Original Research Article

Factors Influencing the Adoption of Climate Resilient Technologies in Semi-Arid Regions: Insights from NICRA in Samba District, Jammu and Kashmir

Abstract

Climate-induced increase in temperature and reduction in rainfall has severely threatened the agriculture productivity and food security of the Indian state of Jammu and Kashmir. National Innovations Climate Resilient Agriculture (NICRA) interventions like crop rotation, soil management and helps farmers adapt the technology to reduce the risk of climate change. Therefore, this paper examines the impact of NICRA interventions on crop yield and income of farmers in a vulnerable and semi-arid region of Samba district of Jammu and Kashmir. The study surveyed 120 farmers of the samba district of Jammu and Kashmir. The ordinary least square method has been used to analyze the data. The results show that attendance to the training, having Kissan credit card and farmers experience have significantly influence the adaptation of NICRA interventions. The study sheds light on positive relation with farm income due to the adaptation of NICRA interventions. Overall, our study proposed policy-related recommendations to encourage farmers to adopt the climate- smart agriculture through NICRA interventions. This includes raising awareness among farmers through high-quality information and training and developing the climate action for the small and marginal farmers of the Samba district of Jammu and Kashmir. This study provides a foundation of understanding the role of NICRA interventions in increasing the farm productivity and income in semi-arid regions.

Keywords: Adaptation, Climate change, Climate Smart Agriculture,Mitigation,Productivity, Sustainable Agriculture

JEL Codes: Q54, Q5

INTRODUCTION

The change in climate affects food security and productivity through rising temperatures and variable rainfall across the world. This has resulted into food insecurity, changes in livelihood,

land degradation, ecosystems and emissions of greenhouse gases (IPCC, 2019). Due to change in the patterns of rainfall there is outbreak of pest that poses significant threat to the productivity and food security (Dinesh et. al ,2018). The IPCC (2022) reported that greenhouse gas concentrations in the air has been reached to an exceptional level for the last decade. It has been predicted that global temperature can rise upto to 1.1 to 3.7 degree Celsius (Urban et. al, 2023).Climate-smart interventions are a strategy to build against the climate change. Climate resilient technologies are enhancing the agricultural productivity and reduce the impact of greenhouse emissions gases (Aafaw and Maggio, 2016). Climate -smart agriculture have three pillar : increase productivity, enhance resilience and reduce emission . There should be integration of policies and adoption level for sustainable agriculture (Lipper et al.,2014). There has been studies which explore the adoption of climate smart practices in South Asia, focusing on perceived benefits and climate risk. The emphasis on the need of awareness and risk management strategies for resilient agriculture is very important (Arya et al., 2018). The empirical studies identify factors such as credit, education, credit access and extension servicesplays an important role in enhancing the adoption level of resilient agriculture practices (Tanjea et al., 2018). There should be integration of adaptation and mitigation strategies in agricultural practices to increase productivity. There are many case studies and empirical evidences to support the benefits of climate resilient technologies in improving the yield of crops, reducing vulnerability among farmers in India's diverse agro-climatic zones (Reddy and Syme, 2015). Given the context of Himachal Pradesh (Sharma and Singh, 2017), they explore the adoption behavior and identify the factors like access to information and institutional support influence the farmers to take up the climate smart practices. The role of policy framework helped the farmers to adopt the interventions and promote sustainable agriculture. The CSA practices in Rajasthan has been influenced by the socio-economic factors and perceived benefits. The policy support in semi-arid regions aims in building the resilience against climate change while ensures the sustainable agriculture (Kumar and Kumar, 2020). The CSA recognized as an important tool for managing the impact of climate change and climate- responsive technologies has been adopted (Rao and Mohan, 2018).

The events of extreme weather have been increased in Jammu and Kashmir. The agriculture sector has been enormously damaged by the variation in the weather. The Government of India

through ICAR and state universities have been increasing the flow of information of climate-smart agriculture (CSA). The National Innovations of Climate Resilience Agriculture (NICRA) is one of the step by ICAR to protect farmer from variable weather conditions. NICRA has been working towards improved crop yield, soil management, improved seed varieties, water management and institutional capacity building. These key NICRA interventions helped the farmers for enhancing the resilience in agriculture and mitigate the adverse effect of the climate change on crop production. In Jammu and Kashmir due to adverse climate change the NICRA interventions have been promoted by the Government of India. The key factors that influence the adoption of climate resilience technologies are govt. support, relevant information and training (Singh, 2013). In Himachal Pradesh, key CSA practices include the adoption of drought-resistant variety, improved irrigation system, soil and water conservation measures (Sharma and Singh, 2017). The present paper contributes to the literature on households adoption level of climate resilience agriculture in Samba district of Jammu and Kashmir. The OLS particularly looks at the factors which affect the adoption of NICRA interventions. Adoption is a long run process that require not only initial adoption but also the maintenance of the interventions so that farmers will mitigate the adverse effect of climate change. The findings of this study will help the policy makers to develop an action plan for the farmers for disseminating and promoting the information of climate resilience technologies.

METHODOLOGY

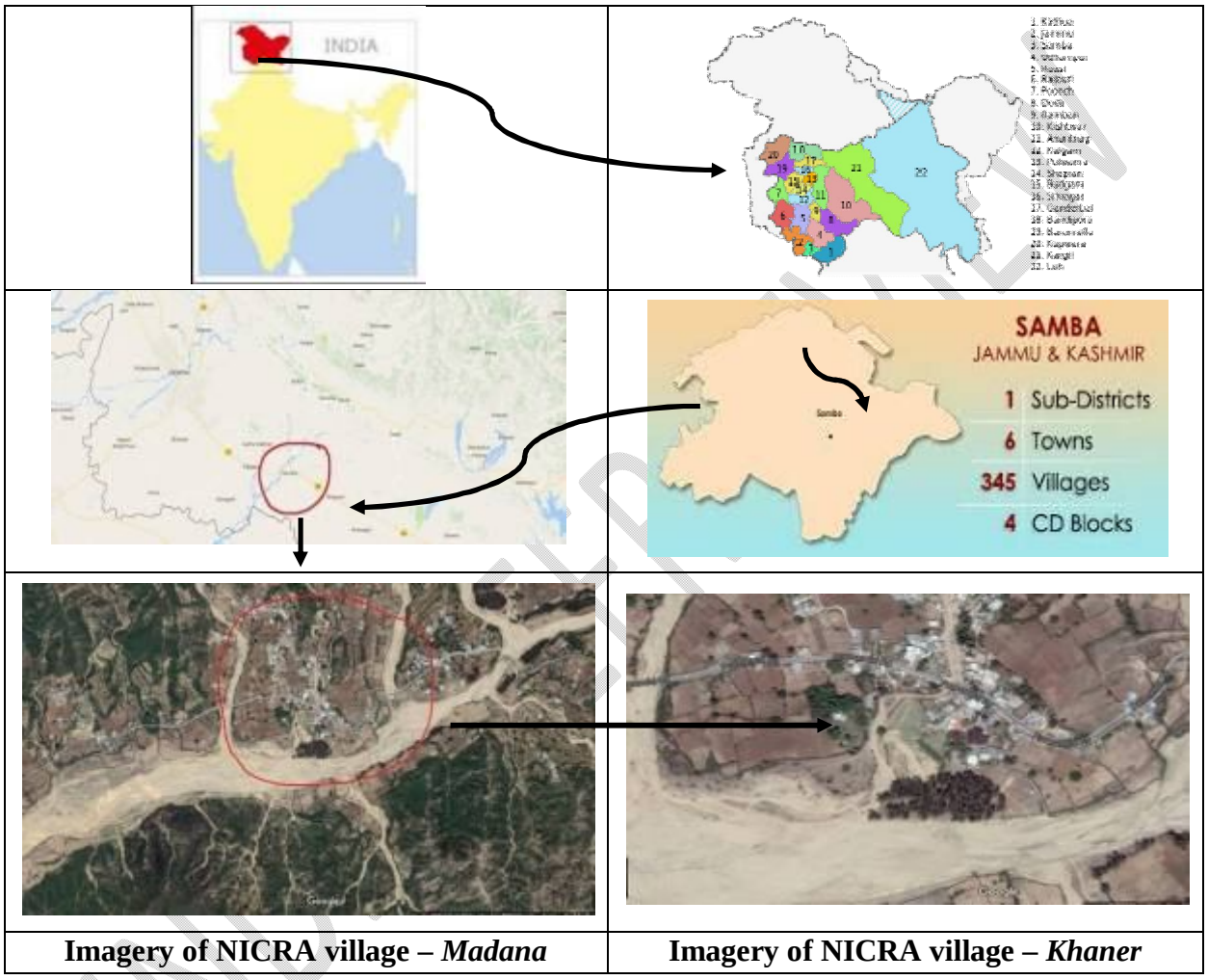
Sources of data

The primary survey has been conducted in Samba district of Jammu and Kashmir. A total sample of 120 farmers has been collected from the three NICRA villages namely Khaner, Khada and Madana in Samba district of Jammu and Kashmir using purposive sampling technique. The villages were selected for implementation ofNational Initiative on Climate Resilient Agriculture (NICRA) Project .The village is situated at a latitude of 32° 39” North and longitude of 74° 53” East at an elevation of 335 meters above the mean sea level and it represents the true *kandi*belt of Samba plain areas and parts of Jammu, Kathua and Udhampur districts of Jammu and at a distance of about 15 km from DLRSS RakhDhiansar..The village is under Khara Madana Gram Panchayat under the Block Purmundal, teh&distt. Samba, J&K.

NICRA Site:

The village '***Khaner***' is situated about 15 kms away from Block: Purmundal and about 40 kms away from teh&distt. Samba HQ. Other two villages namely Madana and Khada are adjacent to Khaner village.

Figure1: Image of NICRA villages:Khaner and Madana – Climate Resilient Agriculture practices in action



Imagery of NICRA village – *Madana* | **Imagery of NICRA village – *Khaner***

Table 1: Characteristics of the NICRA Farmers of Samba District of Jammu and Kashmir

Characteristics	**Adopter**	
	Number	**Percentage (%)**

Sex		
Male	110	91.66%
Female	10	8.33%
Total	120	
Age		
Mean	49.26	
Civil Status		
Married	97	83%
Unmarried	23	19.16%
Total	120	
Education Qualification		
No. of years of Schooling (Mean)	9.04	
Illiterate	0	0
Primary	17	14.16%
High School	96	80%
Graduation and above	7	5.83%
Total	120	

Ordinary Least Square Regression

The adoption of NICRA interventions is measured by numbers of variables like age, experience, social participation, Personal characteristics and demographics measures.

$DC_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots\ldots\ldots\ldots\ldots\ldots + \beta_k X_{ki} + e_i$

Where DC_i is dependent variable adoption of NICRA interventions by i^{th}farmer in the data,

β_0 is intercept, β_1, β_2 ……β_k are regression coefficients, X_1, X_2.....$X_k$are independent variables and

$e_i$is the error term.

RESULTS AND DISCUSSION

OLS model has been used to identify the significant factors affecting the adoption of NICRA interventions. There are number of independent variables which effect the adaptation of NICRA

interventions which helps farmers for the climate- smart Agriculture. The model has adjusted R^2 0.64 i.e. 64% the independent variables can collectively explain the variation in the dependent variable. The factors that significantly and positively explained the adoption level of NICRA interventions are trainings, Farmer Experience, TV as source of information, income and ownership of land (at 1% significance level each) and Agricultural Extension as source of information, KCC, Number of crop (at 5% significance level each) .

Thus, attending training programmes was likely to increase the adoption level of climate resilient agricultural practices. The positive role of the extension officers was also brought the increase in the level of the adoption. TV as a source of information plays an important role in spreading the awareness of NICRA interventions. As TV is the main source of disseminating the information to the mass population. Thus, farmers were becoming aware about climate- smart agricultural practices through television. In addition the farm income also plays an important role in adopting the climate resilient technologies. The Kissan Credit Card (KCC) also an important factor which influences the farmers to adopt the climate resilient interventions. Growing more than one crop also increase the adoption as the farmers are more aware about crop diversification which is less risky than growing one crop at a time. The farmers are looking for new technologies so that they can increase their yield and income. The technological interventions have been improving the awareness, knowledge and skills of the farmers. Our results are consistent with the previousstudies that have been conducted earlier. Adaptation to the climate change has significantly increased farm income the practices like varietal change of seeds, water management have positive and significant impact on net farm incomes (Di Falco et al., 2011). The farmers perception regarding climate change are being influenced by access of information. The services like extension, credit and information regarding climate change increased the climate resilience (Bryan et al., 2013). The positive attitude towards adoption of CSA practices is significant for the farmers of Ghana (Atta-Aidoo et al., 2022). The crop diversification also increase the adoption of CSA practices which correspond to the results (Franke et.al, 2018) which shows how the crop diversification through rotation of crops enhance soil fertility and increase the resilience towards climate variability in Sub-Saharan Africa.

Table 2: OLS Regression Results: Adoption of NICRA Interventions

Variables	**Coefficients**	**p> Z**

Constant	**-2.316**	**0.262**
Farmers		
Sex	0.231	0.563
Age	0.023	0.511
Education	0.033	0.710
Experience	1.19	0.005***
Training	2.871	0.0051***
TV as source of information	1.017	0.000***
Fellow farmer as source of information	0.726	0.267
Agriculture Extension as source of information	1.467	0.028**
Internet	0.234	0.540
Income	1.135	0.0037***
KCC	2.34	0.005**
Farm		
Farm Size	0.087	0.367
Ownership	1.089	0.0071***
Hired Labour	0.283	0.358
Number of crops	2.271	0.000**
Institutional		
Social Access	-0.367	0.687
Institutional Credit Access	0.547	0.261
No. of observation = 120	**F(16,103)= 6.730**	**Prob>p= 0.000**
R^2 = 0.67	**Adj. R^2 =0.64**	**Root MSE= 2.258**

***Significant at 10%, **Significant at 5% and ***Significant at 1%**

The training has been consistently plays an crucial role in adoption of climate smart interventions (Arslan et. al, 2020).Government attention should focus on providing tools, information, training andfinancing to smallholder farmers in the Samba district of Jammu and Kashmir. Beyond this, it is essential to raise awareness among farmers to protect their food security and sovereignty. The most important thing is to implement agricultural practices based on adaptation capacity, which requires, firstly, increased investments to optimize resources; increase productivity; improve the quality; reduce costs; preserve the environment and add value to products.

CONCLUSION

The study focused on the farmers' adoption level of climate resilience technologies which helps them to enhance their crop yield and income the villages of Samba district of Jammu and Kashmir. There are number of factors that positively and significantly affect the adoption of NICRA interventions. The training and information to the farmers played an important role for the initial adoption of climate resilient practices. The role of the Extension officers also has significant effect on farmers for adoption of practices which help them to increase the productivity of the crops. The study highlights the importance of quality and quantity of information at the right time to the farmers. Extension activities play a significant role in promoting the new technologies and interventions towards farmers. The climate- resilient interventions upgrade the knowledge skills and speeded the process of adoption level among farmers. The Government can utilize the power of mass media like TV, newspaper or posters to create awareness among farmers regarding climate- resilient interventions. The KCC provide timely and adequate credit to the farmers which ensure the flexibility for purchase of agriculture inputs like seeds, fertilizers etc. Finally, the adoption of interventions is location-specific, thus the govt. should give more attention at the policy, research and practice of new climate- resilient interventions which will encourage the farmers to adopt them.

Conflict of Interests

The authors declare that there is no conflict of interest**.**

Data availability statement

The data is available from the corresponding author upon reasonable request**.**

Disclaimer

The content , opinions and views expressed in the research communication published in the journal namely These views are of the authors and do not necessarily reflect the views of the organization they belong to.

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