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Impact of NICRA on Cropping Pattern and Extent of Adoption of Climate Resilient Practices on Farmers

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Agriculture is extremely vulnerable to climate change and short duration and higher temperatures eventually reduced yields of crops white encouraging weed and pest proliferation. the changes in precipitation patterns increase the likelihood of short- run crop failure and long run production

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decline Climate resilient technologies are promising tool to guard a farming system from climatic variations. National Initiative on Climate Resilient Agriculture (NICRA) has demonstrated, and promoted application of climate resilient technologies in most vulnerable 100 districts. Krishi Vigyan Kendra, Wyra received NICRA project in the year 2010- 2011 to 2110 - 2011. Many climate resilient technologies were briefed to the farmers in the selected villages. The farmers distinguished the demonstrated technologies to the farmers were adopted with ease. Majority of the NICRA beneficiaries have high adoption to the climate resilient technologies while few of non beneficiaries adopted the technologies.

Keywords: Climate change; climate resilience; NICRA; direct seeding; paddy.

1. INTRODUCTION

Agriculture is the primary source of livelihood for about 58 per cent of India's population. Other natural resource-based enterprises are the foundation for the country's economic growth. The impact of climate change is directly or indirectly related to crop, water and soil as it influences the water availability, changes the intensity and frequencies of drought, effects microbial population reduce soil organic matter reduction, yield reduction and depletion of soil fertility due to soil erosion, etc. The cultivation practices are completely based on climatic situations. An average of 30 per cent reduction in crop yields is anticipated by the mid-21st century in Southasian countries. In India, an increase in temperature by 1.5°C caused reduction in the precipitation of 2 mm rainfall leading to reduced rice yield by 3 to 15 per cent [1]. There was significant negative impact due to climate change, predicted with reduced yield by 4.5-9 per cent, which is roughly up to 1.5 per cent of GDP per annum. Climate change has become an important area of concern to ensure food and nutrition security for the ever growing population. In view of these challenges, the Government of India, with Indian Council of Agricultural Research (ICAR) has taken up a major Network project, National Initiative for Climate Resilient Agriculture. Under this technology demonstration component of NICRA Project , an integrated package of proven technologies were demonstrated in 5 clusters of Khammam District, Enkoor Mandal *i.e.,* Gangula Nacharam, BadruThanda, Colony Nacharam, Rama Thanda and Bheemla Thanda for adaptation with the aim to mitigate the ill effects of climate variability. The five clusters were selected purposively for implementation of NICRA as this region experiences uneven distribution of rainfall, Seasonal drought and heat waves. Krishi Vigyan Kendra, Wyra has taken up the project in the year 2010 to 2021. The objective of the study is to identify the Impact of NICRA project and Extent of adoption of demonstrated climate practices Khammam District of Telangana. Many technologies have widely been accepted by the farmers, technologies were demonstrated in the site such as green gram after paddy, sunhemp seed production after cotton and paddy, insitu moisture conservation in cotton etc.

2. METHODOLOGY

The study was conducted in a five cluster villages of Khammam District, Telangana State India. The NICRA project was implemented in the district by Krishi Vigyan Kendra, Wyra since 2010. The project was implemented in the cluster of five villages, namely Gangula Nacharam, Badruthanda, Colony Nacharam, Rama Thanda and Bheemla Thanda. All the five villages were selected purposively for the study. From each village 15 participants were selected purposively. A total of 120 respondents are randomly selected 60 NICRA beneficiaries and 60 non-NICRA beneficiaries The cropping pattern and extent of adoption of climate resilient practices followed by farmers with reference to climate change adaptation were dependent on various factors.

The technologies assessed include influence of crop diversification, with alternate/ intercrop, livestock and off farm activities, cropping pattern and extent of adoption of climate resilient practices.

3. RESULTS AND DISCUSSIONS

The various aspects related to climate resilient technologies are herewith discussed in the following tables the practice of sole cropping is predominant but is risky and often resulted in low yields or sometimes even in crop failure due to erratic monsoon rainfall and skewed distribution. In such areas, intercropping is a feasible option to minimize risk in crop production, ensure reasonable returns at least from the intercrop and also improve soil fertility with a legume intercrop. Paddy, cotton, green gram are the

major crops in the scarce rainfall zones. Intercropping of these crops is more profitable and is a key drought coping strategy [2].

The Table 1 it is revealed that only eleven farmers were practicing single crop i,e Rice or cotton in the adopted villages while majority of the farmers have adopted different ways to improve the livelihood by practicing intercrop of cotton with green gram, cotton with red gram (37%), Agriculture + Livestock (21.6%) of farmers and low percentage of the farmers with agriculture and off farm activity. Many farmers have taken up intercropping agriculture with livestock to diminish the risk of low returns. In contrast to Non beneficiaries only 28.3 farmers followed intercropping Red gram in cotton or Green gram in Cotton while 36.6% of the farmers preferred single crop in a season. In addition 15% and 20% of the farmers practicing Agriculture with Livestock and Agriculture with off Farm activity respectively. The adoption level is more in beneficiaries as during the tenure NICRA villages are provided with Backyard poultry, fisheries and intercropping technologies were demonstrated and superiority of the technologies were explained. Livestock acts as storehouse of capital insurance against crop production risks [3]. These technologies have also helping the farmers in enhancing the income by selling the milk, eggs and meat. Animal and livestock stabilizes and increases the farm income by having different enterprises at one farm and recycling residues for use thus also decreasing the cost of overall practices [4] Off farm activity includes tailoring, selling vegetables in adjacent villages o r nearby towns, few of the farmers have taken up off - farm activity so as to augment the income and raise their standard of living. in the course of non availability of agricultural works.

The farmers in these villages at present adopted six climate resilient cropping patterns to different extent. Pre inception of NICRA the major share was Paddy or Cotton or chilli as sole crop in Kharif season and the land was kept fallow in rice and cotton growing fields due to water scarcity. The cultivation of pulses was confined to less area. The scientists of KVK, Wyra encouraged farmers to grow Sunhemp and sorghum in water scare areas and recommended growing vegetables, green gram and maize in mildly water available areas during Rabi season.

The finding present in Table 2 reveals that among the six cropping patterns, the widely adopted is Paddy + greengram (25%) followed by cotton+ Sunhemp by 20%, Paddy + Sunhemp by 18.3%,and cotton + maize (15%). While on the contrary cropping patterns namely Cotton-vegetables (5%), Paddy- Sorgum (4%), followed by sole red Gram were narrowly adopted. while from the non - NICRA beneficiaries Cotton + maize (25%) and Paddy + Green gram (16.6%) and sole Red gram is widely adopted. These results were corroborated with Sultana et al. [5].

An item pool of climate resilient practices recommended by NICRA were considered by reviewing the literature like NICRA annual reports for measuring extent of adoption of climate resilient practices. After identifying the practices, responses were collected from the respondents. Scoring of these responses was in the order of 3, 2 and 1 for the full adoption, partial adoption and non-adoption of the practices respectively. The aggregate score of each respondent was obtained by adding the respective score of each item. Later total of aggregate scores was calculated and categorized into low, medium and high based on mean and standard deviation value obtained.

The extent of adoption of climate resilient technologies by the beneficiaries and non beneficiaries are presented in the Table no. 4. Intercropping of cotton with Redgram (77.5%), sowing short duration varieties of green gram crop before paddy (72%), direct seeding in rice (71%) and sun hemp seed production under paddy relay cropping (57%) were fully adopted by the beneficiaries. The farmers were able to garner profitability with optimum resource

Table 1. Agriculture and allied activities

S. No	Agriculture and allied activities	Beneficiaries N= 60		Non -Beneficiaries N= 60	
		Frequency	Percentage	Frequency	Percentage
1	No Diversification only single Crop	7.0	11.6	22	36.6
2	Crop(Alternate/ Intercrop)	37.0	61.6	17	28.3
3	Agriculture + livestock	13.0	21.6	9	15
4	Agriculture + Off farm Activity	3.0	5.0	12	20

Table 2. Cropping patterns adopted by the villagers

		Beneficiaries N= 60		Non -Beneficiaries N= 60	
S.No	**Cropping Pattern**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
1	Paddy – Sunhemp	11.0	18.3	6.0	10
2	Paddy –Sorgum	4.0	6.6	9.0	15
2	Paddy- Green Gram	15.0	25.0	10.0	16.6
3	Cotton – maize	9.0	15.0	15.0	25.0
4.	Cotton –Sunhemp	12.0	20.0	4	6.6
5	Cotton - Vegetables	5.0	8.3	6	10
6	Red Gram	4.0	6.6	10	16.6

Table 3. Extent of adoption of climate resilient practices

S.	Practices	Beneficiaries N= 60						Non -Beneficiaries N= 60					
No		**CA**	**%**	**PA**	**%**	**NA**	**%**	**CA**	**%**	**PA**	**%**	**NA**	**%**
1	Red gram (Square planting)	32	53.3	20	33.3	8	13.3	12	20	7	11.6	31	51.6
2	Intercropping systems (Cotton with Red gram)	43	71.6	12	20	5	8.3	48	80	8	13.3	4	6.6
3	Short duration varieties of Greengram after kharif paddy	52	86.6	5	8.3	3	5	50	83.3	6	10	4	6.6
4	Sun hemp seed production under paddy relay cropping	33	55	13	21.6	15	25	12	20	14	23	34	56.6
5	Direct Seeding in Rice	51	85.0	6	10	3	5	45	75	12	20	3	5
6	Saline tolerant Variety of Rice (WGL-44)	43	71.6	12	20	5	8.3	25	41.6	24	40	11	18.3
7	*Insitu* soil moisture conservation in cotton	23	38.3	15	25	12	20	12	20	33	55	15	25

Table 4. Distribution of the respondents based on the extent of adoption

	Beneficiaries (N=60)		Non- beneficiaries (N=60)	
	Frequency	**Percentage**	**Frequency**	**Percentage**
High	29	48.33	21	35
Medium	23	38.33	26	43.3
Low	8	13.33	13	21.6

efficiency using the tested farmer friendly technologies. Square planting in red gram (60%) and *insitu* soil moisture (43.5%) conservation have less adoption percentage. Whereas the non beneficiaries most of the climate resilient technologies have already widely adopted viz.,

Direct seeding in Paddy, Green Gram Before paddy, Intercropping Systems. The main reason may be the technological feasibility and economically viable. Many of technologies are also adopted by the non – beneficiaries like Direct seeding in rice and green gram after paddy this may be awareness created by the KVK, Wyra Scientist as part of the training programmes in Khammam District. The practices that are not adopted and discontinued, the reason is the farmers may have unfavorable attitude towards the technologies this may be due to lack of awareness of climate change and lack of knowledge on the technologies that the provided by the scientists can be useful to overcome or mitigate the ill effects by climate change.

The above table represents the distribution of respondents based extent of adoption of climate resilient practices. Majority of the respondents from the beneficiaries have high (48.33%) adoption percentage and medium (38.33.8%) adoption followed by low (13) with respect to extent of adoption. In contrast to non-beneficiaries the table reveals that 43.3of the farmers have medium (26%) extent of adoption whereas 35 and 21.6 per cent have high and low extent of adoption respectively.

Concentrated efforts made by the scientists changed the perception of the farmers, the demonstrated technologies are ecologically and economically feasible, hence the more number of beneficiaries has encountered followed by medium extent of adoption. The technologies demonstrated in NICRA are appropriate and hence consequently adopted by the non beneficiaries like Direct seeding in rice, Green gram after paddy, sunhemp seed production after paddy slowly diffused to the adjacent villages famers adopted these technologies with optimism.

4. CONCLUSION

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 [6]

An overwhelming majority of the respondents from the beneficiaries have adopted different climate resilient cropping patterns and resilient technologies. Especially Direct seeding in paddy where in Telangana this practice is considered to be a sustainable technology widely being adopted. Sun hemp after cotton and paddy, and green gram after paddy is also reliable technologies disseminated to the farmers as it is enhancing the income to the farmers with less input requirement. Availability of effective extension services and outreach by the Scientist have contributed higher adoption percentage.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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