

A CASE STUDY :

Efficient utilization of water bodies increasing the cropping intensity of North Pulinpur ADC village of Tripura, India – A case study under NICRA project

■ **Dipankar Dey, Dipak Nath, Lord Litan Debbarma, Subhra Shil, Suresh Chandra Biswas, Ardhendu Chakraborty, Rajib Das, Nurul Islam, Subrata Choudhury and Prasanto Reang**

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SUMMARY : North Pulinpur with GPS location 23°52.836¹ N, 91°35.275¹ E and elevation 47m is one of the draught prone tribal inhabited ADC village of the district Khowai under the state Tripura. The total geographical area of the village is 950 hectare with cultivable area of about 250 hectare only among 806 farm families. So, most of the families are holding either small or marginal farms. There was no perennial streams, rivers, ponds and other irrigation facilities in the village. Prevailing temperature ranges from 16°C to 37°C. Annual rainfall ranges from 2050 to 2550 mm, but almost whole amount goes out to neighboring lower elevated village. Agriculture is the mainstay of the people, about 85 per cent of them engage in agriculture and its allied activities. Farmers earned their livelihood from rainfed rice based monocropped cultivation. Moisture stress during *Kharif* dry spell and winter season which lead to rice based mono-cropping system. Under the National Innovations in Climate Resilient Agriculture(NICRA) Project KVK,Khowai has constructed and rejuvenated 22 water bodies from 2011-12 to 2018-19 at North Pulinpur ADC village; all of which provided life saving irrigation for paddy during *Kharif* dry spell as well as during *Rabi* season through nano pumps installed nearby farm ponds. Before implementation of NICRA project to North Pulinpur ADC village, most of the areas remain dry during *Rabi* season. After the intervention, approximately 26187 ft³ rainwater had been harvested covering an area of about 135.0 ha. for winter vegetables and *Rabi* maize cultivation and during dry period. In addition to this, a total area of about 1 ha waste land had been converted to paddy land using water from community bund. Ponds were also used for composite fish culture with average yield of 30 q/ farmer/year/ha during 2018-19.

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Author for correspondence :

Dipankar Dey

Krishi Vigyan Kendra,
Khowai (Tripura) India
Email: ddey611@gmail.
com

See end of the article for
authors' affiliations

BACKGROUND AND OBJECTIVES

Climate change impacts on agriculture

are being witnessed all over the world, but country like India are more vulnerable in view

of the high population depending on agriculture, excessive pressure on natural resources and poor coping mechanism. The warming trend in India over the past 100 years was estimated to be 0.60°C (Arunachalam, 2011). It is astonishing to know that Agricultural activity also contribute to global warming. The agriculture sector emitted 334.41 million tons of carbon dioxide in 2007. Estimates of green house gas emissions from the agricultural sector arise from enteric fermentation in livestock, manure management, paddy cultivation and agricultural soils and on field burning of crops residue. Climate change is also affecting Tripura in a big way. Its impacts are many and serious like erratic monsoon, spread of pests and diseases, floods, storms, increase in temperature etc. Therefore, small and marginal farmers will be more vulnerable to climate change. Making the farming systems of rural poor of Tripura less vulnerable to climate change is imperative. Managing the connections among agriculture, natural resource conservation and the environment must be an integral part of using agriculture for development. North Pulinpur is one of the draught prone ADC village of Khowai district of Tripura. There are no perennial streams or rivers in the entire village. Cropping system is mainly rice based monocropped which is purely rainfed. Agriculture is the mainstay of the people of North Pulinpur ADC village. Rice is cultivated in the lowlands whereas maize, vegetables are cultivated in the hills. Important livestock are pig, cows, poultry, duck, goat and also fishery contribute handsome percentage to family income. Water scarcity and unavailability of irrigation facility forced the farmers towards practice of Jhumming which leads to high rate of erosion with rapid loss of top soil and reducing agricultural area due to more area being utilized for rubber plantation. So based on this the present Climate Resilience Project entitled “ National Innovations in Climate Resilient Agriculture’ Initially known as ‘National Initiative on Climate Resilient Agriculture’ (NICRA) was started at village North Pulinpur of Khowai Tripura district. This is a network project of the Indian Council of Agriculture Research (ICAR) launched in February; 2011. The project aims to enhance resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. The research on adaptation and mitigation covers crops, livestock, fisheries and natural resource management.

RESOURCES AND METHODS

Work village profile:

North Pulinpur, a tribal village is located at 50 km from state capital Agartala and 25 km from KVK West Tripura Campus. The village comes under Tripura Tribal Area Autonomous District Council (TTAADC) and falls under Teliamura RD Block. The village consists of 5 wards and 806 families with total population of 3681, (Male: 1779 and Female: 1902). The total BPL family is 121. The village is inhabited by 100 per cent tribal community. The total geographical area of the village is 950 hectare where as cultivable area is 250 hectare. There are no perennial streams or rivers in the village. Prevailing temperature ranges from 16°C to 37°C. The soils are classified as hill red loamy to plain sandy loamy soil. Annual rainfall ranges from 2050 to 2550 mm. Agriculture is the mainstay of the people, about 85 per cent of them engage in agriculture and its allied activities. There is a galaxy of scope for integrated farming approach for overall agricultural development of the village which ultimately can contribute to the state.

Development of harvested rainwater based sustainable farming system:

Rain water harvesting structures including community bund, jalkund and farm pond were constructed to minimize water scarcity. Community bund in between two hillocks was meant for harvesting water in rainy season and utilizing for fish cultivation as well as crop cultivation in other seasons. Rooftop water were channelized and collected in jalkund for the utilization of water in the non rainy season. Ponds were constructed to store water. Rejuvenation of ponds was done to maximize water retention and economic utilization even during dry spell of the year. Scientific utilization of the side of pond was not practiced by the farmers earlier. After the KVK initiatives they have started Integrated farming approach. Side of the pond are utilizing for vegetable cultivation such as colocasia, pumpkin, dolichos bean, banana etc. Plantation of drum stick, coconut, beetle nut etc. were done around the side of pond for future income generation. Some of the farmers have started duck cum fish rearing and composite fish culture. Approximately 26187 ft³ rainwater had been harvested by this water harvesting structure, all of which provided life saving irrigation for vegetables during *Kharif* dry spell as well as during *Rabi* summer season covering an area of about 135.0 ha. A total of 9 numbers of farmers were selected from different

catchment areas of the water bodies constructed or rejuvenated under NICRA. Farmer wise details of harvested rainwater based sustainable farming system is given below:

1.	Name of the farmer	Judha Kumar Debbarma
2.	Latitude and longitude of pond/structure	23.87623 and 91.60076
3.	Soil type and depth	Light texture and sandy loam soil
4.	Catchment area/plot area	Area: 0.72 ha
5.	Dimensions of the structure	Top (L W H) : (50'x50'x3') ft Bottom (L W H) : (43'x45'x3') ft Side slope : 1:2
6.	When it was constructed (Year)	28/ 03/ 2012
7.	Whether water was used for Supplemental irrigation in <i>Kharif</i> / <i>Rabi</i> crop	<i>Kharif</i> and <i>Rabi</i> crop
For <i>Kharif</i> crop		
8.	Crop sown and area	SRI with paddy, area: 0.72 ha
For <i>Rabi</i> crop		
9.	Crop sown and area	Maize (0.12ha), bitter gourd (0.16 ha), cucumber (0.08ha), chilli (0.04 ha), boro rice (0.08 ha)
10.	Increase in cropping intensity	From 100% to 166.66%

1.	Name of the farmer	Pati Kanya Debbarma
2.	Latitude and longitude of pond/ structure	23.86814, 91.60779
3.	Soil type and depth	Light texture and sandy loam soil
4.	Catchment area/plot area	Area: 0.24 ha
5.	Dimensions of the structure	Top (L W H) : (16'x26'x2.5')ft Bottom (L W H) : (12'x21'x2.5') ft Side slope : 1:2
6.	When it was constructed (Year)	Year: 14/01/2012
7.	Whether water was used for supplemental irrigation in <i>Kharif</i> / <i>Rabi</i> crop	<i>Kharif</i> and <i>Rabi</i> crop
For <i>Kharif</i> crop		
8.	Crop sown and area	SRI with paddy, area: 0.24 ha
For <i>Rabi</i> crop		
9.	Crop sown and area	Bitter gourd (0.16 ha), cucumber (0.08ha)
10.	Increase in cropping intensity, ha	From 100% to 200%

1.	Name of the farmer	Mantu Debbarma
2.	Latitude and longitude of pond/ structure	23.86915, 91.60477
3.	Soil type and depth	Light texture and sandy loam soil
4.	Catchment area/plot area	Area: 0.64 ha
5.	Dimensions of the structure	Top (L W H) : (16'x36'x3') ft Bottom (L W H) : (9'x28'x3') ft Side slope : 1:1
6.	When it was constructed (Year)	Year: 08/01/2012
7.	Whether water was used for Supplemental irrigation in <i>Kharif</i> / <i>Rabi</i> crop	<i>Kharif</i> and <i>Rabi</i> crop
For <i>Kharif</i> crop		
8.	Crop sown and date of sowing and area	SRI with paddy Date of sowing: 15 th to 20 th June, Area: 0.64 ha
For <i>Rabi</i> crop		
9.	Crop sown and area	Maize (0.12ha), bitter gourd (0.24 ha), cucumber (0.08ha)
10.	Increase in cropping intensity	From 100% to 168.75%

1.	Name of the farmer	Mr. Bhidu Kumar Debbarma
2.	Latitude and longitude of pond/structure	23.86878 and 91.61225
3.	Soil type and depth	Light texture and sandy loam soil
4.	Catchment area/plot area	Area: 0.48 ha
5.	Dimensions of the structure	Top (L W H) : (40'x48x2.5')ft Bottom (L W H) : (37'x44'x2.5')ft Side slope :1: 2
6.	When it was constructed (Year)	14/01/2012
7.	Whether water was used for supplemental irrigation in <i>Kharif</i> / <i>Rabi</i> crop	<i>Kharif</i> and <i>Rabi</i> crop
For <i>Kharif</i> crop		
8.	Crop sown and area	SRI with paddy, area: 0.48 ha
For <i>Rabi</i> crop		
9.	Crop sown and area	Maize (0.12ha), bitter gourd (0.16 ha), cucumber (0.08ha), chilli (0.04 ha), boro rice (0.08 ha)
10.	Increase in cropping intensity	From 100% to 200%

1.	Name of the farmer	Mr. Anil Debbarma
2.	Latitude and Longitude of pond/structure	23.86783 and 91.60500
3.	Soil type and depth	Light texture and sandy loam soil
4.	Catchment area/plot area	Area: 0.48 ha
5.	Dimensions of the structure	Top (L W H) : (40'x50'x2')ft Bottom (L W H) : (35'x43'x2')ft Side slope : 1:2
6.	When it was constructed (Year)	14/01/2012
7.	Whether water was used for Supplemental irrigation in <i>Kharif/Rabi</i> crop	<i>Kharif</i> and <i>Rabi</i> crop
For <i>Kharif</i> crop		
8.	Crop sown and area	SRI with paddy, area: 0.48 ha
For <i>Rabi</i> crop		
9.	Crop sown and area	Maize (0.12ha), bitter gourd (0.16 ha)
10.	Increase in cropping intensity	From 100% to 158.33%

1.	Name of the farmer	Mr. Sujit Debbarma
2.	Latitude and longitude of pond/structure	23.86477 and 91.58838
3.	Soil type and depth	Light texture and sandy loam soil
4.	Catchment area/plot area	Area: 0.48 ha
5.	Dimensions of the structure	Top (L W H) : (40'x45'x2.5')ft Bottom (L W H) : (36'x38'x2.5') ft Side slope : 1: 2
6.	When it was constructed (Year)	09/12/2011
7.	Whether water was used for supplemental irrigation in <i>Kharif/Rabi</i> crop	<i>Rabi</i> crop
For <i>Kharif</i> crop		
8.	Crop sown and area	SRI with paddy, area: 0.48 ha
For <i>Rabi</i> crop		
9.	Crop sown and area	Maize (0.12ha), bitter gourd (0.24 ha), chilli, (0.08 ha)
10.	Increase in cropping intensity	From 100% to 199.66%

1.	Name of the farmer	Mr. Surjya Kumar Debbarma
2.	Latitude and longitude of pond/structure	23.86374 and 91.58991
3.	Soil type and depth	Light texture and sandy loam soil
4.	Catchment area/plot area	Area: 0.64 ha
5.	Dimensions of the structure	Top (L W H) : (40'x45'x2.5') ft Bottom (L W H) : (36'x40'x2.5')ft Side slope : 1: 1
6.	When it was constructed (Year)	14/02/2012
7.	Whether water was used for supplemental irrigation in <i>Kharif/Rabi</i> crop	<i>Kharif</i> and <i>Rabi</i> crop
For <i>Kharif</i> crop		
8.	Crop sown and area	SRI with paddy, area: 0.64 ha
For <i>Rabi</i> crop		
9.	Crop sown and area	Maize (0.12ha), bitter gourd (0.24 ha)
10.	Increase in cropping intensity	From 100% to 156.25%

1.	Name of the farmer	Mr. Janel Debbarma
2.	Latitude and longitude of pond/structure	23.86307 and 91.59021
3.	Soil type and depth	Light texture and sandy loam soil
4.	Catchment area/plot area	Area: 0.32 ha
5.	Dimensions of the structure	Top (L W H) : (29'x38'x4.5')ft Bottom (L W H) : (25'x31'x4.5')ft Side slope : 1 : 2
6.	When it was constructed (Year)	11/12/2011
7.	Whether water was used for supplemental irrigation in <i>Kharif/Rabi</i> crop	<i>Kharif</i> and <i>Rabi</i> crop
For <i>Kharif</i> crop		
8.	Crop sown and date of sowing and area	SRI with paddy, area: 0.32
For <i>Rabi</i> crop		
9.	Crop sown and area	Maize (0.08ha), bitter gourd (0.12 ha)
10.	Increase in cropping intensity	From 100% to 162.5%

Table 9 : Farmer detail		
1.	Name of the farmer	Mr. Nripendra Debbarma
2.	Latitude and longitude of pond/structure	23.87833 and 91.58991
3.	Soil type and depth	Light texture and sandy loam soil
4.	Catchment area/plot area	Area: Area: 0.48 ha
5.	Dimensions of the structure	Top (L W H) : (60'x45'x2.5') ft Bottom (L W H) : (53'x41'x2.5') ft Side slope : 1 : 2
6.	When it was constructed (Year)	08/12/2011
7.	Whether water was used for supplemental irrigation in <i>Kharif</i> / <i>Rabi</i> crop	<i>Kharif</i> and <i>Rabi</i> crop
For <i>Kharif</i> crop		
8.	Crop sown and date of sowing and area	SRI with paddy Date of sowing: 15 th to 20 th June, Area: 0.48 ha
For <i>Rabi</i> crop		
9.	Crop sown and area	Maize (0.08ha), bitter gourd (0.08 ha)
10.	Increase in cropping intensity	From 100% to 133.33%



Villages having similar agro-climatic condition. Due to inadequate fund under NICRA project no water bodies could be constructed during the last 5 years. This problem can be solved by intervention of other related departments like rural development department, Department of Agriculture, Government of Tripura. By convergence with other programmes this successful model can be replicated to the many other villages of Tripura having similar agro-climatic and socio-economic condition.



Conclusion:

Through all these successful interventions on crop diversification, the cropping intensity of the village has been increased from 115 to 170 per cent within 8 years only. Besides this, all the successful climate resilient technologies are horizontally spreading to the nearby

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Authors' affiliations :

Dipak Nath, Lord Litan Debbarma, Subhra Shil, Suresh Chandra Biswas, Arhendu Chakraborty, Rajib Das, Nurul Islam, Subrata Choudhury and Prasanto Reang, Krishi Vigyan Kendra, Khowai (Tripura) India

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