

## Impact of National Innovation of Climate Resilient Agriculture (NICRA) Project on Raising the Income and Employment level of Farmers in the Operational Districts of Odisha

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**ABSTRACT:** Raising the income and employment level of farmers was the biggest challenge for the NICRA project. The study tried to access the NICRA project has any substantial impact on raising the income and employment level of farmers. Various dimensions were taken into account during the study to access the impact level of incomes as well as employment level of farmers. The major dimension like the average land holding of farmers, the number of days associated with NICRA project, the family members looking for employment, the average days of employment available, level of satisfaction among farmers with NICRA, their annual income and savings of NICRA farmers vis-à-vis non-NICRA farmers have been analyzed. The farmers are associated with the NICRA project for  $18.7 \pm 6.7$  days a month with a 95% confidence interval of 17.5 to 19.9 days. The average number of days associated with the NICRA project was highest in the Kalahandi district ( $23.6 \pm 2.2$ , 95% CI 22.9-24.2) and lowest in the Kendrapara district ( $13.1 \pm 3.1$ , 95% CI 12.1-14.1). In the NICRA project on average  $3.4 \pm 0.6$  numbers of family members were looking for wage employment vis-a-vis  $2.3 \pm 0.7$  numbers of family members in the Non-NICRA areas. Out of 120 farmers, more than 4/5<sup>th</sup> have very good and 15.8% have good satisfaction with the NICRA project for employment generation. The mean annual income of NICRA farmers was Rs. 90725.00  $\pm$  30151.7 and that of non-NICRA farmers was Rs. 58016.7  $\pm$  17850.1. The NICRA farmers have significantly higher incomes than non-NICRA farmers ( $p=0.000$ ).

**Keywords:** Climate Resilient Agro-technologies, income and employment generation.

### INTRODUCTION

Indian agriculture not only provides food security but also ensures livelihood security for 58% population. However, agriculture is vulnerable to existing climate variability (Ochieng *et al.*, 2016) and is further aggravated due to the impacts of climate change. Likewise, the operational holding of Indian farmers is regularly shrinking from 1.15ha (2010-11) to 1.08 ha in 2015-16 and more than 86% of farmers belong to marginal and small categories. The farmer categories are diverse, heterogeneous and unorganized. To address the effects of extreme weather events such as cyclones, floods & drought, the government of India (GoI) launched National Initiative on Climate Resilient Agriculture (NICRA) in 100 vulnerable districts in the year 2011. The second phase of the project was commenced in 2017 called National Innovations in Climate Resilient Agriculture (NICRA). With this

milieu, National Innovation on Climate Resilient Agriculture (NICRA) is operating in five climate vulnerable districts of Odisha.

Understanding the current agricultural growth, people's required knowledge and skill on various climate-resilient technologies and coping mechanisms for sustained development (Sarkar *et al.*, 2014). Climate transformation immensely affects the ecosystem, environment, health, and frugality of developing nations. Climate change is not only an environmental challenge, but also it has emerged as the biggest developmental challenge for the planet (Griffiths 2015). Science and technology can solve climate change-related issues (Gardezi and Arbuckle 2020). Over the years, the pace of climate change consequence has raised the temperature by 0.7°C to 2°C. That temperature directly affects the crop production, yield attributes, income and employment of farmers. Mainly the aged, disabled, poor, women-headed households

and landless farmers are the most vulnerable to climate change (Mengistu, 2011).

Socio-economic development safeguarded the quality of life has the core of human development. The promotion of a secure and sustainable livelihood is perhaps the key to improving the economic conditions of the farmers. Agricultural activities are the most important source of income for rural households and contribute 77% of income whereas only 23% of non-agricultural activities (Demissie and Belaineh 2013). The financial, social and human factors can improve the well-being of farmers as well as ensure food security (Fahmi *et al.*, 2013).

Climate change aggravates many challenges to the food and livelihood security of the farming community. The frequency and intensity of extreme weather events are adversely affecting farming practices and crop production (Griffiths 2015). Hence, there is a need to adopt resilience agro-technologies in the agriculture and allied sectors. To access climate change information can improve the awareness level of small holder farmers on climate change. It will help the farmers to increase their level of consciousness on global, national, or local weather events and their impact on agricultural productivity. The dearth of information on appropriate coping mechanisms and adaptation responses may bring about constraints to coping with the adverse climatic hazards and adaptation rate. The major identified information sources are television, radio and local newspapers. The most critical constraints were inadequate information, lack of access to agricultural extension services and scarce modern climate change adaptation technologies (Popoola *et al.*, 2020).

The average annual income of NICRA farmers has significantly increased due to multifarious interventions as well as the convergence of other agriculture and allied activities into the project villages as compared to the non-NICRA villages. Regular follow-up and monitoring of the project interventions have changed income levels as well as the knowledge, skill and attitude level of farmers in the project villages.

## MATERIALS AND METHODS

A mixed research design that combined both qualitative and quantitative research techniques was deployed in this study. This is a test-control study, where the comparison is made between the NICRA- farmers (Test) and non-NICRA farmers (Control group). The districts, blocks and villages were selected following a judgment sampling approach to ensure proper

representation. The respondents were selected following the random sampling method.

In each district, the only block under the NICRA project was selected. In the block two NICRA villages and one non-NICRA village were selected randomly out of the villages. In the selected villages, 20 farmers were selected proportionately from among different categories of farmers following a random process. In each district, one scientist is selected from KVK. A total of 3 Scientists were covered. In each district, two VAWs, and two extension officials of the rank of AAO, DAO, or Chief District Official were selected. In this process, there were 6 VAWs and 6 senior extension officials in the sample in one district. 15 officials each have been taken in the Non-NICRA and NICRA project areas. Out of 30 officials, 6 were scientists, 16 agriculture officers and 8 village-level agriculture staff. A total of 120 NICRA farmers, 60 non-NICRA farmers and 30 Officials were selected for the sample.

Primary data was collected through in-depth interviews with farmers by the researchers in the selected villages. Similarly for qualitative research, Focus Group Discussion was conducted with a group of farmers through interviews to capture the information by the researcher. Data collected under the study was scrutinized, codified and entered into the IBM SPSS Statistics, 24.0 software for analysis.

## RESULTS AND DISCUSSIONS

NICRA farmers adopted more resilient and feasible appropriate practices including improved varieties resistant to drought/flood situations, integrated crop management practices (ICM), soil test-based fertilizer application, judicious use of farm resources, etc. whereas non-NICRA farmers were still practicing conventional methods as well as traditional varieties (Nyasimi *et al.*, 2017). Different factors were responsible to accelerate the income and employment as detailed below:

### A. Association of Farmer with NICRA Project

On an average, the farmers are associated with the NICRA project for  $18.7 \pm 6.7$  days a month with a 95% confidence interval of 17.5 to 19.9 days. The average number of days associated with the NICRA project was highest in the Kalahandi district ( $23.6 \pm 2.2$ , 95% CI 22.9-24.2) and lowest in the Kendrapara district ( $13.1 \pm 3.1$ , 95% CI 12.1-14.1). Table 1 present the details.

**Table 1: Average number of days of association of farmers with NICRA project during a month (daily wages).**

Districts	N	Average No		95% Confidence Interval for Mean		ANOVA 'p' value
		Mean	SD	Lower Bound	Upper Bound	
Kalahandi	40	23.6	2.2	22.9	24.2	0.000
Jharsuguda	40	19.6	8.1	17.0	22.2	
Kendrapara	40	13.1	3.1	12.1	14.1	
Total	120	18.7	6.7	17.5	19.9	

**B. Looking for and getting wage employment**

It was analyzed that on average for how many days the farmers get wage of employment in a month. Table 2 revealed that in the NICRA project on an average 3.4±0.6 numbers family members were looking

for wage employment via-a-vis 2.3±0.7 numbers of family members in the Non-NICRA areas. Among the NICRA farmers, the average number of family members looking for wage employment is significantly higher than among the Non-NICRA farmers (p=0.000).

**Table 2: Family member looking for wage employment and the average number of days in a month get employment.**

Questions	NON-NICRA(n-60)			NICRA(n-120)			Independent sample test 'p' value
	N	Mean	SD	N	Mean	SD	
How many family members looking for wage employment in your family?	60	2.3	0.7	120	3.4	0.6	0.000
What is the average number of days in a month your family members get employment?	60	11.4	2.3	120	13.9	2.1	0.000

It is found that on an average 13.9±2.1 numbers of days the family members get wage employment among the NICRA farmers. The corresponding figure was 11.4±2.3. The average number of days of employment for family members among the NICRA farmers was

significantly higher than Non-NICRA farmers (p=0.000). Table 3 shows that the average number of days of employment for the family due to the NICRA project did not differ significantly among the three districts(p=0.981). The details are below.

**Table 3: Average number of days of employment available for your family in NICRA areas.**

Districts	N	Mean	SD	95% Confidence Interval for Mean		ANOVA 'p' value
				Lower Bound	Upper Bound	
Kalahandi	40	3.4	0.7	3.2	3.6	0.981
Jharsuguda	40	3.4	0.7	3.2	3.6	
Kendrapara	40	3.4	0.6	3.2	3.6	
Total	120	3.4	0.7	3.3	3.5	

**C. Satisfaction of farmers with NICRA project for employment generation**

The satisfaction level of farmers with the NICRA project for employment generation has been tabulated in Table 4.

Out of 120 farmers, more than 4/5<sup>th</sup> have very good and 15.8% have good satisfaction with the NICRA project for employment generation. In the Kalahandi district,

the satisfaction level is very good for 92% of farmers and that for Jharsuguda 82.5%. In the district of Kendrapara 60% of farmers have very good and 37.5% good level of satisfaction. There is a significant association between the level of satisfaction of farmers with the NICRA project for employment generation and the district (p=0.003).

**Table 4: Satisfaction of farmers with the NICRA project.**

Response	District (n=120)						Total		χ <sup>2</sup> , p
	Kalahandi		Jharsuguda		Kendrapara		No	%	
	No	%	No	%	No	%			
Not satisfied	0	0	0	0	0	0	0	0	χ <sup>2</sup> =15.966 p=0.003
Undecided	0	0	0	0	0	0	0	0	
Satisfactory	1	2.5	2	5	1	2.5	3	2.5	
Good	2	5	5	12.5	15	37.5	19	15.8	
Very good	37	92.5	33	82.5	24	60	98	81.7	
Total	40	100	40	100	40	100	120	100	

**D. Last Year Average Annual Income**

Table 5 presents last year's average income of the family of NICRA and Non-NICRA farmers. The mean annual income of NICRA farmers was Rs. 90725.00

±30151.7 and that of non-NICRA farmers was Rs.58016.7 ±17850.1. The NICRA farmers have significantly higher incomes than non-NICRA farmers (p=0.000).

**Table 5: Last year's average annual income of NICRA and Non-NICRA farmers.**

Farmer	N	Income in Rupees		Independent sample test 'p' value
		Mean	SD	
Non-NICRA	60	58016.7	17850.1	0.000
NICRA	120	90725.0	30151.7	

**E. Increase in Average Annual income due to NICRA project**

The farmers associated with the NICRA project were asked what is the increase in annual family income due to the association with the NICRA project. It was found that average the increase in average annual income was to the tune of Rs. 24041.7±9483.4. The maximum was

in the Jharsuguda district (Rs. 25500.0 ±7828.3) and the minimum was in the Kendrapara district (Rs. 21500.0 ±11627.2). Table 6 furnished the details.

This is a self-assessment by the farmers involved in the NICRA project. There is no significant difference in this mean increase among the three districts.

**Table 6: Comparison of the average annual income of families due to the NICRA project districts.**

Districts	N	Mean	SD	ANOVA 'p' value
Kalahandi	40	25125.0	8242.1	0.114
Jharsuguda	40	25500.0	7828.3	
Kendrapara	40	21500.0	11627.2	
<b>Total</b>	<b>120</b>	<b>24041.7</b>	<b>9483.4</b>	

**F. Mean Savings among the NICRA Farmers**

Means saving according to the assessment of non-NICRA farmers is Rs.10472.20 ± 3320.5 and that among NICRA farmers is Rs. 13861.10 ± 5270.4 (Table 7). The difference is significant (p=0.000).

The district-wise increase in mean annual family income due to the impact of the NICRA project is 26% of the total family income in their assessment.

There is a significant difference between NICRA and non-NICRA farmers due to several reasons. NICRA project generated more employment during the project implementation phase.

The crop production and productivity increase many folds due to NICRA interventions and convergence of various schemes in the NICRA villages as compared to non-NICRA villages. NICRA project minimizes the production cost. As a result, NICRA farmers saved more money as compared to non-NICRA farmers in all three districts (Murali *et al.*, 2020). Empowering agricultural communities to obtain sustainable livelihoods through the implementation of strategies that address the common and specific challenges and strengthen the adaptive capacity of both commercial and small-scale farmers in the concerned areas (Wilk *et al.*, 2013).

**Table 7: Comparison of the amount of saving last year between NICRA and Non-NICRA farmers.**

Farmers	N	Mean	SD	Independent sample test 'p' value
Non-NICRA	60	10472.2	3320.5	0.000
NICRA	120	13861.1	5270.4	

**G. NICRA Advantages to Farmers - Views of Officials**

The views of officials (Scientists, Extension Officers) bear significance. Their opinion on involvement in the NICRA project, adoption change in the standard of living, increase in income, creditworthiness, etc. has been discussed in this section.

**(i) Additional Engagement of farmers in Agriculture due to the NICRA project.** In the opinion of 26 out of 30 (93.3%) officials, the farmers are more engaged in agriculture due to the NICRA project for 5 days a month on average. Only 2 have said the additional engagement is 10 days a month (Table 8).

**Table 8: Additional Engagement of farmers in Agriculture due to NICRA project.**

Engaged in days per month	Districts						Total	
	Jharsuguda		Kendrapara		Kalahandi		No.	%
	No.	%	No.	%	No.	%		
5 days a month	10	100	9	90	9	90	28	93.3
10 days a month	0	0	1	10	1	10	2	6.7
15 days a month	0	0	0	0	0	0	0	0.0
20 days a month	0	0	0	0	0	0	0	0.0
25 days or more	0	0	0	0	0	0	0	0.0
Total	10	100	10	100	10	100	30	100

More than 93% of officials stated that the NICRA project has a significant impact on the engagement of farmers and on average 5 days a month they engaged in agriculture. During the years, NICRA farmers employed themselves more in agricultural activities due to more project interventions and infrastructure facilities created during the execution phase of the project. Some of the officials opined that some of the

farmers engaged more than 10 days in a month due to project interventions. During the execution of project interventions, KVK extended all technological know-how, capacity building programmes and overall empowerment of the farming community to enable them to cope with adverse climatic conditions like droughts, floods, erratic rainfall, heatwave, cyclonic storm, etc.

(ii) **Farmers getting Employment.** The majority of the officials (86.7%) opined that the farmers are getting employment round the year in the districts due to the

NICRA project. However, 16.7% opined that they are getting employment for 10 months a year (Table 9).

**Table 9: Farmers getting employment round the year in the districts.**

Engagement in months per year	Districts						Total	
	Jharsuguda		Kendrapara		Kalahandi			
	No.	%	No.	%	No.	%	No.	%
12 months	10	100	9	90	7	70	26	86.7
10 months	0	0	0	0	3	30	3	10.0
8 months	0	0	1	10	0	0	1	3.3
6 months	0	0	0	0	0	0	0	0.0
Others	0	0	0	0	0	0	0	0.0
Total	10	100	10	100	10	100	30	100

NICRA project has more diversified interventions based on the modules that included natural resource management, crop production, livestock, fishery, CHC and income-generating activities. Those activities were executed in NICRA operational villages to address the farmers' needs as well as climate-resilient practices. As a result, farmers have got more employment in the project villages during the implementation of project

interventions. Jharsuguda NICRA villages performed better than Kendrapara and Kalahandi districts.

(iii) **Change in the Standard of Living.** The officials opined that there is a change in the standard of living due to the NICRA project in terms of better food, better shelter, better medical facilities, better education and better clothes. The opinion on each of the items ranges from 33.3% to 46.7% officials Table 10).

**Table 10: Change in the standard of living due to NICRA project.**

Change in the standard of living	Districts						Total	
	Jharsuguda		Kendrapara		Kalahandi			
	No.	%	No.	%	No.	%	No.	%
Better food	4	40	6	60	4	40	14	46.7
Better shelter	2	20	3	30	5	50	10	33.3
Better medical facilities	3	30	8	80	5	50	16	53.3
Better education	8	80	2	20	3	30	13	43.3
Better clothes	3	30	3	30	4	40	10	33.3

Over the years NICRA project helped farmers to get better food, better shelter, better medical facilities, better education and better clothes facilities due to higher income and profit from various activities. The officials stated that the standard of living of NICRA farmers has changed due to multifarious activities. Basic minimum services have improved. Now more than 53% of farmers availing medical facilities followed by 46.7% for better food. Foods are essential for all human beings. Food supplies energy to perform all physical and mental activities. All the officials opined that 43.3% of NICRA farmers are showing interest in their children's education which was very

diminutive before the project. Similarly better shelter and better clothes facilities were availed by 33.3% of farmers in NICRA areas. Overall it shows the project has significant effects on the standard of living of farmers.

*H. Mean annual increase in family income*

Table 11 shows that the mean annual income of APL farmers was  $46454.6 \pm 18121.8$  whereas in BPL categories the mean score was  $49461.5 \pm 19687.5$ . The knowledge, skill and attitude score are directly responsible to enhance the income in both the categories in the NICRA operated villages.

**Table 11: Comparison of Mean annual increase in family income, mean knowledge, skill and attitude score between respondent category.**

Variables	Respondent category				Independent sample 't' test value
	APL		BPL		
	N	Mean $\pm$ SD	N	Mean $\pm$ SD	
Knowledge*	55	69.5 $\pm$ 6.5	65	70.3 $\pm$ 5.4	0.458
Skill*	55	73.3 $\pm$ 6.7	65	74.1 $\pm$ 8.1	0.573
Attitude*	55	91.9 $\pm$ 5.6	65	92.9 $\pm$ 5.4	0.312
Increase in annual family income due to NICRA project <sup>#</sup>	55	46454.6 $\pm$ 18121.8	65	49461.5 $\pm$ 19687.5	0.389
* Score in %					
<sup>#</sup> Income in Rs.					

## CONCLUSION

Govt. implanting various schemes, projects and time-bound interventions to expedite the production of crops as well as the income of the farmers. NICRA project is one of them. NICRA project envisages adaptation of more resilient and feasible appropriate practices including improved varieties resistant to drought/flood situations, integrated crop management practices (ICM), soil test-based fertilizer application, judicious use of farm resources, etc. by farmers in the operational villages whereas non-NICRA farmers were still practicing conventional methods as well as traditional varieties. In this regard, the NICRA project converged various programmes/schemes in the operational villages for holistic development. As a result, NICRA farmers were cultivating remunerative crops as well as micro-enterprises helped them to boost their income and livelihoods. NICRA project helped villagers to change their mindset as well as build their confidence through training and exposure visits. But it is very rare in non-NICRA villages. Hence, new villages are to be covered in the vulnerable districts across the country to minimize the effects of climate change and accelerate the income, employment and saving of farmers in a sustainable manner.

**Conflict of Interest.** None.

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