

Agro-Economic Impact of Climate Resilient Practices on Farmers in Anantapur District of Andhra Pradesh

Yeragorla Venkata Harikrishna¹, Seema Naberia², Sabyasachi Pradhan³ and Paraw Hansdah⁴

ABSTRACT

Climate change is one of the serious challenges to the agriculture sector in order to ensure nutritional and food security for growing population. National Innovations on Climate Resilient Agriculture (NICRA) project aims to improve resilience of Indian agriculture to climate change and climate vulnerability. The present study was conducted to know the impact of the climate resilient technologies upon the NICRA beneficiaries in Anantapur district of Andhra Pradesh. The study was conducted with a sample of 60 respondents from three NICRA project implementing villages. Before-after comparison of NICRA beneficiaries was employed to identify the project impact and the difference was tested using paired t-test and found that it was statistically significant. The results of the study reveals that area under irrigation, crop yield, cropping intensity and annual income of NICRA beneficiaries after the project interventions was significantly higher than that of before the implementation of the interventions. More than fifty percent respondents had medium level of impact of the climate resilient technologies. This study helps the implementing institutions in redesigning the interventions for wide adaption of climate resilient practices.

Keywords: NICRA, Impact, Climate resilient practices

INTRODUCTION

Agriculture in India with more than half is rainfed area, is mostly dependent on monsoon besides the interplay of other biotic and abiotic factors. Agriculture is subjected to various stress and potential yield are seldom attained with stress. Climate change can affect the yield positively as well as negatively. Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia (IPCC, 2013). Climate change projections for Indian sub-continent indicate an increase in temperature by at least 3.3°C by 2080s relative to pre-industrial times (IPCC, 2007a,b). There are evidences of negative effects on yields of wheat and paddy in some parts of India due to raised temperature, moisture stress and lessening of rainy days. Under medium-term (2020–2039) climate change

scenario, crop yield is projected to reduce by 4.5 to 9 per cent, depending on the magnitude and distribution of warming (NICRA, 2013). As agriculture sector has to face the hostile effects of climate change and climate variability, hence adaptation strategies are indispensable for farmers to deal with them (Chunera and Amardeep, 2018). Adaptation is context and location specific. There is no single best approach for reducing hazards across all settings (Rakshit *et al.*, 2016). To overcome the drought, farmers have to be ready to adopt climate resilient agriculture technologies. Various improved agricultural practices evolved for diverse agro-ecological regions in India which have potential to enhance climate change adaptation, if deployed prudently. The Indian government has accorded high priority to Research and Development for coping with climate change in agriculture sector. The Prime Minister's National Action Plan on

¹Ph.D. Scholar, Department of Extension Education, Anand Agricultural University, Anand, Gujarat

²Assistant Professor, ³Ph.D. Scholar, ⁴M.Sc. (Ag.), Department of Extension Education, JNKVV, Jabalpur, Madhya Pradesh

Climate Change has recognised agriculture as one of the eight National Missions. Indian Council of Agricultural Research (ICAR) launched a major network project entitled, National Initiative on Climate Resilient Agriculture (NICRA) during 2010-11, focusing on the process of developing district level contingency plans for all the rural districts of country with Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad as the nodal agency with an outlay of Rs.350 crores for the XI Plan. The project is being implemented at large number of research institutes of ICAR, State Agricultural Universities and KVKs. NICRA has four intervention modules, the four intervention modules are Natural resource management, Crop production, Livestock and fisheries and Institutional interventions. These interventions includes climate resilient practices like micro irrigation systems, crop diversification, introduction of improved varieties, provision of farm machineries through custom hiring centres and increasing climate literacy of farmers. This study was to evaluate the usefulness of Climate Resilient practices in farmer's field. Keeping this in view, an effort has been made to assess the impact of NICRA project on beneficiary farmers in Anantapur district of Andhra Pradesh.

METHODOLOGY

This study was conducted in Anantapur district of Andhra Pradesh during 2017-18 and 2018-19. The study sample comprised of 60 farmers selected randomly from three purposively selected villages i.e. Chamaluru, Peravalli and Chakrayapeta. The selection of districts, blocks and villages were based on the assessed vulnerability of these localities to climate change as determined by National Innovations on Climate Resilient Agriculture (NICRA) of Indian Council of Agriculture Research (ICAR), Government of India in 2011. Before and after comparison was used to outline the impact of the climate resilient practices upon the NICRA beneficiaries. This comparison was done with help of baseline data and recall memory of respondents. The data was collected using a pre-tested structured interview schedule and collected data was analysed in light of pre-determined objective for the present study. As the data obtained were quantitative in nature, paired t-test was employed to find the significance of differences.

The impact of NICRA project was calculated by combining all the four indicators viz., Percentage change in area under irrigation [A], Percentage change in crop yield [B], Percentage change in cropping intensity [C], Percentage change in annual income [D]. The final score of impact of NICRA project expressed in Percentage was arrived by using the formula:

$$\text{Impact of NICRA project on beneficiary farmers} = \frac{A+B+C+D}{4}$$

The respondents were grouped into three categories of low, medium and high based on the mean and standard deviation. The results were expressed in the form of frequencies and percentages.

RESULTS AND DISCUSSION

Impact of NICRA project on beneficiary farmers

Percentage change in area under irrigation [A]

It was observed from Table 1 that, 59.04 percentage increase in area under irrigation was observed among the NICRA beneficiaries due to the adoption of climate resilient technologies. The results of the 't' value (11.56) revealed that there was significant difference in area under irrigation between before and after the adoption of climate resilient technologies. The results from Table 2 reveals that nearly two-third of the beneficiaries (65.00%) were under medium level followed by high level (23.33%) and low level (11.67%) of percentage change in area under irrigation. The probable reason might be due to fact that conservation of rain water through farm ponds and sustainable use of irrigation water through micro irrigation brought the additional land under irrigation. Babu *et al.* (2016) reported that 97.98 percentage increase in area under irrigation was observed among the Andhra Pradesh Micro Irrigation Project (APMIP) beneficiaries due to adoption of Micro irrigation system in Chittoor district.

Percentage change in crop yield [B]

It was concluded from Table 1 that, 30.06 per cent increase in crop yield was observed among the NICRA beneficiaries after the adoption of climate resilient technologies. The results of the 't' value (29.77) revealed that there was significant difference in crop yield between

Table 1: Percentage change in indicators due to adoption of climate resilient technologies

Indicators	Before adoption	After adoption	Difference	Percentage change	t - value
Area under irrigation	1.05 hectares	1.67 hectares	0.62 hectares	59.04	11.56**
Crop yield	1.926 tonnes/ha	2.505 tonnes/ha	0.579 tonnes/ha	30.06	29.77**
Cropping intensity	98.43	139.37	40.94	41.59	14.398**
Annual income	57,733.33 rupees	90520.08 rupees	32786.75 rupees	56.78	25.37**

**Significant at P < 0.01

before and after the adoption of climate resilient technologies. The results from the Table 2 stated that majority of the beneficiaries (63.33%) were under medium level followed by high level (20.00%) and low level (16.67%) of percentage change in crop yield. The possible reason might be adoption of climate resilient practices increased the availability the irrigation water, usage of improved varieties and input use efficiency which improves the quality and quantity of produce. There was an increase in average yield for rice, maize, ragi, redgram and groundnut with yield 41.51, 35.64, 26.53, 6.28 and 7.33 q/ha respectively in comparison to previous yields of NICRA farms (Jasna *et al.*, 2017).

Percentage change in cropping intensity [C]

It was revealed from Table 1 that, 41.59 per cent increase in cropping intensity among the NICRA beneficiaries after adoption of climate resilient technologies. The results of the ‘t’ value (14.39) revealed that there was significant difference in area under irrigation between before and after the adoption of climate resilient technologies. The results from Table 2 shows that more than half of the beneficiaries (56.67%) were under medium level followed by high level (30.00%) and low level (13.33%) of percentage change in cropping intensity. Mono cropping was observed before the implementation of NICRA. After the implementation of NICRA, as the water was saved through climate resilient technologies, the beneficiaries had shifted to intercropping and multi cropping. Hence there is increase in cropping intensity. Babu *et al.* (2016) stated that 126.94 percentage increase in Cropping Intensity observed as a result of Micro irrigation system for APMIP beneficiaries in Chittoor district.

Percentage change in annual income [D]

It was concluded from Table 1 that, 56.78 per cent increase in income was observed among the NICRA beneficiaries after the adoption of climate resilient technologies. The results of the ‘t’ value (25.37) revealed that there was significant difference in area under irrigation between before and after the adoption of climate resilient technologies. The findings from Table 2 indicates that more than half of the beneficiaries (58.34%) were under medium level followed by high level (23.33%) and low level (18.33%) of percentage change in annual income. The reason for increased income levels may be due to increase in irrigated area and yield levels of NICRA beneficiaries due to implementation of climate resilient technologies. There was a change in income by 2.56 fold in ginger and 2.67 folds in turmeric through mulching of beds in Kyrdem village (Medhi *et al.*, 2018).

Impact of NICRA project on beneficiary farmers

$$\begin{aligned} \text{Impact of NICRA project} &= \frac{A+B+C+D}{4} \\ &= \frac{59.04+30.06+41.59+56.78}{4} \\ &= 46.86 \end{aligned}$$

It is clear from the results showed in Table 1 that, there was 46.86 per cent of impact of NICRA project observed among the beneficiaries.

Findings of Table 2 indicated that more than half of the beneficiaries (51.67%) were under medium level of impact of NICRA Project followed by high level (30.00%) and low level (18.33%) of impact of NICRA Project.

Table 2: Distribution of respondents according to the Percentage change in Indicators due to adoption of climate resilient technologies

S.No.	Indicators	Category	Respondent Farmers (n=60)	
			Frequency	Percentage
1.	Change in area under irrigation (ha)	Low	7	11.67
		Medium	39	65.00
		High	14	23.33
2.	Change in crop yield (tonnes/ha)	Low	10	16.67
		Medium	38	63.33
		High	12	20.00
3.	Change in cropping intensity	Low	8	13.33
		Medium	34	56.67
		High	18	30.00
4.	Change in annual income (Rupees)	Low	11	18.33
		Medium	35	58.34
		High	14	23.33
5.	Overall impact of NICRA project	Low	11	18.33
		Medium	31	51.67
		High	18	30.00

The visible favourable impact of NICRA on its beneficiaries might be due the need based components of NICRA project.

The NICRA project tackles all the aspects of development of dry areas in a holistic approach coming with ridgeline. In the first instance, soil and water conservation works taken up on free of cost by the agency where, farm ponds and percolation ponds, were constructed in the NICRA village. This has maximized the rain water storage and conservation which made the beneficiaries to attain higher yield and increased cropping intensity by intercropping systems, availability of water throughout the season through rain water structures have made them to achieve diversified farming. The establishment of the custom hiring centre has made the beneficiaries to take up timely operations related to production. These climate resilient technologies along with convincing of the beneficiaries through series of extension educational activities have made them to increase their income over the years, resulted in better infrastructure facilities and resources, which might have resulted in higher social status as well. There was 68.63 percent

impact of APMIP observed among the beneficiaries. Majority of the respondents had medium level (45.83%) of impact in Chittoor district (Babu *et al.*, 2016). Pise *et al.* (2018) reported that, 57.50 per cent of beneficiaries of NICRA had medium level of overall impact of NICRA followed by (22.50%) low and (20.00%) high level of overall impact of NICRA on the beneficiaries of NICRA project in Shekta village.

CONCLUSION

National innovations on climate resilient agriculture (NICRA) is a great initiative taken by ICAR, with the objective to improve the resilience of Indian agriculture covering crops, livestock and fisheries to climatic variability and climate change. The current research stressed impact of climate resilient practices demonstrated at NICRA villages due to its increased adoption. With a network of institutions functioning in every locality, the practices gained speed in their adoption and effectiveness. The study exposes that, there is significant increase in area under irrigation, crop yield, annual income and cropping intensity of beneficiaries had been observed after the adoption of climate resilient technologies of NICRA

project. This is likely due to effect climate resilient practices like drip irrigation, crop diversification, farm ponds construction, usage of early maturing varieties and healthy soil management practices. Findings revealed an encouraging influence of the demonstrated technologies in various areas of farmer's life of NICRA village. It might be helpful to accelerate the mind set of non-adopters from the awareness stage to adoption stage for climate resilient technologies of NICRA project. The findings will offer the feedback to the implementing institutions engaged in dissemination of climate resilient practices for further reshaping the interventions, in order to improve its outcome and output.

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