Adoption of Climate Resilient Agricultural Technologies by Farmers

Balasubramani Nanjappan[1]

Abstract

Climate change affects the livelihood of farmers and hence there is a need for adaptation. The present study was conducted in two States from northern and southern parts of India, viz., Uttarakhand and Karnataka respectively, to find out the adaptation strategies followed by the respondents and various constraints involved in adopting climate resilient agriculture practices. The study reveals that a majority of the respondents (80.00%) have replaced long duration varieties with short duration varieties and adopted water conservation through Contour/ Graded bunds formation (75.56%).In addition they have also adopted improved agronomic practices such as crop rotation (88.88%), mulching (78.00%) and disease management of animals through regular vaccination (73.33%).A majority of the respondents (64.44%) have used custom hiring centers for undertaking timely operations. Meanwhile, they were facing various constraints in adopting climate resilient agricultural practices due to limited knowledge on climate resilient adaptation measures, inadequate number of extension functionaries at grass root level, and inadequate weather based farm advisories. Hence it is suggested that capacity building of farmers on several climate smart practices may be undertaken through various extension approaches for strengthening the farmers' ability to tackle the ill effects of climate change.

Keywords: Climate Change; Climate Resilient Technologies; Agriculture; Farmers

Introduction

India is a large emerging economy with a variety of geographical regions, biodiversity, and natural resources. The natural resources and environment however, are already under pressure as a result of rapid urbanization, industrialization and economic development. Climate change is projected to exacerbate these pressures furthermore. Climate change with its associated variability is a concern to developing countries, especially for India where about 700 million people in the rural areas depend on climate-sensitive sectors like agriculture, forestry, fisheries and animal husbandry for their livelihood. The Maplecroft Climate Change Vulnerability Index (2011) ranks India as the world's most vulnerable country.

[1]Deputy Director, National Institute of Agricultural Extension Management (MANAGE), Rajendranagar, Hyderabad. Email: balasubramani@manage.gov.in

Among the various efforts being undertaken by public and private organizations to combat climate-related risks and uncertainties in agriculture, adaptation is identified as one of the policy options to reduce the negative impact of climate change.

Several studies in different countries show that without adaptation, climate change is generally detrimental to the agriculture sector; while with adaptation, the vulnerability can be reduced to the large extent. The present study was undertaken to find out the adoption of climate resilient agriculture and animal husbandry practices by the farmers and the constraints involved in the adoption with the following specific objectives:

1 To document the climate resilient technologies adopted by the farmers

2 To ascertain the constraints faced by the farmers in adopting the climate resilient technologies.

Research Methodology

The study was carried out in two States of India, namely, Uttarakhand and Karnataka which were most frequently exposed to climate vagaries namely floods and drought respectively. These two States were adopted under the National Innovations on Climate Resilient Agriculture (NICRA) project of Government of India based on the vulnerability index. Dunda village of Uttarkashi district in Uttarakhand State and Nagenahalli village of Tumkur district in Karnataka State were purposively selected. A total of 45 farmers who were the beneficiaries of the NICRA project were selected randomly as respondents. The primary data were collected using both structured and semi-structured interview schedule and focus group discussion was also conducted to collect qualitative data from the farmers. The quantitative data were analyzed using statistical tools like percentage, frequency, and Garret Ranking technique to interpret and draw meaningful results.

Garret Ranking Technique

The collected data were tabulated and analysed statistically using the Garret Ranking technique. The values obtained were transformed into scores by using the formula:

Percent position =

Where,

R_{ij} = Rank given by i^{th} factor and j^{th} individual

N_j = Number of factors ranked by j^{th} individual

The percent position was calculated for the ranks as well as their corresponding Garrets table value. The respondents were asked to rank each item according to the severity of the constraints faced by them. The collected data were arranged in factor (constraints) and rank wise, later Garret Value was multiplied with Garret table value. The total score was calculated by multiplying Garret Value with the rank assigned by the respondents. Further, Garret score was calculated by dividing the total score by the number of respondents and the rank was assigned according to Garret score.

Results and Discussion

Table 1. Adoption of Climate ResilientTechnologies by Respondents

n = 45

S.No.	Particulars	Adopted	Not Adopted
1	Change in the cropping system	29 (64.44)	16 (35.56)
2	Change in planting time	19 (42.22)	26 (57.78)
3	Replacing long duration varieties with short duration varieties	36 (80.00)	9 (20.00)
4	Adoption of improved varieties	32 (71.11)	13 (28.89)
5	Adoption of improved agronomic practices		
	a) Summer ploughing	20 (44.44)	25 (55.66)
	b) Crop rotation	40 (88.88)	5 (11.12)
	c) Inter cropping	35 (76.00)	10 (24.00)
	d) Adjusting spacing	17 (56.00)	28 (48.00)
	e) Mulching	22 (78.00)	23 (32.00)
	f) Application of FYM	40 (88.00)	5 (12.00)
	g) Application of vermi compost	20 (24.00)	23 (76.00)
	h) Use of in-Situ/ Green Manure	8 (17.78)	37 (82.22)

S.No.	Particulars	Adopted	Not Adopted
6	Timely application of pesticides	26	19
		(57.78)	(42.22)
7	Water conservation methods		
	a) Bunds (Contour/graded)	34	11
		(75.56)	(24.44)
	b) Farm pond	28	17
		(62.22)	(37.78)
	c) Micro irrigation systems	16	29
		(35.56)	(64.44)
8	Application of balanced fertilizer based on soil test	29	18
		(64.44)	(35.56)
9	Application of micronutrients	22	23
		(48.89)	(51.11)
10	Usage of bio control agents/bio pesticides	15	30
		(33.33)	(66.67)
11	Adoption of IFS (Integrated Farming System)	8	37
		(17.78)	(82.22)
12	Use of Green House/shade net/protected cultivation	5	40
		(11.11)	(88.89)
13	Feed management practices		
	a) Improved fodder varieties	32	13
		(71.11)	(28.89)
	b) Silage making	12	33
		(26.67)	(73.33)
	c) Mineral mixture	22	23
		(48.89)	(51.11)
	d) Concentrated feed mixture	21	24
		(46.67)	(53.33)
14	Disease management of animals		
	a) Regular vaccination	33	12
		(73.33)	(26.67)
	b) Deworming	29	16
		(64.44)	(35.56)
	c) Calf register	6	39
		(13.33)	(86.67)
15	Shed management		
	a) Shade	26	19
		(57.78)	(42.22)
	b) Flooring	27	18
		(60.00)	(40.00)

S.No.	Particulars	Adopted	Not Adopted
	c) Cooling system (Sprinkler, fan, gunny bag)	12	33
		(26.67)	(73.33)
	d) Regular cleaning of the shed	32	13
		(71.11)	(28.89)
16	Adoption of additional enterprises		
	a) Fisheries	1	44
		2.22	(97.78)
	b) Goatery	11	34
		(24.44)	(75.56)
	c) Poultry (backyard)	21	24
		(46.67)	(53.33)
17	Usage of custom hiring centres	29	16
		(64.44)	(35.56)

Adaptation to climate change is considered as an important response option worthy of research and assessment, not simply to guide the selection of the best mitigation policies, but rather to reduce the vulnerability of farmers to the impact of climate change. In the study area,the majority of the respondents (64.44%) have changed their cropping system from paddy and wheat to millets, vegetable crops and other commercial crops, mono-cropping to diversified cropping. Nearly half of the respondents(42.22%) have changed their planting dates such as delayed sowing in the crops like vegetable pea and barnyard millet.

When it comes to adoption of improved varieties, 71.11 per cent of the respondents have adopted short duration paddy and finger millet crops to effectively manage drought and 80.00 per cent of the respondents have adopted drought resistant fodder varieties like Napier Co-3 and African Tall (Maize crop),fodder sorghum (CoFS - 29) and Ragi (ML-365).

Climate-smart agronomic practices adopted by the respondents are crop rotation (88.88%) (Ragi to Vegetable Pea, Paddy to Wheat) and intercropping (76.00%) (*Ragi+ Pigeon pea, Wheat+ Vegetable pea*), mulching in vegetable crops such as tomato, chillies (78.00%), application of Farm Yard Manure (88.00%), application of vermi composting (24.00%).These agronomic practices help the farmers to manage climate change effectively besides getting assured income. As the irrigation water source and groundwater are dwindling rapidly, farmers of Uttarakhand state have adopted farm ponds (65.00%) and micro irrigation (60.00%) such as sprinklers, drip irrigation etc., as a part of water conservation practices/techniques. Majority of the respondents (65.00%) have started applying micronutrients to the fields based on the soil health card recommendation to supplement all the necessary

nutrients to the crop as a way of reducing the expenditure on fertilizers and it is also helpful in reducing the indiscriminate use of fertilisers in the cultivation of crops. About 30.00 per cent of the respondents adopted Integrated Farming System (IFS) to sustain the farming against the backdrop of climate change.

As far as the animal husbandry practices are concerned, the respondents have adopted improved practices in the field of livestock such as regular vaccination of animals (73.33%), shade protection to animals (57.78%), deworming of animals (64.44%), cleaning of animal shed on a daily basis (71.11%). Around 65 per cent of the respondents have enrolled as members of Custom Hiring Centre (CHC) initiated by NICRA enabling the small and marginal farmers to make use of seed drillers, harvesters, levellers, weed cutter, trencher, land leveller, disc harrows, power weeder etc.

However, in both the States the respondents have not adopted silage making practices due to lack of awareness. Necessary efforts may therefore be taken by NICRA to impart training and capacity building on the preparation of silage for the preservation of green fodder for the lean season to cope with the fodder shortage during extreme climatic vagaries. The findings were in line with the finding of Maiti *et al*, 2015, Nhemachena, C. and Hassan, R. 2007. Parameswaranaik *et al*, 2016 and Arora, 2006.

Table 2. Constraints faced by Respondents in adopting Climate Resilient Technologies

n=45

S. No.	Constraints	Garret Mean Score	Rank
1	Limited knowledge on climate resilient adaptation measures	52.98	I
2	Inadequate number of extension functionaries at grass root level	47.68	II
3	Inadequate weather based farm advisories	44.68	III
4	Lack of knowledge about climate change	42.21	IV
5	Inadequate training regarding climate resilient practices	41.08	V
6	Lack of feedback/reporting system (between extension, research and clients/end-users)	38.54	VI
7	Lack of access to timely information on climate vagaries	31.25	VII
8	Inadequate number of automatic weather stations	30.72	VIII
9	Lack of access to climate resilient crop varieties &other inputs (Drought / Heat resistance etc.)	28.80	IX
10	Less expertise of field staff on climate change and its management practices	24.88	**X**

The information on the constraints experienced by the respondents is depicted in Table2. To reduce the vulnerability and negative impact of climate change on agriculture the farmers have to play an important role to overcome the adverse effects by implementing many alternate strategies in agriculture and allied activities. Under such circumstances farmers were facing various constraints to take up adaptation measures to overcome ill effects of climate change.

Limited knowledge on climate resilient adaptation measures was perceived as the most severe constraint with Garret Mean Score (GMS) 52.98. This may be due to the fact that all the climate resilient technologies might not have been given to individual respondents, rather they might have been given a single climate resilient technology either water harvesting (farm ponds) or demonstration of improved varieties etc.The inadequate number of extension functionaries at grass root level was another major constraint (GMS 47.68). Due to this reason, the respondents might have felt that the contact with extension functionaries was very less. Inadequate weather based crop advisories (GMS 44.68) was the third most severe constraint felt by the respondents. The respondents felt that some more weather based crop advisories would have helped them to cope up with the changing climate.

Lack of knowledge about climate change (GMS 42.21), inadequate training regarding climate resilient practices (GMS 41.08),lack of access to improved crop varieties and other inputs and less expertise of field staff on climate change and its management practices were the least perceived constraints by the respondents with a GMS score 28.80 and 24.88, respectively. This might be due to the fact that Krishi Vigyan Kendra(KVK) of respective areas were providing seeds of High Yielding Varieties and planting materials free of cost, constructed farm ponds, check dams, in the study area. The farmers were very satisfied with the work of KVKs as well as NICRA Project.

Conclusion

Climate change has a direct effect on agriculture affecting the most vulnerable segment of small and marginal farmers of India. From the above study, it can be concluded that beneficiaries of NICRA have adopted various climate resilient agricultural practices such as change in cropping/planting system and making use of custom hiring centres etc. The respondents were also perceiving various constraints like limited knowledge on adaptation measures, inadequate weather based farm advisories etc. In this context the capacity building of farmers on several climate smart practices may be undertaken through various extension approaches and techniques to make the villages more climate resilient.

References

Arora A S. (2006). Socio-Economic and communication variables associated with level of knowledge and degree of adoption of improved dairy husbandry practiced in Uttaranchal. *Indian Journal of Dairy Science* 59(5): pp 337–43.

Arya, D. (2010). Climate change influence on phonological events and socioeconomic status of village communities in Garhwal Himalaya, Reflections of Climate Change Leaders from the Himalayas, Leadership for Environment and Development (LEAD) report, India, New Delhi.

IPCC. (2007). Climate Change 2007: Synthesis Report: Contribution of Working Groups I, II and III. *Fourth Assessment report of the Intergovernmental Panel on Climate Change*. Core Writing Team, Pachauri R K and Reisinger A, IPCC, Geneva, 2008: pp 45-78

Garrett, H. E. and Woodworth, R. S. (1969) Statistics in Psychology and Education.Vakils, Feffer and Simons Pvt. Ltd., Bombay.p 329.

Maiti Sanjit, Jha Sujeet Kumar, Garai Sanchita, Nag Arindam, Chakravarty R, Kadian K S, Chandel B S, Datta K and Upadhyay R C. (2014). Adaptation strategies followed by livestock rearers of coastal Odisha and West Bengal to cope up with climate change. *Indian journal of Animal Sciences* 84(6): pp 652–59.

Nhemachena, C. and Hassan, R. (2007). Micro-level analysis of farmers' adaptation to climate change in Southern Africa. *IFPRI Discussion Paper No. 00714*, International Food Policy Research Institute, Washington DC.

Parameswaranaik J, R. Senthil Kumar, R. S. Bhawar, N.P. Darshan and Diksha Patel. (2016). Factors influencing adaptation strategies by livestock owners to combat climate variability in Karnataka state: Application of ordered logistic regression model. *Indian journal of Animal Sciences,* 86(9):pp74-78.

Ravi Shankar K., Nagasree. K., Venkateswarlu.B and Maraty Pochaiah. (2011). Constraints and Suggestions in Adopting Seasonal Climate Forecasts by Farmers in South India. *Journal of Agricultural Education and Extension*, 17(2): pp 153-163.