments have emerged in the agricultural risk management domain like crop insurance, contract farming, etc., modalities to enable the sharing of knowledge and experience are absent, particularly to small and marginal farmers. Risk management strategies are currently operating in silos and lack a platform to share information, catalyse collaboration and discuss the best farming practices. Therefore, the piecemeal approach in managing agricultural risks is not serving the needs of the agriculture sector and majority of the farmers continue to lack knowledge of or access to risk management solutions. So, effective risk management in agriculture requires an understanding of the critical risks faced by the farmers and the solutions available to manage those risks.

In view of the above, we are motivated to conduct the present research study with a special focus on risk coping strategies of farmers in rain-fed agricultural States of Karnataka, Maharashtra, and Madhya Pradesh – in three out of the 'Big Five' States in India. We selected Bundelkhand region in Madhya Pradesh, Vidharbha region in Maharashtra, and rain-shadow region in Karnataka for the purpose of this study. We selected these three States as they face frequent droughts in India (Dogra, 2016). Through the current study, we propose to examine the risk-bearing strategies of the resource-poor farmers and facilitate the policymakers to develop appropriate strategies to face the drought conditions. Specifically, objectives of our study are as given below:

1. To examine the coping practices and risk-bearing strategies adopted by the farmers during the drought period,and

2. To evaluate the institutional arrangements towards drought-proofing and drought relief measures as part of the risk management architecture.

The rest of the paper is organised in the following manner: In the second section, review of literature is done. Research methodology is explained in the third section. Empirical analysis, based on our field study along with some policy recommendations are presented in the fourth section. The last section concludes the study.

Review of Literature

Drought is as natural as climate and its variability. As climate change is a common phenomenon, rainfall is expected to vary and dry regions will be the worst hit; intense and extreme droughts are predicted at higher frequencies in the near future (Choudhury and Sindhi, 2017). Droughts can be hydrological, meteorological, agricultural, and are based on rainfall, and water availability for the crops during the growing season (O'Farelland Anderson, 2010). Droughts have natural and social dimensions too; however, it is the social dimension that turns a drought into a disaster.

According to India Meteorological Department, a year is considered as 'drought year' when annual rainfall is deficient by 20 per cent of the long period average or more; when annual rainfall is deficient by 25-40 per cent of the long period average or more, it is treated as 'severe drought year'; when the spatial coverage of drought is more than 40 per cent, then it is called an 'all-India severe drought year'. While it is difficult to mark the onset and end of a drought, its impact can be severe and can affect the poorest and the most deprived sections of the society (NRSC, 2008). Drought risk emanates from loss of lives, deteriorated health status, and absence of sustainable livelihoods that could occur to a particular community or a society over a specified time period.

Long-term data indicates that rain-fed areas in India witness three to four drought years in every 10 year period. However, no definite trend is seen on the frequency of droughts as a result of climate change. A study conducted by Chowdhury et al., (1989) ranked the year 1918 as the worst drought year of the last century - a year in which 68.70 per cent of the total area of the country was affected by drought. Since beginning of the 21st Century, India experienced droughts in quick succession, of which drought in the year 2009 significantly affected the Kharif crop (crop cultivated during monsoon season in India spans from June to September in every year). It was the second-largest all India monsoon rainfall deficit since 1972 (11.4 per cent below normal; rainfall data, India Meteorological Department, Ministry of Earth Sciences, Government of India). Incidentally, the year 2009 was also recorded as the warmest year during the past several centuries across the world. As per a recent study conducted by Rangarajan & Kannan (2018), India experienced consecutive droughts during 2008-09 and 2009-10 which negatively impacted the yields in agriculture.

The amount of rainfall and its spatial distribution are crucial factors in assessing the performance of agriculture. The probability of monsoon being erratic is 40 per cent of the time which can have a negative impact on crop production in the absence of appropriate strategies to deal with such eventualities (Srinivasaraoet. al., 2013). The increase in frequency of heavy rainfall events during the

last 50 years in the Central part of India marks a significant shift in the climatic pattern of India (Goswami, 2006).

To understand and manage droughts, it is necessary to accept that human influence is as integral to drought as climate change (Van Loon et al., 2016). While lower rainfall is the underlying cause for drought, diverse socio-economic, biological and agricultural factors determine the severity of its impact (Wilhite and Glantz, 1985). Sensitivity to droughts can be minimised by diversifying food crops, efficient methods of irrigation, and keeping away from drought-prone crops (Adger et al., 2003) such as sugarcane in Maharashtra.

Considering the increase in the frequency of droughts in different parts of India, there has been a shift in public policy from drought relief to drought preparedness and risk mitigation measures. An increase in agricultural productivity is the key to improve the living conditions of the farming community, besides promoting non-farm activities through forward and backward linkages (Singh, 2013).

Research Methodology

Based on the review of literature, we designed our research methodology to fulfill objectives of the study. The study intends to rely on primary as well as secondary data, related to the agro-meteorological aspects (weather risks) of the study regions. Agriculture department officials maintain data related to the farmers' response to decline in rainfall during different stages of crop growth. While 2007-08 represents normal (rainfall) year, the reference year for drought is 2009-10 in this context.

Besides, we developed a semi-structured schedule to collect the primary data from the farming community through random sampling method. In each region (namely Bhudlekhand region in Madhya Pradesh (MP), Vidharbha region in Maharashtra, and rain shadow region in Karnataka), we selected one rain-fed district (which is frequently affected by drought, based on the secondary data available with the respective State Agriculture Department). In each district, we selected one block and in each block, we selected two villages to collect the primary data. The details of our sample are given in Table 1.

As shown in Table 1, we administered schedule on 30 farmers in each sampled village. Overall, from the three regions, we interviewed 180 respondents from six villages in this regard. We also conducted focus group discussions (FGD) to collect first-hand information from the farming community on the risk coping mechanisms and available institutional arrangements during droughts. Later, we analysed their sources of incomes, agricultural credit, issues in repayment of loans, strategic options of the farmers during drought period, and institutional arrangements made during the drought period to overcome the crisis. We processed our data by using SPSS. After analysing income levels of the farmers during

normal and drought periods, we also assessed the extent of income inequality pertaining to the sample respondent households through Gini Coefficient. Finally, we showed the extent of inequality through Lorenz curve.

Gini's coefficient = $\{(X_i)^* (Y_i+1) \} - \{(X_i+1) * (Y_i)\} / 10000$

Where,

X_i is cumulative percentage of farmer households in the ith class.

Y_i is cumulative percentage of total income in the ith class.

Table 1: Sample Villages from Rain-fed Agricultural Regions

Region / State	District/ Block	Gram Panchayat	Sample Farmers	Classification of sample farmers*
Rain-shadow Region / Karnataka	Tumkur / Sira	1. Kota	30	*In each state, we collected sample in the following way:*
		2. Modaluru	30	
Bhudlekhand Region / Madhya Pradesh	Chhatarpur / Gourihar	1. Chauhani	30	*a.* 20 marginal farmers
		2. Prakash Bahmari	30	b. 20 small farmers
Vidharbha Region / Maharashtra	Yavatmal / Arni	1. Pandhuma	30	c. 10 medium farmers
		2. Tenouli	30	
		Total	180	d. 10 large farmers

*Marginal farmer: Owner/Cultivator of land up to 2 ha; Small farmer: above 2 ha and up to 4 ha; Medium farmer: above 4 ha and up to 8 ha; Large farmer: above 8 ha

Empirical Findings of the Study

The primary data collected from the study area have been tabulated and discussed broadly under three sub-heads namely,

I. Economic and financial aspects of drought

II. Risk management measures adopted by the farmers during the drought period

III. Institutional measures undertaken by the government/non-governmental agencies to mitigate the drought situation

Economic and Financial Aspects of Drought

(a) Variability in the farmers' incomes during the drought year

Here, we compared the sources of income of the farmers during normal rainfall year and drought period in all the three study regions. Table 2 captures the variability of income streams of the respondents during this period.

It may be noted that total sample size of the study is 180 households and is spread across three regions. As per Table 2, while 179 out of 180 sample respondents are involved in the farming activity, 49 respondents are involved in agricultural labour work during the normal rainfall year so as to generate additional income apart from farming. While 13 farmers are engaged in rearing milch animals, 12 farmers are involved in rearing sheep/goats during the same period. It may be noted that the entire sample of households derive their income from multiple sources of livelihoods as per Table 2.

It is observed that during the normal rainfall year, agriculture fetches the highest average income of Rs. 37,765, followed by rearing of goats and sheep with an average income of Rs. 19,166 per household at the overall level (i.e., in all the three districts). Other important sources of income include agricultural labour as well as non-agricultural labour, and rearing of milch animals such as cows and buffaloes.

It is noticed from the Table 2 that the income from agriculture in the study region declined by 83.2 per cent during the drought period; similarly, income from rearing of milch animals decreased by 69.2 per cent mainly due to lack of water and fodder for the animals; income from agricultural labour work also decreased by 38.4 per cent during the same period. On the other hand, income from non-agricultural labour work increased by 44.1 per cent during this period. While 91 out of 180 respondents continued farming activity, 53 people turned as agricultural labourers during the drought period. As such, the number of households engaged in farming during normal rainfall year and drought year differs in Table 2. However, the total sample size remains at 180 both in the case of normal rainfall year and drought year. 35 respondents undertook non-agricultural labour work and 26 households derived their income from National Rural Employment Guarantee Scheme (NREGS) during this period. It is interesting to note that the respondents in our study region received higher income (31.5 per cent) from the NREGS, a flagship programme of the Government of India, during the drought period. This can be viewed as supporting evidence for continuation of such welfare schemes in drought-prone areas.

It is observed from Table 2 that the farmers' households who undertook agricultural labour increased from 49 to 53; however, their total wage income came down from Rs. 4,11,500 to Rs. 2,53,300 on account of lower demand for labour during the drought year. In FGD too, majority of the farmers opined that the level of wages was either normal or low on account of subdued demand for labour during the drought conditions. Overall, there was a substantial decline of 71.8 per cent in the total income of the respondents in the three study districts which adversely affected their standard of living, purchasing power, and social safety nets during the drought period.

Table 2: Source of Incomes of Farmers during Normal Year and Drought Year

Source of Income		Normal Year				Drought Year				% of Change
		Chhatarpur	Tumkur	Yavatmal	Average/ Total	Chhatarpur	Tumkur	Yavatmal	Average/ Total	
1. Agriculture	Mean	31467	30916	50800	37765	14809.5	6735	27353	12451	
	N	60	59	60	179	21	53	17	91	
	Sum	1888000	1824000	3048000	6760000	311000	357000	465000	1133000	-83.2
2. Agricultural labour	Mean	5750	4167	9289	8398	3552	5000	5942	4779	
	N	8	3	38	49	25	2	26	53	
	Sum	46000	12500	353000	411500	88800	10000	154500	253300	-38.4
3. Milch animals (Cow, Buffalo, etc.)	Mean	-	6727	47500	13000	-	5111	6000	5200	
	N	-	11	2	13	-	9	1	10	
	Sum	-	74000	95000	169000	-	46000	6000	52000	-69.2
4. Rearing of goats / sheep	Mean	19166	-	-	19166	20000	-	-	20000	
	N	12	-	-	12	12	-	-	12	
	Sum	230000	-	-	230000	240000	-	-	240000	+4.3
5. Non-agricultural labour	Mean	6400	5000	21375	12250	3769	8000	14095	10085	
	N	10	2	8	20	13	1	21	35	
	Sum	64000	10000	171000	245000	49000	8000	296000	353000	+44.1
6. Government welfare schemes like NREGS*	Mean	-	4826	-	4826	10000	5375	7000	5615	
	N	-	23	-	23	1	24	1	26	
	Sum	-	111000	-	111000	10000	129000	7000	146000	+31.5
7. Others including migration/petty business	Mean	-	12800	15000	13167	-	9471	15000	10163	
	N	-	5	1	6	-	7	1	8	
	Sum	-	64000	15000	79000	-	66300	15000	81300	+2.9
Grand Total					**8005500**				**2258600**	**-71.8**

*NREGS refers to National Rural Employment Guarantee Scheme launched by Government of India to provide 100 days of

employment in a year to a single person per rural household, especially in drought-hit areas.

Note: 1) N = 180 households in normal rainfall year as well as drought year

2) a) Mean Income during normal rainfall year = Rs. 44,475 (=80,05,500/180)

b) Mean Income during drought year = Rs.12,458 (=22,58,600/180)

c) Sum represents total income of the households from the above-mentioned sources of livelihoods

Table 3: Distribution of Households (HHs) according to Total Household Income and Computation of Gini Coefficient - Normal Year

Class of Farmers	Number of HHs (Pi)	Total Income (Rs.) (Qi)	Percentage Of Pi	Percentage Of Qi	Cumulative of Pi	Cumulative of Qi
Marginal	60	1565000	33.33	19.55	33.33	19.55
Small	60	2476500	33.33	30.93	66.67	50.48
Medium	30	1159000	16.67	14.48	83.33	64.96
Large	30	2805000	16.67	35.04	100.00	100.00
Total	180	8005500	100.00	100.00		

Gini Coefficient during normal rainfall year = [(33.33*50.48-19.55*66.67)+(66.67*64.96-50.48*83.33)+(83.33*100.00-64.96*100.00)] = 8671.67/10000=0.87

Assessment of Inequality in the Income Distribution of the Farmers

The extent of inequality in the incomes of the sample farmer households is captured in the normal as well as drought periods through computation of Gini-coefficient and the same is depicted through Lorenz curve. The extent of inequality in the income in the sample households is high at 0.87 (value of Gini-coefficient) during the normal rainfall year (in Figure 1) and this declined to 0.19 during the drought period (in Figure 2), implying a drastic reduction in income inequality to the extent of 68 basis points. One plausible explanation for this is that while small and marginal farmers abstain from investing in crops and engage in non-agricultural activities and NREGS during the drought period, large and medium farmers invest in crops with a ray of hope on the monsoon.

Further, we need to read the Gini-Coefficient along with the average income levels of the farmers to better understand the inequality of income distribution. In the normal year, each sample household received an income of Rs. 44,475 (=80,05,500/180; Table 3) and this dipped to Rs.12,458 (=22,58,600//180; Table 4) in the drought period, thus registering a deterioration of 71.8 per cent. This phenomenon is better captured in Table 5.

As per Table 5, large farmers' households were the worst affected category due to occurrence of drought (with a standard deviation of 31,004 in their income during the drought year). Similarly, medium farmers too were adversely affected during this period (with a standard deviation of 22,850). However, small and marginal farmers' households were relatively less affected due to the drought

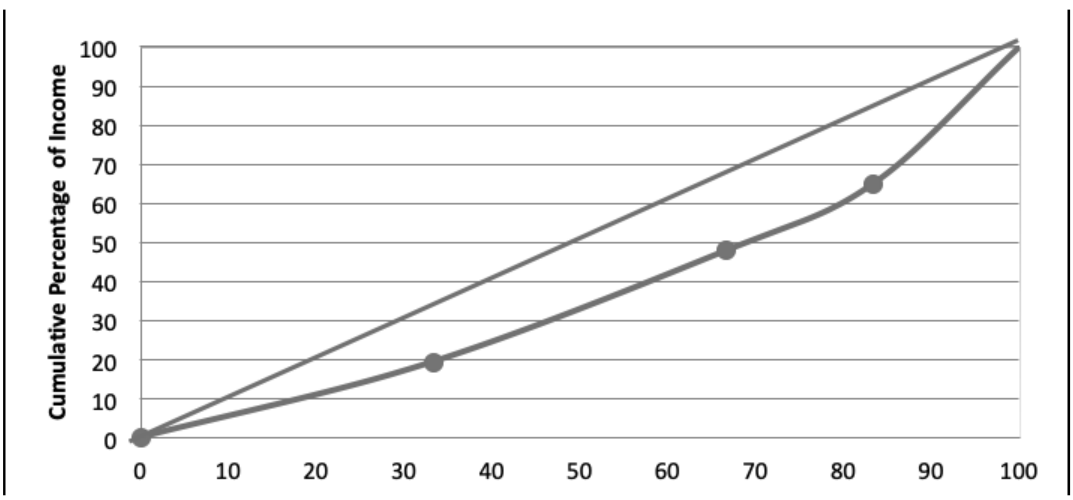

Figure 1 : Cumulative Percentage of Farmer HHs - Normal Year

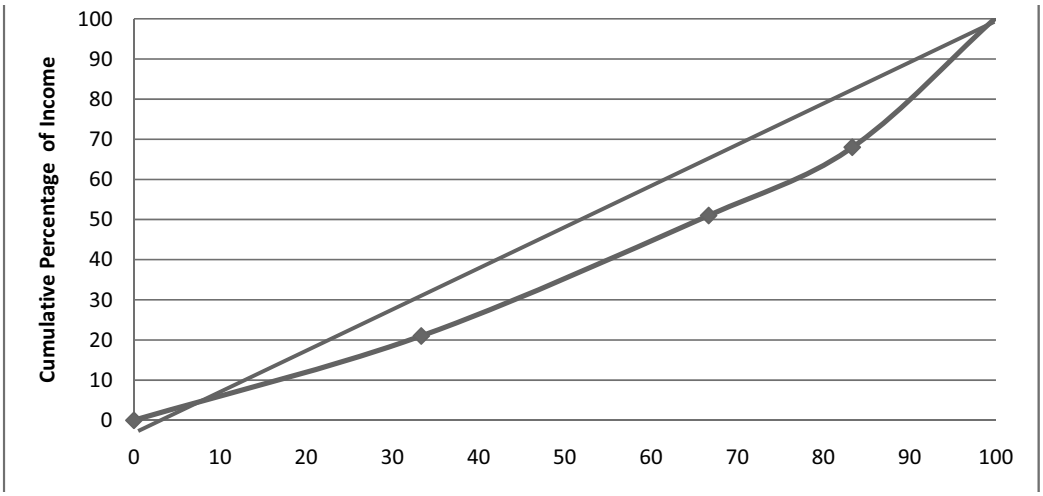

Figure 1 : Cumulative Percentage of Farmer HHs - Drought Year

conditions in the study regions as they might have depended on other sources of income (like rearing of milch animals, sheep, goats, and undertaking of non-agricultural labour work) during the drought period. Besides, they might not have invested more in crops based on their native wisdom and foresight in the drought-prone areas. As per Table 5, medium farmers' households experienced 74.8 per cent variation in their average income during the drought year. While marginal farmers witnessed negative variation of 68.9 per cent in their average income, large farmers experienced 74 per cent drop in their average income during the drought year. Overall, there is a negative variation of 71.8 per cent in the average income of sample households in the study region during the drought year when compared to the normal rainfall year.

Purpose of Loans taken by the Respondents

As per Table 6, cultivating crops is the major purpose of loans taken by the sample respondents (93.9 per cent), followed by purchase of irrigation equipment - sprinkler/ drip irrigation/pipelines. The farmers also utilised the money to purchase carts and bullocks (13.3 per cent) and purchase of tillers (12.2 per cent) and agricultural implements (6.7 per cent). As majority of the farmers took either crop loans or loans for purchase of irrigation equipment, they wanted to face their region-specific drought conditions through various irrigation methods (sprinkler/ pipelines, drip irrigation). It is observed that around 96 out of 180 farmers purchased irrigation equipment as part of their risk coping strategy. While in Yavatmal district, all the six purposes are reported for obtaining loans, in other two regions (Chhatarpur and

Table 4: Distribution of Households (HHs) according to Total Household Income and Computation of Gini-coefficient in Drought Year

Class of Farmers	Number of HHs (Pi)	Total Income (Rs.) (Qi)	Percentage Of Pi	Percentage Of Qi	Cumulative of Pi	Cumulative of Qi
Marginal	60	487000	33.33	21.56	33.33	21.56
Small	60	750000	33.33	33.21	66.67	54.77
Medium	30	292100	16.67	12.93	83.33	67.70
Large	30	729500	16.67	32.30	100.00	100.00
Total	**180**	**2258600**	**100.00**	**100.00**		

Gini-coefficient during drought year = (33.33*54.770-21.56*66.67+66.67*67.70-54.77*83.33+83.33 * 100.00-67.70* 100.00) = 1900.73/10000=**0.19**

Table 5: Variation of Income of Farmers' Households

Class of Farmers	Number of HHs	Income of the HHs during Normal Year (Rs.)		Income of the HHs during Drought Year (Rs.)		% of variation in average HHs' incomes between normal and drought years
		Average	Standard Deviation	Average	Standard Deviation	
Marginal	60	26083	27839	8117	15488	68.88
Small	60	41275	34837	12500	22710	69.72
Medium	30	38633	25790	9737	22850	74.80
Large	30	93500	49209	24317	31004	73.99
Total	**180**	**44475**	**40998**	**12548**	**23013**	**71.79**

Tumkur), cultivation of crops and purchase of agricultural implements are the major reasons cited for taking loans by the farmers.

Farmers' Problems in Repayment of Loans

Further, the schedule had a question related to the reasons behind non-repayment of loans by the borrowers in the study region.

In many cases, the loans are still outstanding at the time of administration of our schedule; when enquired about the reasons for non-repayment of the loans, the farmers cited lack of remunerative prices in the market (98.3 per cent) as the major reason, followed by expectation of loan waiver from the government (96.1 per cent), and crop loss due to drought (93.3 per cent), and low yields (90.6 per cent).

Risk Management Measures Adopted by Farmers (Demand Side)

Farmers' Response to Drought Situation

The respondents in all the three study districts are asked to indicate the way they respond to a situation when they face early drought when compared to a normal rainfall year. In fact, these options are available for majority of the farmers to overcome the drought situation (demand side of the issue). As part of this, 16 different ways of responding to the situation are identified and the respondents are asked to rank the first five out of the 16 options. The results are depicted in Table 8.

The results at the aggregate level show that providing crop saving irrigation (preference index of 2.5) followed by cultivating long duration crops (preference index of 2.4), and use of family labour to reduce cost of cultivation (preference index of 1.9) are the most preferred strategies adopted by the farmers when they face early drought situation in the three study districts. It is noticed that in Chhattarpur district, the farmers adopted crop saving irrigation technique during critical crop growth stage through the existing traditional water bodies. Migration and cultivating fodder crops are the fourth and the fifth popular options, respectively among the farmers during early drought period in these regions.

Coping Strategies - Indigenous Crop Saving Techniques

Farmers use their traditional wisdom to overcome the crisis in crop management and rely on indigenous techniques as outlined in Table 9 While most of the farmers (83.3 per cent) applied 25 per cent of recommended level of fertilisers due to uncertainty of rainfall during drought period in our sample districts, 60.6 per cent of the farmers used pesticides only on occurrence of pests. Some of the farmers (43.3 per cent) used last year crop grains as seeds, while some others (36.1 per cent) used subsidised seeds, provided by the agricultural department in order to reduce their costs during this period. While 29.4 per cent of the respondents mentioned that they used manual labour to avoid weeds and

Table 6: Purpose of Credit taken by the Farmers

District	Crop Loan	Purchase of Tillers	Purchase of cart/ bullocks	Agriculture Implements	Irrigation equipment -Sprinkler / Pipelines	Equipment for drip irrigation
1. Chhatarpur (60 Farmers)	60.0 (100.0)	--	1 (1.7)	5 (8.3)	--	--
2. Yavatmal (60 Farmers)	52 (86.7)	22 (36.7)	22 (36.7)	4 (6.7)	56 (93.3)	40 (66.7)
3. Tumkur (60 Farmers)	57 (95.0)	--	1 (1.7)	3 (5.0)	--	--
Total (180 Farmers)	**169 (93.9)**	**22 (12.2)**	**24 (13.3)**	**12 (6.7)**	**56 (30.1)**	**40 (22.2)**

Note: a). Figures in parenthesis are percentages in the sample size (3 * 60 = 180)
b). As the question elicited multiple responses with regard to the purpose of the loan, the percentages do not add up to 100.

pests, 36.7 per cent of the farmers followed a strategy of harvesting crop to grow vegetables or fodder for their cattle so as to increase their revenue during this period.

Institutional Arrangements during Drought (Supply Side)

We made a survey to examine the extent of institutional arrangements made

Table 7: Problems in Repayment of Credit by the Respondents

District	Crop Loss due to drought	Lack of remunera-tive prices	Low yields	Expectation of loan waiver
1. Chhatarpur (60 Farmers)	59 (98.3)	59 (98.3)	60 (100.0)	58 (96.7)
2. Yavatmal (60 Farmers)	49 (81.7)	58 (96.7)	43 (71.7)	59 (93.3)
3. Tumkur (60 Farmers)	60 (100.0)	60 (100.0)	60.0 (100.0)	59 (98.3)
Total (180 Farmers)	**168 (93.3)**	**177 (98.3)**	**163 (90.6)**	**173 (96.1)**

Note: a). Figures in parenthesis are percentages in the sample size (3 * 60 = 180)
b). As the question elicited multiple responses with regard to non-repayment of the loans, the percentages do not add up to 100.

Table 8: Strategic Options of Farmers to Face Early Drought Period

Strategic Options of Farmers	Normal Rainfall		Early Drought Period	
	Weighted Rank (Scale 1 to 5)	Preference Index	Weighted Rank (Scale 1 to 5)	Preference Index
1. Preparedness with seeds of short duration crops like millets and cereals	32	**0.2**	24	**0.1**
2. Cultivating long duration crops to overcome drought	193	**1.1**	434	**2.4**
3. Use of indigenous fertilisers and pesticides	176	**1.0**	121	**0.7**
4. Short-term loan from money lenders	221	**1.2**	115	**0.6**
5. Providing crop saving irrigation	185	**1.0**	456	**2.5**
6. Use of family labour to reduce the cost of cultivation	160	**0.9**	349	**1.9**
7. Leaving land fallow	100	**0.6**	145	**0.8**
8. Cultivating fodder crops	218	**1.2**	266	**1.5**
9. Mulching with straw/hay stone or slab	91	**0.5**	115	**0.6**
10. Dependence on livestock	139	**0.8**	134	**0.7**
11. Distress sale of cattle	83	**0.5**	62	**0.3**
12. Migration	128	**0.7**	326	**1.8**
13. Distress sale of assets	106	**0.6**	17	**0.1**
14. Use of subsidised fertilisers	130	**0.7**	64	**0.4**
15. Use of subsidised seeds	153	**0.9**	45	**0.3**
16. Credit from Kisan credit cards	247	**1.4**	98	**0.5**
Total	**2610**	**14.5**	**2685**	**14.9**

Table 9: Techniques Adopted by the Respondents during the Drought Period

Crop Saving Techniques	Yes	No	Neutral	Total
1. Fallow ploughing to harvest rainwater	15 (8.3)	163 (90.6)	2 (1.1)	180 (100.0)
2. To reduce cost, using last year crop grains as seeds	78 (43.3)	101 (56.1)	1 (0.6)	180 (100.0)
3. Using subsidised seeds provided by agriculturaldepartment	65 (36.1)	114 (63.3)	1 (0.6)	180 (100.0)
4. Application of fertilisers				
i) 25% of recommended	150 (83.3)	10 (5.6)	20 (11.1)	180 (100.0)
ii) 50% of recommended	18 (10.0)	62 (34.4)	100 (55.6)	180 (100.0)
iii) 100% in two splits	22 (12.2)	69 (38.3)	89 (49.5)	180 (100.0)
iv) No fertilisers	12 (6.7)	56 (31.1)	112 (62.2)	180 (100.0)
v) Use of vermi-composting	21 (11.7)	73 (40.6)	86 (47.8)	180 (100.0)
vi) Use of indigenous fertilisers	46 (25.6)	74 (41.1)	60 (33.3)	180 (100.0)
5. Application of pesticides				
i) Only on occurrence of pests	109 (60.6)	67 (37.2)	4 (2.2)	180 (100.0)
ii) Use of indigenous methods to drive-away the pests	33 (18.3)	92 (51.1)	55 (30.6)	180 (100.0)
iii) Use of manual labour to avoid weeds and pests	53 (29.4)	117 (65.0)	10 (5.6)	180 (100.0)
6. Shift in cropping system from irrigated crops to dryland crops	18 (10.0)	161 (89.4)	1 (0.6)	180 (100.0)
7. Inter-cultural operations like harrowing, passing cultivator to improve soil moisture	15 (8.3)	165 (91.7)	-	180 (100.0)
8. Irrigating the crop during the critical crop growth period	23 (12.8)	157 (87.2)	-	180 (100.0)
9. Harvesting crop as vegetable or fodder	66 (36.7)	114 (63.3)	-	180 (100.0)
Note: Figures in parenthesis are percentages in the sample size (3 * 60 = 180)				

by government as well as non-governmental organisations (supply side) towards drought-proofing in all three regions in order to assess their adequacy level at the time of crisis. The results are reported in Table 10.

It is clear from the Table 10 that nearly half of the farmers received quality seeds from the agricultural department during this period in our study region. Besides, 37.8 per cent of the farmers received advisory services, 31.7 per cent of the sample obtained fertilisers and 26.1 per cent of the respondents got fodder seeds from the department. With regard to agricultural credit, 34.4 per cent of the farmers obtained loans from banks and financial institutions through Kisan Credit Cards during this period. Among the three sample districts, institutional support from the Agriculture Department in Tumkur district, Karnataka appears to be on a better footing than others.

Policy Recommendations

We observed from the FGD that the farmers (especially small and marginal holders) are finding it difficult to execute the contingency plan in the study region during the early drought period. They are constrained in procuring the quality inputs (especially short duration seed varieties, fertilisers, etc.) and also in obtaining credit for sowing crops

Table 10: Institutional Arrangements towards Drought Proofing

Drought Proofing Measure	Chhatarpur	Yavatmal	Tumkur	Total
1. Agriculture department providing quality seeds	17 (28.3)	13 (21.7)	59 (98.3)	**89 (49.4)**
2. Distribution of fertilisers by agricultural department	11 (18.3)	4 (6.7)	42 (70.0)	**57 (31.7)**
3. Agriculture advisory services on types of crops	8 (13.3)	19 (31.7)	41 (68.3)	**68 (37.8)**
4. Credit facilities through Kisan Credit Card (crop loans)	12 (20.0)	34 (56.7)	16 (26.7)	**62 (34.4)**
5. Distribution of fodder seeds by agricultural department	6 (10.0)	28 (46.7)	13 (21.7)	**47 (26.1)**
6. Provision of credit at low interest rate through SHGs	2 (3.3)	18 (30.0)	3 (5.0)	**23 (12.8)**
7. Provision for farm ponds	--	9 (15.0)	35 (58.3)	**44 (24.4)**
8. Vaccination for livestock to avoid diseases	2 (3.3)	25 (41.7)	--	**27 (15.0)**

Note: Figures in parenthesis are percentages in the sample size (3 * 60 = 180)

on timely basis. Hence, it is suggested that the Agriculture Department may execute the contingency plan by supplying the required inputs, instead of advising the farmers to do so. Further, proper and timely agro advisory services like forecasting drought conditions should be extended to the farmers so that they can adjust their sowing dates.

Agriculture department should also plan for harvesting and conservation of rainwater in traditional water bodies by undertaking desilting operations through wage employment schemes like NREGS to achieve 'more crop per drop'. Our results show that there are very few alternative employment opportunities available for the small and marginal farmers and they are mainly dependent on agriculture for their livelihoods in the study districts during the drought period. As such, concerted efforts should be made to create employment avenues outside agriculture for small and marginal farmers to reduce migration. Institutional arrangements need to be scaled up as done elsewhere in the developed economies to reduce farmers' distress and ensure food and nutritional security to the drought-hit regions.

In our study region, we noticed that the scope for repayment of loans obtained through kisan credit cards is very limited for the farmers, especially when the drought is looming large. Hence, small and marginal farmers are hesitant to approach banks and formal financial institutions for credit. However, money lenders/traders extend credit to small and marginal farmers for purchase of seeds, fertilisers, pesticides, etc., with a view to procuring the agricultural produce from the farmers at a lower price in future. Sainath (2000) showed how money lenders squeesed the poor farmers/agricultural labourers by levying exorbitant rates of interest (often 120 to 200 per cent per annum) in rural India and how the latter committed suicide to escape from the clutches of these modern-day Shylocks. To prevent this widespread exploitation, money lenders may be made as partners in formal financial institutions like small finance banks.

We need to accept the fact that climate change is a ground reality; so more efforts and funds are needed to prepare the farmers in particular to face the emerging challenges of climate change. According to the Economic Survey 2017-18, climate change can adversely impact agricultural yields to the extent of 15-25 per cent. Hence, there is an imperative need to deepen the penetration of crop insurance and develop climate-resilient technologies in the agricultural sector.

By following the Telangana government's initiative, policymakers may consider implementing Rythu Bandhu scheme (Farmers Investment Support Scheme) in drought-prone areas, wherein the cash is directly paid by the government to the farmers during the crop seasons.

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By following the Telangana government's initiative, policymakers may consider implementing Rythu Bandhu scheme (Farmers Investment Support Scheme) in drought-prone areas, wherein the cash is directly paid by the government to the farmers during the crop seasons.

Conclusions

Drought is as natural as climate and its variability. Droughts have natural and social dimensions too; however, it is the social dimension that turns a drought into a disaster. In the current research study, we made a modest attempt to evaluate the risk-coping strategies of farmers in rain-fed agricultural States of Karnataka, Maharashtra, and Madhya Pradesh – three drought-prone States in India. We found that there was an overall decline of 71.8 per cent in the total income of the respondents in the three study districts which adversely affected their standard of living, purchasing power and social safety nets during the drought period. The extent of inequality in the incomes of the sample households is high (reflected in the Gini-coefficient of 0.87) during the normal rainfall year and this declined to 0.19 during the drought period, implying that the inequality in the income distribution of the sample group is relatively lower during the drought period. While large and medium farmers households were the worst affected due to occurrence of droughts, small and marginal farmers were relatively unscathed as they might have depended on other sources of income (like rearing of milch animals, sheep, goats, and undertaking agricultural/non-agricultural labour work) during the drought period.

Most of the farmers availed short-term loans for crops and long-term loans to purchase drip/sprinkler irrigation equipment from the banks and financial institutions in the study region as part of their risk-coping strategy. Majority of the borrowers in the study region expressed the view that they are unable to repay the loans as they receive non-remunerative prices for their agricultural produce during normal rainfall year. It is interesting to observe that they are not repaying the loans to banks/financial

institutions mainly due to expectation of loan waivers from the government.

The results at the aggregate level show that adopting crop saving irrigation followed by cultivating long duration crops and using family labour to reduce the cost of cultivation are the most preferred strategies embraced by the farmers when they face early drought situations in the three study districts. Migration and cultivating fodder crops are the other popular options among the farmers during the early drought period. It is interesting to note that the respondents in our study region received higher income (31.5 per cent) from NREGS, a flagship programme of Government of India, during the drought period; this can be viewed as supporting evidence for continuation of such welfare schemes in drought-prone areas.

Farmers use their native wisdom to overcome the crisis in crop management and rely on indigenous techniques like applying one-fourth of recommended level of fertilisers, using pesticides only on occurrence of pests, and harvesting crops to grow vegetables or fodder for their cattle so as to increase their revenue during the drought period. While some farmers opted for short duration crops and cultivated drought-resistant crops, others used drip/sprinkler irrigation systems to overcome the crisis. We found that the farmers received adequate support from the State Agriculture Department in the form of quality seeds, fertilisers and fodder seeds in the sample districts. However, we noticed that among the three sample districts, institutional support from the agriculture department in Tumkur district, Karnataka appears to be on a better footing than others. Our study assumes significance as it has implications to the farmers, bankers, line department officials, policymakers, researchers, and human rights activists.

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