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Research Article

ADOPTION OF CLIMATE RESILIENT TECHNOLOGIES IN AGRICULTURE- A STUDY IN SCARCE RAINFALL ZONE OF ANDHRA PRADESH

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Abstract: The Climate resilient Technologies in Agriculture were proved as the best adaptation strategies available which would enhance resilience in agriculture rather than focus on yield enhancement. The study was conducted in NICRA villages of Kurnool and Anantapur districts of Andhra Pradesh with 180 respondents with an objective to know the extent of Climate Resilient Technologies adopted in Agriculture and association of independent variables with the extent of adoption. Results revealed that seventy-four per cent was the level of full adoption of all crop production technologies. Intercropping ranked first in adoption of the technology followed by, adoption of drought tolerant varieties and going for alternate crops, use of weather based agro advisory services, cultivating short duration varieties and adopting drought mitigation sprayings. The profile characteristics like mass media exposure score, capacity building programmes attended, extension contact score, perception on climate change index, perception on climate resilient technologies and weather based agro advisory services had shown positive and significant relation with adoption of climate resilient technologies in crop production.

Keywords: *Climate resilient Technologies, NICRA villages*

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Introduction

Climate change is emerging as a major threat on agriculture, food security and livelihood of millions of people in many places of the world [1]. Climate smart Agriculture focuses on developing resilient food production systems that lead to food and income security under progressive climate change and variability [2,3]. Many agricultural practices and technologies such as minimum tillage, different methods of crop establishment, nutrient and irrigation management and residue incorporation can improve crop yields, water and nutrient use efficiency and reduce Greenhouse Gas (GHG) emissions from agricultural activities [4]. A meta-analysis of crop simulation under several climate scenarios found that farm level adaptations can increase crop yields by an average of 7–15% when compared to without adaptation [5].

The identification and prioritization of CSA technologies support climate change adaptation planning in agriculture by designing an investment portfolio across various agro-ecological zones. When designing climate resilient implementation strategies at the farm level, one must consider adaptation options that are well evaluated and prioritized by local farmers in relation to prominent climatic risks in that location [6]. Farmers' acceptance for climate resilient technologies is linked with prevailing climatic condition. Farmers' preference and willingness to pay for climate smart technologies differ significantly based on its and its cost benefit ratio. Farmers' priorities differ from technology to technology based on their gender, age, and land holding size. Farming system and location [7].

Hussain *et al*., (2013) [8] concluded that Crop adaptation strategies *viz*., changes from long to short duration varieties (75%), changes in planting dates (85%), changes in quantity of seeds, fertilizer application, number of irrigation and spacing were adopted by majority (73%) of the farmers. Jasna *et al*., (2015) [9] stated that technologies demonstrated, through NICRA in imparting resilience in terms of mitigation and adaptation to climate vulnerability, in Gumla district of Jharkhand and Tumkur of Karnataka.

Through introduction of crop varieties tolerant to drought, temperature and flood, a noticeable increase in production was achieved by linseed variety Sekhar (63.46 %), black gram variety Uttara (64.15 %), niger variety Birsa Niger-1 (106.7 %), sweet potato variety Birsa Sakarkand-1 (88.83 %) and ragi variety GPU-28 (61.91 %) in the demonstrated fields.

According to Akshith *et al*., (2020) [10] revealed 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) followed by installation of sticky traps in cotton (II Rank), 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 (VI Rank).

Materials and Methods

The study was conducted in Kurnool and Anantapur districts of Andhra Pradesh during August 2022. Three villages from Kurnool district and three villages from Anantapur district were purposively chosen as NICRA project was being implemented. The climate vulnerabilities of the district's occurrence of drought, terminal moisture stress, heat stress, haze. A sample of thirty was drawn randomly from each village thus making sample size of 180 farmers. The data was collected using a structured schedule and analyzed using frequency distribution, percentage and mean and descriptive statistics were used to test the hypothesis of the study. List of climate resilient technologies recommended under NICRA project and implemented by KVKs in Kurnool and Anantapur in the six NICRA adopted villages was considered for the present study. The technologies implemented under Crop Production were studied purposively. The extent of adoption of CRA technologies by each respondent was obtained using three-point continuum (fully adopted, partially adopted, not adopted with scores 2, 1 and 0).

The minimum score was 0 and maximum score was 360. Based on the scores obtained each technology was ranked.

Table-1 Distribution of Farmers according to Adoption of Crop Production Technologies in the study area.

SN	Technology	No Adoption	Partial adoption	Full adoption	Total	Score	Rank
1	Alternate Crops	24	6	150	180	306	3
	%	13.30%	3.30%	83.3	100		
2	Drought tolerant varieties	15	17	148	180	311	2
	%	8.30%	9.4	82.22	100		
3	Intercropping	16	13	151	180	315	1
	%	8.90%	7.20%	83.9	100		
4	Drought mitigation sprays	24	62	94	180	250	6
	%	13.33	34.44	52.22	100		
5	Use of short duration varieties	26	27	127	180	281	5
	%	14.44	15	70.55	100		
6	Weather based crop advisories	19	27	134	180	295	4
	%	10.55	15	74.44	100		

Level of adoption was also done using descriptive statistics. 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, Weather based Agro Advisory services.

Results and Discussion

Adoption of Crop Production technologies in the study area

From the [Table-1] and [Fig-1] it is understood that the cultivation of alternate crops that suits to the eco system was fully l adopted by farmers (83.3 %) ,13.3 per cent have not adopted the technology and 3.3 are non-adopters. Regarding the adoption of drought tolerant varieties 82.2 per cent are fully cultivating the drought tolerant varieties followed by 9.4 per cent are partially cultivating and 8.3 per cent are not cultivating the drought tolerant varieties. Majority of the farmers (83.9%) are adopting intercropping system, however 8.9 per cent are not adopting and 7.2 per cent are partially adopting the technology. Regarding the drought mitigation techniques 52.22 per cent of the farmers are adopting the technology however 34.44 per cent are partial adopters and 13.33 per cent are non-adopters. Regarding cultivation of short duration varieties majority of the farmers (70.55 %) are following, however 15.0per cent are partially adopting and 14.4 per cent are not adopting the technology. Regarding weather-based crop advisories majority of the farmers (74.44 %) adopted the technology followed by partial adoption (15.0%) and non-adoption (10.55 %).

As per the scores obtained in adoption of the Crop Production technologies intercropping system ranked top followed by cultivation of drought tolerant varieties (2), alternate crops (3), weather based crop advisories (4), Cultivation of short duration varieties (5) and drought mitigation techniques.

Intercropping of pulses with millets with red gram was fully adopted by the farmers. With age, experience and capacity building and demonstrations farmers are taking up intercropping with suitable varieties of millets and red gram. Farmers believe intercropping system is like crop insurance and they are sure of getting at least one crop in adverse situations. The bimodal distribution of rainfall is also accelerating farmers to go for inter cropping. Capacity building programmes, demonstrations at the village level and availability of the varieties may be the reason for adoption of the technology widely by rainfed farmers. The findings are in tune with Rao (1988), Maddison (2006) Jasna (2014) Arun K *et al*., (2016) and Majumder *et al*., (2019) [11].

Climate change is posing a great challenge to food security of the people there is need for drought tolerant varieties. Regarding the cultivation of drought tolerant varieties, the adoption was good because the perception of the farmers regarding the varieties was high through capacity building programmes and demonstrations. Good number of demonstrations of drought tolerant varieties were done by farmers. Filed visits were made and farmers were exposed to varietal characteristics like rooting traits, tolerance to heat etc. The capacities of the farmers were enhanced with varietal characteristics as the farmers stick on to the crops that are in vogue because of climatic conditions and market price. For Crops like fox tail millet, bajra, jowar, red gram bengal gram demand for drought tolerance varieties is high and the seed is also made available at the village level. This may the reason for better adoption. The findings are in tune with De Wit (2006) Nhemachena and Hassan (2007) [12], Yesuf *et al*., (2008) [13], Pathak (2012) [14], Hussain *et al*., (2013), & Jasna (2015).

To cope up with the climate change scenario farmers are switching over to alternate crops. In the project area farmers used to cultivate desi cotton previously. With the change in onset of monsoon desi cotton cultivation is not economical. With the intervention of the project alternate crops like setera, pearl millets, soya bean were introduced for diversification in agricultural production system, stabilize the farm income and enhance human health. Availability of suitable varieties for taking up as sole crop or intercrop at the village level, remunerative price for millets and low cost of cultivation, all these factors may be the reason for choosing alternate crops in place of desi cotton. The findings are in tune with Gbetibouo (2009) [14], Mertz *et al*., (2009) [15], Pathak (2012) where climate ready crop varieties ranked top in mitigating climate vulnerability. Majumder *et al*., (2019) also reported the same.

Use of short duration varieties was also widely adopted by the farmers in the climate change scenario. The long duration varieties are facing terminal moisture stress with the early cessation of monsoon. Sometimes haze is also a problem which is coinciding with flowering particularly red gram. Due to haze the flowering is adversely affected and leading to poor yields whereas short duration varieties escape haze as the crop reaches pod filling stage. More over short duration varieties require less water than long duration varieties. Short duration varieties are preferred in the intercropping system and double cropping system by the farmers. Age, experience and exposure to the technology and availability of the seed material may be the reason for adoption of the technology. The findings are in tune with Gbetibouo (2009), Mertz *et al*., (2009), Pathak (2012) where climate ready crop varieties ranked top in mitigating climate vulnerability. Majumder *et al*., (2019) also reported the same.

Adoption of drought mitigation strategies to mitigate moisture stress by spraying KNO_3 and Urea was adopted less by farmers comparatively because the dry spells are often long in the study area. The strategies hold good for short term dry spells and also farmers feel it's a burden.

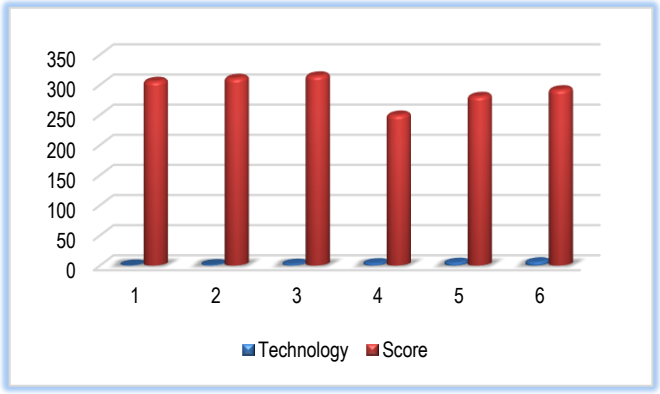

Fig-1 Scores of the Crop production technologies in the study area
1. Alternate crops, 2. Drought tolerant varieties, 2. Intercropping system
4. Drought mitigation strategies, 5. Short duration varieties, 6. Weather based crop advisories

Level of adoption of Crop Production technologies in the study area

The mean, standard deviation and coefficient of variation in the level of adoption of farmers on Crop production technologies. The mean score of adoption of Crop production technologies is 134.00, which signifies that majority of the farmers

agreed that crop production technologies are helpful in mitigating climate change effect in agriculture. It was followed by partial adoption for which mean score was 25.33. It was observed that non adoption to climate resilient technologies mean score was 20.66 The coefficient of variation for partial adoption (77.86) which signifies that it was highly inconsistent among the farmers [Table-2] .

Table-2 Descriptive Statistics on level of adoption of Crop Production technologies in the study area

Statistics	No adoption	Partial Adoption	Full adoption
Mean	20.667	25.33	134
Standard Deviation	4.63	19.725	21.86
Co-efficient of variation	22.419	77.86	16.316

Association of Profile Characteristics of Farmers and Extent of adoption of Climate resilient technologies

It can be inferred from the data presented in the [Table-3] that Mass media exposure (0.326), Capacity building programmes attended (0.540), Extension contact score (0.459), Perception on climate change index (0.405), Perception of climate resilient technology index (0.520) and Weather based Agro Advisory services (0.267) had positive and significant association at one per cent level of probability. It could be inferred that there was significant relationship between these independent variables and level of adoption of CRA technologies by farmers. But the remaining variables such as Age(0.051), Education (0.102), farming Experience(0.122),and land holding size (0.123) were showing positive relation with level of adopting technologies but not significant.

It could be perceived from the table Mass Media exposure Score, Capacity building programmes attended, Extension contact score, Perception on climate change index ,perception on climate resilient technologies and Weather based Agro Advisory services had shown positive and significant relation with adoption. The probable reason for the positive and significant association of Mass media score was that most of the farmers have televisions and mobile phones. Agro advisories were received by them regularly. Capacity building programmes attended score was also high as the farmers in the NICRA villages underwent training programmes on various aspects of climate resilient technologies in agriculture seasonally. The results are in tune with Akshita *et al*., (2020).

Extension contact has a positive and significant association with the extent of adoption. This may be due to the availability of Rythu Barosa Kendras at the village level and frequent contact of KVK Scientists with farmers. Farmers with high pereptin index on climate change and climate resilient technologies had positive and significant association with adoption of the technologies. This may be because of the farmers are constantly exposed by KVK in the project villages by holding discussions, field visits and field demonstrations.

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 helped farmers in taking up contingency crop planning, reduced their vulnerability to climatic variabilities, which may have further contributed towards the higher levels of adoption of CRA technologies by the farmers. The results are in line with the findings of Akshita *et al*., (2020), Mohokar *et al*., (2019) [16] & Manjunath *et al*., (2018) 17].

Table-3 Correlation of Independent variables with Adoption of Climate Resilience Technologies

SN	Variable	Score
1	Variable	Score
2	Age	0.051
3	Education	0.102
4	Farming Experience	0.122
5	Landholding size	0.123
6	Mass Media exposure Score	0.326**
7	Capacity Building Programmes Attendance Score	0.540**
8	Extension Contact Score	0.459**
9	Perception on Climate Change Index	0.405**
10	Perception on Climate Resilient Technologies Index	0.520**
11	Weather bases agro advisory services	0.267**

Conclusion

The study revealed that majority of the farmers fully adopted the climate resilient technologies in agriculture. Adoption of the intercropping technology was highest, followed by cultivation of drought tolerant varieties and alternate crops. Independent variables such as mass media exposure, capacity building programmes, extension contact, perception on climate change index and perception on climate resilient technologies index and Weather Based Agro Advisory Services have positive and highly significant association with adoption of the climate resilient technologies. Policy may be framed keeping in view of the findings of the study so that the technologies can be up scaled to the similar agro-climatic zones.

Application of research: Study of climate resilient technologies in scarce rainfall zone of Andhra Pradesh

Research Category: Climate Resilient Technologies

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Study area / Sample Collection: Kurnool and Anantapur districts of Andhra Pradesh

Cultivar / Variety / Breed name: Nil

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