Success Stories

On

Climate Smart Agricultural practices under National Innovations on Climate Resilient Agriculture (NICRA)

Adopted village: North Pulinpur ADC Village

Chief Editor : Dr. Dipak Nath,
Editor : Dipankar Dey
Contributors : Dipankar Dey,
Subhra Shil,
Ardhendu Chakraborty,
Subrata Choudhury,
Lord Litan Debbarma

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NICRA
National Innovations in Climate Resilient Agriculture

Krishi Vigyan Kendra (KVK), Khowai (An ISO certified institute)

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Chief Editor : **Dr. Dipak Nath,** Senior Scientist and Head
Editor : **Dipankar Dey,** Subject Matter Specialist: Soil Science
Contributors : **Dipankar Dey,** SMS-Soil Science
Subhra Shil, SMS-Horticulture
Ardhendu Chakraborty, SMS- Plant protection
Subrata Choudhury, Programme Assistant-Fishery
Lord Litan Debbarma, Senior Research Fallow

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Preface

The Indian Council of Agricultural Research has established a network of Krishi Vigyan Kendras (KVK) in the country aiming at assessment, refinement and demonstration of technology/ products. The activity off the KVK include conducting on- farm trial to identity the location specificity of technologies under various farming system, frontline demonstration to establish the production potentials of improved technologies on the farmer's fields, training of farmers to update their knowledge and skills, and training of extension personnel to orient them in the frontier areas of technology development. Seeds and planting materials produced by the KVKs are made available to the farmers. A large number of extension programmes are organized by the KVKs to create awareness about improved technologies among the farmers.

Enhancing the adaptive capacity and building resilience of the farming communities is important in the context of climate variability and to cope with these extreme events effectively. As part of the Technology Demonstration Component (TDC) of NICRA, proven technologies are being demonstrated in climatically vulnerable district of the country. The objective is to impart resilience under variable climates and consequently enhance the pace of adoption of these resilient technologies by stakeholders. On- farm participatory demonstrations were taken up in 121 climatically vulnerable districts across the country through KVKs.

The project has been implemented by KVK, Khowai in North Pulinpur village which is located at 50 km from state capital Agartala and 25 km from KVK Khowai Campus identified under climate vulnerability, i.e., drought like situation. 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 habited by 100% tribal community with Tripuri tribe. The total geographical area of the village is 950 ha with reserved forest 150 ha, hillock soil 350 ha, unregistered land 150 ha, cultivated area 250 ha and miscellaneous area 50 ha. The one time cultivated area is 150 ha, two time cultivated area 50 ha and three time cultivated area 50 ha. There are no perennial streams or rivers in the village. 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 percent of them engage in agriculture and its allied activities. Cropping system is rice base important crops are paddy, chilli, cowpea, potato, maize, yam, pea, mustard, colocasia, cucurbits, pumpkin, fruits like mango, pine apple, citrus, banana etc. Rice is cultivated in the lowlands whereas maize, vegetables and rest of the crops are cultivated in the tillas. Important livestocks are pig, cows, poultry, duck and goat etc. Fishery is another allied sector with good potential which contribute handsome percentage to family income. There is a galaxy of scope for integrated faming approach for overall agricultural development of the village which ultimately can contribute to the state.

An attempt has been made to document the important success stories through interventions of KVK, Khowai. I hope this publication will act as a supplement for attaining the envisioned development of agriculture and allied sector.

Date: 12th March, 2018

Dr. Dipak Nath
Sr. Scientist and Head

NICRA

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Introduction:

Climate change pertains to increase in atmospheric concentration of carbon di oxide and global warming. Present day atmospheric carbon di oxide level hovers around 397 ppm which is significant increase over the pre-industrial level of 280 ppm.It is anticipated that the concentration level will double by the end of this century.A consequence of increased green house gas emissions is the entrapment of heat within the earth"s atmosphere leading to an alarming rate of global warming.Global average increase in mean annual temperature is estimated 0.8 degree Celsius till now. An increasing rate of warming has taken place across the globe over the last 25 years. For example 11 of the 12th warmest years on record have occurred in the 1996-2005 period. Global mean temperatures are likely to witness of 4 degree Celsius towards the end of this century. Between the seasons warming in the rainy season will be less pronounced than the winter months in India (IMD,2010).Another climate change features significantly influencing agro-ecosystems is the change in seasonal rainfall patterns. Increased frequency in occurrence of extreme weather events such as cyclones, heat wave, cold wave, frost and hail storm over short period exert adverse influence on crop performance.

Farmers need to intelligently adapt to the changing climate in order to sustain crop yields and and farm income. Traditionally technology transfer in agriculture has aimed to increase the farm productivity. However, in the context of climate change farmers need to adapt quickly to enhance their resilience to increasing threats of climatic variability such as droughts, floods and other extreme weather events. Over the years an array of practices and technologies have been developed by researchers towards fostering stability in agricultural production against the onslaught of seasonal variation. Adoption of such resilient practices and technologies by farmers appears to be more a necessary than an option. Therefore,a reorientation in technology transfer approach is necessary.

Technology demonstration under the National Innovations on Climate Resilient Agriculture is implemented by Krishi Vigyan Kendra,Khowai(Formerly known as KVK,West Tripura) at North Pulinpur ADC Village which is a drought prone village. The goal of demonstration component under NICRA is to mainstream some of the successful practices and technologies that promote resilience to climate change and to upscale the proven practices in all the vulnerable villages of Tripura. The bulletin documents the Successful practices and technologies that proved helpful to the farmers of North Pulinpur ADC village to cope with climatic variability faced during the last six years of project implementation by the KVK Khowai.

Authors

Content

Module-1
Natural Resource Management

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Efficient use of Water Harvesting Structures

Dipankar Dey

Introduction

Under the NRM component KVK,Khowai constructed and rejuvenated 22 numbers of Ponds during 2011-12 to 2016-17 at North Pulinpur ADC village; all of which provided life saving irrigation for paddy during kharif dry spell as well as rabi crops during winter season.

Impact: Before implementation of NICRA project to North Pulinpur ADC village, most of the areas remain dry during rabi season. After the intervention, approximately 26187 ft^3 rainwater had been harvested covering an area of about 35.0 ha. for winter vegetables and rabi maize cultivation 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 45 kg/farmer/year during 2016-17.

Before NICRA

KVK, Khowai has successfully introduced TPS presently known as Hybrid Potato Seed (HPS) technology which was previously unknown to the farmers of North Pulinpur as comparatively less irrigated second crop after *Aman* paddy with the provision of irrigation from the rejuvenated pond or newly excavated pond under NRM intervention of NICRA. Similarly, after kharif paddy fallow land is now successfully utilized by introduction of second crops like maize var. HQPM 1, bitter gourd with mulching practice to conserve soil moisture.

After NICRA

These water reservoir structures are also using for table fish production. Adaptation of SRI in paddy by the farmers could minimize the losses due to water shortage in paddy cultivation. Keeping in mind cluster demonstration on SRI paddy cultivation using high yielding variety of Gomoti,Tripura Chikon Dhan,Tripura Nirogi Dhan was demonstrated at an area of 89 ha. Second crop for winter season after kharif paddy could also be grown earlier or in time if medium duration paddy varieties are grown instead of long duration commonly grown variety Ranjit that takes about 140-150 days for harvesting. Through all these successful interventions on crop diversification, the cropping intensity of the village has been increased from 115 to 165 % within 6 years only.

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Phase wise Newly Constructed pond in the NICRA Village:

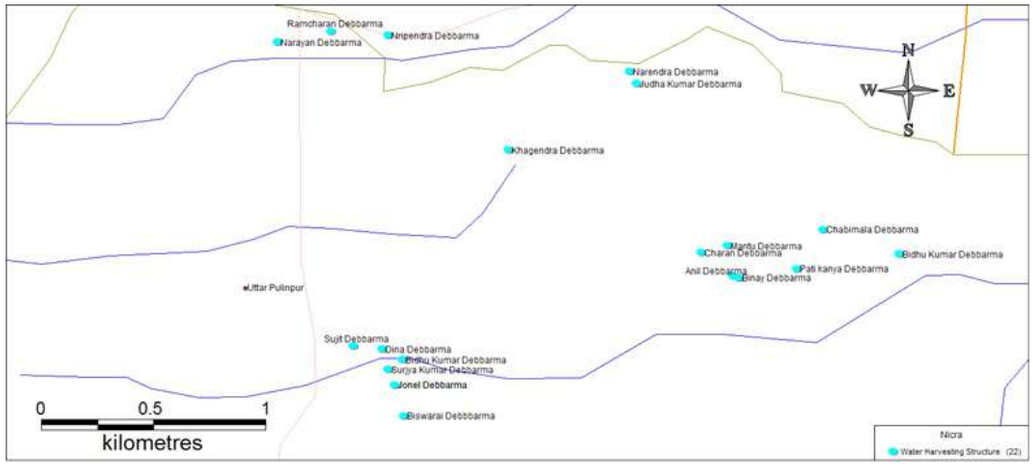

Fig: **Digital Map of Water harvesting structures at N. Pulinpur ADC constructed and rejuvenated under NICRA**

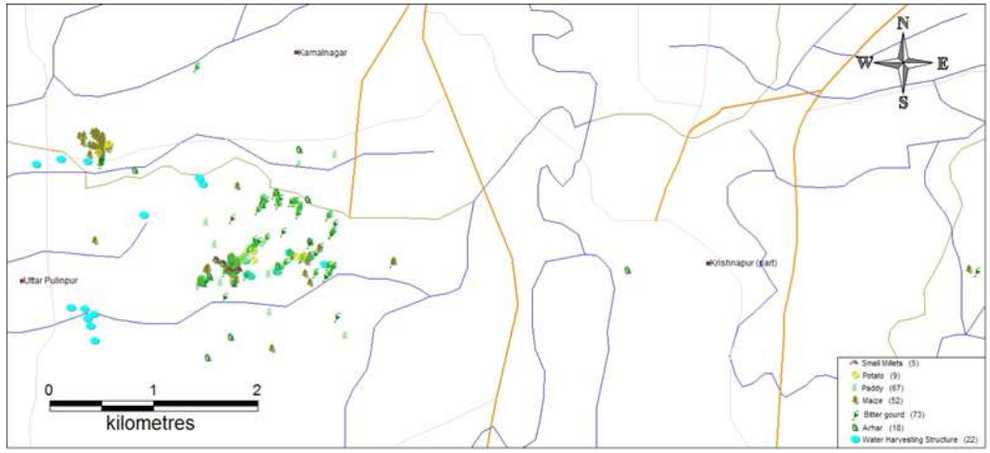

Fig: Digital map of pond based farming systems of North Pulinpur ADC Village

Recycling of Organic waste

Dipankar Dey

Introduction:

Cycle of Jhum (2-3 years) leads to large scale loss of forest resources, loss of fertile top soil due to erosion and loss of carrying capacity of the soil and reducing agricultural area due to more area being utilized for rubber plantation. Rearing of cattle in North Pulinpur village was only for milk production purpose and cow dung were used in the crop field. . In this regard, to cope up with soil fertility deterioration in shifting climate for optimum utilization of dairy KVK, Khowai has demonstrated Vermicompost production technology along with its application and benefits at adapted village and production of bio-gas using cow dung.

Impact:

After successful adoption of the technology, each beneficiary is now harvesting on an average of around 5 quintal Vermicompost along with fifteen litre vermiwash/chamber (2m×1m×0.6m×2)/cycle. The adopted farmers are regularly using the Vermicompost & Vermiwash in their agricultural land and also selling to other farmers. Intervention has also been taken on demonstration of use of vermicompost as fish pond manure to cope up with mortality and morbidity of fishes due to abiotic stress.

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Table : Economics of vermicomposting and vermicompost as fish feed

Technology	Area/ unit No.	Yield (Demo)	Yield (local)	Economics of demonstration (Rs.)				Economics of local (Rs.)			
				Gross Cost (Rs)	Gross Return (Rs)	Net Return (Rs)	BCR	Gross Cost (Rs)	Gross Return (Rs)	Net Return (Rs)	BCR
Vermicomposting	30	1.5 t/yr	NA	5600 /unit	15000/ unit	9400 /unit	2.68	NA	NA	NA	NA
Use of Vermicompost in fish pond	0.08 ha	25 q/ha	20 q/ha	1.25 Lakh /ha	2.5 Lakh /ha	1.25 Lakh /ha	2	1.2 Lakh /ha	2 Lac /ha	0.8 Lakh /ha	1.6

Module-2
Crop Production

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Farmers' prosperity through SRI technology interventions

Dipankar Dey

Introduction :

The System of Rice Intensification is not a new method or technology. It is just altering the management practices to make more productive phenotype from the same genotype of rice plant. Artificial environment is created for growth and development of rice plant for exploitation of its full genetic potential, land and water resources.

SRI is based on the following principles:

- Young seedlings between 8-12 days old (2-3 leaf stage) are transplanted to preserve potential for tillering and rooting ability;
- Careful planting of single seedlings rather than in clumps that are often plunged in the soil; Transplanting of tender seedlings need care to minimize root trauma.
- Wider spacing at 25 cm x 25 cm. in square planting rather than in rows; This can also be done with the help of rope by marking.
- Use of cono-weeder/ rotary hoe/power weeder to aerate the soil as well as controlling weeds; The first advantage of using the weeder is the control of weeds and also adding organic matter to the soil. This gives the benefits of cultivating a green manure crop. Further, the soil gets aerated and the roots are exposed to air. This results in profuse growth of diverse soil micro organisms which make nutrients available to the plant.
- Alternate wetting and dry method rather than continuous flooding in the field; as the soil is not flooded, the roots of the paddy plants grow healthy, deeply in all directions. The root growth is extensive also due to the wide spacing. As the field is intermittently irrigated and dried, the micro organisms grow well which make nutrients available to the plants. This method also helps in better growth and spread of roots.
- Use of organic manure or Vermicompost / FYM.

Interventions of KVK, Khowai

North Pulinpur is a tribal village of Khowai district of Tripura. People of this village are mostly Schedule tribe and mainly depend on agriculture. Paddy is the major crop of the village and they used to grow it in both Kharif as well as in Rabi season. Earlier, they were growing paddy by using traditional system of cultivation like irregular spacing, no seed treatment, continuous flooding, seedling of older age, use of more than 3 nos seedling during transplanting, no plant protection measures etc. With the technological and critical input support of KVK, Khowai in collaboration with Department of Agriculture, Govt of Tripura with financial assistance from NFSM under Cluster demonstration programme of SRI on HYV paddy during the year 2016-17 a total of 30 ha area covered with 59 number of farmers.

All the mentioned principals for SRI was being followed and critical input support was given with the help of Department of Agriculture,Govt of Tripura.Regular field visits were also made by the Subject Matter Specialists of different discipline.

Impact

Before KVK intervention the farmers earned only Rs. 0.1 lakh/ha with BC ratio around 1.25 by cultivating paddy under conventional management. After KVK intervention for the same with a huge success of the paddy production, On an average they got got a yield of 7.5 t/ha. They earned a gross return of around Rs. 0.9 lakh/ha by selling the produce in local market with average price of Rs. 12.00/kg. They have spent around Rs. 0.51 lakh/ha as total cost of production including land preparation, input cost, labour etc. So, their net return from paddy cultivation with the adoption of KVK guidance was Rs. 0.39 lakh/ha and BC ratio for the same was around 1.76. The farmers are really acting as motivator for several other farmers to adopt the SRI cultivation method provided by KVK.and because of that nearby 2 villages also adopted SRI cultivation in the kharif season of 2017-18.

Economics:

Crop		Traditional system(pre KVK intervention.)					After KVK intervention(SRI Cultivation)				
	Cost of Cultivation (Rs./Ha)	Production (ton /ha)	Gross Income(Rs.)	Net Income (Rs.)	B:C ratio	Cost of Cultivation (Rs.)	Production (Ton. /ha)	Gross Income (Rs)	Net Income (Rs.)	B:C ratio	
Paddy,var. TRC-2005-1 (Gomoti)	Input Cost: Seeds: 1000.00 Fertilizer and manure : 4292.00 Labour(Includes Nursery preparation,Sowing, land preparation transplanting,weeding,Crop cutting): 40625.00 Total Cost: 45917.00	4.8	57600	11683	1.25	Input Cost: Seeds:120.00 Fertilizer manure and bio fertilizer: 2400.00 PPC: 1700.00 Labour Cost(Includes Nursery preparation,Sowing,land preparation transplanting,weeding,spraying,Crop cutting): 46875.00 Total Cost: 51095.00	Yield: 7.5 ton/ha	90000.00	38905.00	1.76	

Extent of adoption:
At North Pulinpur ADC Village, with the technological support of KVK Khowai a total of 120 ha area are already covered under SRI technology.

Constrains: The major constrain in relation to SRI cultivation in paddy was found that shortage of labour for timely intercultural operations

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Activities at a glance to promote SRI

Awareness programme of SRI in Collaboration with ICAR Tripura Centre

Method Demonstration of SRI

Up-Scaling of SRI technology in a Cluster Mode

Promotion of Indigenous Marker for SRI

Presence of Officials from State Dept. of Agriculture, Govt. Of Tripura

Field Day

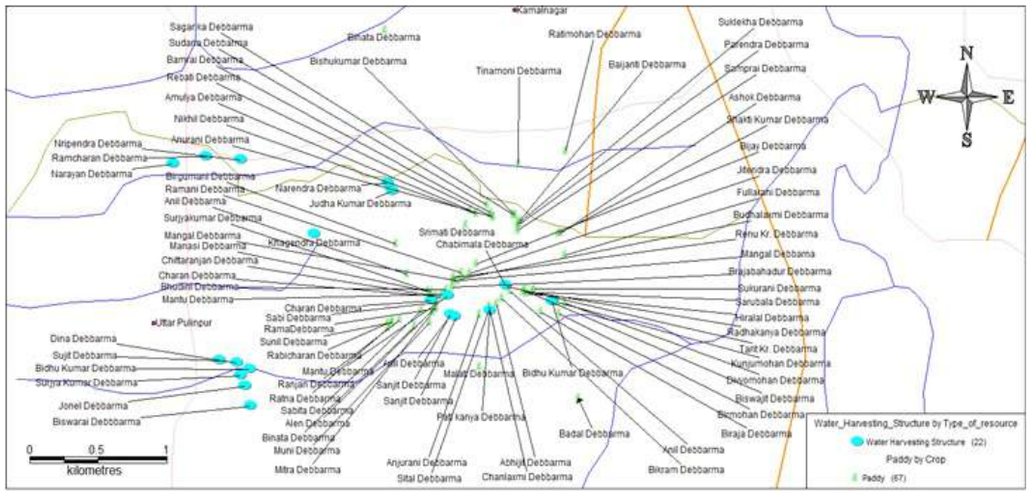

Fig: Water Harvesting Structure based SRI cultivation at North Pulinpur ADC Village during the Year 2017-18

Fig: Water Harvesting Structure based SRI cultivation at North Pulinpur ADC Village during the Year 2017-18(Satellite View)

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Mulching in bitter gourd for In-situ moisture conservation

Subhra Shil

Introduction

North Pulinpur ADC Village of khowai Tripura is a drought prone area of the district. Farmers of this village were following monocropping i.e only Aman paddy. After Aman Paddy the land used to keep fellow during the remaining period of the year due to water scarcity. As this village was under NICRA project, main emphasis was given on construction of rain water harvesting structures to minimise the water scarcity and to increase the cropping intensity under the supervision of KVK. With the initiation of KVK, Bittergourd was introduce to the village with mulching practice. Initially some farmers were selected and provided with sufficient training on mulching. And small demonstrations were given during the year 2012-13. After getting confidence of growing bitter gourd with straw mulching with assured profit, they increased the area under bittergourd cultivation with life saving irrigation from the farm pond constructed under the project.

Impact and economics

Technology intervention:

1. Use of Bitter gourd variety Jyoti bolder
2. Time of planting: First week of January
3. Use of straw mulching to cope up with the adverse climatic condition was special practice. It helped to reduce soil moisture loss as well as for easy trailing of the bitter gourd vines on the ground.
4. Use of Balanced fertilizer as recommended by soil testing report.

Before KVK intervention in the village total area under bitter gourd cultivation was 1.2 ha and after the intervention there was huge horizontal spread of this crop and at present farmers are growing this crop in an area of 8.16 ha which was earlier remain totally fallow after kharif paddy.

Another important point is that as they are growing paddy as previous crop and now they can easily use the paddy straw for mulching purpose. Now most of the farmers of the village have accepted this technology under water stress situation.

Economics:

Economics of Bittergourd Cultivation / ha area	Cost involved (Rs)
Input Cost	1
Seed	10,000.00
Fertilizer and organic manure	20,000.00
Straw	7,000.00
PPC	15,000.00
Labour Cost (Including land preparation, sowing, spreading of mulching material, irrigation, harvesting etc)	90,000.00
Average yield /ha	97 q/ha
Gross Cost	1,00,000.00
Gross income	2,81,300.00
Net income	1,81,300.00
Benefit Cost Ratio	2.81

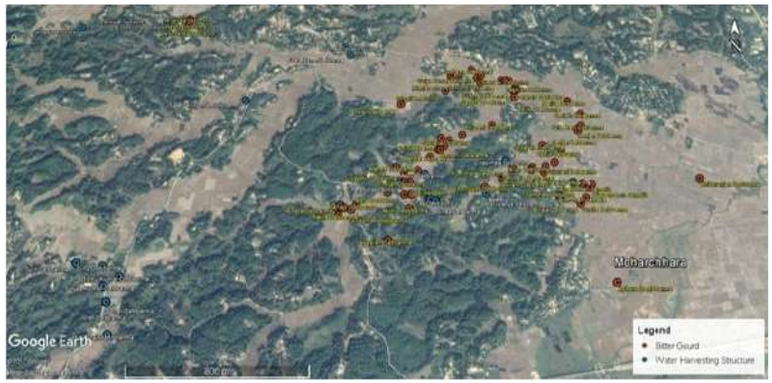

Fig: : Water Harvesting Structure based Bitter Gourd cultivation at North Pulinpur ADC Village

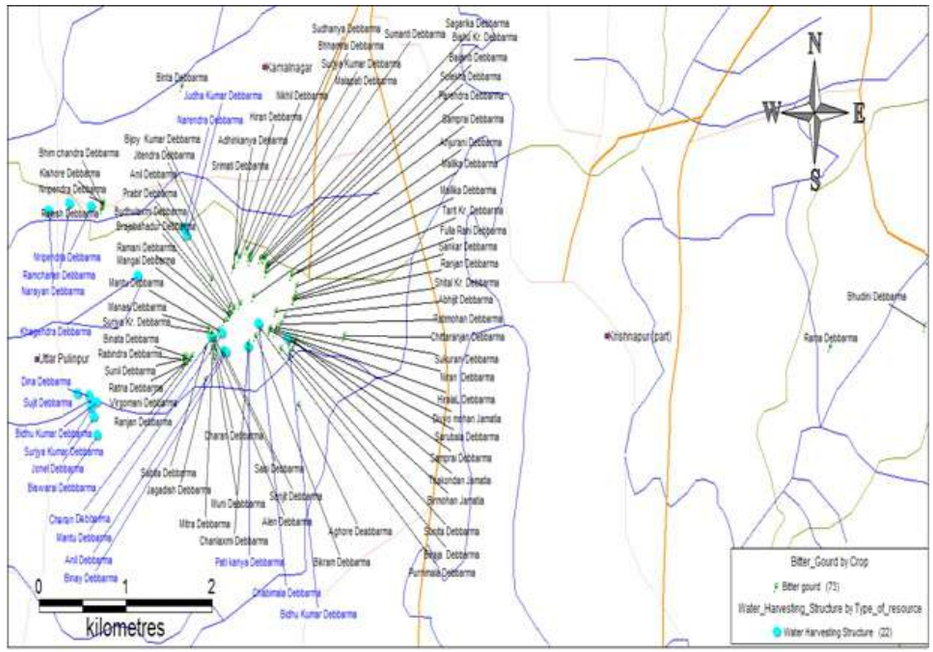

Fig: Water Harvesting Structure based Bitter Gourd cultivation at North Pulinpur ADC Village

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Use of Pheromone Traps for Eco Friendly Management of Fruit Fly in Cucurbits

Ardhendu Chakraborty

Introduction

In Pulinpur ADC Village of Khowai district, farmers are diversifying from traditional rice-maize system to vegetable crops. The area under vegetable crops is increasing day by day. During winter and rainy season, cucurbits are cultivated in majority of area under vegetables crops. The major cucurbits grown by farmers are cucumber, bottle gourd, bitter gourd, sponge gourd, etc. The farmers sold the cucurbits in local as well as distant mandis/markets like Teliamura, Moharcherra, Khowai, etc. During rainy season fruit fly is a major threat that adversely affects the yield as well as quality of cucurbits. Farmers of the village use various insecticides to control this insect, which is not only harmful to the human health but also affect the environment adversely. The Krishi Vigyan Kendra-Khowai introduced pheromone traps for the management of fruit fly in cucurbits. The KVK has assessed this technology during the year 2015-16 by conducting On-Farm testing for its efficacy in Tripura conditions. Based on the results of these trials and subsequent demonstrations at farmers field, the farmers of the village has started demanding this technology on payment basis from KVK, Khowai. Now, the farmers are purchasing it through KVK, Khowai as well as from private dealers.

Interventions of KVK

KVK, Khowai has conducted On-farm Testing (OFTs) of pheromone traps during the year 2015 and 2016 at 8 farmers' fields in cucumber, bitter gourd, sponge gourd, ridge gourd etc. Subsequently, for up-scaling the technology in the district, 45 demonstrations covering two development blocks of Khowai district including North Pulinpur village were laid out during 2016-17. The farmers were also educated about the technology during on and off-campus training programmes conducted on production and protection of vegetable crops.

Output

Due to intervention of KVK, Khowai, the farmers have adopted this innovation especially by those who are cultivating cucurbits during rainy/winter season. The adoption of this innovation resulted in reduction of losses by about 50 per cent and the yields of the different crops increased from 20-25 percent. Further, the quality of produce has also improved. The net returns of the farmers have also increased as they are not spraying expensive insecticides frequently.

Table 1: Major extension activities on fruit fly management

Activities	Year	Area (ha)/No	No of farmers
OFTs	2015-16	0.50	2
	2016-17	1.50	6
FLDs	2016-17	5.0	45
Trainings	2015-16	-	68
	2016-17	-	182
Advisory service	2015-16	-	56
	2016-17	-	124

Symptoms of frut fly infestation in various cucurbitaceous crops

Outcome and Impact

The results of OFTs and FLDs conducted on pheromone traps in the village were encouraging and farmers have started demanding these pheromone traps from KVK, Khowai on payment basis. The other farmers are also purchasing pheromone traps from various sources including private dealers. This technology has reduced pesticide use and saved money of farmers. This technology was adopted by about 80 percent cucurbit growers of the village for the management of fruit fly due to its

Table 2: Economics of using pheromone traps for the management of fruit fly in bitter

Economics of Demonstration (Rs./ha)					Economics of Farmer Practice (Rs/ha)				
Yield (q/ha)	Gross Cost (Rs.)	Gross Return (Rs.)	Net Return (Rs.)	BCR	Yield (q/ha)	Gross Cost (Rs.)	Gross Return (Rs.)	Net Return (Rs.)	BCR
100	95000	290000	195000	3.05	80	85000	200000	115000	2.35

Future Aspect

Since the technique employed is male annihilation technique, the population of the pest will automatically decline in future. This will be highly beneficial for the farming community which were otherwise employing blanket application of insecticides and getting poor yield due to heavy fruit fly attack in the district. Further, the farmers are now being trained to lower the cost of the technology by making homemade traps. Used mineral water or soft drinks bottles may be utilized with four windows of 1.5cm diameter. The wooden blocks should be placed almost at the same level of the windows. The use of plastic water/soft drinks bottles are also performing well and lowering the cost of technology. Farmers may purchase only lures to be recharged in the home made traps. Scientists of the KVK are now popularizing the home made traps among cucurbits growers for maximum adoption of the technology at lowest cost.

Installation of fruit fly trap

Low cost fruit fly trap

Module-3

Fishery and Livestock Interventions

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Composite Fish Culture bringing success to farmers

Subrata Choudhury

Introduction:

Scientific management of fishery were not practiced before NICRA intervention in the adopted village. As most of the ponds of North Pulinpur ADC village are seasonal in nature the farmers of the the village could not grow fishes profitably before the NICRA intervention. After initiation of NICRA during the year 2011, KVK Khowai constructed and rejuvenated many water bodies with an objective to increase the overall income of the farmers. Generally the fish is considered as one of the most important component of farm produce for the nutritional security elsewhere in the country but in Tripura under the existing scenario it is not for the nutritional security but for the food security in as much as the 95% of the total population are fish eaters .People cannot take their daily rice without supplementation of fish as one of the main item irrespective of caste creed and socio economical status. Thus there is a huge scope of commercialization of fishery.

Composite fish culture has been found to be productive and economical venture as compare to conventional fish culture. KVK Khowai Selected five numbers of progressive farmers during the year 2016-17 and trained them about Composite fish culture under different Capacity building programme of NICRA. After getting proper training these farmers applied their technical knowledge of composite fish culture in their farm ponds constructed and rejuvenated under NICRA.

Name of the Species	Weight of fish/ Quarterly interval	Production	Cost	Total Income	Net Profit	BCR
Catla 30%, Ruhu 50%, Mrigal 20%. Stocking density 500 nos.	**June:** Catla-250gm, Rohu-150gm, Mrigal-125gm. **September:** Catla-450gm, Rohu-300gm, Mrigal-250gm. **December:** Catla-500gm, Rohu-400gm, Mrigal-350gm. **March:** Catla-700gm, Rohu-500gm, Mrigal-450gm.	266 kg	13900.00	31920.00	18020.00	2.29

Extent of Adoption

After observing the success of these five farmers many other farmers of the village are now showing their interest in Composite fish culture

Module-4
Institutional Interventions

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Small farm mechanization through Custom Hiring Centres for farm mechanization

Dipankar Dey,
Lord Litan Debbarma

Introduction

Mechanization brings in timeliness and precision to agricultural operations, greater field coverage over a short period, cost effectiveness, efficiency in use of resources and applied inputs, conservation of available soil moisture under stress condition and provision of adequate drainage of excess rain and flood waters. Custom hiring centres (CHCS) for farm implements were established at North Pulinpur ADC village under NICRA project which could successfully empower farmers to tide over the shortage of labour and improve efficiency of agricultural operations. A committee of farmers nominated by the gram sabha manages the custom hiring centre. The rates for hiring the machines/implements are decided by the village climate risk management committee. This committee also uses the revenue generated from hiring charges for repair and maintenance of the implements and remaining goes into revolving fund.

Extent of adoption

From the inception of the Project to 2016-17 a total of 163.4 ha area has been covered under by implements hired from custom hiring centre covering 312 nos. of Tribal farmers of the North Pulinpur ADC Village village resulting in Net Revenue with the VCRMC is Rs. 35255.00 upto 2016-17.

Constrains

A. No permanent shelter for CHC.
B. Repairing of machineries.
C. Transportation of heavy machineries is restricted due to undulating topography.

Conclusion

It is concluded there is an ample scope of more development of custom hiring centre in the North Pulinpur ADC village. As the topography of the village is undulating in nature so the scope of light machineries are more as compare to heavy machineries, in such a scenario the more light machineries should be promoted and the villagers should be trained accordingly. Moreover the maintenance of the machinery is another major issue which is major constrain of the CHC as because most of the machinery are not in a good condition to operate. During winter season as because the source of water is very limited so the villagers have to depend on pump set for providing irrigation so more pump set should be provided for getting a very good irrigation facility in the village which can ultimately increase the cropping intensity. So, we can say that although a great height have been achieved by CHC but there is a more scope to make this facility available to each and every farmer of the North Pulinpur village and that will be the ultimate success of this centre; keeping the concept of CHC of the village there is a scope to develop CHC in each and every villages of the state for overall development of the farming community.


CUSTOM HIRING CENTRE
KAMI HUMKRAI CLIMATE RISK
MANAGEMENT COMMITTEE
NORTH PULINPUR, WEST TRIPURA
PROJECT :- NICRA
IMPLEMENTED BY:- DIVYODAYA KRISHI VIGYAN
KENDRA
CHEBRI , WEST TRIPURA


WELCOME
KVK, West Tripura
Chebri, Khowai (Tripura)