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Impact of Climate Resilient Technological Interventions in Jodhpur District of Rajasthan

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ABSTRACT

The agriculture practices in Rajasthan are difficult due to high temperature and low rainfall. The Technology Demonstration Component of National Innovation on Climate resilient Agriculture Project was implemented through KVK, CAZRI, Jodhpur to address climate change issues and improving livelihood of farmers of the region. The study was conducted during 2021-22 and 120 respondents were selected randomly from two villages of Jodhpur district of Rajasthan, to access utility of the services, adoption status and outcome of technological interventions of NICRA. The utility of supply of seeds and critical inputs was perceived as most useful followed by animal health care, availability of farm machinery respectively. The adoption of short duration and drought tolerant varieties of *kharif* crops lead to 34.20 per cent average yield increase. The adoption of improved breeds and mmineral mixture supplements & multi-nutrient feed block accorded second and third respectively on the basis of extent of adoption. The cropping intensity was increased by 18.52 per cent and employment (man days) increased by 16.80 per cent after NICRA interventions. Per family annual income increased by 65.17 per cent and average savings increased by 80 per cent after the NICRA project.

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 (Bal et al., 2016). Agriculture production is mainly dependent on climatic conditions. All the sectors and societies of world are vulnerable to climate change, but agriculture being primarily dependent on climate, is among the most vulnerable group. Building the capacity of extension scientists on impact of climate change especially in harnessing the increased CO level and Carbon sequestration processes and climate resilient species of plants and animal for promotion of remunerative agriculture is always stressed upon (Ghanghas et al., 2015) and to support farm level decisions and minimize the loses in adverse climatic and weather conditions farmers' understanding about interaction of climate and agro-ecosystem need to be bridged through inclusion of farmers' communication network (Ravikumar et al., 2015). Applying right resources at the right place and, at the right time, using the right method with combination of technologies and practices can help in achieving optimum resource stewardship and resource conservation in the farmers' field (Shitu et al., 2018). Rainfall is the key variable influencing crop productivity in rainfed agriculture. Intermittent and prolonged droughts are major cause of yield reduction in most crops. The rainfall drives water availability and determines sowing time (rainfed crops), temperature drives crop

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growth, duration, dry spells cause significant impact on standing crops, physiology, loss of economic products (fruit drop) and extreme events (high rainfall/floods/heat wave/cold wave/cyclone / hail/frost) cause enormous losses of standing crops. Rainfed crops are likely to be worst hit by climate change because of the limited options for coping with variability of rainfall and temperature (Anonymous, 2015). Rajasthan, largest state of India is among the leading producers of mustard, pearl millet, cumin, coriander and fenugreek, which shows the importance of the state in Indian agriculture. The agriculture practices in Rajasthan are more tough due to harsh dry climate in major area of the state. To address these issues, ICAR has launched a major network project, National imitative on Climate Resilient Agriculture (NICRA) and Technology Demonstration Component of project was implemented through Krishi Vigyan Kendra, Central Arid Zone Research Institute, Jodhpur since 2011. The important climatic vulnerabilities of the Jodhpur district were high drought proneness, heat stress, low rainfall, mid and terminal dry spells. The present study was conducted with an objective to access utility of the services provided by the KVK under NICRA project and to access the agro-economic impact of technological interventions on beneficiaries.

METHODOLOGY

The study was conducted at purposively selected two villages (Purkhawas and Lunawas Khara) of Jodhpur district of Rajasthan during 2021-22 where NICRA-TDC project is functional since 2011 through KVK, CAZRI, Jodhpur. A list of beneficiaries of project was prepared and from this list 120 respondents were randomly selected. The usefulness of the services provided by the KVK was measured by recording choice of the beneficiaries against each service provided by KVK on five-point continuum scale (Highly Useful, Useful, Undecided, Not Useful and Not Useful). The sum of scores of each service was calculated by multiplying the frequency under each category i.e. Highly Useful, Useful, Undecided, Not Useful and Not Useful at All with scores 4, 3, 2, 1 and 0, respectively.

The extent of adoption of Climate Resilient Technological Interventions (CRTI) was obtained from the responses of an individual on a three-point continuum (fully adopted, partially adopted, not adopted) scale, with scores 2, 1 and 0, respectively. The total score of each CRTI was obtained by multiplying the frequency under each category (Fully Adopted, Partially Adopted, Not Adopted) with their respective scores (*i.e.*, fi *0+fj *1+fk*2). The possible maximum and minimum scores were 240 and 0, respectively. The mean score for each technology was obtained by dividing the total score with total sample size (120) and the ranks were given accordingly.

The outcome of most significant interventions which have increased yield and improved livelihood of respondents were observed and data were presented. To assess the change, the beneficiaries of NICRA were compared with their pre- NICRA position. Before-after comparison was made possible with the help of baseline data and recall memory of respondents. The average score of beneficiaries before and after NICRA was worked out and percentage increase or decrease was calculated mentioned below:

$$\text{Percent increase/decrease} = \frac{\text{Average Score after-Average Score before}}{\text{Average Score after}} \times 100$$

The difference between the two scores (before and after) was statistically tested using paired t-test and comparison at particular level of significance.

RESULTS AND DISCUSSION

Utility of services perceived by Beneficiaries

The results regarding the utility of services provided by NICRA as perceived by beneficiaries are presented in Table 1. The supply of seed and critical Inputs service was perceived as most useful by awarding first rank with sum of scores equal to 387. The majority of the farmers (45.83%) has perceived as useful, whereas, 25 percent farmers perceived as highly useful and similar farmers (25%) undecided. The reason behind most importance of this service may be that farmers are using their own traditional seed and non-awareness as well as non-availability of climate resilient improved seed and other inputs.

Table 1. Utility of the services provided by KVK under NICRA-TDC

Service	Sum of Scores	Rank
Supply of Seed and Critical Inputs	387	I
Animal Health Care	346	II
Availability of Farm Machinery	344	III
Trainings	306	IV
Weather based Agro. Advisories	248	V

The animal health care services was perceived second most important service and 51.67 per cent respondents perceived as useful, 23.33 per cent respondents as highly useful, undecided (15.00%), and not useful (10.00%). The findings are supported with Yankam et al., (2019). The second most preference to this service might be due to importance of livestock in economy of arid region. The Availability of Farm Machinery got rank third on its utility. The 26.67 per cent beneficiaries perceived it to be highly useful, while as 43.33 per cent perceived it as useful followed by undecided (21.67%), not useful (6.67%) and not useful at all (01.67%). The findings are in line with Kisku et al., (2022) who reported majority (75%) of the farmers had moderate perception towards custom hiring services. Utility of trainings got fourth rank with sum of scores equal to 306. It was perceived as highly useful by 26.67 per cent respondents, useful (21.67%), undecided (35.00%), not useful (13.33%) and not useful at all (3.33%).

The Meena et al., (2022) also observed need to undertake awareness-increasing programs to change people's attitudes and improve the adaptive capacity of farmers in dealing with current and future climate change. Weather based agro advisory services usefulness got fifth rank with sum of scores equal to 248. The 11.67 per cent of the beneficiaries perceived WBAAS as highly useful, 20 per cent as useful, 35 per cent were undecided, 30 per cent perceived as not useful and 3.33 per cent perceived as not useful at all. The findings are in partial confirmation with Kumar et al., (2022) who reported that almost, 70 per cent of registered

Table 2. Adoption and Outcome of Most Significant Interventions in NICRA village

Intervention	Adoption		Outcome
	Mean Score	Rank	(% increase in yield)
Short duration and drought tolerant varieties of Kharif crops	1.80	I	34.20
Improved Breedof Cow, Buffalo and Goat	1.75	II	29.80
Mineral mixture supplements & Multi-nutrient feed block	1.72	III	22.70
Custom Hiring Centre	1.67	IV	20.00
Rain water harvest based Nutritional Garden	1.53	V	15.20
Women Friendly Ddrudgery Reducing Implements	1.42	VI	12.00
Compost and Vermi Composting	1.27	VII	9.80
Arid Fruit Cultivation	0.86	VIII	8.50

farmers have followed information for agriculture practices through Meghdoot application of agro-meteorology advisory services .

Adoption and outcome of most significant climate resilient technological interventions

The ranking of CRTI based on the mean scores of extent of adoption along with outcome in the form of increase in yield have been presented in Table 2. The adoption of short duration and drought tolerant varieties of Kharif crops was accorded first rank with mean score 1.80. The average yield increase of 34.20 per cent over traditional practices was recorded by adoption HHB-67 and MPMH-17 varieties of Bajra, CZM-2 of moth bean, GM-4 and IPM-02-3 varieties of mungbean. The similar results were found by with Sultana et al., (2020). The higher adoption of short duration and drought tolerant varieties was found due to low and erratic rainfall in the region.

The adoption of improved breed of cow, buffalo and goat got second rank with mean score 1.75. The 29.80 per cent (average) increased yield in comparison to previous non descriptive breed was observed by adoption of Murrah (buffalo), Tharparkar (cattle) and Sirohi (goat) breeds for breeding purpose. The Rao et al., (2017) observed doubled income (Rs. 18,000 from Rs. 9000) by adoption of innovative rearing of Konkan Kanyal goat with locally available resources. The adoption of mineral mixture supplements & multi-nutrient feed block accorded third rank with mean score 1.72. The 22.70 per cent increase of milk yield was observed in milch animals. Besides increased milk yield, the digestibility as well as picca habit of animals were improved and animals also came in heat regularly. The Harikrishna & Seema (2021) also reported that the 75 per cent of farmers adopted the usage of molasses-urea blocks and 68.33 per cent beneficiaries adopted the area specific mineral mixture.

The utilization of custom hiring centre based equipments for increasing production of crops and livestock was observed fourth most adopted intervention with mean score 1.67. The 20 per cent increase in yield was observed by adoption of this intervention. The Seed cum fertilizer drill for timely sowing of crop and drilling fertilizers during sowing window, Water tanker for drinking of human beings as well as livestock and critical irrigation of plants, Sprayer and duster for controlling insect-pests and diseases and Weighing machine for farm and livestock products have good impact in study area as well as adjoining villages. The Rain water harvest based Nutritional Garden (Mean Score-1.53), Women Friendly Drudgery Reducing Implements (Mean Score- 1.42) Compost and Vermi Composting (Mean Score-1.27), and Arid Fruit Cultivation (Mean Score-0.86) were ranked fifth, sixth, seventh and eighth respectively by the farmers on the basis of extent of adoption. The 15.20, 12.00, 9.80 and 8.50 per cent increased yield was recorded by adoption of Rain water harvest based Nutritional Garden, Women Friendly Drudgery Reducing Implements (Improved kassi, Improved Weeder, Garbage carrier, double screening grain cleaner, Improved Badi maker etc.), Compost and Vermi Compostingand Arid Fruit Cultivation respectively. The findings are similar to Kumari et al., (2022) who reported that 150 m^2 area of kitchen garden fulfilled more than requirement of vegetable in daily routine diet for Family (Up to 6 Members) in Rabi season (82.71%) followed by 82.71 per cent in *Kharif* season and 66.08 per cent in Zaid season and average net saving was Rs. 6037.98 in a year through the kitchen garden. The Jasna et. al. (2017) also reported that timely availability of inputs and right technologies and Machineries for agricultural operations through CHC and seed bank contributed positively and higher employment.

Change in Selected variables after NICRA Iinterventions

The data presented in Table 3 reveals that the mean cropping intensity of beneficiaries before NICRA was 105.28 and after NICRA project it increased to 123.80, this clearly shows that the interventions under NICRA has successfully raised the cropping

Table 3. Change in Selected Variables after NICRA Intervention

Variable	Before NICRA intervention (average)	After NICRA intervention (average)	Percentage increase/decrease	t- value
Cropping intensity (%)	105.28	123.80	18.52	21.02**
Employment (Man Days)	204.93	239.35	16.80	10.57**
Annual Income (Per Family)	1,12,000	185000	65.17	15.60**
Savings (Rs)	6820	12280	80.00	7.45**
Expenditure on Luxurious items (Rs)	8250	15300	85.45	10.20**

** Significant at 1 per cent level of significance

intensity. The 18.52 per cent increase of cropping intensity through NICRA interventions was found statistically significant when tested with paired t-test with t=21.02 at one per cent level of significance. The similar results were found by Lone, T A (2021). The employment (man days) has also increased by 16.80 per cent from 204.93 man days before NICRA to 239.35 man days after NICRA and data were found to be statistically significant. The per family annual income has increased by 65.17 per cent from Rs. 1,12,000 before NICRA to Rs. 185000 after NICRA and average savings of the beneficiaries was increased by 80.00 per cent after the NICRA project. The average expenditure on luxurious items by beneficiaries before NICRA was increased by 85.45 percent from Rs. 8250 to Rs. 15300.

CONCLUSION

It was concluded from the study that timely availability of drought resistant variety seeds and other critical inputs is most useful service intervention for increasing production and productivity of crops in arid region. The animal health care and availability of farm Machinery services are also important intervention to cope with climatic vulnerabilities. The higher adoption of short duration and drought tolerant varieties of Kharif crops, improved breed of cow, buffalo and goat andmineral mixture supplements & multi-nutrient feed blockby farmers shows their higher interest and positive attitude towards improved methods of farming for their livelihood improvement. The significant increase in cropping intensity,andemployment opportunity along with higher annual income, savings and expenditure on luxurious items by beneficiary farm families have proved good impact of the project in the study area.

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