Research Article

Indian Journal of Extension Education
Vol. 58, No. 2 (April–June), 2022, (30-34)

ISSN 0537-1996 (Print)
ISSN 2454-552X (Online)

Adoption of Climate Resilient Agricultural Technologies by Farmers in Nalgonda district of Telangana State

Akshith Sai Pabba[1]*, Ravinder Naik V.[2] and Sudha Rani V.[3]

[1]Ph.D. Scholar, Division of Dairy Extension, ICAR-National Dairy Research Institute, Karnal, Haryana, India
[2]Associate Professor, Department of Agricultural Extension, College of Agriculture, PJTSAU, Rajendranagar, Hyderabad, India
[3]Director, Extension Education Institute (Southern Region), Hyderabad, India
*Corresponding author email id: akshithsai136@gmail.com

ARTICLE INFO

Keywords: Climate change, Climate resilient agricultural technologies, Adoption, Nalgonda, NICRA

http://doi.org/10.48165/IJEE.2022.58206

ABSTRACT

Over the past few decades, climate change has become inevitable. In the present scenario, the focus from yield intensification is switched over to the adaptation to climate change. Climate Resilient Agricultural (CRA) technologies are observed as the best adaptation options available which could enhance the resilience of agriculture. The present study investigates the extent to which CRA technologies are being adopted by the farmers in the National Innovations in Climate Resilient Agriculture (NICRA) project implemented villages of Nalgonda district in Telangana state. It further examined the association of profile characteristics of respondents with the extent of adoption of CRA technologies. A structured interview was used to obtain data from 120 respondents. Results revealed medium to high levels of adoption of CRA technologies by the farmers with renovation and/or use of farm ponds, introduction and raising of medium duration variety in red gram *viz.*, LRG-52 and preventive vaccination in livestock among the highly adopted technologies. The profile characteristics *viz.*, farm size, annual income, innovativeness, information seeking behaviour, achievement motivation, and Weather Based Agro Advisory Services had positive and significant association with the extent of adoption of CRA technologies by the farmers.

INTRODUCTION

Climate change has become a global concern demanding attention and action due to the rising global temperatures, widespread melting of ice, changes in the intensity and frequency of occurrence of extreme events. In a densely populated country like India, particularly the effects of climate change are more detrimental in view of its highly vulnerable nature. The projected change in climate for 2100 indicated an increase in the temperature and rainfall between 2.5- 4.4°C and 15 and 24 per cent respectively (Bal et al., 2016). In view of these extreme climatic uncertainties, it is obvious that Indian agriculture is highly vulnerable to climate change as climate is the direct input for production. In addition, more than 60 per cent of the total cropped area under irrigation in India is still dependent on the vagaries of monsoon (Saxena & Kumar, 2014).

In view of the increased importance to address the development needs of more vulnerable populations of the country, Indian Council of Agricultural Research (ICAR) has launched a major network project on February, 2011 *i.e.*, National Initiative on Climate Resilient Agriculture later renamed as National Innovations in Climate Resilient Agriculture (NICRA). Under this project, location specific Climate Resilient Agricultural (CRA) technologies are being recommended and implemented in the project villages to enhance the resilience of Indian agriculture covering crops, livestock and fisheries to climatic variability and climate change.

During the present times, it has become vital to take action in encouraging the farmers adopt the CRA technologies in order to

Received 23-09-2021; Accepted 18-01-2022

enable them to cope up with the aberrant effects of climatic variability and change (Archana, 2017). The present study was undertaken with an objective to assess the extent of adoption of these recommended practices in the selected villages in Nalgonda district of Telangana state.

METHODOLOGY

For the purpose of drawing sample, multistage simple random sampling technique was used for the study. Nalgonda district of Telangana State was selected purposively as it is one among the 100 districts selected for the NICRA (National Innovations on Climate Resilient Agriculture) project implementation. The important climatic vulnerabilities of the district were high drought proneness, heat stress, mid and terminal dry spells etc. Three villages namely Nandyalagudem, Boring thanda and Kotha thanda of Athmakur (S) Mandal in the erstwhile Nalgonda district of Telangana State were selected purposively as the NICRA interventions are being implemented in these villages. A sample size of 40 farmers was selected at random from each village thus comprising a total sample size of 120. The data collected were analysed using frequency distribution, percentage and mean. Pearson Correlation was used to test the hypothesis of the study.

The list of CRA technologies recommended under NICRA project and implemented by Krishi Vignan Kendra (KVK), Gaddipally in the respective locale of study was considered for the present study. These technologies were implemented under four modules namely, National Resource Management (NRM), Crop production, Livestock and fisheries, Institutional interventions. The extent of adoption of CRA technologies by each respondent was obtained from the responses of the individual on a three-point continuum (fully adopted, partially adopted, not adopted with scores 2,1,0) by summation of the scores obtained from all the items included in the four modules. The possible minimum and maximum scores were 0 and 40, respectively. Based on the obtained minimum and maximum scores, the respondents were classified in to five groups *i.e.*, very low, low, medium, high and very high using exclusive class interval technique. The ranking of CRA technologies under each module was given based on the mean scores of the extent of adoption. The total score of each technology was obtained by multiplying the frequency under each category (not adopted, partially adopted, fully adopted) with their respective scores (*i.e.*, f_i*0+f_j*1+fk*2). Further, the mean score for each technology was obtained by dividing the total score with total sample size (120) and the ranks were given accordingly for the technologies under each module.

The Pearson correlation analysis was performed with the extent of adoption of CRA technologies and profile characteristics of farmers *viz.*, Age, gender, education, family size, farming experience, farm size, annual income, source of irrigation and socio-political participation, innovativeness (Verma, 1970), information seeking behaviour (Rao, 1985), risk taking ability (Supe, 1969), decision making behavior (Sobhana, 1990), Achievement motivation (Kota, 2017), Weather based Agro Advisory services (Archana, 2017) and scientific orientation (Supe, 1969).

RESULTS AND DISCUSSION

Extent of adoption of CRA technologies by the farmers

The ranking of CRA technologies under each module based on the mean scores of extent of adoption were presented in Table 1.

Table 1. Ranking of Climate Resilient Agricultural (CRA) technologies based on mean scores of extent of adoption

Intervention		Responses		
		Total Score	Mean Score	Rank
Natural resource management				
1.	*In-situ* moisture conservation practices in cotton and/or Red gram	190	1.58	III
2.	Soil test based fertilizer application	198	1.65	II
3.	Red gram sowing with BBF planter	183	1.53	IV
4.	Cotton sowing with Ridge and Furrow planter	145	1.21	VI
5	Renovation and/or use of farm ponds	207	1.73	I
6.	De silt and tank silt application to red chalka soils (light soils)	177	1.48	V
Crop production				
7.	Introduction of medium duration variety LRG-52	202	1.68	I
8.	Cotton + Red gram (6:1) inter cropping system	184	1.53	III
9.	Foliar nutrient management in cotton and red gram	175	1.46	IV
10.	Seed production of red gram PRG-158	156	1.30	V
11.	Installation of sticky traps in cotton	194	1.62	II
12.	Vegetable cultivation rather than growing cereal and pulse crops	140	1.17	VI
Livestock and podder production				
13.	Popularization of backyard poultry	99	0.83	III
14.	De- worming to livestock	118	0.98	II
15.	Improved fodder production APBN-1 and Co-4	86	0.72	IV
16.	Preventive vaccination	129	1.08	I
17.	Green fodder cultivation (MP- Chari)	62	0.52	V
Institutional interventions				
18.	Custom hiring center for timely field operations (i.e., rotavators, chaff cutters, puddlers, sprayers etc.)	132	1.10	I
19.	Gaining climate literacy through village weather station	97	0.81	III
20.	Village seed bank/ fodder bank	124	1.03	II

Natural Resource Management (NRM) module

The ranks assigned to each technology under the NRM module revealed that renovation and/or use of farm ponds was highly adopted (I Rank) followed by soil test based fertilizer application (II Rank). The probable reason may be because the farmers were educated by the officials on the importance of farm ponds in restoring water and utilizing it for providing supplemental irrigation during the periods of drought. Nearly all the farmers were found to have done soil testing in their fields and are following soil test based fertilizer application. Majority of the farmers were found to have adopted *in-situ* moisture conservation practices in crops *viz.,* cotton and red gram (III Rank) like bunding, deep ploughing, mulching, etc., probably due to the realization of the highly beneficial nature of these technologies. Some of the results obtained were similar to the findings of Brar et al., (2020), on the other hand meetings and discussions brought awareness of the changes happening in the villages due to global climate change and rains becoming quite unpredictable and erratic leading to creation of water sharing groups (Gupta et al., 2021).

Crop production module

It was observed that majority of the farmers were found to have fully adopted the introduction and raising of medium duration variety in red gram *viz.,* LRG-52 (I Rank) which was frequently distributed under the project followed by installation of sticky traps in cotton (II Rank) to protect the crop from sucking pest attack, cotton + red gram (6:1) inter cropping system (III Rank), foliar nutrient management in cotton and red gram (IV Rank), seed production of red gram PRG-158 (V Rank) and vegetable cultivation rather than growing cereal and pulse crops (VI Rank). The reason for low adoption of vegetable cultivation was probably because it was grown only as contingent crop and for home consumption rather than a commercial crop by the respondents.

Livestock and fodder production

The results of the ranks assigned to each technology under livestock and fodder production revealed that majority of the farmers who possess livestock adopted the preventive vaccination to protect from diseases (I Rank) followed by de-worming in livestock (II Rank), popularization of backyard poultry (III Rank), improved fodder production APBN-1 and Co-4 (IV Rank) and green fodder cultivation (MP- Chari) (V Rank). The farmers were found to have low adoption of cultivation of fodder varieties due to the limited water resources and occurrence of drought. The results were similar to the findings of Chouksey et al., (2021).

Institutional interventions

It was observed that utilization of Custom Hiring Centre (CHC) for timely field operations (I Rank) was highly adopted as it saved up to 80 per cent of field costs and enabled timely field operations to the farmers followed by partial adoption of village seed bank/ fodder bank (II Rank) and low adoption of gaining climate literacy through village weather station (III Rank).

From the data presented in Table 2 on the extent of adoption of CRA technologies it was apparent that two-fifth (39.17%) of the respondents had high levels of adoption of CRA technologies followed by one- fourth (25.84%) of the respondents with medium level of adoption. Whereas, one-fifth (20%) of the respondents were observed to have very high level of adoption of CRA technologies. The probable reason for medium to higher level of adoption of CRA technologies might be attributed to the higher information seeking behavior, scientific orientation, innovativeness, achievement motivation, and utilization of WBAAS (Weather Based Agro Advisory Services) by majority of the respondents. Additional reasons may be due to the satisfying results produced by the technologies in coping with climate change through reduced exposure and sensitivity towards agriculture and increase in the adaptive capacities of the farmers through crop diversification, contingency plans and enhanced incomes.

Table 2. Distribution of respondents based on the extent of adoption of CRA technologies

S.No.	Category	Percentage
1	Very low	11.66
2	Low	3.33
3	Medium	25.84
4	High	39.17
5	Very high	20.00

Association of profile characteristics of respondents and extent of adoption of CRA technologies by the farmers

It can be inferred from the data presented in Table 3 that farm size, annual income, innovativeness, information seeking behavior, achievement motivation and WBAAS had positive and significant association at one per cent level of probability whereas, education, risk taking ability, decision making behavior, scientific orientation had positive and significant association at five per cent level of probability with the extent of adoption of CRA technologies by the farmers. The probable reason for the positive and significant association of farm size with the extent of adoption of CRA

Table 3. Association of profile characteristics of respondents and adoption of CRA technologies

S.No.	Characteristics	Correlation coefficient (r)	p value
1	Age	0.21	0.796
2	Gender	0.16	0.14
3	Family size	1.49	0.151
4	Farming Experience	-0.41	0.633
5	Education	0.19*	<0.05
6	Farm size	2.81**	<0.01
7	Source of Irrigation	0.27	0.502
8	Annual Income	0.25**	<0.01
9	Innovativeness	1.21**	<0.01
10	Information Seeking Behavior	2.86**	<0.01
11	Risk Taking Ability	0.19*	<0.05
12	Decision Making Behavior	0.18*	<0.05
13	Sociopolitical Participation	1.28	0.07
14	Achievement Motivation	0.28**	<0.01
15	Weather Based Agro Advisory Services (WBAAS)	0.25**	<0.01
16	Scientific Orientation	1.63*	<0.05

Note: **- at 1% level of significance; *- at 5% level of significance technologies may be that medium and large farmers had high extension contacts to receive required information, the capacity to invest money and readily try new technologies. In contrast, the small and marginal farm land holders tend to take low risks due to various limitations. The results are similar to the findings of Chouksey et al., (2021); Mohokar et al., (2019); Rai et al., (2018) and Harikrishna et al., (2019), while they are in contrast with Manjunath et al., (2018). Similarly, individuals with higher annual income were generally enthusiastic to take up new enterprises *viz.*, mulberry cultivation and raised their crop fields by adopting CRA technologies to further enhance their income levels. Realization of the beneficial nature of CRA technologies in terms of income earned might have contributed to the high level of adoption of CRA technologies.

Innovativeness has a positive and significant association of with the extent of adoption of CRA technologies may be because an individual with higher innovativeness will basically show willingness to try new ideas by which he tends to collect more information regarding those ideas or practices. Further, the beneficiaries gathered information from the officials of KVK, NICRA and through discussions with other farmers in the village about the benefits and problems in the adoption of CRA technologies, which may have contributed to the positive and significant association of information seeking behavior with the adoption of CRA technologies by the farmers. The obtained results are in agreement with the findings of Mohokar et al., (2019) & Manjunath et al., (2018). The possible reason for the positive and highly significant association of achievement motivation with the extent of adoption of CRA technologies could be the desire for excellence, which motivated the farmers to take up certain activity, accomplish it in a certain direction and achieve the aspired results. Achievement motivation encourages farmers to try new ideas, take higher risks and seek necessary information on CRA technologies in order to attain the desired results. The results are in concordance with Nyasimi et al., (2017); Mohokar et al., (2019) & Manjunath et al., (2018).

The probable reason for positive and significant association of utilization of WBAAS by the farmers and adoption of CRA technologies at one per cent level of probability might be that, increase in the utilization of WBAAS prepared the farmers in taking up contingency crop planning, reduced their exposure and sensitivity towards climatic variabilities, which may have further contributed towards the higher levels of adoption of CRA technologies by the farmers. Education level had positive and significant association of with the extent of adoption of CRA technologies at five per cent level of probability may be due to the normal tendency of individuals with higher education to analyse, interpret and understand the beneficial effects of technologies with less trouble may be. The results are in line with the findings of Mohokar et al., (2019) & Manjunath et al., (2018).

The high risk taking ability of the farmers may have favored them to overcome the limitations through managing the available resources and recognize the positive results from the adoption of CRA technologies. Additionally, better decision making behavior might have helped the farmers think of all possible opportunities available and decide the best course of action, that could bring them profits by reducing the risks associated with climate related stimuli. Furthermore, discussions, field days, meetings and trainings conducted by the NICRA officials on scientific farming methods, which enhance climate resilience may have contributed to their understanding of the things scientifically with interest. These may be the possible reasons for the positive and significant association of risk taking ability, decision making behavior and scientific orientation with the extent of adoption of CRA technologies at five per cent level of significance. Similar results were reported by Chouksey et al., (2021) & Manjunath et al., (2018).

CONCLUSION

The study revealed that majority of the respondents had high level followed by medium level of adoption of CRA technologies. Certain technologies in the four modules *viz.*, renovation and/or use of farm ponds, introduction and raising of medium duration variety in red gram *viz.*, LRG-52 and preventive vaccination in livestock were found to have higher level of adoption whereas other technologies *viz.*, vegetable cultivation, popularization of backyard poultry, green fodder cultivation (MP- Chari), gaining climate literacy through village weather station were low in adoption by the farmers. An extension plan may be framed keeping in view the findings of the study so that the technologies being adopted in medium and low extent can be up scaled to higher extent of adoption to gain superior benefits.

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