Enhancing Resilience and Adaptive Capacity of Farmers to Climate Variability

Experience of NICRA

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2017

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Preface

Indian Council of Agricultural Research launched National Innovations in Climate Resilient Agriculture (NICRA), a nation-wide project in 2011 in response to the challenge of climate change facing indian agriculture. The project aims to enhance resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. The overall focus of technology demonstrations under NICRA is to enhance resilience of farms and the farming community to climate risks so as to ensure sustainability over a period of time. Thus the emphasis is on adaptation to climate variability which entails appropriate response to contingency situations. Sustainability is the immediate goal in highly intensive production systems facing natural resource degradation. Therefore, the central objective of technology demonstrations in such regions is not on enhancing productivity but on interventions related to coping with vulnerability as well as improvement in natural resource use efficiency for sustaining the productivity gains.

Technology Demonstration Component in Zone-VIII is being implemented in nine most vulnerable districts namely, Belgavi, Davanagere, Chikkaballapura and Tumkur in Karnataka; Namakkal, Villupuram, Ramanathapuram and Nagapattinam in Tamil Nadu and Alleppey in Kerala.

The interventions being implemented are based on four modules, *i.e.* Natural resources management, Crop production, Livestock and fisheries and Institutional interventions. Climate vulnerabilities addressed are drought, flood, cyclone, heat wave *etc.* Demonstration of appropriate practices and technologies with a climate focus evolved by the NARS is taken up in farmer participatory mode in NICRA villages. The NICRA villages have become hubs of learning on climate resilient agriculture in a short span, opening up opportunities for horizontal and vertical diffusion of the successful interventions in other parts of the districts. The authors take this opportunity to gratefully acknowledge the co-operation and assistance of all the Heads of NICRA KVKs and SMSs under ICAR-ATARI Bengaluru, all NICRA farmers, VCRMC members, Scientists and Department officials for their valuable contribution in bringing out this publication. The authors also acknowledge the financial support of ICAR-CRIDA, Hyderabad for the study through NICRA.

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Bengaluru

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Foreword

Climate change is a challenge for global food and nutritional security for a growing human population. In this respect, agriculture has emerged as a major ecosystem of concern and discussion in India. ICAR has launched an initiation '*National Innovations in Climate Resilient Agriculture*' (NICRA) which aims to enhance resilience of Indian agriculture to climate change and climate variability through strategic research and technology demonstration. The Technology Demonstration Component (TDC) of NICRA as on-farm participatory demonstration of available technologies is being implemented in 151 most vulnerable districts of the country. Climate vulnerabilities being addressed are drought, flood, cyclone, heat wave *etc*. Demonstration of appropriate practices and technologies with a climate focus evolved by the NARS is taken up in farmer participatory mode in NICRA villages. The NICRA villages have become centres of learning on climate resilient agriculture. I am glad that this component in a short period of time has generated enormous interest and enthusiasm amongst farmers, administrators and policy makers.

This publication documents successful interventions related to climate resilient practices and technologies that have potential for up-scaling in other parts of the country facing similar vulnerability. I compliment the team ATARI, Zone-VIII, Bengaluru for compiling successful interventions from nine NICRA KVKs. I also appreciate the Krishi Vigyan Kendras and NICRA farmers who have taken active part in this very important initiative. The experiences and lessons learnt through this initiative will have a significant impact on shaping our strategy towards securing a climate resilient agriculture.

(A. K. Singh)

Dated : 28.03.2017

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INTRODUCTION

Climate change impacts on agriculture are being witnessed all over the world, but countries like India are more vulnerable in view of large population depending on agriculture and excessive pressure on natural resources. Indian farmers have evolved various coping mechanisms over time, but these mechanisms are not enough to cope with the extreme weather aberrations witnessed in the recent years. Therefore, there is a need to use modern science combined with indigenous knowledge of farmers to enhance the resilience of Indian agriculture to climate change. In order to deal with climate change and its impacts, the Indian Council of Agricultural Research (ICAR) initiated National Innovations in Climate Resilient Agriculture (NICRA), a multi- institutional, multi- disciplinary network project in 2011. The project aims to enhance resilience of Indian agriculture to climate change and climate variability through strategic research and technology demonstration. The Technology Demonstration Component (TDC) of NICRA as on-farm participatory demonstration of available technologies is being implemented in 151 most vulnerable districts with the help of 100 Krishi Vigyan Kendras. This component is being coordinated by CRIDA and Agricultural Technology Application Research Institutes (ATARI) in the country with the following objectives:

- To enhance the resilience of Indian agriculture covering crops, livestock and fisheries to climate variability and climate change through development and application of improved production and risk management
- To demonstrate site specific technology packages on farmers field for adapting to current climate risk
- To demonstrate an integrated package of proven technologies in a village or cluster of hamlets of each district
- To enhance the capacity of scientists and other stakeholders in climate resilient agricultural research and its applications

In Zone-VIII, it is being implemented in nine most vulnerable districts namely, Belgavi (drought/heat), Davanagere (drought/heat), Chikkaballapura (drought/heat) and Tumkur (drought) in Karnataka, Namakkal (drought), Villupuram (drought/flood/cyclone), Ramanathapuram (drought/flood/cyclone/salinity) and Nagapattinam (drought/flood/salinity) in Tamil Nadu and Alleppey (water inundation/drainage) in Kerala since XI Plan period. During XII Plan, three more districts namely, Gadag and Kalaburagi in Karnataka and Thiruvarur in Tamil Nadu were included as drought prone districts for the implementation of project.

Conceptualisation / Project formulation and addressing of climatic vulnerabilities

The project was conceptualised based on the following steps:

- Analysis of climatic constraints of the village based on long term data
- Assessment of natural resources status of the village
- Identification of major production systems
- Studying of existing institutional structures and identifying the gaps
- Focus group discussion with the community to finalize the interventions

The interventions being implemented are based on four modules, *i.e.* (1) Natural resources management (2) Crop production (3) Livestock and fisheries and (4) Institutional interventions. Climate vulnerabilities addressed are drought, flood, cyclone, heat wave *etc.* Demonstration of appropriate practices and technologies with a climate focus evolved by the NARS is taken up in farmer participatory mode in NICRA villages. The NICRA villages have become hubs of learning on climate resilient agriculture in a short span opening up opportunities for horizontal and vertical diffusion of the successful interventions in other parts of the districts.

This publication documents the successful interventions related to climate resilient practices and technologies that have been adopted by farmers besides having higher potential for up-scaling under similar situations. Some of the technologies have potential co-benefits towards reduction in emissions. These successful interventions of nine KVKs have been discussed state-wise as under:

KARANATAKA

The NICRA-TDC was implemented in four districts of Karnataka state namely, Belgavi, Davanagere, Tumkur and Chikkaballapura through KVKs. In order to deal with the climate change in the right earnest, extensive demonstration of location specific best-bet practices (agricultural technologies/package of practices contributing to climate resilience) on farmers' field in a village or cluster of hamlets in each of the selected districts have been undertaken as described below:

KVK, BELGAVI

NICRA - Village: Bilakundi

The village **Bilkundi** is selected on the basis of vulnerability of its agriculture to climatic variability.

Major climatic vulnerability of the village:

- Recurrent droughts (Early, Mid-season and Terminal)
- Uncertain and intermittent rainfall, dry spells and heat waves
- Water logging in low lands-canal irrigation – poor drainage

No. of households : 419
Total cultivated area : 998 (ha)
Major soil types : Red and Black
Mean annual rainfall : 439
Majorcrops : Sugarcane, Maize, Wheat, Bengal gram
Climate Vulnerability : Drought, Heat wave, Intermittent Rainfall

a) Rainfall trend of the district

Historical Trends in Rainfall		Decadal Average		
		1980-1990	1990- 2000	2000-2010
Average No. of rainy days		35	33	35
No. dry spells during *kharif* season	> 10 days	4	4	0
	> 15 days	2	0	2
	> 20 days	0	2	3
No. of intensive rain-spells	> 60 mm per day	0	0	0

1. Predominant farm enterprises

(i) Cropping pattern: Major cropping systems

Single crop: Sugarcane, Maize, Pigeon pea, Groundnut

Double crop: Soybean-Maize, Green gram-Wheat, Maize-Bengal gram, Sorghum-Bengal gram

Intercrop: Bajra + Pigeon pea (2:1 or 2:4), Groundnut + Pigeon pea (4:1), *Rabi*-Jowar + Bengal gram (2:1)

Strip Crop: Jowar and Green gram, Bajra and Green gram, Bajra and Horse gram

(ii) Area and productivity of major crops

Crop	Area (ha)	Yield (q/ha)
Sugarcane	213	65 (tonnes)
Maize	461	62.5
Wheat	219	27.5
Kapali wheat	107	22.5
Bengal gram	223	12.5
Sunflower	331	13.50
Groundnut	256	15.00
Bajra	205	05.60

(iii) Predominant varieties of major food crops in the village

Crop	Name of variety / hybrid(s)	No. of farmers using improved varieties/hybrids	Area under improved varieties/ hybrids (ha)
Wheat	DWR-162 & UAS-304	74	109
Bengal gram	JG -11	25	55
Bajra	ICTP - 8203	22	51
Maize	CP-818 & Seed tech	225	110

(iv) Cropping intensity (%): 220

(v) Horticulture crops (fruits, vegetables, flower crops *etc.*,), area and productivity of each crop

Crop	Area (ha)	Yield (q/ha)	Name of variety/ hybrid(s)	Area under improved varieties/ hybrids (ha)
Banana	2.25	452	Robusta	2.25
Brinjal	0.5	125	Udupi gulla	1.0
Onion	0.75	250	Arka kalyan	1.5
Chilli	0.5	250	Jwala K.D.S.C-1	2.0

(vi) Area under fodder cultivation (ha), No. of farmers growing green fodder : 5 ha and 25 farmers

(vii) Major source(s) of irrigation: Open well, tube well, canal, ponds, village tanks *etc.*,

Source of irrigation	Area under irrigation(ha)
Open well	144
Tube well	72
Canal	50

(viii)Micro-irrigation

Micro-irrigation	Area (ha)	No. of farmers
Drip	12	12

(ix) Livestock

Livestock type	Total No.	No. of livestock owners	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Small ruminants	731	313	20%	FMD	30	5.10
Large ruminants	1069	412	25%	HSBQ	60	10
Poultry	126	-	-	-	-	-
Any other				FMD and Blue Tongue		
Sheep	650	17	5%		75	12
Goat	313	125	10%		80	5

(x) Milk productivity (liters/milch animal/day): 4-5 l/animal/day

2. Resource availability

(a) Status of common pool resources (CPRs): grazing lands, water bodies, any other

CPR	Area (ha) or Numbers	Status (before start of NICRA)
Grazing land (ha)	60 ha	65 ha
Water bodies (No.)	191 No's	205 No's
Any other (specify)		
Canal (ha)	425 ha	505 ha

(b) NRM structures

NRM structure	No's	Storage Capacity (m^3)	No. of farmers benefited	Protective Irrigation potential* (ha)	Status (Defunct/ effectively used)
Open well	188	1000 m^3	188	150 ha	Effectively used
Gully plugging	500 units	-	88	-	Effectively used

(c) Status of farm mechanization before start of NICRA:

No. of tractors available in the village: 8

3. Socio-economic status

(a) No. of households

Category	Number
General	683
OBC	1897
SC	250
ST	20
Total	**2850**

(b) Literacy rate (%): Male: 44; Female: 26

Average family income from agricultural and allied activities

Category	No. of Families	Annual income (Rs./Family)
Marginal	170	30000-35000
Small	192	40000-50000
Large	57	75000-100000

(c) Workers engaged in agricultural activities: 65%

(d) Insurance coverage (numbers): Crop insurance/livestock insurance

Type of insurance	No. of Farmers
Livestock	35

Actual weather of the village during project period

The climatic/weather data pertaining to Bilkundi village during the project period are collected, analyzed and presented as under:

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells >10-15 days (No.)	Dry spells >15 days (No.)	Highest rainfall intensity events (> 60 mm) (No.)	Water inundation floods> 10 days (No. of events)	Rainfall (mm)		
								Khairf	*Rabi*	Summer
2011	538.0	333.1	29	3	2	0	0	185.3	136.2	11.6
2012		235.6	21	3	2	1	0	139.4	93.51	2.75
2013		273.0	31	2	2	1	0	127.2	136.8	9.0
2014		505.5	42	4	2	0	0	301.1	178.4	23.0
2015		343.7	26	4	4	0	0	191.2	139	13.5

Module I: Natural Resources Management

This module consists of interventions related to *in-situ* moisture conservation, water harvesting and recycling for supplemental irrigation, improved drainage in flood prone areas, conservation tillage where appropriate, artificial ground water recharge and water saving irrigation methods.

NRM structures: In Belgavi, as a part of rainwater harvesting, one community pond/tank was constructed in 2011-12, one open well recharge was implemented in 2014-15 and bunds were strengthened in 27.12 ha area, 52 waste weirs bund were constructed in 25 farmers' field and 5 *nalas* were renovated/desilted in 2014-16 (Table 1).

Table 1: Inventory of NRM structures

Structures/Years of Construction	Category	2011-12	2014-15	2015-16	Total
Community pond/tank	Constructed : Storage tank	1No	-	-	**1 No**
Recharging of open/tube wells with silt trap	Constructed : Open well recharge pit	-	1 No	-	**1No**
Others (Specify)					
Strengthening of Bunds	Strengthening of existing bunds	-	27.12 ha	-	**27.12 ha**
Waste weirs : Bunds	Constructed : Waste weirs	-	52No's	-	**52No's**
Desilting of *nalas*:	Renovated : Desilting of NALAS	-	3 No's	2 No's	**5No's**

Leveling and compartment bunding: Leveling combined with bunding helps in reducing soil erosion as well as runoff to an appreciable extent by enhancing infiltration of water into the soil. Ten farmers demonstrated improved technology by covering 8.8 ha area by growing pigeon pea in 2015-16. This improved technology recorded higher crop yield of 10 q/ha when compared to farmers practice of 7.5 q/ha (Table 2).

Impact: Yield increased 2.5 q/ha and net income of Rs.15000/ha gained over local check (farmers' practice) by maintaining soil moisture through leveling and compartment bunding.

Table 2: Effect of leveling and formation of compartments on soil moisture storage

Year	No. of participating farmers		Area covered (ha)		Pigeon pea yield (q/ha)		Per cent increase in yield
	I T	C	I T	C	I T	C	
2015-16	10	10	8.8	12	10.00	7.50	33.3

I T: Levelling and formation of compartments **C: Without leveling and formation of compartments**

Trench cum bunding: The trench cum bunding served dual purpose. Firstly the bunds built across the slope with appropriate sections arrested soil erosion and secondly the trenches served as water reservation pits that keep soil moisture intact for longer duration. Trenches measuring 1.2 × 0.6 × 0.45 m were opened all around the field. In 2011-12, 88 farmers demonstrated trench cum bunding technology in 163.18 ha area and pigeon pea was grown with higher crop yield of 13.50 q/ha with 35 % increase in yield when compared to farmers practice 10q/ha. The cost for opening of trench cum bunding for the area covered is about Rs. 7,50,000/- (Table 3).

Impact: Increase in yield of 3.5 q/ha with net income of Rs.21, 000 /ha was realized over farmers practice by conserving soil and water through trench cum bunding.

Table 3: Impact of trench cum bunding on field crops (2011-12)

No. of participating farmers		Area covered (ha)		Pigeon pea yield (q/ha)		Cost for opening of trench cum bunding for the area covered (Rs.)
I T	C	I T	C	I T	C	
88	25	163.18	22	13.50 (35 %)	10.00	7,50,000

I T: Trench cum bunding **C: Without Trench cum bunding**

Contour Bunding: In the year 2011-12 and 2012-13, 30 farmers demonstrated contour bunding technology in 50 ha area by growing green gram and pigeon pea as a *kharif* crops and sorghum as a *rabi* crop with higher per cent increase in yield (2011-12: GG: 54.3%, J: 13.6% and 2012-13: PP: 34.6% and S: 21.2%) when compared to farmers practice (Table 4). This technology was horizontally expanded to an area of 79 ha in subsequent years in the village.

Impact: Average yield increased by 63% in green gram, 35% in pigeon pea and 21% in sorghum.

Table 4: Impact of contour bunding on crops

Year	No. of participating farmers		Area covered (ha)		Area brought under cultivation (ha)				Crop yield (q/ha)			
	I T	C	I T	C	I T		C		I T		C	
					B	A	B	A	*Kharif*	*Rabi*	*Kharif*	*Rabi*
2011-12	20	20	40	8	BL	15	BL	6	GG: 5.40 (54.3%)	S: 8.75 (13.6%)	GG :3.50	J:7.70
2012-13	10	10	10	6.5	BL	5	BL	3	PP: 8.75 (34.6%)	S: 9.15 (21.2%)	PP:6.50	J:7.55

IT: Contour Bunding, C: Without contour bunding, B: Before, A: After, BL: Barren land, PP: Pigeon pea, GG: Green gram, S: Sorghum

Tank silt application: Tank silt application helps to build soil fertility and water holding capacity. Three farmer's demonstrated application of tank silt (120 t) to their field crops in 2.8 ha area during 2014-15 and higher *rabi* sorghum crop yield of 15.50 q/ha and B: C ratio of 3.22 was recorded when compare to no tank silt application (Table 5).

Impact: Soil fertility enhanced by application of tank silt and yield increased by 36.6 % with additional net income of Rs. 7790 /ha.

Table 5: Effect of tank silt application on crop yield (2014-15)

No. of participating farmers		Area covered (ha)		Quantity of tank silt application (t)	Crop yield (q/ha)		Economics (Rs./ha)			
							Net returns		B:C Ratio	
I T	C	I T	C	I T	I T	C	I T	C	I T	C
3	3	2.8	1.2	120	RS : 15.50 (36.6 %)	RS: 11.35	27800	20010	3.22	3.1

I T: Tank Silt application, C: Without tank silt, RS: *Rabi* Sorghum

Deep Ploughing: Deep ploughing for soil and moisture conservation was demonstrated by 35 farmers in an area of 25 ha during 2011-14 and higher yields were recorded in horse gram, bajra and finger millet crops when compare to no deep ploughing (Table 6).

Impact: Deep ploughing reduced runoff and conserved soil and water and also helped to increase crop yields upto 35 %.

Table 6: Effect of deep ploughing on soil loss and crop yield

Year	No. of participating farmers		Area covered (ha)		Crop yield (q/ha)		Per cent increase in yield
	I T	C	I T	C	I T	C	
2011-12	15	15	10	6	HG : 12.00	HG: 10.00	20.00
2012-13	10	10	10	4	B : 8.75	B : 6.50	34.62
2013-14	10	10	5	4	FM : 27.00	FM : 24.75	9.09

I T: Deep ploughing, C: Unploughed, FM: Finger millet, HG: Horse gram, B: Bajra

Mulching: Crop mulching for improving moisture and organic carbon content was demonstrated by 3 farmers in an area of 0.4 ha. Turmeric and chilli crops recorded higher crop yield of 23.01 q/ha and 96.01 q/ha respectively, when compared to farmers' practice (Table 7).

Impact: Mulching with biodegradable waste in chilli and turmeric maintained soil moisture and increased yield upto 7 %.

Table 7: Effect of crop mulching on moisture and organic carbon content

Year	No. of participating farmers	Area covered (ha)	Crop yield (q/ha)		Per cent increase in yield
	I T	I T	I T	C	
Turmeric	1	0.2	23.01	21.36	7.72
Chilli	2	0.2	96.01	89.62	7.13

I T: Crop mulching, C: Control

Soil Health Card: Soil fertility status information helps the farmers to maintain the fertility and productivity of soil resources through need based external application of fertilizers. In this regard fertility assessment was carried out by collecting and analyzing 250 soil samples from different survey numbers of the village for the following parameters;

Macro nutrients – Nitrogen, Phosphorus and Potassium

Secondary nutrients – Sulphur

Micro nutrients – Copper, Iron, Zinc, Manganese

Based on the analytical values recorded for different parameters, soil health cards were generated and issued to the participating farmers. These Soil health cards can be used to recommend the nutrient application for the major crops. The average soil fertility status of the village is presented in Table 8.

Table 8: Summary of results of soil testing across the village

Particulars	Range	Mean	Remarks
pH (1:2)	4.17-8.32	6.58	Medium
Electrical conductivity (dsm^{-1})	0.036-0.277	0.796	Medium
Organic carbon (%)	0.15-1.2	1.224	Medium
Nitrogen ($mg\ kg^{-1}$)	24.3-194.4	193.6	Low
Phosphorus ($mg\ kg^{-1}$)	0.6-41.5	15.29	Medium
Potassium ($mg\ kg^{-1}$)	18-255	202.8	Medium
Sulphur ($mg\ kg^{-1}$)	1.4-61.1	17.76	Medium
Iron ($mg\ kg^{-1}$)	5.2-208.9	35.02	High
Zinc ($mg\ kg^{-1}$)	0.25-1.84	2.183	High

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Preparation of Compost: Preparation of compost, vermi compost, bio digester and bio gas was demonstrated by 20 farmers by producing 60 tonnes of compost and applied to 8 ha area of their own field. 20 farmers demonstrated vermicompost by producing 27 tonnes and applied to 31.5 ha area of their own field. Bio digester was demonstrated by three farmers and biogas by 10 farmers (Table 9).

Impact: Application of compost enhanced soil fertility and water holding capacity and reduced use of chemical fertilizers by 25 to 30%.

Table 9: Impact of compost to ecosystem

Compost	No. of participating farmers	Quantity of compost produced (t)	Application of compost - Area covered (ha)	Income generated from compost, if any
Compost	20	60	8	Applied to their own field
Vermicompost	20	27	31.5	
Bio digester	3	-	1.2	
Bio gas	10	-	-	

Tree based farming system: Tree planting was taken up on degraded ridge lands in the village. In order to ensure better survival rate, planting was done on the bunds after digging the trenches in entire area. Tree based farming system of mango was taken in 1 ha area by one farmer, 58 lime saplings were planted in 1.4 ha area and 44 custard apple were planted in 0.4 ha area (Table 10). The exercise has created great awareness among the farmers about the role of trees in improving the soil and water conservation besides helping in micro climate and carbon sequestration in the long run.

Impact: Improved soil and water conservation helped to maintain micro climate.

Table 10: Area brought under perennial crops after NICRA

Perennial crops	Area (ha) and Number
Mango	1ha and 1 farmer
Lime	1.4 ha and 58
Custard apple	0.4 and 44

Desilting of existing *nala*: Desilting of 5 dongari nala's was done in Yadagud village during 2014-16. Thirty nine farmers were benefitted and storage capacity of water tank also increased facilitating supplement irrigation to crops in both *kharif* and *rabi* season's.

Impact: 38 open wells and one bore well have been recharged by 5 desilted *nalas* and protective irrigation was given to crop through water stored in *nalas* (Table 11).

Desilting of dongari *nala*

Desilting of Janamatti *nala*

Desilting of Thaladappa *nala*

Table 11: Impact of desilted dongari *nala*- Yadagud village

Year	No. of Units	No. of participating farmers	Length of the channel desilted (m)	Water storage in tank (m^3)		Area (ha) under *kharif*		Area (ha) under *rabi*		*Kharif* crop yield (kg/ha)		*Rabi* crop yield (kg/ha)	
				Before	After	B	A	B	A	B	A	B	A
2014-15	3	25	3084	873	3959	Desilting was done after both the seasons of 2014-15				-	-	-	-
2015-16	2	14	1587	470	1587	-	21.9	-	7.3	855	956	875	1150

B: Before, A: After

Water storage capacity created: Under the project, through repair and renovation of various NRM structures in the village on additional water storage capacity of 4673.38 m3 was created (Table 12)

Table 12: Total water storage capacity created in the NICRA village over the years

Name of structures constructed / repaired	Investment (Rs.)	No. of participating farmers	Water storage capacity (m^3)		Protective irrigation potential created (ha)	Area under cultivation (ha)				Cropping intensity (%)
			Before	After		Before		After		
						Kharif	*Rabi*	*Kharif*	*Rabi*	
Dongari Nala	75381	7	379.62	1419.37	11.4	4.8	1.4	8.4	6.2	173.8
Thaladappa Nala	26772	5	73.85	443.12	7.6	2.4	1.2	6.4	5.6	187.5
Janamatti	121608	13	419.34	2096.7	16.2	6.4	3.6	14.4	11.4	179.16
Walake Tota	85649	9	486	1615	7.4	2.4	0.8	6	4.8	180.0
Janamatti School Tota	29163	5	171.72	629.72	4.4	1.8	0.6	3.2	2.4	175.0
Total			**1530.53**	**6203.91**						

Module II: Crop Production

This module consists of introduction of drought/temperature tolerant varieties, advancements of planting dates, water saving paddy cultivation methods (SRI, aerobic, direct seeding), frost management in crops, community nurseries for delayed monsoon and location specific intercropping systems.

Varietal demonstrations

Soybean (JS-335): The demonstration was carried out in 10.3 ha area covering 19 participating farmers. Soybean (JS-335) variety yielded 2875 kg/ha in comparison with farmer variety monetta (2205 kg/ha) with B: C ratio of 3.64 and 3.18, respectively (Table 13).

Impact: Yield increased upto 670 kg/ha with net profit of Rs.17306/ha by use of short duration and non shattering soybean variety JS-335.

Table 13: Performance of soybean (JS-335)

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2011-12	Demo	JS-335	5.5	11	3000	59497	3.43
	FP	Monetta	-	-	2000	34875	2.65
2012-13	Demo	JS-335	4.8	8	2750	73300	3.85
	FP	Monetta	-	-	2410	63310	3.70
Total/ Average	**Demo**	**JS-335**	**10.3**	**19**	**2875**	**66399**	**3.64**
	FP	**Monetta**	**-**	**-**	**2205**	**49093**	**3.18**

Pigeon pea (TS-3R): The demonstration was carried out in 9.5 ha area covering 20 participating farmers. Pigeon pea (TS-3R) variety yielded 1152 kg/ha in comparison with farmer local variety (858 kg/ha) with B: C ratio of 3.03 and 2.42, respectively (Table 14).

Impact: Increase in yield by 294 kg/ha with additional net profit of Rs.17640 /ha by use of improved, medium duration and wilt resistant pigeon pea variety TS-3R was achieved.

Table14: Performance of pigeon pea (TS-3R)

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2011-12	Demo	TS-3R	5	10	1350	38840	3.56
	FP	Local	-	-	1000	17850	2.47
2012-13	Demo	TS-3R	4.5	10	953	25692	2.49
	FP	Local	-	-	715	14820	2.36
Total/ Average	**Demo**	**TS-3R**	**9.5**	**20**	**1152**	**32266**	**3.03**
	FP	**Local**	**-**	**-**	**858**	**16335**	**2.42**

Green gram (S-4): The demonstration was carried out in 7.6 ha area covering 12 participating farmers. Green gram (S-4) variety recorded a higher grain yield of 620 kg/ha when compared to farmers' local variety (425 kg/ha) with B: C ratio of 2.72 and 2.67, respectively (Table 15).

Impact: Increase in yield by 195 kg/ha with additional net profit of Rs.6651 /ha gained by the use of short duration, drought tolerant and synchronized maturity green gram variety S-4. The vertical area spread was from 10 ha to 25 ha in the subsequent years.

Table 15: Performance of green gram (S-4)

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2011-12	Demo	S-4	4.0	6	700	22325	2.76
	FP	Local	-	-	500	14750	2.40
2012-13	Demo	S-4	3.6	6	540	18530	2.68
	FP	Local	-	-	350	12803	2.94
Total/ Average	**Demo**	**S-4**	**7.6**	**12**	**620**	**20428**	**2.72**
	FP	**Local**	**-**	**-**	**425**	**13777**	**2.67**

***Kharif* Horse gram (GPM-6):** The demonstration was carried out in 9.6 ha area covering 20 participating farmers. Horse gram (GPM-6) variety recorded a higher grain yield of 883 kg/ha when compared to farmer local variety with 708 kg/ha. The B: C ratio was 2.35 for GPM-6 as compared to 2.20 for the local (Table 16).

Impact: Increased yield by 175 kg/ha with additional net profit of Rs.3259 /ha by use of contingent crop variety GPM-6 besides enhanced the soil fertility.

Table 16: Performance of horse gram (GPM-6) in *kharif*

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2011-12	Demo	GPM-6	4	5	1200	18250	2.56
	FP	Local	-	-	1000	15975	2.77
2012-13	Demo	GPM-6	4.8	6	800	13550	1.89
	FP	Local	-	-	650	11300	1.93
2015-16	Demo	GPM-6	0.8	9	650	12000	2.60
	FP	Local	-	-	475	6750	1.90
Total/ Average	**Demo**	**GPM-6**	**9.6**	**20**	**883**	**14600**	**2.35**
	FP	**Local**	**-**	**-**	**708**	**11341**	**2.20**

Bajra (ICTP-8203) in *Kharif*: The demonstration was carried out in 12.4 ha area covering 23 participating farmers. Bajra (ICTP-8203) variety recorded a higher grain yield of 900 kg/ha when compared to farmer's local variety (720 kg/ha) with B: C ratio of 2.38 and 2.35 respectively (Table 17).

Impact: Vertical area spread under the variety was from 8 ha to 20 ha in the following years.

Table 17: Performance of *kharif* bajra (ICTP-8203)

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2011-12	Demo	ICTP-8203	5.4	9	875	14675	3.04
	FP	Local	-	-	650	11650	2.97
2012-13	Demo	ICTP-8203	7	14	925	4600	1.71
	FP	Local	-	-	790	4125	1.72
Total/ Average	**Demo**	**ICTP-8203**	**12.4**	**23**	**900**	**9638**	**2.38**
	FP	**Local**	**-**	**-**	**720**	**7888**	**2.35**

***Rabi* Bengal gram (JG-11):** The demonstration was carried out in 14.4 ha area covering 38 participating farmers. Bengal gram (JG-11) variety recorded a higher grain yield of 1780 kg/ha when compared to farmer's practice of using a local variety (1290 kg/ha) with B: C ratio of 3.42 and 3.07, respectively (Table 18).

Impact: JG-11 variety has spread up to 65% of area in the village and farmers got additional profit of Rs. 1750/ha.

Table 18: Performance of rabi bengal gram (JG-11)

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2012-13	Demo	JG-11	1.2	5	1997	61770	4.40
	FP	A-I	-	-	1460	44410	4.17
2014-15	Demo	JG-11	13.2	33	1563	44402	2.45
	FP	A-I	-	-	1120	26471	1.97
Total/ Average	**Demo**	**JG-11**	**14.4**	**38**	**1780**	**53086**	**3.42**
	FP	**A-I**	**-**	**-**	**1290**	**35441**	**3.07**

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Finger millet (GPU-48) in *Kharif*: The demonstration was carried out in 1 ha area covering 2 participating farmers in 2013-14. Finger millet (GPU-48) variety recorded a higher grain yield of 2700 kg/ha when compared to farmer practice of using a local variety (2475 kg/ha) (Table 19).

Impact: Increase in yield by 225 kg/ha with additional net profit of Rs.1975 /ha by use of improved finger millet variety GPU-48 was realised.

Table 19: Performance of finger millet (GPU-48)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	GPU-48	1	2	2700	29250	3.60
FP	Local	-	-	2475	27275	3.77

Foxtail millet (PS-4) in *Kharif*: The demonstration was carried out in 2 ha area covering 10 participating farmers in 2013-14. Foxtail millet (PS-4) variety recorded a higher grain yield of 950 kg/ha when compared to farmer's practice of using a local variety (795 kg/ha) with B: C ratio of 1.60 and 1.45, respectively (Table 20).

Impact: Gained additional net profit of Rs.1730 /ha by use of new foxtail millet variety PS-4.

Table 20: Performance of foxtail millet (2013-14) in *kharif*

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	PS-4	2	10	950	5695	1.60
FP	Local	-	-	795	3965	1.45

***Rabi* Wheat (DWR-2006):** The demonstration was carried out in 32 ha area covering 80 participating farmers. *Rabi* wheat (DWR-2006) variety recorded a higher seed yield of 1388 kg/ha when compared to farmer's practice of using a local variety (DWR-162) with 1031 kg/ha. The B: C ratio was also higer (2.25) as compared to 1.82 with local (Table 21).

Impact: Increased yield by 357 kg/ha with additional net profit of Rs.6468 /ha by use of drought tolerant *rabi* wheat variety DWR-2006 to the farmers of the village..

Table 21: Performance of *rabi* wheat

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2013-14	Demo	DWR-2006	12	30	1625	12721	1.55
	FP	Local	-	-	1186	7185	1.38
2014-15	Demo	DWR-2006	20	50	1150	22750	2.94
	FP	Local		-	875	15350	2.41
Total/ Average	**Demo**	**DWR-2006**	**32**	**80**	**1388**	**17736**	**2.25**
	FP	**Local**	-	-	**1031**	**11268**	**1.82**

Intercropping System

Groundnut + Pigeon pea (3:1) in *Kharif*: The demonstration was carried out in 4.8 ha area covering 12 participating farmers in 2013-14. In intercropping system of groundnut + pigeon pea (3:1), groundnut recorded a higher pod yield of 875 kg/ha when compared with farmer practice of sole crop of groundnut (local variety) yielding only 630 kg/ha with B: C ratio of 2.09 and 2.46, respectively (Table 22).

Impact: After NICRA intervention majority farmers practicing intercropping system instead of sole crop and getting additional net return of Rs. 3655 /ha.

Table 22: Performance of groundnut + pigeon pea (3:1) in *kharif* -2013-14

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	GPBD-4 + TS-3R	4.8	12	875	20120	2.09
FP	TMV-2	-	-	630	16465	2.46

Bajra + Horse gram (1:2) in *Kharif:* The demonstration was carried out in 3 ha area covering 10 participating farmers in 2013-14. In intercropping system of bajra + horse gram (1:2), bajra recorded a higher grain yield of 425 kg/ha when compared to farmer's practice of growing a sole crop of bajra (local variety) yielding only 335 kg/ha (Table 23).

Impact: Additional yield of 90 kg/ha was obtained by use of contingent crop variety GPM-6 along with bajra.

Table 23: Performance of bajra + horse gram (1:2) in *Kharif*-2013-14

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	ICTP-8203 + GPM-6	3	10	425	13690	1.98
FP	Local	-	-	335	14260	2.90

Sorghum + Bengal gram (1:3) in *Rabi:* The demonstration was carried out in 4 ha area covering 10 participating farmers in 2013-14. In intercropping system of sorghum + bengal gram (1:3), sorghum recorded a higher grain yield of 1865 kg/ha when compared to farmer's practice of growing a sole crop of bengal gram (local variety) yielding only 1345 kg/ha. The B: C ratio was 4.20 and 3.63, respectively for inter cropping and sole crop (Table 24).

Impact: Additional yield of 520 kg/ha and net profit of Rs.18301/ha was realised by following intercropping system.

Table 24: Performance of sorghum +bengal gram (1:3) in *Rabi* - 2013-14

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	M 35-1 + JG-11	4	10	1865	58245	4.20
FP	JG-11	-	-	1345	39944	3.63

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Sorghum + Bengal gram (2:4) in *Rabi:* The demonstration was carried out in 16 ha area covering 40 participating farmers in 2014-15. In intercropping system of sorghum + bengal gram (2:4), sorghum recorded a higher grain yield of 2875 kg/ha when compared to farmer practice of local varieties in sorghum + bengal gram (2:4) yielding only 2450 kg/ha. The B: C ratio was 2.81 and 1.96 respectively in improved and local varieties (Table 25).

Impact: Improved varities (BJV-44 + JG-11) replaced local varities (M 35-1 + A-I) in sorghum + Bengal gram intercropping system.

Table 25: Performance of sorghum +bengal gram (2:4) in *Rabi*-2014-15

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	BJV- 44 + JG-11	16	40	2875	51853	2.81
FP	M 35-1 + A-I	-	-	2450	33600	1.96

Safflower + Bengal gram (2:4) in *Rabi*: The demonstration was carried out in 4 ha area covering 10 participating farmers. In intercropping system of safflower + bengal gram (2:4), improved varieties recorded a higher grain yield of 2700 kg/ha when compared with farmer practice of local varieties in the intercropping yielding only 2280 kg/ha (Table 26).

Impact: Improved bengal gram variety JG-11 has replaced the M35-1 variety of sorghum in intercropping with safflower.

Table 26: Performance of safflower + bengal gram (2:4) in *Rabi* - 2014-15

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	A-I + JG-11	4	10	2700	87962	2.87
FP	A-I +Local	-	-	2280	70489	2.62

Module III: Livestock and Fisheries

Use of community lands for fodder production during droughts/floods, improved fodder/feed storage methods, preventive vaccination, improved shelters for reducing heat stress in livestock are the activities carried out under this module.

Animal health camp and vaccination: Animal health camp and vaccination was carried out covering 1498 animals against weakness, debility, fever, under developed genital and off feed in 2014-15 involving department of Animal Husbandry and Veterinary Science (Table 27).

Impact: Villagers became aware of FMD and HSBQ vaccinations and importance.

Table 27: Animal health camp and vaccination (2014-15)

Activity	No. of animals treated	Other dept. associated	Vaccination against disease
Animal health check up	1498	Dept. AH andVS	Weakness, Debility, Fever, Underdeveloped genital and Off feed

Fodder production: Fodder production was carried out by introduction of new variety of napier grass during 2012-13. Hybrid napier grass (APBN-1) was grown in 1ha area covering 7 farmers and yielded green fodder of about 56.7 t/ha/season. As a result of good feeding an increase in milk prodution (3.11%) was noticed as compared to farmer's practice of local fodder (2.70%). In the year 2013-14, hybrid napier grass (APBN-2) was grown in 1.95 ha area covering 15 farmers and yielded green fodder of about 54.7 t/ha/season. Silage unit was establishment in 2013-14 for maize and napier grass covering 4 farmers and by using this silage for the milch animals there was an increase in milk prodution (8.40%) with intervention when compared to without silage feeding (9.30%) (Table 28).

Impact: Introduction of new fodder varities increased the milk production.

Table 28: Fodder production

Year	Activity	Variety	Area (ha)	No. of participating farmers	Green fodder yield (t/ha/season)	Milk yield (liters/day)		Remarks
						1*	2**	
2012-13	Fodder production	APBN-1	1	7	56.7	3.11	2.7	9.30 % of milk is increased
2013-14		APBN-2	1.95	15	54.7	3.82	3.5	15.02% of milk is increased
2013-14	Silage unit establishment	Maize and Napier grass	-	4	-	8.4	9.3	–10.7 % in milk production

*** With intervention** ****without intervention**

Local breed up gradation: Usmanabadi, Boer and Shirohi breeds were used for local breed upgradation in 11units benefitting 274 farmers during the years 2012-16. Further, 78 farmers were benefitted through Kilar Bull and He-buffalo by 2 units (Table 29).

Impact: Existing local breeds were up graded as improved breeds.

Table 29: Local breed upgradation

Year	Activity/Breed	No. of animals	No. of participating farmers
2012-13	Usmanabadi, Boer and Shirohi breeds	3 units	3
2013-14		3 units	119
2014-15		3 units	124
2015-16		2 units	28
2012-16	Kilar Bull and He-buffalo	2 units	78

Animal nutrition and fodder enrichment: Supplementation of mineral and vitamin mixture during lean period was carried out in 2013-14. About 133 cattles of 42 farmers were benefitted and 18 % of increase in milk production was noticed. Similarly in 2014-15, 95 cattles were benefitted with the treatment and an increase of 9.35 % milk yield was observed by 51 farmers in the village (Table 30).

Impact: Milk production increased up to 10 % and 0.5 to 1 % fat increased.

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Table 30: Animal nutrition and fodder enrichment

Year	Activity	No. of participating farmers	Type of animals	No. of animals benefited	Economic impacts
2013-14	Supplementation of mineral and vitamin mixture during lean period	42	Cattles	133	18% increase in milk production
2014-15		51		95	9.35% increase in milk production

Improved shelter: Cemented floor housing was constructed for 73 cow, bullock and buffalo benefitting 25 farmers in 2012-13 (Table 31).

Impact: Disease incidence reduced and ensured availability of good quality organic manures.

Table 31: Improved shelter (2012-13)

No. of participating farmers	No. of animals	Type of animal	Type of housing	Type of material used (Locally available)	Cost of housing/ farmer (Rs.)	Economic impact	
						1*	2**
25	73	Cow, bullock and buffalo	Cemented floor	Concrete (sand and cement)	6000	4.9	4.33

*** With intervention **Without intervention**

Module IV: Institutional Interventions

The module consists of institutional interventions either by strengthening the existing ones or initiating new ones relating to seed bank, fodder bank, commodity groups, custom hiring centre, collective marketing group, introduction of weather index based insurance and climate literacy through a village weather station.

Custom Hiring Center

The main objective of custom hiring center (CHC) is to supply farm implements to the small and marginal farmers at reasonable charge on hire. This helps the small and marginal farmers to take up farm operations on time. Small equipments like weeders, markers, sprayers, drum seeder *etc.*, help the small / marginal farmers in completing the farm operations in time.

Under this intervention, 256 farmers benefitted by covering 268.12 ha area utilising implements from the CHC. The rates for hiring the implements / machines of CHC are fixed by Village Climate Risk Management Committee (VCRMC). The revenue generated from these implements during the years from 2011-16 was Rs. 54,260/- (Table 32).

Table 32: Performance of custom hiring center for farm implements and machinery

Year	Area covered (ha)	No. of farmers using implement	Revenue generated from CHCs (Rs)
2011-12	28	40	10450
2012-13	108.5	70	10550
2013-14	97.62	104	24450
2014-15	16	31	7350
2015-16	18	11	1460
Total of 5 years	**268.12**	**256**	**54260**

Capacity Building

KVK organised training programmes on different need based aspects with apparent objective of making the farmers of NICRA villages potential human resources with socially and financially comfortable and make their agricultural practices climate resilient.

A total of 29 capacity building programmes were conducted in different thematic area during the years 2011-16 under NICRA *viz.* Agricultural meteorology, Hi tech horticulture, Soil fertility management, Livelihood management for farm women, Increasing milk production, Exposure visit on crop production technology for horticulture and forage crops, Crop production and Motivation in sericulture. About 1176 farmers and 49 farm women were participated (Table 33).

Impact: Farmers knowledge and skills on technologies on dry land and horticultural crops have improved.

Table 33: Capacity building (HRD) programmes organized under NICRA since inception

Sl. No.	Thematic area	No. of Courses	No. of participating farmers		
			Male	Female	Total
1	Agricultural Meteorology	1	37	-	37
2	Hi Tech Horticulture	2	71	11	82
3	Soil Fertility Management	5	183	10	193
4	Livelihood Management for Farm Women	1	44	-	44
5	Increasing Milk Production	5	217	6	223
6	Exposure visit on Crop Production Technology for Horticulture and Forage crops	4	225	-	225
7	Crop Production	10	364	17	381
8	Motivation in Sericulture	1	35	5	40
Total		**29**	**1176**	**49**	**1225**

Extension Activities

In order to create mass awareness about the climate resilient technologies, large numbers of extension activities were organised by KVK under NICRA at KVK farms and in the NICRA village as well. The details of extension activities organised were Agro advisory services, Field day, Diagnostic visits, Exposure visits, Method demonstration, Group discussion, Commodity groups totalling 240 extension programmes in which 1485 farmers and 210 farm women were participated (Table 34).

Impact: Farmers awareness on organic farming, establishment of orchard, seed treatment and symptoms of pest and diseases has improved.

Table 34: Extension activities organized under NICRA (2011-2016)

Sl. No.	Name of the activity	Number of programmes	No. of participating farmers		
			Male	Female	Total
1	Agro advisory services	128	197	73	270
2	Field day	3	255	44	299
3	Diagnostic visits	49	148	34	182
4	Exposure visits	6	103	-	103
5	Method demonstration	8	51	38	89
6	Group discussion	38	533	3	536
7	Commodity groups	8	198	18	216
Total		**240**	**1485**	**210**	**1695**

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KVK, CHICKBALLAPUR

NICRA - Village: S. Raghuttahalli

The village S. Raghuttahalli is selected on the basis of vulnerability of its agriculture to climatic variability.

Climatic Vulnerability

S. Raghuttahalli village is located in the eastern dry zone of Karnataka that falls in rain shadow belt. The main vulnerability is drought which is occurring more frequently in last few decades.

No. of households : 215
Total cultivated area : 154.27 ha
Major soil types : Red sandy loam
Mean annual rainfall : 590.51 mm
Major crops : Finger millet, Pigeon pea, Groundnut
Climate Vulnerability : Drought

a) Rainfall trend of the district

Historical Trends in Rainfall		Decadal Average		
		1980-90	1990-2000	2000-2010
No. of rainy days		30	23	28
No. of dry spells during *kharif* season	➢ 10 days	1	1	1
	➢ 15 days	1	1	1
	➢ 20 days	1	2	3
No. of intensive rain spells	> 60 mm per day	3	0	3

1. Predominant farm enterprises

(i) Cropping pattern: The cropping systems under dry land agriculture are groundnut followed by finger millet, finger millet and intercrops of groundnut and pigeon pea as well as finger millet and pigeon pea.

(ii) Major cropping systems: Dry farming

(iii) Area and productivity of major crops:

Crop	Area (ha)	Yield (q/ha)
Paddy	21.66	20-25
Finger millet	4.14	9-12
Pigeon pea	19.65	6-8
Groundnut	36.00	4-5
Tomato	8.12	40-45

(iv) Predominant varieties of major food crops (up to 4 crops) in the village

Crop	Name of variety / hybrid(s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village
Paddy	Jaya, Hamsa	4	1.5
Finger millet	Indaf-9 series	15	7.0
Pigeon pea	TTB-7	15	9.0
Groundnut	TMV-2, K-3	22	19.0

(v) Cropping intensity (%): 112

(vi) Horticulture: crops (fruits, vegetables, flower crops etc), area and productivity of each crop

Crop	Area (ha)	Yield (q/ha)	Name of variety/ hybrid(s)	Area under improved varieties/ hybrids (ha) in the village
Tomato	12.05	400-450	US-618, 1196	4
Onion	28.80	100-200	Kalyani, local	2
Mango	8.12	180-200	Badam, Mallika, Bengaluru	4
Cashew	3.50	4-5 kg/plant	Ullal-1	1.5
Coconut	3.204	35-40 nuts/palm	Local tall	-

(vii) Area under fodder cultivation (ha) and number of farmers growing green fodder: Two hectare area, six farmers

(viii) Major source(s) of irrigation: Open well, tube well, canal, ponds, village tanks *etc.*,

Source of irrigation	Area (ha) under irrigation
Tube well	27.02 ha
Village tank	12 (Seasonal)

(ix) Micro-irrigation:

Micro-irrigation	Area (ha)	No. of farmers
Drip	2.4	6

(x) Livestock:

Livestock type	Total number	No. of livestock owners	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Small ruminants	283	20	2%	Foot and Mouth Disease	60	9

(xi) Milk productivity (liters/milch animal/day): 9

(xii) Inland fisheries: Practiced or not?, if yes, please give the following details: No

2. Resource availability

(a) Status of common pool resources (CPRs): Grazing lands, water bodies, any other

CPR	Area (ha) or Numbers	Current status (before start of NICRA)
Grazing land (ha)	2.064	Dried
Water bodies (No.)	5 tanks	Defunct
Gundu thopu (Tamarind orchard)	6 ha	Effectively in use

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(b) NRM structures

Name of NRM structure	No's	Storage Capacity (m^3)	No. of farmers benefited	Protective Irrigation potential* (ha)	Status (Defunct/ effectively used)
	1	2	3	4	5
Farm pond	2	10 × 15 × 5	2	2	Defunct
Village tank	5	-	108	8	Utilizing
Percolation tank	2	12 × 10 × 2	2	2	Defunct
Open well	2	-	2	1	Effectively utilized
Check dam	3	Width-15m	150	-	-
Gully plugging	-	Height-3m			

*** Two protective irrigations at a depth of 5 cm per irrigations;**

(c) Status of farm mechanization before start of NICRA: No. of tractors, power tillers, seed drills, weeders, threshers, *etc.*,

No. of tractors - 5, No. of power tillers - 2 No. of seed drills - 10,

No. of weeders - 4 No. of threshers - 2

3. Socio-economic status

(a) No. of households

Category	No. of households
General	24
OBC	150
SC	45
ST	32
Total	**251**

(b) Literacy rate (%): Male: 50, Female: 69

Average family income from agricultural and allied activities

Category	No. of families	Annual income (Rs./family)
Marginal (1-2.5 ha)	128	11000
Small (< 1.0 ha)	50	16000
Large (> 5.0 ha)	20	38000

(c) Workers engaged in agricultural activities (%) : 42

(d) Insurance coverage (numbers): Crop insurance/livestock insurance *etc.*, specify

Type of insurance	No. of farmers
Crop	Nil
Livestock	60 farmers for cows
Weather	Nil

Actual weather of the village during project period

The climatic/weather data pertaining to S.Raguttahalli village during the project period are collected, analyzed and presented as under:

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells >15 days (No.)	No. of highest rainfall intensity events (> 60 mm)	Water inundation floods > 10 days (No. of events)	Rainfall (mm)		
								Khairf	*Rabi*	Summer
2011	740.0	107.5	12	2	1	0	0	52	55.5	0
2012		799.9	28	4	4	2	2	452.5	97	250.4
2013		827.5	33	3	4	2	1	611.6	61	154.9
2014		353.7	17	3	5	0	0	230.2	0	123.5
2015		1163.0	47	2	4	4	3	499	492	172

Module I: Natural Resources Management

This module consists of interventions related to *in-situ* moisture conservation, water harvesting and recycling for supplemental irrigation, soil health management, rain water management and water storage structures *etc*.

NRM structures: Eight farm ponds during the year 2011-12, 13 percolation tanks/recharge pits in the year 2011-12, 2 bore wells recharge during the period 2013-15, 2 check dams in 2011-12, cleaning/desilting of 8 drainage channels in 2011-16, 2 *nala* bunds and SEB work (trench cum bund) in 110 ha area during 2011-16 were carried out under NRM module (Table 35).

Table 35: Inventory of NRM structures

Structures / Years of Construction	Category	2011-12	2012-13	2013-14	2014-15	2015-16	Total
No. of farm ponds	Constructed	8	-	-	-	-	**8**
Percolation tanks/ Recharge pits (No.)	Constructed	13	-	-	-	-	**13**
Recharging of open/tube wells with silt trap	Constructed	-	-	1	1	-	**2**
No. of check dams	Constructed	2	-	-	-	-	**2**
Drainage channel	Cleaning/ desilting	2	-	1	5	-	**8**
***Nala* bund**	Constructed	1	-	-	1	-	**2**
Trench cum bund (ha)	Constructed	30	15	15	30	20	**110**

Farm ponds: 8 farm ponds of dimension (m) Top (L W H): 10 × 7 × 2, Bottom (L W H):7x5.5x1 with water storage capacity of 140 m^3 each were constructed in 2012. 867 m^3 of water was harvested in 8 farm ponds and 3.7 ha area was brought under protective irrigation in which groundnut in 3.3 ha and finger millet in 0.4 ha were cultivated by giving 8 protective irrigations in *kharif* season. In 2013, 869 m^3 of water was harvested in 8 farm ponds and 3.7 ha area was brought under protective irrigation in which groundnut was grown by giving 3 protective irrigation in *kharif* season. In 2014, 616 m^3 of water was harvested in 8 farm ponds and 3.7 ha area was brought under protective irrigation (groundnut-0.8 ha and finger millet-2.9 ha) by giving 9 protective irrigation in *kharif* season. In 2015, 979 m^3 of water was harvested in 8 farm ponds and 2.2 ha area was brought under protective irrigation (groundnut-2.2 ha, finger millet-0.8 ha, pigeon pea 0.4 ha, castor 0.4 ha and intercrop of groundnut + pigeon pea - 0.8 ha) by giving 22 protective irrigations in *kharif* season (Table 36).

Impact: Additional water storage capacity of 3331 m^3 was created through farm ponds which was used for providing protective irrigations to 15.7 ha area that resulted in the increased yield by 18 per cent and net income by Rs. 12,000 per ha.

Table 36: Details of farm pond and their capacity

No. of Farm ponds	Year	Total Amount of water stored in farm pond (m^3)	Area brought under protective irrigation (ha)	Cultivation of crop with area (ha)	No. of Supplemental irrigation given in *kharif* season
8	2012	867	3.7	Groundnut : 3.3 Finger millet : 0.4	8
	2013	869	3.7	Groundnut : 3.7	3
	2014	616	3.7	Groundnut : 0.8 Finger millet : 2.9	9
	2015	979	4.6	Groundnut : 2.2 Finger millet : 0.8 Pigeon pea : 0.4 Castor : 0.4 Groundnut + Pigeon pea : 0.8	22

Trench cum bunding: Trench cum bunding (dimensions 5 × 1 × 0.5 m) was under taken all around the field. 164 farmers demostrated trench cum bunding technology in 110 ha from 2011-16 and cultivated crops like finger millet and groundnut crops with higher yield when compared to farmers practice. The cost for opening of trench cum bunding for the area covered was about Rs. 6, 71,320/- (Table 37).

Impact: Trench cum bund structure was created all along the field to improve *in-situ* rainwater conservation. As a result, crop yields were improved by 7.31 to 18.45 per cent in groundnut and by 5.65 to 16.57 per cent in finger millet compared to check. This improvement was due to better availability of soil moisture for extra period of 8-10 days compared to fields where no *in-situ* conservation structures were made.

Table 37: Impact of trench cum bunding on field crops

Year	No. of participating farmers	Area covered (ha)	Per cent increase in yield				Cost for opening of trench cum bunding for the area covered (Rs.)
	I T	I T	I T		C		
			Crop	Yield (kg/ha)	Crop	Yield (kg/ha)	
2011-12	31	25	GN	1115 (7.31%)	GN	1039	1,53,000
	6	5	FM	1988 (8.40%)	FM	1834	30,600
2012-13	23	9	GN	1103 (9.64%)	GN	1006	55,080
	8	6	FM	2291 (6.26%)	FM	2156	36,720
2013-14	28	10	GN	986 (8.95%)	GN	905	61,200
	10	5	FM	2132 (5.65%)	FM	2018	30,600
2014-15	22	22	GN	764 (18.45%)	GN	645	1,36,682
	12	8	FM	1238 (16.57%)	FM	1062	49,708
2015-16	17	16	GN	1063 (9.47%)	GN	971	94,184
	7	4	FM	2243 (6.71%)	FM	2102	23,546

I T: Trench cum bunding, C: Without Trench cum bunding, FM: Finger millet, GN: Groundnut

Broad Bed Furrow: BBF technology was demonstrated by 148 farmers in 45.3 ha area during 2011-16. Groundnut and pigeon pea crops grown with this technology have recorded higher crop yield when compared to farmers practice.

Impact: Broad bed and furrow technology helped to increase water absorption and storage capacity in the soil profile thereby improvement of soil property that helped in withstanding long dry spells. As a result yields improved in pigeon pea (19-24 %) and groundnut (11-20.2 %) over the check (Table 38).

Table 38: Impact of broad bed and furrow on yield of crops

Year	No. of participating farmers	Area covered (ha)		Crop yield (kg/ha)				Percentage increase in yield over control	Cost for opening of broad bed furrow (Rs./ha)
	I T	I T	C	I T		C			
				Crop	Yield (kg/ha)	Crop	Yield (kg/ha)		
2011-12	1	1	0.4	GN	925	GN	816	13.36	2160
	4	1.6	1.6	PP	1477	RG	1209	22.17	3200
2012-13	11	4.4	1	PP	1440	RG	1156	24.57	4400
	45	9	1	GN	1012	GN	842	20.19	2250
2013-14	31	12.4	1	PP	1284	RG	1074	19.55	5400
2014-15	40	10.5	1	GN	988	GN	862	14.62	No inputs
2015-16	16	6.4	0.8	GN	1084	GN	976	11.07	7200

I T: Broad bed and furrow C: Without Broad based furrow, GN: Groundnut, PP: Pigeon pea

Tank silt application: Application of tank silt was carried out by 208 farmers in 185.52 ha area during 2011-12, 2013-14 and 2015-16 by applying 11,595 tonnes of tank silt to the groundnut and finger millet crop in which higher yield and B:C ratio were recorded when compare to no tank silt application (Table 39).

Impact: Tank silt application improved supply of essential elements and improvement in the soil moisture storage and supply in the root zone for prolong periods leading to better crop growth and yield.

Table 39: Effect of tank silt application on crop yield

Year	No. of participating farmers	Area covered (ha)	Quantity of tank silt application (t)	Crop yield (kg/ha)		Economics (Rs./ha)							
						Cost of cultivation		Gross returns		Net returns		B:C Ratio	
	I T	I T	I T	I T	C	I T	C	I T	C	I T	C	I T	C
2011-12	55	65.92	4120	GN: 1068 (26.2%)	GN :846	13814	12857	37380	29610	23566	16753	2.71	2.30
	12	10.64	665	FM: 1898 (23.2%)	FM :1541	12500	12800	32688	26539	20188	13739	2.62	2.07
2013-14	52	40	2500	GN: 1083 (17.3%)	GN :923	16450	16000	40613	34613	24163	18613	2.47	2.16
	14	8.96	560	FM: 2053 (8.3%)	FM :1895	14550	15700	35372	32651	20822	16951	2.43	2.08
2015-16	58	48.88	3055	GN: 1130 (16.5%)	GN:970	21250	21675	50850	43650	29600	21975	2.39	2.01
	17	11.12	695	FM: 2250 (8.1%)	FM :2082	20600	20120	47500	43148	26900	23028	2.31	2.14

I T: Tank Silt application, C: Without tank silt, FM: Finger millet, GN: Groundnut

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Soil health card as monitoring tool: A total of 381 samples were collected, analyzed and issued soil health cards to 208 farmers. The test results indicated that most of the samples were slightly acidic with low organic carbon and nitrogen status, medium in available phosphorus and potassium. Most of the micro nutrients were found sufficient in the tested samples (Table 40).

Impact: Based on the soil test reports, soil remedial measures were take up to correct the deficiency problems through integrated approach, by using bio-agents, organic sources and need based inorganic fertilizer applications. This improvement encouraged the farmers to grow high value horticulture crops like carrot, gourds, cut rose flowers, *etc.,*

Table 40: Summary of results of soil testing across the village

Particulars	Range	Mean	Remarks
pH (1:2)	4.17-8.32	6.03	Acidic
Electrical conductivity (dsm^{-1})	0.036-0.277	0.087	Normal
Organic carbon (%)	0.15-1.2	0.336	Low
Nitrogen ($mg\ kg^{-1}$)	24.3-194.4	96.8	Low
Phosphorus ($mg\ kg^{-1}$)	0.6-41.5	23.4	Medium
Potassium ($mg\ kg^{-1}$)	18-255	303	Medium
Calcium ($mg\ kg^{-1}$)	75-2150	2.21	Sufficient
Magnesium ($mg\ kg^{-1}$)	72-580	1.66	Sufficient
Sulphur ($mg\ kg^{-1}$)	1.4-61.1	11.2	Medium
Iron ($mg\ kg^{-1}$)	5.2-208.9	38.7	Sufficient
Manganese ($mg\ kg^{-1}$)	3.4-47.7	140.5	Sufficient
Zinc ($mg\ kg^{-1}$)	0.25-1.84	1.4	Sufficient
Copper ($mg\ kg^{-1}$)	0.06-2.47	2.32	Sufficient

Rainwater Management

Percolation ponds: Percolation ponds were dug to reduce the velocity of runoff from the fields and to recharge the groundwater. Thirteen percolation ponds were constructed in appropriate places across the fields in the village with 3165 m^3 rainwater storage capacity by these ponds benefitting over 40 farmers.

Impact: As a result of digging percolation ponds additional rainwater storage capacity of 3165 m^3 was created benefitting 40 farmers in the village. These farmers brought additional area of 9.8 ha under cultivation by using water from their recharged open wells (04) and bore wells (79).

Recharge of bore wells: Recharging of two bore wells was done by diverting runoff water into less yielding bore wells. The water flowing in the channel was made to pass through a filter media before entering into recharge structure to avoid accumulation of silt. Continuous drought over the years had rendered many of the bore wells with zero yield or very low yield. Due to this reason even farmers with irrigation

facilities were forced to reduce the cropping area especially in summer. However, by this intervention and also overall impact of NRM activities in the village, the bore wells were rejuvenated. Due to extended availability of water cropping intensity increased.

Impact: Due to overall impact of NRM activities in the village, the bore wells have been rejuvenated and started yielding good amount of water for cultivating various agriculture and horticulture crops in an area of about 31.6 ha area (Table 41).

Table 41: Recharging of bore wells as a result of NRM activities

Year	Total No. of bore wells	Before NICRA		After NICRA	
		No. of functional wells	No. of defunct wells	No. of functional wells	No. of defunct wells
2011-12	55	41	14	41	14
2012-13	70			53	17
2013-14	73			44	29
2014-15	79			26	53
2015-16	79			79	0

Check dams: Check dam is a type of structure which dams up small nallahs in order to break flow of water during the monsoon and allows it to seep into the soil. It helps in ground water recharge in the area. Recharge of water helps in raising the water table in the area.

Impact: By constructing 2 check dams, 28 farmers have benefitted. As a result an additional area of 5.5 ha of groundnut and finger millet were brought under protective irrigation (Table 42).

Table 42: Details of check dams

No. of Units	No. of participating farmers	Dimension of the Structure (l m × b m × d m)	Water Storage Capacity (m^3)	Increased area under irrigation (ha)	Crops	Crop yield in *kharif* season (kg/ha)
1	17	30.00 × 11.10 × 2.55	850	2	Groundnut	1077
1	11	35.00 × 15.00 × 2.10	1100	3.5	Finger millet	2221

Water storage structure

Rejuvenation of community tanks: Community tanks were desilted and widened with increased additional water storage capacity. Nearly 70 farmers were benefitted by desilting of 4 community tanks and water storage was increased from 8, 44,947 m^3 to 8,56,542 m^3 (Table 43).

Impact: Desilting of village tanks not only increased the water storage capacity of existing tanks, but also enriched the soil fertility in an area of 55 ha belonging to 68 farmers.

Table 43: Details of water storage capacity of community tanks

Name of the pond	Intervention	No. of Participating farmers	Area desilted (Dimension) (l m × b m × d m)	Water storage capacity (m^3)	
				Before	After
Mavidakunte	Desilting	18	155 × 30.87 × 1	166522	171307
Chintalakunte	Desilting	22	51 × 60 × 1	111015	114075
Kothkunte	Desilting	12	155 × 19.71 × 1	493400	496455
Yarkunte	Desilting	16	45 × 15.44 × 1	74010	74705

Total water storage capacity created in the NICRA village: An additional storage capacity of 315 ha.cm of water has been generated through construction of various water conservation structures. Details are given in Table 44.

Table 44: Total water storage capacity created in the NICRA village over the years

Name of structures constructed / repaired	Investment (Rs.)	No. of farmers benefitted	Water storage capacity (m^3)		Protective irrigation potential created (ha)	Area under cultivation (ha)				Cropping intensity (%)
			Before	After		Before		After		
						Kharif	*Rabi*	*Kharif*	*Rabi*	
Farm ponds	92,070	8	0	1,120	20	16.5	-	18.8	2	1.11
Percolation ponds	90,202	13	0	4,420	-	-	-	-	-	-
Desilting	3,37,021	68	0	11,595	-	-	-	-	-	-
Nala bund	5,93,018	46	0	12,420	52	24	-	25.3	3.4	1.13
Check dam	4,63,283	24	0	1,950	25	10	-	12	0.5	1.04

Impact: Water collected in the village water tank and nala bunds was not utilized for irrigation since the district administration had issued direction to Panchayaths not to release water for irrigation as the district comes under critical zone of groundwater exploitation. However, this non utilization of the stored water helped in recharge of open wells and bore wells which ensured drinking water supply during summer months.

Module II: Crop Production

This module comprised introduction of drought tolerant varieties, short and long duration varieties, integrated crop management practices, integrated pest and disease management, intercropping system and broad bed furrow method in improved varieties.

Varietal demonstrations

Finger millet (MR-6): Long duration finger millet variety (MR-6) was demonstrated by 49 farmers in an area of 22.6 ha. The MR-6 variety recorded higher yield of 1991 kg/ha, while in check it was 1783 kg /ha. The comparative BC ratio was 2.28 and 1.92 in demonstration and check, respectively (Table 45).

Impact: Cultivation of HYV of finger millet (MR-6) helped to increase the yield by 13 per cent over conventional varieties and added net income of Rs. 4931 per ha compared to farmers' practice.

Table 45: Performance of long duration finger millet variety (MR-6)

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Straw yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2012-13	Demo	MR-6	7.6	19	1961	4358	18483	2.21
	FP	*Indaf*	-	-	1791	3980	14471	1.88
2013-14	Demo	MR-6	15	30	2037	4461	22673	2.35
	FP	*Indaf*	-	-	1775	3888	16823	1.96
Total/ Average	**Demo**	MR-6	**22.6**	**49**	**1999**	**4409**	**20578**	**2.28**
	FP	*Indaf*	-	-	**1783**	**3934**	**15647**	**1.92**

Drought tolerant, short and long duration varieties of finger millet: Finger millet varieties GPU-28, KMR-204 and MR-6 were taken up in an area of 29.98 ha. The yield of finger millet varieties was low because the crop was resown and suffered from sever drought in 2014-15.

Impact: Cultivation of drought tolerant finger millet (GPU-28, KMR-204 and MR-6) in an area of 29.98 ha helped to harvest 8 per cent higher yield over conventional varieties even though the year experienced severe drought (Table 46).

Table 46: Cultivation of drought tolerant, short and long duration varieties of finger millet (2014-15)

Variety	Sowing date	Seed yield (kg/ha)	Fodder yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio	Area covered (ha)
GPU-28	04.06.2014 then resown on 22.08.2014	269	505	1163	1.25	6.5
KMR-204		279	524	1381	1.30	10.6
MR-6		332	623	2534	1.55	12.88

Integrated Crop Management

Finger millet (GPU-28): Introduction of finger millet GPU-28 variety against existing *indaf series* was taken up through 40 demonstrations in 16 ha. This variety gave 22.22 per cent increase in yield over check, by recording 1944 kg/ha and 1590 kg/ha with comparative cost benefit ratio of 2.66 and 2.01 in demonstration and check, respectively (Table 47).

Impact: Cultivation of medium duration finger millet variety in an area of 16 ha helped to increase yield by 22 per cent over conventional variety and added net income of Rs. 7140 per ha compared to farmers practice.

Table 47: Performance of finger millet (GPU-28) in 2011-12

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	GPU-28	16	40	1944	20881	2.66
FP	*Indaf series*	-	-	1590	13741	2.01

Groundnut (KCG-2): Introduction of a new variety KCG-6 in groundnut against existing variety JL-24 was taken up with 20 demonstrations in an area of 8 ha. Appreciable level of increase in yield was recorded (31.32 %) as against existing variety with cost benefit ratio of 2.83 and 2.13 in demonstration and check, respectively. The average yield recorded in demonstration by Cv. KCG-2 was 1067 kg/ha as against 813 kg/ha in JL-24 (Table 48).

Impact: Appreciable level of increase in yield (31.32 %) and net income was observed in groundnut cultivation with KCG-2 variety as against farmers' variety.

Table 48: Performance of groundnut (KCG-2) in 2011-12

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	KCG-2	8	20	1067	24138	2.83
FP	JL-24	-	-	813	15091	2.13

Pigeon pea (BRG-1): One hundred demonstrations were taken up in 40 ha with introduction of new pigeon pea variety BRG-1 against existing TTB-7. The BRG-1 recorded higher grain yield of 1363 kg/ha as against farmers practice (TTB-7) with 1141 kg/ha. The B: C ratio was 2.68 and 2.06 in demonstration and farmers practice, respectively (Table 49).

Impact: The new variety BRG-1 recorded higher seed yield and gave higher income against farmers practice (TTB-7) to the pigeon pea farmers.

Table 49: Performance of pigeon pea (BRG-1)

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2011-12	Demo	BRG-1	14.8	37	1391	24131	2.55
	FP	TTB-7	-	-	1154	16333	1.99
2012-13	Demo	BRG-1	21.6	54	1304	25311	2.84
	FP	TTB-7	-	-	1095	17641	2.17
2013-14	Demo	BRG-1	3.6	9	1394	30865	2.66
	FP	TTB-7	-	-	1174	21176	2.03
Total/ Average	**Demo**	BRG-1	**40**	**100**	**1363**	**26769**	**2.68**
	FP	TTB-7	**-**	**-**	**1141**	**18383**	**2.06**

Pigeon pea (BRG-2): Eighty three demonstrations were taken up in 20.6 ha with introduction of new pigeon pea variety BRG-2 against existing TTB-7. The average yield of demonstration was 1252 kg/ha while in TTB-7, it was 1061 kg/ha. The B: C ratio was 2.58 and 2.02 in demonstration and farmers' practice, respectively (Table 50).

Impact: The farmers realised higher yield and net returns by shifting to BRG-2 variety compared to local varities.

Table 50: Performance of pigeon pea (BRG-2)

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2011-12	Demo	BRG-2	9.6	24	1311	22864	2.58
	FP	TTB-7	-	-	1124	15970	1.99
2012-13	Demo	BRG-2	6	34	1191	22084	2.62
	FP	TTB-7	-	-	1015	16080	2.12
2013-14	Demo	BRG-2	5	25	1255	26996	2.54
	FP	TTB-7	-	-	1046	18149	1.96
Total/ Average	**Demo**	BRG-2	**20.6**	**83**	**1252**	**23981**	**2.58**
	FP	TTB-7	-	-	**1061**	**16733**	**2.02**

Horse gram (PHG-9): Horse gram (PHG-9) was introduced by conducting 30 demonstrations at farmer fields in an area of 12 ha. The comparative cost benefit ratio was 3.17 in demo and 2.18 in check. PHG-9 recorded highest yield of 972 kg/ha against local with only 738 kg/ha (Table 51).

Impact: Horse gram introduction as a contingent crop improved the soil fertility.

Table 51: Performance of horse gram (PHG-9) in 2011-12

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	PHG-9	12	30	972	6651	3.17
FP	Local	-	-	738	3988	2.18

Field bean (HA-4): Sixteen demonstrations were taken up in 6.4 ha with an yield of 3598 kg/ha in HA-4 variety as compared to 3048 kg/ha in check. The cost benefit ratio of 4.05 and 3.02 were recorded in demonstration and check, respectively (Table 52).

Impact: The HA-4 recorded higher seed yield by 18 per cent as against local variety and gave better returns to the farmers.

Table 52: Performance of field bean (HA-4)

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2011-12	Demo	HA-4	2.4	6	4618	33765	5.33
	FP	Local	-	-	3916	26184	3.90
2013-14	Demo	HA-4	4	10	2577	14795	2.76
	FP	Local	-	-	2180	10403	2.14
Total/ Average	**Demo**	HA-4	**6.4**	**16**	**3598**	**24280**	**4.05**
	FP	Local	-	-	**3048**	**18293**	**3.02**

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Integrated Pest and Disease Management (IPDM)

IPDM in Tomato (US-618): Ten demonstrations in IPDM of tomato were taken up in 4.8 ha area. The fruit yield demonstration was 611 q/ha while in check, it was 552 q/ha giving an increase of 11.10 per cent in demonstration. The comparative BC ratio was 2.62 and 2.16 in demonstration and check, respectively (Table 53)

Impact: Eco-friendly IPDM practices increased the income of the farmers by Rs. 41,856/- apart from reducing the cost of chemical pesticides by 20 per cent.

Table 53: Integrated pest and disease management in tomato (US-618) in 2011-12

Treatments	Variety	Area covered (ha)	No. of participating farmers	Fruit yield (q/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	US-618	4.8	10	611	191318	2.62
FP	-	-	-	552	149462	2.16

Demo: Use of Plant protection chemicals and bio agents

FP: Indiscriminate use of pesticides (No bio agent)

Intercropping System

Finger millet (GPU-28) + Pigeon pea (BRG-1): Nine demonstrations were conducted in 3.6 ha on intercropping of finger millet and pigeon pea with definite proportion (8:2) and proved intercropping always better by getting cost benefit ratio of 2.61 in intercrop as compared to sole finger millet (2.34) and sole pigeon pea (1.97). However, intercrop and sole crop of finger millet did not differ much in yield with 1705 + 384 kg/ha in intercrop (finger millet + pigeon pea) compared to 1737 kg/ha of sole finger millet and 1145 kg /ha in sole pigeon pea (Table 54).

Impact: Intercropping was found to provide better returns to the farmers as compared to sole crops of finger millet and pigeon pea.

Table 54: Performance of finger millet (GPU-28) + pigeon pea (BRG-1) in 2011-12

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Intercrop yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	GPU-28+ BRG-1	2.4	6	1707	387	27235	2.62
FP	GPU-28	-	-	1737	-	15450	2.15
Demo	GPU-28+ BRG-1	1.2	3	1703	380	26929	2.60
FP	BRG-1	-	-	1145	-	20517	1.97

Finger millet (KMR-204) + Pigeon pea (BRG-2): Nine demonstrations were conducted in 3.6 ha on intercropping of finger millet and pigeon pea with definite proportion and intercropping was found superior by getting cost benefit ratio of 2.79 in intercrop as compared to sole finger millet (2.33) and sole pigeon pea (2.48) (Table 55).

Impact: From economic point of view intercropping systems proved better in terms of higher B:C ratio (2.79) compared to sole crops of finger millet (2.33) and pigeon pea (2.48).

Table 55: Performance of finger millet (KMR-204) + pigeon pea (BRG-2) in 2013-14

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Intercrop yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	KMR-204+ BRG-2	2.4	6	1900	417	27184	2.81
FP	KMR-204	-	-	1955	-	14979	2.33
Demo	KMR-204+ BRG-2	1.2	3	1844	421	27070	2.77
FP	BRG-2	-	-	1234	-	19838	2.49

Groundnut (KCG-6) + Pigeon pea (BRG-1): Intercropping of groundnut (KCG-6) and pigeon pea (BRG-1) (8:2) was under taken through 83 demonstrations in 43 ha area and recorded higher yield in intercropping of groundnut+ pigeon pea (811 + 387 kg/ha) when compared to monocroppings (pigeon pea-913 kg/ha and groundnut-825 kg/ha). The cost benefit ratio in intercropping was 2.45 as compared to sole crop of pigeon pea with 1.94 and sole crop of groundnut with 1.92 (Table 56).

Impact: Farmers realised higher yield and net returns in intercropping when compared to sole crop.

Table 56: Performance of groundnut (KCG-6) + pigeon pea (BRG-1)

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Intercrop yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2011-12	Demo	KCG-6+ BRG-1	18	18	938	450	29146	2.77
	FP	KCG-6	-	-	985	-	17612	2.06
	Demo	KCG-6+ BRG-1	15	15	897	493	28961	2.75
	FP	BRG-1	-	-	1126	-	17102	2.15
2013-14	Demo	KCG-6+ BRG-1	5	25	705	-	20175	2.15
	FP	KCG-6	-	-	666	-	13285	1.78
	Demo	KCG-6+ BRG-1	5	25	704	217	20068	2.14
	FP	BRG-1	-	-	700	-	12142	1.72

Groundnut+ Pigeon pea intercropping (8:2 or 10:2): Intercropping of groundnut + pigeon pea was covered in 45.5 ha area with definite proportion. Even though 2014-15 was a drought year with early season rains, the yield of groundnut in the village was atleast 25.75 per cent of normal yield due to *in-situ* moisture conservation methods adopted as compared to only 5 to 15 per cent yields in neighbouring villages (Table 57).

Table 57: Performance of groundnut+ pigeon pea intercrop with appropriate ratios (8:2 or 10:2) in 2014-15

Crop	Groundnut (kg/ha)	Pigeon pea (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio	Area Covered (ha)
Groundnut + Pigeon pea	309	274	11797	2.06	45.5

***In-situ* moisture conservation—Green manure / Broad Bed Furrow**

Green manure incorporation: Incorporation of horse gram bio-mass as green manure in finger millet demo plots improved the organic matter content from 0.11 to 0.14 %. After incorporation of green manure, the finger millet crop was taken with a yield of 1898 kg/ha when compared to farmers practice with only

1741 kg/ha. Similarly, incorporation of green manure horse gram in groundnut demo plots improved the organic matter content from 0.09 to 0.13 % and the groundnut crop yielded 768 kg/ha when compared to 720 kg/ha in the farmers practice (Table 58).

Impact: Incorporation of horse gram as a green manure helped in increasing the yield and improved soil fertility.

Table 58: *In-situ* incorporation of green manures (2012-13)

Treatments	OC% Before Green manure	OC% After Green manure	Crop and variety	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	0.11	0.14	Finger millet	1898	21989	2.74
FP	0.11	0.11	(GPU-28)	1741	19403	2.62
Demo	0.09	0.13	Groundnut	768	29686	2.50
FP	0.09	0.09	(KCG-2)	720	27240	2.42

Broad bed and furrow in finger millet: Fourteen demonstrations were taken up on BBF with finger millet (Cv. MR-204) in 5.6 ha. The highest yield in demonstration was 2063 kg/ha as against check with only 1850 kg/ha. The comparative cost benefit ratio was 2.44 and 1.98 in demonstration and check, respectively (Table 59).

Impact: The net benefit was higher by Rs. 5,245/- per ha in BBF demonstration as compared to farmers practice.

Table 59: Performance of improved finger millet variety (2012-13)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	KMR-204	5.6	14	2063	20993	2.44
FP	*Indaf series*	-	-	1850	15748	1.98

Broad bed and furrow in groundnut: Broad bed furrow in groundnut was demonstrated in 61 farmers fields covering 15.4 ha. The higher yield recorded was in broad bed furrow demonstration plots when compared to farmers practice. The farmer opined that BBF in groundnut helps in conserving soil, moisture and applied fertilizer which in turn increased the yield.

Impact: The groundnut farmers harvested about 20 per cent higher yield in BBF plots during both 2012-13 and 2013-14. BBF in groundnut helps in conserving soil, moisture and applied fertilizer which in turn increased the yield (Table 60).

Table 60: Performance of groundnut varieties

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2012-13	Demo	TMV-2	9	45	1012	21488	2.30
	FP		-	-	842	13919	1.79
2013-14	Demo	KCG-6	6.4	16	1082	27420	2.29
	FP		-	-	976	21580	1.98

Broad bed and furrow in groundnut varieties: Broad bed furrow in improved varieties of groundnut (KCG-2 and K-6) was taken up in 43.9 ha area in 2014-15. These varieties performed well in broad bed furrow method (Table 61)..

Impact: Among the two varieties of groundnut both responded evenly when grown in broad bed furrow in terms of yield and other benefits.

Table 61: Performance of groundnut improved varieties under BBF (2014-15)

Variety	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio	Area covered (ha)
KCG-2	379	7772	1.91	19.80
K-6	388	7884	1.90	24.10

Broad bed and furrow in pigeon pea: Forty two demonstrations were taken up on BBF in pigeon pea (BRG-1) in 16.8 ha. The highest yield of 1367 kg /ha was obtained in demonstration plots as against check (1115 kg /ha). The comparative cost benefit ratio was 2.53 and 1.96 in demonstration and check, respectively (Table 62).

Impact: Similar to groundnut, pigeon pea also responded positively to BBF technology which resulted in increased yield by 22.6 per cent to the farmers with higher returns.

Table 62: Performance of pigeon pea

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2012-13	Demo	BRG-1	4.4	11	1284	28093	2.61
	FP		-	-	1074	19004	2.00
2013-14	Demo		12.4	31	1450	31495	2.46
	FP		-	-	1156	20249	1.92
Total/ Average	**Demo**		**16.8**	**42**	**1367**	**29794**	**2.53**
	FP		-	-	**1115**	**19627**	**1.96**

Broad bed and furrow in improved pigeon pea varieties: Broad bed furrow in improved varieties of pigeon pea (BRG - 1 and BRG - 2) was taken up in 51.3 ha area in 2014-15. These varieties performed well in broad bed furrow method.

Impact: Both pigeon pea varieties *viz.*, BRG-1 and BRG-2 tested evenly when grown in BBF in terms of yield and other benefits (Table 63).

Table 63: Performance of pigeon pea improved varieties under BBF in 2014-15

Variety	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio	Area covered (ha)
BRG-1	225	4024	1.71	23.00
BRG-2	233	4003	1.67	28.30

Module III: Livestock and Fisheries

Animal health camp and vaccination against diseases, use of community lands for fodder production during droughts/floods, local breed upgradation, animal nutrition and fodder enrichment *etc*., were the activities carried out under this module.

Animal health camp and Vaccination: Animal health checkup was carried out for 213 animals in 2011-12 and 256 animals in 2012-13.

Impact: Animal health camp and vaccination helped in prevention of diseases.

Fodder production: During 2012-13, napier grass(Co-3/Co-4) was grown in 1 ha area covering 5 farmers and producing green fodder 3.48 t/ha in kharif, 3.17 t/ha in rabi and 2.93 t/ha in summer seasons. By feeding this fodder there was an increase in milk (up to 9.5 l/ animal/day) compared to farmers practice of feeding (8.8 l/ animal/day). Perennial sorghum was grown in 1ha area covering 5 farmers yielded 3.3 t/ha/season green fodder. Milk yield increased (9.27 l/animal/day) by feeding this fodder when compared to without intervention (8.24 l animal/day) in the year 2012-13 (Table 64).

Impact: With the introduction of improved fodder varieties, the milk yield improved by 7 per cent per animal per day.

Table 64: Green fodder production (2012-13)

Activity	Crop	Variety	Area (ha)	No of participating farmers	Green fodder yield (t/ha/season)	Milk yield (liters/day)	
						1*	2**
Kharif	Napier	Co-3/ Co-4	1	5	3.48	9.46	8.80
Rabi		Co-3/ Co-5	1	5	3.17	9.50	8.80
Summer		Co-3/ Co-4	1	5	2.93	9.26	8.60
Perennial	Sorghum	Multicut	1	5	3.30	9.27	8.24

*** With intervention** ****Without intervention**

Local breed upgradation: Three farmers were benefitted from introduction of sheep breed Narisuvarna and 14 pairs of lambs were born during 2011-16.

Impact: Twining in sheep and improved grazing efficiency was achieved..

Animal nutrition and fodder enrichment: Supplementation of mineral and vitamin mixture during lean period was carried out for 57 cattles benefitting 20 farmers and 6.32 % increase in milk was achieved in 2012-13. Supplementation of Voss cal calcium syrup was carried out for 24 cattles benefitting 10 farmers achieved 8.19 % increase in milk production (Table 65).

Impact: As a result of supplementing with mineral and vitamin mixture the milk production increased.

Table 65: Animal nutrition and fodder enrichment

Year	Activity	No of participating farmers	Type of animals	No animals benefited	Economic impacts
2012-13	Supplementation of mineral and vitamin mixture during lean period	20	Cattles	57	6.32 % increase in milk production
2013-14	Supplementation of Voss cal calcium syrup	10	Cattles	24	8.19 % increase in milk production

Module IV: Institutional Intervention

The module consists of institutional interventions either by strengthening the existing ones or initiating new ones relating to seed bank, fodder bank, commodity groups and custom hiring centre. Trainings on different themes were also provided to the farmers under capacity building. Extension activities were conducted to create awareness among farmers.

Custom Hiring Center: Under this intervention, 247 farmers benefitted by covering 357.7 ha area utilizing implements from the CHC. Rent of the equipments varied from the type of the equipment and revenue generated from these implements during the period 2011-16 was Rs. 38,655/- (Table 66).

Impact: The implements in custom hiring centre were available for timely operations at village level particularly during peak sowing season.

Table 66: Performance of custom hiring center for farm implements and machinery

Year	Area covered (ha)	No. of farmers using implement	Revenue generated from CHCs (Rs)
2011-12	54.1	29	2085
2012-13	65.2	55	4180
2013-14	81.2	63	5230
2014-15	4	2	200
2015-16	153.2	98	26960
Total of 5 years	**357.7**	**247**	**38655**

Capacity Building: KVK organised training programmes on different need based aspects with apparent objective of making the farmers of NICRA villages potential human resources with socially and financially comfortable and make their agricultural practices climate resilient. A total of 25 capacity building programmes were conducted in different thematic areas during the year 2011-16 *viz*. agricultural meteorology, IPM, soil fertility management, livelihood management for farm women, increasing milk production and exposure visits. About 742 farmers and 369 farm women were participated (Table 67).

Impact: Training programmes helped to increase the knowledge level of participants by 36 % in soil fertility management and 48% in crop production and dairy animal management. Two farmers of S. Raghuttahalli have adopted raised ridges and furrows in citrus orchards after their visit to KVK, Baramathi.

Table 67: Capacity building (HRD) programmes organized under NICRA (2011-2016)

Sl. No.	Thematic area	No. of Courses	No. of participating farmers		
			Male	Female	Total
1	Agricultural Meteorology	4	164	36	200
2	IPM	5	101	18	119
3	Soil Fertility Management	6	202	164	366
4	Livelihood Management for Farm Women	2	5	47	52
5	Increasing Milk Production	2	37	17	53
6	Exposure visit on Animal Husbandry	1	45	10	55
7	Exposure visit on Crop Production technology for Horticulture and Forage crops	5	188	77	265
Total		**25**	**742**	**369**	**1110**

Extension Activities: In order to create mass awareness about the climate resilient technologies, large numbers of extension activities were organised by KVK under NICRA at KVK farm and in the NICRA village. The details of extension activities organised were agro advisory services, field day, mass campaign, diagnostic visits, exposure visits and method demonstrations through off campus trainings and group discussions. Altogether 326 extension programmes were organised and about 1688 farmers and 486 farm women were participated (Table 68).

Table 68: Extension activities organized under NICRA (2011-2016)

Sl.No.	Name of the activity	Number of programmes	No. of participating farmers		
			Male	Female	Total
1	Agro advisory services	243	213	30	243
2	Field day	3	165	10	175
3	Mass campaign	1	122	2	124
4	Diagnostic visits	12	34	02	36
5	Exposure visits	5	233	87	320
6	Method demonstration	22	89	26	115
7	Off campus trainings	19	509	282	790
8	Group discussion	21	323	47	21
Total		**326**	**1688**	**486**	**1824**

KVK, DAVANAGERE

NICRA - Village: Siddanuru

Climatic vulnerability

ICAR-Taralabalu Krishi Vigyana Kendra has adopted the village Siddanuru (Elevation 2134' in MSL; N 14 degree 25.528' ; E 76 degree 02.812') in Davangere district for the implementation of NICRA. The village comes under the Central Dry Zone (Zone-4) of Karnataka with hot climatic conditions during March to May.

Name of the village : Siddanuru
District : Davangere
No. of households : 205
Total cultivated area : 358 ha
Major soil types : Red soils
Mean annual rainfall : 590 mm
Majorcrops : Maize, Cotton, Finger millet, Arecanut, Banana and Tomato
Climate Vulnerability : Drought

The major climatic vulnerability of the village is drought. The extent of crop loss under drought ranged from 60-70% and it is a practice that livestock were sold for minimum prices due to scarcity of fodder during drought years. Climatic vagaries are quite substantial in the village. The main source of water is rainfall and some farmers have tube wells.

a) Rainfall trend of the district

Historical Trends in Rainfall		Decadal Average 2000-2010
No. of rainy days		47
No. dry spells during *kharif* season	> 10 days	15
	> 15 days	5
	> 20 days	3
No. of intensive rain-spells	> 60 mm per day	4

1. Predominant farm enterprises

(a) Cropping pattern:

(i) Major cropping systems: Finger millet – Jowar, Maize – Vegetables
Maize + Pigeon pea, Cotton – Vegetables

(ii) Area and productivity of major crops:

Crop	Area (ha)	Yield (q/ha)
Maize	198	48
Finger millet	15	21
Jowar	10	35
Pigeon pea	10	10
Cotton	40	18
Sugarcane	12	600

(b) Predominant varieties of major food crops in the village :

Crop	Name of variety/ hybrid	No. of farmers using improved varieties	Area under improved varieties/ hybrid (ha)
Maize	Hybrid (Pioneer, Kaveri, Syngenta, NAH-1137 (UAS-B)	100	198

(c) Cropping intensity (%) : 100

(d) Horticulture: Crops, area and productivity of each crop

Crop	Area (ha)	Yield (q/ha)	Name of variety/ hybrid(s)	Area under improved varieties/ hybrid (ha)
Banana	80	315	Yelakki	20
Mango	10	175	Alphanso	10
Sapota	05	112	Cricket ball	05
Tomato	20	568	Shivam	15
Brinjal	10	267	Dhruva, Mahyco	10
Chilli	10	185	US-612	10
Arecanut	80	28	Local	-
Coconut	25	85nuts/plant	local	-

(e) Area under fodder cultivation (ha) and number of farmers growing green fodder: 10 ha, 26 farmers

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(f) Major source(s) of irrigation:

Source of irrigation	Area (ha) under irrigation
Tube well	70

(g) Micro-irrigation:

Micro-irrigation	Area (ha)	No. of farmers
Drip	40	79
Sprinkler	05	03

(h) Livestock:

Livestock type	Total Number	No. of livestock owners	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Small ruminants	54	17	5-6	FMD, Entero-toximea	100	5
Large ruminants	445	85	30-35	FMD, BQ, Mastitis	100	2-3
Poultry	90	20	10	Ranikhet	-	10

(i) Milk productivity (litres/milch animal/day): 5-6

(j) Inland fisheries: Practiced or not?: No

(k) Other enterprises: Nil

2. Resource availability

(a) Status of common pool resources (CPRs):

CPR	Area (ha) or No.	Current status*(before start of NICRA)
Grazing land	195	Effectively used
Water bodies	02	

(b) NRM structures:

Name of NRM structure	Number	Number of farmers benefited	Status (Defunct/ effectively used)
Village tank	1	205	Effectively used
Open well	1	-	Defunct

(c) Status of farm mechanization before start of NICRA: Major crops in the village are maize, cotton and vegetables. There is no farm mechanization in the village except tractor ploughing.

3. Socio-economic status

(a) No. of households

Category	Number
General	108
OBC	04
SC	90
ST	01
Total	**203**

(b) Literacy rate (%):

Particulars	Total Population	Literacy	Percentage
Male	507	357	70.4
Female	430	303	70.5

(c) Land holding pattern:

Category	No. of families	Percentage
Marginal (<1 ha)	45	22.17
Small (1-2.5 ha)	77	37.93
Large (>5 ha)	81	39.90

(d) Workers engaged in agricultural activities (%): 95

Actual weather of the village during project period

The climatic/weather data pertaining to Siddanuru village during the project period are collected, analyzed and presented as under:

Year	Normal rainfall (mm)	Total rain-fall (mm) (Jan-Dec)	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells >15 days (No.)	No. of highest rainfall intensity events (> 60 mm)	Water inundation floods > 10 days (No. of events)	Rainfall (mm)		
								Khairf	*Rabi*	Summer
2011		219.2	28	3	1	0	0	185.5	33.7	0
2012		368.9	36	2	1	0	0	195.6	42.0	131.3
2013		699.9	67	1	0	2	0	383.9	35	281
2014		786.3	67	1	0	1	0	576.8	150	59.5
2015		653.0	36	1	1	2	0	410	100	143

Module I: Natural Resource Management

This module consists of interventions related to *in-situ* moisture conservation, soil health management, composting, tree based farming system and rain water management *etc.*

NRM Structures: A total of 24 ponds @ 6, 3 and 15 farm ponds were constructed in Davanagere during the years 2011-12, 2012-13 and 2014-15 respectively. One community pond/tank was renovated in the year 2015-16. One check dam was renovated during the year 2013-14, desilting of village tank was done in 2015-16 besides cleaning and desilting of Balapanamatti channel, Rajagaaluve channel and Kodisara channel in the year 2011-12 (Table 69).

Table 69: Inventory of NRM structures

Structures construction	Category	2011-12	2012-13	2013-14	2014-15	2015-16	Total
No. of farm ponds	Constructed	06	03	-	15		**24**
Community pond/tank	Repaired/ Renovated	-	-	-	-	01	**01**
No. of Check dams	Repaired/ Renovated	-	-	01	-	-	**01**
Drainage Channel	**Cleaning/desilting**						
	Desilting of village tank	-	-	-	-	01	**01**
	Balapanamatti Channel	01	-	-	-	-	**01**
	Rajagaaluve Channel	01	-	-	-	-	**01**
	Kodisara Channel	01	-	-	-	-	**01**

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Farm ponds: Six farm ponds of dimensions 10 × 10 × 3m were constructed in 2012 with a water storage capacity of 300 m^3. in which 1330 m^3 of water was harvested and 1.4 ha area was brought under protective irrigation, in which cotton, maize, fodder crops, arecanut, tomato crops were cultivated by giving 3 *kharif* and 6 *rabi* protective irrigation. In 2013, 734 m^3 of water was harvested in 3 farm ponds and 0.6 ha area was brought under protective irrigation, in which fodder and tomato crops were cultivated by giving 2 *kharif* and 4 *rabi* protective irrigation. In 2015, 7350 m^3 of water was harvested in 15 farm ponds and 5.4 ha area was brought under protective irrigation, in which finger millet, pigeon pea, fodder crops, beans were cultivated by giving 5 *kharif* and 7 *rabi* protective irrigation (Table 70).

Impact: Farm ponds have clearly indicated that farmers can get additional income/ benefits through supplemental irrigation to crops during moisture stress periods.

Table 70: Details of farm ponds and their capacity

No. of Farm ponds	Year	Amount of water stored (m^3)	Area brought under protective irrigation (ha)	Cultivation of crop with area (ha)	Crop wise yield (q/ha)	Net returns (Rs/ha)	No. of supplemental irrigation	
							Kharif	*Rabi*
6	2012	1330	1.4	Cotton (0.4)	12.8	22,800	3	6
				Tomato (0.2)	125	39,250		
				Fodder crops (Co-3) (0.2)	2200	43,750		
				Maize +Pigeon pea(0.6)	50.3	28,300		
3	2013	734	0.6	Fodder crops(Stylo) (0.2)	520	13,750	2	4
				Tomato (Mulching with Polythene sheet) (0.4)	445	1,34,350		
15	2015	7350	5.4	Finger millet (1.0)	29.5	43,950	5	7
				Maize+ Pigeon pea(6:2) (3.6)	46.91	64,620		
				FodderCrops (DHN-6) (0.4)	800/annum	1,17,550		
				Beans (0.4)	84.3	45,715		

Soil Management

Trench cum bunding: Trench cum bunding of dimensions 1.5 × 1.2 × 0.6 m was opened all around the field. One hundred and Eight two farmers demonstrated trench cum bunding technology by covering 74.8 ha area during the years 2011-12, 2012-13 and 2014-15 by growing maize, finger millet and maize + pigeon pea intercrop with increased yield when compared to farmers practice. The cost for opening of trench cum bunding for the area covered was about Rs. 4, 11,475/- (Table 71).

Impact: Helped in conserving soil and moisture which in turn increased the yield of crops.

Table 71: Impact of trench cum bunding on field crops and soil moisture conservation

Year	No. of participating farmers		Area covered (ha)		Yield				Cost (Rs.)
					I T		C		
	I T	C	I T	C	Crop	Yield (kg/ha)	Crop	Yield (kg/ha)	
2011-12	36	36	12	12	M + PP	2920+530 (28.1%) CEY- 5110	M	3980	50,000
2012-13	92	92	36.8	-	M FM	4690 (21.5%) 2350 (32.0%)	M FM	3860 1780	2,00,000
2014-15	54	54	26	-	M + PP	3720 +580 (31.1%) CEY-6450	M	4450	1,61,475

I T: Trench cum bunding, C: Without Trench cum bunding, FM: Finger millet, PP: Pigeon pea, M: Maize

Tank silt application: Tank silt application was demonstrated by 12 farmers in 12 ha area. About 324 tonnes of tank silt was applied during 2015-16. The impact is yet to be ascertained.

Soil health cards: 100 soil samples were collected and analyzed. All the NICRA farmers have been issued soil health cards with specific advisories for the majr crops. Soils of Siddanuru are neutral in pH with normal EC and contained medium levels of nitrogen and potassium, low level of phosphorous on an average (Table 72).

Table 72: Summary of results of soil testing across the village

Particulars	Range	Mean	Remarks
pH (1:2)	4.17-8.32	7.2	Neutral
Electrical conductivity (dsm^{-1})	0.036-0.277	0.17	Normal
Organic carbon (%)	0.15-1.2	0.26	Low
Nitrogen ($mg\ kg^{-1}$)	24.3-194.4	142.3	Medium
Phosphorus ($mg\ kg^{-1}$)	0.6-41.5	8.7	Low
Potassium ($mg\ kg^{-1}$)	18-255	95	Medium
Iron ($mg\ kg^{-1}$)	5.2-208.9	5.2	Sufficient
Manganese ($mg\ kg^{-1}$)	3.4-47.7	2.9	Sufficient
Zinc ($mg\ kg^{-1}$)	0.25-1.84	0.56	Deficient
Copper ($mg\ kg^{-1}$)	0.06-2.47	0.6	Sufficient

Preparation of Compost: Four farmers demonstrated vermicompost and ablout 96-100 tonnes was produced and applied to 16-18 ha area (Table 73).

Table 73: Compost production

Compost	No. of participating farmers	Quantity of compost produced (t)	Application of compost - Area covered (ha)	Income generated from compost, if any
Vermicompost	4	96-100	16-18	Used for the their own fields (Arecanut & Pomegranate)

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Tree based farming system: This programme has created great awareness among the farmers about the role of trees in improving soil and water conservation besides helping in improving micro climate and carbon sequestration in the long run. The details of plantings under the project are provided in Table 74. This program also catered the demand of fodder to goat and sheep during summer.

Table 74: Tree based saplings planting under NICRA

Perennial crops	Before NICRA (No.)	After NICRA No. of sapplings planted
Honge	455	3710
Jamboo	06	14
Neem	584	15
Teak	880	3132
Silver oak	578	4229
Mango	187	500
Tamarind	88	200
Sapota	94	40
Jackfruit	08	24
Melia Dubia (Hebbevu)	0	1100

Rainwater Management

Rejuvenation of community tanks: Community farm pond, farm pond and check dams were desilted and widened benefiting 69 farmers with water storage capacity enhancing from 766 m^3 to 4272 m^3 (Table 75).

Table 75: Details of water storage capacity created in the village for the community use

Name of the pond	Intervention	No. of Participating farmers	Area desilted (Dimension) (l m × b m × d m)	Water storage capacity (m^3)	
				Before	After
Community farm pond	Desilting and widening	37	21.53 × 15.39 × 6.77	234	2242
Farm Pond		9	16 × 15.3 × 3	100	734
Check dam		23	27 × 16 × 3	432	1296

The total water storage capacity created in the village though various NRM intrventions is presented in table 76.

Table 76: Total water storage capacity created under NICRA

Name of structures constructed / repaired	Investment (Rs.)	No. of farmers benefitted	Water storage capacity (m^3)		Area under cultivation (ha)		Cropping intensity (%)
			Before	After	Before *Kharif*	After *Kharif*	
Farm ponds	-	24	-	-	-	15	200
Deepening and widening of pond	55,080	30	234	2242	-	-	150
Deepening and widening of check dams	40,000	1	432	1296			200
Desilting of village tank	80,100	15	-	-	-	-	100
Balapanamatti Desilting and clearing of channels	31,300	21	-	-	12	20	150
Desilting /clearing of Rajagaaluve	1,12,000	38	-	-	30	40	150
Desilting / clearing of Kodisara	35,000	18	-	-	7	10	150

Impact of NRM Interventions

Farmers have gained awareness on need for soil and moisture conservation, rainwater harvesting, increasing green cover in the farm area to improve the water table. Hesitation and doubts have disappeared from most of the farmers about allocating their bit of land for such interventions. They are now confident and able to appreciate the significance of natural resource management technologies in coping the weather vagaries.

Module II: Crop Production

This module consisted of integrated crop management, intercropping systems and introduction of tomato variety Arka Rakshak for disease tolerance.

Integrated Crop Management

Finger millet varieties: Finger millet is a minor crop in the village though an important food item. Only 10% of farmers conventionally grow finger millet for dual purpose. NICRA project introduced two high yielding varieties of finger millet (GPU-28 and GPU-48) which are well suited for drought and late sown conditions. The 62 demonstrations carried out in 24.8 ha area revealed that the yield of finger millet in demo plot was 2218 kg/ha as compared to 1820 kg/ha with farmer practice (Table 77). GPU-48 is a short duration variety with 100 days and farmers accepted the variety for late sown condition.

Impact: The finger millet area has increased mainly due to increased yield of grain and fodder with improved varieties compared to local varieties.

Table 77: Performance of finger millet varieties

Year	Area covered (ha)	No. of farmers	Seed yield (kg/ha)		Net returns (Rs./ha)		Benefit cost ratio	
	Demo	Demo	Demo	FP	Demo	FP	Demo	FP
2011-12 (GPU-28)	12.8	32	2242	1476	19569	8453	2.34	1.62
2012-13 (GPU-48)	6	15	2188	1927	19069	15330	2.00	1.84
2013-14 (GPU-48)	6	15	2225	2057	21581	19246	2.10	2.03
Total / Average	**24.8**	**62**	**2218**	**1820**	**20073**	**14343**	**2.15**	**1.83**

Demo: Proper spacing, Seed treatment with bio fertilizers, HYV

FP: High seed rate and use of local varieties, improper spacing and no seed treatment

Groundnut: Groundnut is another minor crop in the village grown by only 3% of the farmers. Introduction of drought and *tikka* disease tolerant groundnut variety ICGV 91114 from ICRISAT which gave 1818 kg/ha as against 1480 kg/ha in TMV-2 with B: C ratio of 1.79 as against 1.49 in farmers variety. This demonstration was carried out in 1.3 ha area benefitting 4 farmers (Table 78).

Impact: Few farmers were earlier growing the groundnut cv.TMV-2. Introduction of groundnut cv. ICGV-91114 improved the yield and fodder quality. Now ICGV-91114 had replaced TMV-2 variety in the village.

Table 78: Performance of groundnut

Year	Treatments	Variety	Area covered (ha)	No. of farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2012-13	Demo	ICGV-91114	0.9	3	1700	19100	1.78
	FP	TMV-2	-	-	1400	11983	1.50
2013-14	Demo	ICGV-91114	0.4	1	1890	20,160	1.80
	FP	TMV-2	-	-	1520	11,680	1.47
Total / Average	**Demo**	**ICGV-91114**	**1.3**	**4**	**1818**	**19630**	**1.79**
	FP	**TMV-2**	**-**	**-**	**1480**	**11832**	**1.49**

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Horse gram: The demonstration was carried out in 13.2 ha area benefitting 33 farmers in 2014-15. PHG-9 variety from UAS Bangalore gave a yield of 543 kg/ha with B: C ratio of 2.86 against local variety with 239 kg/ha and B: C ratio of 1.78 (Table 79). Besides grains, fodder from horse gram is of great value to the farmers with livestock.

Impact: After the harvest of the maize crop, many farmers have adopted the technology of growing the horse gram as an intercrop in the pigeon pea. Due to this activity, the cropping intensity of the village increased from100 to 200 per cent.

Table 79: Performance of horse gram (2014-15)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	PHG-9	13.2	33	543	13597	2.86
FP		-	-	239	4048	1.78

Field bean (HA-4): The demonstration was carried out in 7.2 ha area benefitting 18 farmers in 2014-15. Field beam is grown under rainfed situation in the village covering an area of 15% using the local variety which is long duration and low yielder. NICRA project introduced the high yielding variety HA-4 which yielded 1820 kg/ha (pods) in comparison with farmer variety 1330 kg/ha with B: C ratio of 2.14 and 1.60, respectively (Table 80).

Impact: Short duration variety is best suited to summer where we can use the harvested rainwater from farm pond for protective irrigation. This crop has spread in the village to nearly 20 ha and farmers are growing mainly as a vegetable crop.

Table 80: Performance of field bean (2014-15)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Pod yield (kg/ha) Vegetable	Net returns (Rs./ha)	Benefit cost ratio
Demo	HA-4	7.2	18	1820	18931	2.14
FP		-	-	1330	9748	1.60

Demo: Short duration HA-4 with IPM measures

FP: Local variety with higher seed rate and no IPM measures were takenup

Cotton (MRC 6918): The demonstration was carried out in 5.2 ha area covering 13 farmers in 2011-12. Spraying of $MgSO_4$ @ 5-10 g/l of water 60 DAS, when there was leaf reddening had reduced the incidence and increased the yield. Crop suffered at flowering and boll formation stage (2-9-2011 to 20-9-2011) with 20 days of dry spell. At that stage, use of water soluble fertilizers, KNO_3 @ 10g/l of water at boll formation stage increased the yield even under drought condition. The yield of the cotton in demo plot was 1300 kg/ha as compared to 1100 kg/ha with farmer practice (Table 81).

Impact: Cost of production of cotton was high with use of chemical fertilizers and pesticides. With the introduction of micro nutrient ($MgSO_4$) and macro nutrient (KNO_3) increased the yield with reduction in cost of production. Now the farmers in the village are using water soluble fertilizers during the dry spells for cotton.

Table 81: Performance of cotton (2011-12)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	MRC 6918	5.2	13	1300	23212	2.04
FP	Private	-	-	1100	17981	1.83

Demo: Wider Spacing (3ft × 3ft), Use of WSF (Macro and Micro nutrients)

FP: Closer Spacing (3ft × 2ft), Improper Nutrient management

Intercropping System

Maize (NAH-2049) + Pigeon pea (BRG-2): The demonstration was carried out in 76 ha area covering 190 participating farmers. The average yield of the maize + pigeon pea in demo plot was 4169 kg/ha + 455 kg/ha in comparison with farmer practice of sole pigeon pea yield 4279 kg/ha with B: C ratio of 2.10 and 1.76, respectively (Table 82).

Impact: Farmers who have gone for intercropping with BRG-2 pigeon pea variety obtained bumper yield. Now, the whole village is practicing intercropping of pigeon pea with maize.

Table 82: Performance of maize (NAH-2049) + pigeon pea (BRG-2)

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Maize yield (kg/ha)	Intercrop yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2011-12	Demo	NAH-2049 + BRG-2	4.8	12	4193	258	23662	2.05
	FP	Private	-	-	4314	-	19601	1.91
2012-13	Demo	NAH-2049 + BRG-2	30.8	77	4203	260	23826	2.06
	FP	Private	-	-	4338	-	19819	1.92
2013-14	Demo	NAH-2049 + BRG-2	40.4	101	4111	845	42777	2.19
	FP	Private	-	-	4186	-	13948	1.46
Total / Average	**Demo**	**NAH-2049 + BRG-2**	**76**	**190**	**4169**	**455**	**30088**	**2.10**
	FP	**Private**	**-**	**-**	**4279**	**-**	**17789**	**1.76**

Maize (NAH-2049) + Pigeon pea (BRG-1): The demonstration was carried out in 3 ha area covering 8 farmers in 2011-12. The yield of the maize+ pigeon pea in demo plot was 4160 kg/ha + 300 kg/ha as compared to 4274 kg/ha with farmer practice. B: C ratio was 2.07 with intercropping and 1.90 with sole crop of maize (Table 83).

Table 83: Performance of maize (NAH-2049) + pigeon pea (BRG-1) in 2011-12

Treatments	Variety	Area covered (ha)	No. of participating farmers	Maize yield (kg/ha)	Pigeon pea yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	NAH-2049 + BRG-1	3	8	4160	301	24298	2.07
FP	Private	-	-	4274	-	19226	1.90

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Horticultural crops

Tomato (Arka Rakshak): The demonstration was carried out in 2 ha area covering 10 farmers with tomato cv.Arka Rakshak and use of improved hybrid, seed treatment with bio fertilizer, use of pheromone traps, cultivation of marigold as trap crop and proper usage of PP chemicals. This variety yielded 58.4 t/ha in comparison with farmer practices (private variety) 44.8 t/ha with B: C ratio of 2.99 and 2.57, respectively (Table 84).

Table 84: Performance of tomato variety Arka Rakshak (2014-15)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Fruit yield (t/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	Arka Rakshak	2	10	58.4	116626	2.99
FP	Private	-	-	44.8	82177	2.57

FP: Use of private varieties, Non use of Biofertilizers, Non timely application of PP chemicals

Overall Impact of Crop Interventions

Farmers have realized the importance of using improved high yielding varieties/ hybrids with proper nutrient and pest management practices as they have enhanced the income and increased cropping intensity. Timely operations, right crop selection and suitable management strategies have now become part of the farming practices for the farmers of Siddanuru village.

Module III: Livestock and Fisheries

Animal health camps and vaccination against disease, use of community lands for fodder production during droughts/floods, local breed upgradation, production of vermicompost and fodder are the activities carried out under this module.

Animal health camp and vaccination: Prophylactic measures were taken against epidemic diseases covering 1782 animals during the year 2011-15 (Table 85). More and more of awareness created among the livestock owners on the benefit of deworming and vaccination against contagious and infectious diseases. Due to these interventions, no diseases out break observed among the livestock and there was an increase in milk production in the village.

Table 85: Animal health camp and vaccination (2011-15)

Activity	No. animals treated	Other dept. associated	Vaccination against disease
Prophylactic measures	1782	Department of AH and VS	Epidemic diseases

Fodder production: During 2011-12, napier grass was grown in 0.5 ha area covering 5 farmers. The green fodder yield was 90.8 t/ha/season and there was an increase in milk (5.86 l/day) with the intervention when compared to without intervention (4.80 l/day). In the year 2012-13, Stylosanthes was grown in 7.9 ha area covering 79 farmers. The green fodder yield was 25.3 t/ha/season and milk yield increased (7.74 l/day) with the intervention when compared to without intervention (6.70 l/day). In the year 2014-15, production of fodder through hydroponics was carried out covering 10 farmers with green fodder yield of 6.83 tonnes (Table 86).

Impact: Earlier farmers were struggling to meet the dry matter requirements of livestock due to the scarcity of both green and dry fodders. Due to the year round fodder production with HYV of fodder crops, farmers are meeting their fodder requirements quite easily. Now, around 74 farmers in the village are growing these fodder crops and have even spread to adjacent villages.

Table 86: Fodder production

Year	Activity	Crop and Variety	Area (ha)	No of participating farmers	Green fodder yield (t/ha/season)	Milk yield (liters/day)	
						Demo	Check
2011-12	Fodder production	Napier (Co-3)	0.5	5	90.8	5.9	4.8
2012-13		Stylosanthes (S.hemata)	7.9	79	25.3	7.7	6.7
2014-15	Production of fodder (kg/day) through hydroponics	Azolla	15 × 4 × 1	10	0.683/pond/year	-	-

Local breed upgradation: Local breed up gradation was carried out in Davanagere during 2011-12. Two Bellary (sheep) rams of NARI Suvarna breed were introduced in herd comprising 21 local Ewes. Now, the herd comprises 40 healthy animals reared under semi-free range condition.

Impact: Up gradation of local sheep with NARI Suvarna ram helped in improving the herd. Five to six other farmers in the village showing interest in the production of NARI Suvarna as it is giving more number off springs.

Vermicompost production: Vermicompost production was carried out by four farmers and produced 5.13 t / annum and by applying to crops reduced the cost of vegetable production by 40-50 % and increased the production by 25-30 %.

Impact: After seeing the benefits of vermicompost application to vegetable crops under demonstrations, more than 10 farmers in the village have started doing vermicompost production by heap method.

Animal nutrition and fodder enrichment: Supplementation of mineral and vitamin mixture during lean period was carried out for 86 cattles benefitting 43 farmers. This led to 10-15 % increase in milk production and reducing feeding cost by 15-20 % in the year 2013-14. Enrichment of low quality feeding stuff was carried out for cattles benefitting 76 farmers and by this intervention there was 17.53 % increase in milk production in 2014-15.

Impact of Livestock Interventions: These interventions have helped in production of high yielding fodders throughout the year supporting milk production and ensured the sustained income for farm families. After NICRA project, fodder production has become a regular part of farming in each and every farm family.

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Module IV: Institutional Intervention

The module consists of institutional interventions either by strengthening the existing ones or initiating new ones relating to seed bank, fodder bank, commodity groups, custom hiring centre, capacity building and extension activities for the benefits of farmers.

Custom Hiring Center: Under this intervention, 2687 farmers benefitted by cultivating 60.8 ha area utilizing the implements from the CHC. Rent of the equipments varied from the type of the equipment and revenue generated during the period 2011-16 was Rs. 64,014/- (Table 87).

Table 87: Performance of custom hiring center for farm implements and machinery

Year	Area covered (ha)	No. of farmers using implement	Revenue generated from CHCs (Rs)
2011-12	12.0	395	12079
2012-13	13.5	368	14465
2013-14	09.1	413	9420
2014-15	19.6	1259	23505
2015-16	06.6	252	4545
Total of 5 years	**60.8**	**2687**	**64014**

Capacity Building

The KVK organised training programmes on different need based aspects with apparent objective of making the farmers of NICRA villages potential human resources and make their agricultural practices climate resilient.

A total of 37 capacity building programmes were conducted in different thematic area during the period 2011-16 under NICRA *viz.* Agricultural meteorology, IPM, Hi-tech horticulture, Soil fertility management, Fish culture, Livelihood management for farm women, Increasing milk production, Organic agriculture, Exposure visit on animal husbandry and Exposure visit on farm mechanization. About 609 farmers and 155 farm women were participated in these capacity building programmes (Table 88).

Table 88: Capacity building (HRD) programmes organized under NICRA (2011-2016)

Sl. No.	Thematic area	No. of Courses	No. of participating farmers		
			Male	Female	Total
1	Agricultural Meteorology	4	63	0	63
2	IPM	5	143	7	150
3	Hi Tech Horticulture	3	67	0	67
4	Soil Fertility Management	2	25	3	28
5	Fish Culture	1	43	9	52
6	Livelihood management for Farm women / Farmers	4	47	26	73
7	Increasing Milk Production	5	58	101	159
8	Organic Agriculture	2	22	1	23
9	Exposure visit on Animal Husbandry	9 Days	109	8	98
10	Exposure visit on Farm Mechanization	2	32	0	15
Total		**37**	**609**	**155**	**728**

Extension Activities

In order to create mass awareness about the climate resilient technologies, large numbers of extension activities were organised at KVK farm and in the NICRA village. The type of extension activities organised were Agro advisory services, Field day, Mass campaign, Diagnostic visits, Exposure visits, Method demonstration, Off campus trainings, Group discussion Animal health check-up, all together 214 extension programmes were organised for about 1601 farmers and 313 farm women during the period 2011-2016 (Table 89).

Table 89: Extension activities organized under NICRA (2011-2016)

Sl. No.	Name of the activity	Number of programmes	No. of participating farmers		
			Male	Female	Total
1	Agro advisory services	123	242	41	283
2	Field day	02	172	04	176
3	Mass campaign	03	87	04	91
4	Diagnostic visits	21	25	-	25
5	Exposure visits	06	119	25	144
6	Method demonstration	20	381	86	467
7	Off campus trainings	14	284	23	307
8	Group discussion	21	225	130	355
9	Animal health check-up	04	66	0	66
Total		**214**	**1601**	**313**	**1914**

Overall Impact of Institutional Interventions

Custom hiring center has certainly helped small farmers in timely agricultural operations. Small implements were found to be more useful to farmers. Exposure visit to other NICRA villages and other institutions have certainly widened the horizon of our farmers in climate related aspects in farming. Their interest in farming and ability to making it a profitable venture amidst climatic aberrations has received a boost through NICRA project.

KVK, TUMKUR

Village: D. Nagenahalli

Climatic vulnerability

Drought, dry spells and extreme temperature.

No. of households : 269

Total cultivated area : 190 ha

Major soil types : Red sandy soil, Red loamy soil

Mean annual rainfall : 696 mm

Major crops : Finger millet, Maize, Groundnut, Pigeon pea, Tomato, Mango

Climate Vulnerability : Drought, Dry spells, Extreme temperature

a) Rainfall trend of the district

Historical Trends in Rainfall		Decadal Average		
		1980-1990	1990- 2000	2000-2010
No. of rainy days		56	55	49
No. dry spells during *kharif* season	> 10 days	2	5	8
	> 15 days	2	3	8
	> 20 days	0	1	3
No. of intensive rain-spells	> 60 mm per day	0	1	1

1. Predominant farm enterprises

(i) Cropping pattern: Crops/cropping systems, area under major crops (cereals, pulses, oilseeds, commercial crops)

Major cropping systems: Finger millet + Dolichos

Area and productivity of major crops:

Crop	Area (ha)	Yield (q/ha)
Finger millet	98.9	10.5
Maize	8.9	26
Groundnut	38.9	12
Pigeon pea	10.1	11

(ii) Predominant varieties of major food crops (up to 4 crops) in the village

Crop	Name of variety/ hybrid(s)	No. of farmers using improved varieties/hybrids	Area under improved varieties/ hybrids (ha) in the village
Finger millet	Gutte	140	200
Paddy	Hamsa	12	5

(iii) Horticulture: crops (fruits, vegetables, flower crops *etc.*,), area and productivity of each crop

Crop	Area (ha)	Yield (q/ha)	Name of variety/ hybrid(s)	Area under improved varieties/ hybrids (ha) in the village
Mango	15.5	200	Raspuri	15
Tamarind	1.7	1.5	Local	
Banana	1.5	1200	Puttabale	1.5
Tomato	2.0	202	Lakshmi	1
Chilli	1.5	5	Local	
Onion	3.0	12	Arka	0.5
Areca nut	13	120	Local	
Coconut	7	4000 (no's)	Local	
Chrysanthemum	1.7	5	Local	
Aster	2	4.5	Local	

(iv) Area under fodder cultivation (ha) and number of farmers growing green fodder: 30 farmers cultivated fodder in 5.4 ha.

(v) Major source(s) of irrigation: Open well, tube well, canal, ponds, village tanks *etc.*

Source of irrigation	Area (ha) under irrigation
Open well	8
Tube well	20
Canal	0
Ponds	2
Village tank	3

(vi) Micro-irrigation: -Nil-

(vii) Livestock:

Livestock type	Total number	No. of livestock owners	Major livestock diseases
Small ruminants	831	230	Foot and mouth,
Large ruminants	440	200	Bloat,
Poultry	540	215	Wooden tongue in cattle

(viii) Milk productivity: 2l/milch aminal/day

(ix) Inland fisheries: Practiced or not? No if yes, please give the following details

Where practiced: No

2. Resource availability

(a) Status of common pool resources (CPRs): grazing lands, water bodies, any other

CPR	Area (ha) or No.	Current status* (before start of NICRA)
Grazing land (ha)	8	Defunct
Water bodies (No)	3	Defunct

***whether under effective use/encroached/defunct *etc.*,**

(b) NRM structures:

Name of NRM structure	No's	Storage Capacity (m^3)	No. of farmers benefited	Protective Irrigation potential*(ha)	Status (Defunct/ effectively used)
	1	2	3	4	5
Farm pond	15	12000	20	1.5	Defunct
Village tank	3	150000	15	5	Defunct
Percolation tank	0				
Open well	23	19000			Defunct
Check dam	7	5800	10	3	Defunct
CCT	0				
Graded bunds	30		20		Defunct
Trenches	0				
Gully plugging	5		5		Defunct
Any others (specify)					

* Two protective irrigations at a depth of 5 cm per irrigations;

(c) Status of farm mechanization before start of NICRA:

No. of tractors -5, Power tillers -2

3. Socio-economic status

(a) No. of households: 269

Category	No.
General	910
OBC	65
SC	130
ST	195
Total	**1300**

(b) Literacy rate (%):

Male: 53, Female: 44

Average family income from agricultural and allied activities

Category	No. of families	Annual income (Rs./family)
Marginal	115	3000
Small	128	6000
Large	6	25000

(c) Workers engaged in agricultural activities (%) : 70

(d) Insurance coverage (numbers): Crop insurance/livestock insurance *etc,* **specify:**

---Nil-

Actual weather of the village during project period

The climatic/weather data pertaining to D.Nagenahalli village during the project period are collected, analyzed and is as follows:

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells> 10-15 days (No.)	Dry spells> 15 days (No.)	No. of highest rainfall intensity events (> 60 mm)	Water inundation floods> 10 days (No. of events)	Rainfall (mm)		
								Khairf	*Rabi*	Summer
2012	696.0	779	49	3	1	1	0	310	193	276
2013		824	50	4	0	1	0	500	169	155
2014		1082	63	2	0	3	0	560	225	297
2015		1132	67	1	1	3	0	335	460	337

Module I: Natural Resource Management

This module consists of interventions related to *in-situ* moisture conservation, water harvesting and recycling for supplemental irrigation, improved drainage in flood prone areas, conservation tillage where appropriate, artificial groundwater recharge, water saving irrigation methods, soil health management, tree based farming system and rainwater management *etc.*

NRM Structures: Large number farm ponds were constructed and 38 farm ponds were repaired/renovated during 2011-16. Four community ponds/tanks were repaired/ renovated and 11 percolation tanks/ recharge pits were constructed in the year 2011-12. Two bore wells were recharged during the year 2011-12 besides five check dams were constructed and 22 were repaired during 2011-16. Cleaning/desilting of three drainage channels was carried out during 2011-12 and 2015-16 (Table 90).

Table 90: Inventory of NRM structures

Structures/Years construction	Category	2011-12	2012-13	2013-14	2014-15	2015-16	Total
Farm ponds	Constructed	33	27	13	7	1	**81**
	Repaired/ Renovated	12	12	5	4	5	**38**
Community pond/tank	Repaired/ Renovated	1	1	2	-	-	**4**
Percolation tanks/ Recharge pits (No.)	Constructed	11	-	2	-	-	**13**
Recharging of open/tube wells with silt trap	Constructed	2	-	-	-	-	**2**
No. of Check dams	Constructed	5	-	-	-	-	**5**
	Repaired/ Renovated	6	11	1	2	2	**22**
Drainage Channel	Cleaning/desilting	2	-	-	-	1	**3**

Farm ponds: In 2012, 33 farm ponds of 2 different dimensions (m) 20 × 20 × 2 and 10 × 10 × 2 with water storage capacity of 800 and 200 m^3 were constructed and 8000 m^3 of water was harvested. Utilizing this water, about 13 ha area was brought under protective irrigation in which, groundnut, maize and aster crops were grown by giving protective irrigations: 11 in *kharif* and 21 in *rabi* seasons. In 2013, 27 farm ponds with storage capacity of 800 and 200 m^3 were constructed and 6800 m^3 of water was harvested. Using this water, about 10 ha area was brought under protective irrigations in which finger millet, groundnut and aster crops were grown by giving 10 *kharif* and 28 *rabi* protective irrigation. In 2014, 3000 m^3 of water was harvested in 13 farm ponds and 5 ha area was brought under protective irrigation by cultivating finger millet, groundnut and tomato. In 2015, water was harvested in seven farm ponds in which two ponds were lined with silpaulin sheet and 700 m^3 of water was harvested and 2 ha area was brought under protective irrigation in which aerobic paddy and aster were grown by giving 7 *kharif* and 22 *rabi* protective irrigations.

In 2016, 19 m^3 of water was harvested only in one farm pond lined with silpaulin and 31 ha area was brought under protective irrigation in which groundnut, aerobic paddy, finger millet and aster were grown by giving 14 *kharif* and 38 *rabi* protective irrigations (Table 91).

Impact: Harvested rainwater from farm ponds was used for providing critical irrigation to crops during dry spells in *kharif*. Because of critical irrigation the crop loss was minimized and yield of the crop was increased. Farm pond motivated farmers to cultivate *rabi* crops. This in turn helped farmers to earn more income by combating climate change. Farm ponds were constructed in the fields with a dual purpose *viz.*, firstly to help farmers provide supportive irrigation to the crops when required and secondly to allow maximum seepage of water into the ground so as to recharge the underground aquifers.

Table 91 : Details of farm pond, lining material and their capacity

No. of Farm ponds	Year	Type of lining material (if any)	Total Amount of water stored in farm pond (m^3)	Area brought under protective irrigation (ha)	Cultivation of crop with area (ha)	No. of Supplemental irrigation in *Kharif* /*Rabi* crop/ Both season	
						Kharif	*Rabi*
33	2012	-	8000	13	Groundnut-7	3	8
					Maize-4	4	-
					Aster-2	4	13
27	2013		6800	10	Finger millet-3	3	8
					Groundnut-4	3	8
					Aster-3	4	12
13	2014		3000	5	Finger millet-2	3	8
					Groundnut-2	3	8
					Tomato-1	4	11
7	2015	Silpaulin 2 Nos	700	2	Aerobic Paddy Mas-26-1	3	10
					Aster-1	4	12
1	2016	Silpaulin 1 Nos	19	31	Groundnut-10	3	8
					Aerobic Paddy Mas-26-5	3	10
					Finger millet-11	3	8
					Aster-5	4	12

Soil Management

Leveling and compartment bunding: Six farmers demonstrated this improved technology in 4 ha by growing finger millet and groundnut in 2011-12. This improved technology recorded higher finger millet yield of 2200 kg/ha and groundnut yield of 900 kg/ha when compared to no treatment of land (1800 kg/ha and 700 kg/ha respectively). In 2012-13, 15 farmers were benefitted from this technology by covering 5 ha of maize and paddy. This improved technology recorded higher maize yield of 3200 kg/ha and paddy yield of 3100 kg/ha when compared to no treatment with only 2500 kg/ha and 2700 kg/ha, respectively. Similarly, this technology was adopted in 2013-14 and 2014-15 by 18 farmers cultivating 6 ha area and benefitted with higher yields of crop (Table 92).

Impact: Leveling of uneven farms and farms with slopes reduced the soil erosion and increased soil moisture content thereby increased the yield of the crops.

Table 92: Effect of leveling and formation of compartments on soil moisture storage

Year	No. of participating farmers	Area covered (ha)	Crop yield (kg/ha)		Per cent increase in yield
	I T	I T	I T	C	
2011-12	6	4	FM: 2200 GN: 900	FM: 1800 GN: 700	FM: 22.2 GN: 28.6
2012-13	15	5	M : 3200 P: 3100	M: 2500 P : 2700	M : 28.0 P: 14.8
2013-14	9	2	P : 3150 T : 27000	P : 2700 T : 24000	P : 16.7 T : 12.5
2014-15	9	4	FM: 2600 GN: 1000	FM: 2000 GN:750	FM: 30.0 GN: 33.3

I T: Leveled and formation of compartments **C: Without leveling and formation of compartments**

FM: Finger millet, **GN: Groundnut,** **M: Maize,** **P: Paddy,** **T: Tomato**

Trench cum bunding: Trenches measuring 5 × 1 × 0.75 m of trenches were opened all around the field covering 128 ha belonging to 217 farmers during 2011-2016. Maize, finger millet and groundnut were cultivated on these fields with higher crop yields when compared to farmers' practice. The cost for opening of trench cum bunding for the area covered was about Rs. 8, 61,000/- (Table 93).

Impact: Trench cum bunding arrested soil erosion and served as water reservoir pits that keeps soil moisture intact for longer duration. Forestry tree species like *melia dubia*, *acacia aurculiformis*, teak, silver oak, glyricidia were planted on the bunds which helped in mitigating the climate change.

Table 93: Impact of trench cum bunding on field crops and soil moisture conservation

Year	No. of participating farmers		Area covered (ha)	Per cent increase in yield	Cost for opening of trench cum bunding for the area covered (Rs.)
	I T	C	I T		
2011-12	100	80	128.0	FM (11%), M (10%), GN (14%)	5,60,000
2012-13	55	20		FM (13%), M (11%), GN (15%)	1,40,000
2013-14	27	7		FM (15%), M (13%), GN 17%)	49,000
2014-15	20	16		FM (20%), M (18%), GN 20%)	1,12,000
2015-16	15	5		FM (23%), M (20%), GN 22%)	35,000

I T:Trench cum bunding, **C:Without Trench cum bunding,** **FM: Finger millet,**

M:Maize, **GN: Groundnut**

Contour Bunding: During the year 2011-12, demonstrated contour bunding in 1.5 ha area to two farmers by growing finger millet as a *kharif* crop with higher yield of 2200 kg/ha when compared to farmers practice with only 1900 kg/ha (Table 94).

Impact: Adoption of contour bunding led to control of soil erosion, promote water retention and increased crop production.

Table 94: Impact of contour bunding on crops

No. of participating farmers	Area covered (ha)	Area under cultivation (ha)		Crop yield (kg/ha)		Per cent increase in yield
I T	I T	I T		I T	C	
		B	A	*Kharif*	*Kharif*	15.8
2	1.5	2	1.5	FM :2200	FM : 1900	

I T: Contour Bunding C: Without contour bunding, FM: Finger millet, B: Before, A: After

Tank silt application: Application of tank silt was demonstrated by 90 farmers in 57 ha area during 2011-14 and 705 tonnes of tank silt was applied to the finger millet, groundnut and maize crops in which higher yield and B: C ratio were recorded (Table 95).

Impact: Silt application increased soil fertility and crop yields.

Table 95: Effect of tank silt application on crop yield

No. of participating farmers	Area covered (ha)	Quantity of tank silt application (t)	Crop yield (kg/ha)	Economics (Rs./ha)				
				Net returns		B:C Ratio		
I T	I T	I T	I T	C	I T	C	I T	C
25	20	250	FM: 2400 (26.3 %)	FM:1900	17700	8550	2.40	2.12
50	31	380	M: 3300 (22.2 %)	M : 2700	18900	14500	2.50	2.30
15	6	75	GN: 1200 (50.0%)	GN: 800	18200	9800	2.40	1.89

I T: Tank Silt application, C: Without tank silt, FM: Finger millet, GN: Groundnut, M: Maize

Deep Ploughing: Demonstration of deep ploughing was carried out by 75 farmers in 45 ha area during 2011-13 and obtained higher yield in groundnut and finger millet crops when compare to farmer practice (Table 96).

Impact: Ploughing or sub soiling with a chisel plough helped in breaking the hard pan layer and promoted deeper rooting leading to better crop yields.

Table 96: Effect of deep ploughing on soil loss and crop yield

Year	No. of participating farmers	Area covered (ha)	Crop yield (kg/ha)		Per cent increase in yield
	I T	I T	I T	C	
2011-12	40	30	FM : 2100	FM : 1800	16.67
2012-13	35	15	GN: 1050	GN : 900	16.67

I T: Deep ploughing, C: Unploughed, FM: Finger millet, GN: Groundnut

Crop mulching: Crop mulching was carried out in tamarind orchard by 14 farmers covering an area of 6 ha. This technology gave yield when compared to farmers practice (Table 97). Moisture content and organic carbon content were also increased in crop mulching.

Horse gram was shown during *kharif* season. This crop covers the soil completely because of their spreading nature. This reduces the splash effects of rain drops on the soil, conserves more moisture, improve the soil fertility when the plant residues are incorporated.

Table 97: Effect of crop mulching on moisture and organic carbon content

No. of participating farmers	Area covered (ha)	Moisture content (% w/w basis) cm *				Organic carbon content (%)		Crop yield (kg/ha)		Per cent increase in yield
		0-15		15-30						
I T	I T	I T	C	I T	C	I T	C	I T	C	
14	6	13	9	16	11	0.8	0.5	Tamarind 10yr, 5200	Tamarind 10yr, 4600	13.04

I T: Crop mulching, C: Control

Stubble mulching: Stubble mulching was demonstrated by 11 farmers on 4 ha and obtained higher crop yield in finger millet when compared to farmer practice. Moisture content increased in stubble mulching when compared to farmers practice (Table 98).

The stalks were left on the soil surface after harvest of the maize crop and the stalk initially used as mulch and later incorporated into the soil. It reduced soil erosion and increased the organic matter and biological activity.

Table.98: Effect of stubble mulching on moisture

No. of participating farmers	Area covered (ha)	Moisture content (% w/w basis) cm *				Crop yield (kg/ha)		Per cent increase in yield
		0-15		15-30				
I T	I T	I T	C	I T	C	I T	C	I T
11	4	12.5	8.5	15.5	10.5	FM: 3100	FM: 2700	14.8

IT: Stubble mulching, C: Control, FM: Finger millet

Soil Health Card

Soil fertility status information helps to overcome constrains affecting the fertility and productivity of soil resources. Soil health cards can be used to recommend the nutrient application for the major crops. 160 soil samples were collected in the NICRA village and analysed for major and micro nutrients. The results are presented in Table 99.

Table 99: Summary of results of soil testing across the village

Particulars	Range	Mean	Remarks
pH (1:2)	4.17-8.32	4.63	Low
Electrical conductivity (dsm^{-1})	0.036-0.277	0.096	Safe
Organic carbon (%)	0.15-1.2	0.21	Low
Nitrogen (mg kg^{-1})	24.3-194.4	34.02	Low
Phosphorus (mg kg^{-1})	0.6-41.5	21.2	High
Potassium (mg kg^{-1})	18-255	45	Low
Calcium (mg kg^{-1})	75-2150	75	Low
Magnesium (mg kg^{-1})	72-580	99	Low
Sulphur (mg kg^{-1})	1.4-61.1	18.7	High
Iron (mg kg^{-1})	5.2-208.9	19.7	High
Manganese (mg kg^{-1})	3.4-47.7	10.3	High
Zinc (mg kg^{-1})	0.25-1.84	0.45	Low
Copper (mg kg^{-1})	0.06-2.47	0.25	Low

Preparation of Compost: Demonstration of vermicompost unit was carried out by 44 farmers by producing 116 tonnes of vermicompost. This was applied to 20 ha area and generated an income of Rs.3, 48,000 /- (Table 100).

Impact: The compost application benefitted the land in many ways, including as a soil conditioner, a fertilizer and as a natural biocontrol for soil.

Table 100: Impact of compost to ecosystem

Year	Compost			
	No. of participating farmers	Quantity of compost produced(t)	Application of compost - Area covered (ha)	Income generated from compost, if any (Rs.)
2013-14	12	36	6	108000
2014-15	16	40	7	120000
2015-16	16	40	7	120000

Tree based farming system: The programme has created great awareness among the farmers about the role of trees in improving soil and water conservation besides helping in improving micro climate and carbon sequestration in the long run. It supplies fodder to goat and sheep during summer. About 43.6 ha additional area was brought under tree farming in the village (Table 101).

Table 101: Area brought under perennial crops under NICRA

Perennial crops	Before NICRA (ha)	After NICRA (ha)
Mango	15.5	19.5
Tamarind	1.7	8.7
Aonla	0.4	4.4
Cashew	0	2
Jamoon	0	0.5
Melia dubia	0	15
Acacia auriculiformis	0	7
Silver oak	1	3
Pongamia	2	3
Teak	0.5	1.5
Neem	0.2	0.3
Total	**21.3**	**64.9**

Agri-Horti system: Demonstration of agri-horti system of mango/ tamarind/amla-finger millet was carried out in 2011-12 by 30 farmers in 12 ha area in which finger millet gave higher yield of 2100 kg/ha as compared to sole finger millet grain yield (1850 kg/ha) (Table 102).

Table 102: Impact of agri-horti system on yield of crop

No. of participating farmers	Area covered (ha)	Crop yield (kg/ha)		Percent increase in yield
IT	IT	IT	C	
30	12	Finger millet - 2100 (Agri-horti system of Tamarind, Amla, Mango, Melia dubia)	Finger millet-1850	13.51

IT: Agri-horti system, C: Sole crop

Rainwater Management

Percolation ponds: Thirteen percolation ponds were dug benefitting over 13 farmers. Total rainwater storage capacity of these ponds was 1750 m^3.

Percolation ponds were constructed to reduce the velocity of water flowing down from the fields and to recharge the ground water, open wells and bore wells.

Recharge of bore wells: Recharging of bore wells were implemented and an increase in discharge was noticed.

Recharge of bore wells were constructed by diverting run off water into defunct and less yielding bore wells. The water flowing in the channel was made to pass through a filter media before entering into recharge structure to avoid accumulation of silt.

Table 103: Recharging of bore well –functional and defunct bore wells

Total No. of bore wells	Before NICRA		After NICRA	
	No. of functional wells	No. of defunct wells	No. of functional wells	No. of defunct wells
29	10	19	47	0

Impact of recharging of bore well against defunct bore well: The discharge of water from the recharged borewell increased to 126.28 l/min as against 20.74 l/min before the recharge.

Check dams: To break flow of water and infilteration, 5 check dams of dimensions (30 × 8 × 1.5, 20 × 6 × 1.5, 20 × 8 × 1, 40 × 50 × 3, 15 × 3 × 1 m) were constructed with water storage capacity of 6750 m^3 during the period 2011-16 (Table 104). Farmers benefitted with an increased area under irrigation by growing chrysanthemum, groundnut, finger millet, paddy, tomato and maize crops.

Impact: Check dams helped in recharge of ground water table and water out put from the open wells and bore wells also has increased in the village.

Table 104: Details of check dams

Year	Increased area under irrigation (ha)	No. Supplemental irrigation in *Kharif/ Rabi/* both season			Crop yield (kg/ha)	
		Crop	*Kharif*	*Rabi*	*Kharif*	*Rabi*
2011-12	1	Groundnut	3	8	900	850
2012-13	2	Chrysanthemum	4	11	14000	12500
		Groundnut	3	9	950	900
2013-14	2	Paddy	3	10	3100	2950
		Tomato	4	12	26000	23500
2014-15	2	Finger millet	3	8	2500	2100
		Tomato	4	11	27500	24000
2015-16	2	Maize	4	9	3300	2650
		Groundnut	4	10	1100	1000

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Water storage structure: Three cemented storage structures were constructed by 3 farmers and 710 m^3 of water was harvested and utilized the stored water for irrigation to 3 ha area (Table 105).

Impact: Cemented water storage structures were constructed in the village to minimize the seepage and percolation loss of water. Whenever there is power availability, ground water was stored in the structures and utilized for irrigation during night time.

Table 105: Details of cemented storage structure

Year	No. of Units	No. of participating farmers	Dimension (l m × b m × d m)	Storage capacity (m^3)	Increased area under irrigation (ha)
2011-12	1	1	18 × 6 × 2.5	270	1
2014-15	2	2	12 × 11 × 2 15 × 6 × 2	444	2

Plastic film lining to prevent seepage and percolation losses in soil: Three water storage tanks have been lined with plastic sheets of dimension 10×10×3 m by 3 farmers. Reduction in water losses through percolation and seepage to the maximum extent (38-71 %) was observed. Lining with plastic film has benefitted reduction of water loss in red sandy soil (70.85 %) compared to that of red clay soil (38%). This led to increase in area under irrigation by 4 ha (Table 106).

Table 106: Effect of lining with plastic film on seepage and percolation losses in soil (2014-15)

No. of Units	No. of participating farmers	Total area irrigated (ha)	Drop in depth per day (cm)					
			Red Sandy soil		Percent reduction in water loss	Red clay soil		Percent reduction in water loss
I T	I T	I T	I T	C		I T	C	
3	3	4	10.2	35	70.85	9.4	15.2	38.2

IT: Lining with Plastic film, C: Without lining with plastic film

Desilting and widening of defunct farm ponds and check dams: Desilting of 19 farm ponds were carried out with a water storage capacity of 8350 m^3 and renovation of 8 defunct check dams were done creating water storage capacity of 10,700 m^3 (Table 107).

Impact: The water storage capacity is increased by desilting and widening of defunct water harvesting structures. It in turn helped recharge of surrounding open and bore wells. The harvested water can be used for supplemental irrigation.

Table 107: Desilting and widening of defunct farm ponds and check dams

Year	No. of Units		No. of participating farmers		Dimension (l m × b m × d m)		Water storage capacity (m^3)	
	D	R	D	R	D	R	D	R
2014-15	19	8	40	6	10 × 10 × 2	20 × 8 × 2	8350	10700

D: Desilting of farm ponds, R: Renovation of defunct check dams

Rejuvenation of community tanks: Community tanks were desilted and widened creating additional water storage capacity. Desilting, blocking of leakage and diversion channel were made to village tank, small tank and *mandara katte* in the village benefitting 57 farmers. Water storage has increased from 92,150 m^3 to 1,51,075 m^3 (Table 108)

Impact: It is serving as a drinking water source for village animals.

Table 108: Details of water storage capacity of community tanks

Name of the pond	Intervention	No. of participating farmers	Area desilted (Dimension) (l m × b m × d m)	Water storage capacity (m^3)	
	Desilting/ Repair/ Leakage/ Plugging *etc.*,			Before	After
Village tank	Desilting, Blocking of leakage, diversion channel	45	130 × 160 × 7	90000	145600
Small tank	Desilting, Blocking of leakage	7	30 × 40 × 3	1600	3600
Mandara katte	Desilting	5	25 × 25 × 3	550	1875

Desilting of existing *nala*: Desilting of 3 *dongari nalas* was done in D.Nagenahalli village, Tumkur benefitting 45 farmers (Table 109).

Water storage capacity of the tank increased and supplement irrigation was given in both seasons of *kharif* and *rabi* crops.

Table 109: Impact of desilted *dongari nala* in D.Nagenahalli Village

No. of Units	No. of participating farmers	Length of the channel desilted (m)	Water storage in tank (m^3)		No. of Supplemental irrigation given in *kharif* season	Area (ha) under *kharif*	Area (ha) under *rabi*	*Kharif* crop yield (kg/ha)		*Rabi* crop yield (kg/ha)	
			Before	After		A	A	B	A	B	A
3	45	2300	90000	145600	11	8	5	GN- 950	GN -1100	GN - 900	GN -1150

B: Before, A: After, GN: Groundnut

Impact of NRM activities: An additional water storage capacity of 97710 m^3 was created with various rainwater harvesting structures benefiiting 251 farmers of the village.

Table 110: Total water storage capacity created in the NICRA village- D.Nagenahalli

Name of structures constructed / repaired	Investment (Rs.)	No. of farmers benefitted	Water storage capacity (m^3)		Area under cultivation (ha)	
			Before	After	Before	After
					Kharif	
New farm pond, Percolation pond, New check dam, Water storage structure, Plastic lining of farm pond, Rejuvenation of farm pond, Rejuvenation of check dam, Rejuvenation of small community tank, Desilting and widening of catchment channel for the village tank (1200 m)	1917000	251	102000	199710	12	59

Module II: Crop Production

This module consisted of varietal demonstration of finger millet, improved varieties of pigeon pea, drought tolerant aerobic paddy, intercropping system, improved varieties of tomato and chilli, drip irrigation in vegetables and horticultural crops, sprinkler irrigation system in flower crops and use of plastic mulching in tomato and chilli production.

Varietal demonstrations

Finger millet (ML-365): The demonstration of short duration finger millet (ML-365) was carried out in 120 ha area covering 315 farmers. The performance of the ML-365 variety was significantly superior over local variety. The average yield of finger millet ML-365 was 2528 kg/ha compared to that of local finger millet 1840 kg/ha. The farmer was benefitted with additional yield of 688 kg compared to local variety (Table 111).

Impact: Finger millet ML-365 was found suitable for delayed monsoon and late sowing in the village.

Table 111: Growing of ML-365 finger millet to cope with early season drought

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Benefit cost ratio
2011-12	Demo	ML-365	20	70	2240	2.29
	FP	Local	-	-	1580	1.36
2012-13	Demo	ML-365	25	65	2350	2.74
	FP	Local	-	-	1750	1.78
2013-14	Demo	ML-365	50	110	2800	2.74
	FP	Local	-	-	2100	1.78
2015-16	Demo	ML-365	25	70	2720	1.85
	FP	Local	-	-	1930	1.37
Total/ Average	**Demo**	**ML-365**	**120**	**315**	**2528**	**2.41**
	FP	**Local**	-	-	**1840**	**1.57**

Pigeon pea (BRG 2): The demonstration on pigeon pea was carried out in 47 ha area covering 262 farmers. BRG 2 a short duration and high yielding variety is suitable for dryland and late sowing condition. The performance of the pigeon pea BRG -2 (1182 kg/ha) was found superior to the local variety of pigeon pea (962 kg/ha) in the village. The farmer got benefitted with additional yield of 226 kg compared to local variety (Table 112).

Impact: Pigeon pea BRG-2 was found suitable for dry land agriculture and late sowing condition besides resistant to pod borer.

Table 112: Pigeon pea (BRG 2) to cope with delayed monsoon

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Benefit cost ratio
2011-12	Demo	BRG-2	20	113	1260	2.03
	FP	Local	-	-	1020	1.58
2012-13	Demo	BRG-2	8	32	1180	2.90
	FP	Local	-	-	910	1.89
2013-14	Demo	BRG-2	10	35	1180	2.90
	FP	Local	-	-	910	1.89
2014-15	Demo	BRG-2	3	32	1130	2.79
	FP	Local	-	-	1020	2.60
2015-16	Demo	BRG-2	6	50	1190	2.10
	FP	Local	-	-	950	1.70
Total/ Average	**Demo**	**BRG-2**	**47**	**262**	**1188**	**2.54**
	FP	**Local**	-	-	**962**	**1.93**

Aerobic paddy (MAS-26): Aerobic rice MAS-26 is grown like any other dry land crops such as maize or sorghum on dry soils. It uses 60 per cent less water for cultivation. Less lodging and high grain and fodder yield. Aerobic rice emits 80-85 % lesser methane gas into the atmosphere thus keeping the environment safe.

The demonstration of aerobic paddy MAS-26 was carried out in 10 ha by 22 farmers. The performance of the aerobic paddy MAS-26 (3388 kg/ha) was found to be superior to the local variety of paddy (2850 kg/ha). The yield of aerobic paddy MAS-26 increased to an extent of 18.86 % (Table 113).

Table 113: Performance of drought tolerant aerobic paddy

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Benefit cost ratio
2012-13	Demo	MAS 26	2	5	3750	2.13
	FP	Local	-	-	2980	1.87
2013-14	Demo	MAS 26	1	2	3350	2.13
	FP	Local	-	-	2980	1.87
2014-15	Demo	MAS 26	2	5	3250	2.20
	FP	Local	-	-	2840	1.90
2015-16	Demo	MAS 26	5	10	3200	2.01
	FP	Local	-	-	2600	1.70
Total/ Average	**Demo**	**MAS 26**	**10**	**22**	**3388**	**2.12**
	FP	**Local**	**-**	**-**	**2850**	**1.84**

Intercropping system

Finger millet + Pigeon pea (8:2): The demonstration of intercropping of finger millet + pigeon pea (8:2) was carried out in 10 ha area covering 30 farmers in 2012-13. Finger millet + pigeon pea (8:2) system gave finger millet yield of 2350 kg/ha and yield of 120 kg/ha with net return of Rs.17400/ha. Whereas mono cropping system gave total net return of Rs.12800.The farmers got an additional income of Rs.4600/- (Table 114).

Table 114: Yield and economics of finger millet + pigeon pea (8:2)

Intervention	Area covered (ha)	No. of participating farmers	Finger millet yield (kg/ha)	Pigeon pea yield (kg/ha)	Net returns (Rs./ha)
Finger millet + Pigeon pea (8:2)	10	30	2350	120	17400
Monocropping	-	-	-	-	12800

Maize+ Pigeon pea (2:1): The demonstration was carried out in 3.5 ha area covering 9 farmers. Maize yield of 3500 kg/ha and pigeon pea yield of 110 kg/ha with net return of Rs.36000/ha was obtained with intercropping as compared to monocropping system which gave Rs.31200 as net returns.The farmers got an additional income of Rs.4800/- (Table 115).

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Table 115: Performance of maize+ pigeon pea (2:1)

Intervention	Area covered (ha)	No. of participating farmers	Maize (kg/ha)	Pigeon pea (kg/ha)	Net returns (Rs./ha)
Maize+ Pigeon pea (2:1)	3.5	9	3500	110	36000
Monocropping	-	-	-	-	31200

Groundnut + Pigeon pea (3/4:1): Demonstration of groundnut + pigeon pea (3/4:1) was carried out in 8 ha area covering 60 farmers. In the system, groundnut recorded a yield of 1740 kg/ha and pigeon pea 130 kg/ha with net return of Rs.38600/ha. Whereas mono cropping of groundnut system gave only Rs.33500 as net returns.The farmers got an additional income of Rs.5100/- (Table 116).

Table 116: Performance of groundnut + pigeon pea (3/4:1)

Intervention	Area covered (ha)	No. of participating farmers	Groundnut (kg/ha)	Pigeon pea yield (kg/ha)	Net returns (Rs./ha)
Groundnut + Pigeon pea	8	60	1740	130	38600
Monocropping	-	-	-	-	33500

Impact: The recommended inter cropping system in D.Nagenahalli are finger millet + pigeon pea (8:2), maize+ pigeon pea (2:1) and groundnut + pigeon pea (3/4:1). Adoption of intercropping system improved soil fertility, gave higher yield and income to the participating farmers of the village.

Horticultural Crops

Improved variety of chilli: The chilli variety Arka Lohit is a high yielding open pollinated variety yielding 8-10 t/ha of green chilli in dryland. The variety has performed well in dryland. The net income from cultivation of this variety was 25% higher than local variety thereby on an average farmer could get Rs.24000/- net profit per hectare.

Drip irrigation in vegetables and horticultural crops: Around 1.2 ha vegetables, 1.2 ha arecanut, 0.6 ha mango plot were installed with drip system benefitting 8 farmers. It has been observed that crop under drip gave higher yield, good quality produce and hence fetched higher returns.

Sprinkler irrigation system in flower crops: Sprinkler irrigation was adopted for 0.4 ha in flower crops and 0.6 ha in vegetables crops. It was observed that vegetables and flower crops gave higher yields and good quality produce besides greater water economy when irrigated by sprinklers. It gives overall irrigation efficiency as high as 80-82 % as compared to 30-50% in surface irrigation.

Plastic mulching in tomato and chilli production: Plastic mulching was promoted in tomato and chilli cultivation in the village for ensuring higher yield and better quality tomato and chilli production through 20 demonstrations. The yield of plastic sheet mulched tomato and chilli gave yield to the tune of 15 tonnes and 10 tonnes/ha respectively.

Module III: Livestock and Fisheries

Under the module animal health camp and vaccination, use of community lands for fodder production during droughts/floods are the activities carried out.

Animal health camp: Under animal health camp, preventive vaccination was given to 403 animals benefitting 44 farmers. De-worming was carried out in 65 animals benefitting 32 farmers. Animal health checkup was carried out for 403 animals benefitting 44 farmers (Table 117).

Impact: Checking animals' health and giving preventive vaccination regularly improved animal health and immune system for climate change and increased milk and meat production.

Table 117: Animal health camp

Activity	Participating farmers (No.)	Animals treated (No.)	Remarks
Preventive vaccination	44	403	Improved Animal health there by increased milk and meat production
De-worming of animals	32	65	Improved animal health
Animal health check up	44	403	Improved animal health there by increased milk and meat production

Fodder production

Cultivation of fodder helps timely availability of fresh fodder to the cattle, increasing animal health and milk yield. This also helps farmer earn extra income. Fodder production was carried out by 20 farmers.

Module IV: Institutional Intervention

The module consists of institutional interventions either by strengthening the existing ones or initiating new ones relating to seed bank, fodder bank, commodity groups, custom hiring centre, trainings on different themes under capacity building and extension activities.

Custom Hiring Center: Under this intervention, 738 farmers benefitted by cultivating 50.3 ha area using the implements from the CHC. Rent of the equipments varied from the type of the equipment. The revenue generated from these implements during the period 2012-16 was Rs. 39,513/- (Table 118).

Impact: Various farm machinery were made available to farmers through hiring at low prices. This helped farmers to carry out agriculture practices in time. Use of farm machines also helped to bring down labor cost and saves time.

Table 118: Performance of custom hiring centers

Year	Area covered (ha)	No. of users	Revenue generated (Rs.)
2012-13	22.3	382	14590
2013-14	19	227	6213
2014-15	4	107	5660
2015-16	5	22	13050
Total of 5 years	**50.3**	**738**	**39513**

Capacity Building: The KVK organised training programmes on different need based aspects with apparent objective of making the farmers of NICRA village potential human resources and make their agricultural practices climate resilient. A total of 10 capacity building programmes were conducted in different thematic area during the period 2011-16 under NICRA *viz*. IPM, Soil fertility management and Exposure visit on crop production technology for horticulture and forage crops. About 232 farmers and 46 farm women could participate in these programmes (Table 119).

Impact: The participating farmers helped other farmers to know about new technologies related to climate resilient agriculture and motivated them to adopt.

Table 119: Capacity building (HRD) programmes organized under NICRA (2011-2016)

Sl. No.	Thematic area	No. of Courses	No. of participating farmers		
			Male	Female	Total
1	IPM	2	33	5	38
2	Soil fertility management	6	129	33	162
3	Exposure visit on crop production technology for horticulture and forage crops	2	70	8	78
Total		**10**	**232**	**46**	**278**

Extension Activities

In order to create mass awareness about the climate resilient technologies, large number of extension activities were organised by KVK under NICRA at KVK farm and in the NICRA village. The extension activities organised are Field days, Diagnostic visits, Exposure visits, Method demonstration and Group discussions. Altogether 342 extension programmes were organised in which 1218 farmers and 156 farm women participated (Table 120).

Impact: Helped to create mass awareness about the climate resilient technologies through NICRA village.

Table 120: Extension activities organized under NICRA (2011-2016)

Sl.No.	Activity	Programmes (No.)	No. of participating farmers		
			Male	Female	Total
1	Field day	7	306	48	350
2	Diagnostic visits	280	340	45	385
3	Exposure visits	2	70	8	78
4	Method demonstration	3	52	5	57
5	Group discussion	50	450	50	500
Total		**342**	**1218**	**156**	**1370**

TAMIL NADU

The NICRA-TDC was implemented in four districts of Tmil Nadu state namely, Namakkal, Villupuram, Nagapattinam and Ramanathapuram through KVKs. In order to deal with the climate change in the right earnest, extensive demonstration of location specific best-bet practices (agricultural technologies/package of practices contributing to climate resilience) on farmers' field in one village in each of the selected districts have been undertaken as described below:

KVK, NAMAKKAL

NICRA - Village: Vadavathur

Climatic vulnerability

Vadavathur in Erumaipatty block of Namakkal district is a drought-prone village with annual rainfall of less than 400 mm. The mean maximum and minimum temperatures are 46 and 12° C. Undulating and slopy lands have aggravated the drought condition due to lack of scope,percolation of rainwater in the catchment and water storage areas. This has led to monocropping (October to January) during north-east monsoon.

No. of the village : Vadavathur
Name of the district : Namakkal
No. of Households : 869
Total cultivated area : 525 ha
Major soil type : Sandy loam
Mean annual rainfall : 400 mm
Major cropping systems : Onion, sorghum and groundnut
Climate vulnerability : Drought

a) Rainfall trend of the district

Historical Trends in Rainfall		Decadal Average		
		1985-1990	1991- 2000	2001-2010
No. of rainy days		48	49	50
No. dry spells during *kharif* season	> 10 days	2	2	2
	> 15 days	1	1	1
	> 20 days	7	1	2
No. of intensive rain-spells	> 60 mm per day	3	2	0

2. Predominant farm enterprises

(i) Cropping pattern:

Kharif – Onion, Groundnut, Pulses, Groundnut + Pulses, Sorghum, Vegetables

Rabi – Onion, Paddy- Vegetables

(ii) Area and productivity of major crops:

Crop	Area (ha)	Yield (q/ha)
Sorghum	225	25
Groundnut	128	20

(iii) Predominant varieties of major food crops in the village: Nil

(iv) Cropping intensity (%): 130

(v) Horticulture: Crops, area and productivity of each crop

Crop	Area (ha)	Yield (q/ha)	Name of variety/ hybrid(s)	Area under improved varieties/ hybrids (ha)
Onion	425	105	Local	12
Ribbed gourds	6	270	Local	2
Tomato	2	300	PKM-1	-
Jasmine	1	38	Ramanathapuram	30 cents

(vi) Area under fodder cultivation (ha) and number of farmers growing green fodder: 212 ha, 96 farmer

(vii) Major source(s) of irrigation:

Source of irrigation	Area (ha) under irrigation
Open well	374
Tube well	125
Ponds	2
Village tank	5

(viii) Micro-irrigation:

Micro-irrigation	Area (ha)	Number of farmers
Drip	4	8

(ix) Livestock:

Livestock type	Total numbers	Number of livestock owners	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Small ruminants	775	254	2	PPR	40	5
Large ruminants	295	112	80	FMD	90	-
Poultry	750	432	-	Ranikhet	60	20

(x) Milk productivity (litres/animal/day): 14

(xi) Inland fisheries: Practiced or not? : No

(xii) Other enterprises : Nil

2. Resource availability

(i) Status of common pool resources (CPRs):

CPR	Area (ha) or numbers	Current status*(before start of NICRA)
Grazing land	49.5	Used for grazing by sheep and goat during lean season

(ii) NRM structures:

NRM structure	No.	Storage capacity (m^3)	No. of farmers benefited	Protective irrigation potential*	Status (Defunct/ effectively used)
Farm pond	3	56,360	3	4	-
Village tank	5	1,66,140	73	2	3 defunct
Open well	374	41,25,500	187	3	50% defunct
Check dam	3	40,535	23	-	1 defunct

***Two protective irrigation at a depth of 5 cm per irrigation**

(iii) Status of farm mechanization before start of NICRA: Tractor : 07

3. Socio-economic status

(i) No. of households

Category	Number
OBC	815
SC	54
Total	869

(ii) Literacy rate (%): Male: 30, Female: 13

(iii) Land holding pattern:

Category	No. of families
Marginal	385
Small	230
Large	75
Land less farmer	179

(iv) Workers engaged in agricultural activities (%): 90

Insurance coverage (numbers): Crop insurance/livestock insurance *etc*.,

Actual weather of the village during project period

The climatic/weather data pertaining to Vadavathur village during the project period is as follows:

Year	Normal rainfall (mm)	Total rainfall (mm) (Jan-Dec)	Rainy days (No.)	Dry spells> 10-15 days (No.)	Dry spells> 15 days (No.)	No. of highest rainfall intensity events(> 60 mm)	Water inundation floods> 10 days (No. of events)	Rainfall (mm)		
								Khairf	*Rabi*	Summer
2011 (Sep-Dec)	410.0	405.46	31	1	1	0	0	0	316	0
2012		469.6	30	2	9	2	0	146.8	245	76
2013		639	24	5	7	4	0	284	269	48
2014		548.3	32	4	7	1	0	307	217.3	24
2015		487	29	5	8	0	0	270	208	0

Module I: Natural Resource Management

This module consists of interventions related to *in-situ* moisture conservation, water harvesting and recycling for supplemental irrigation, soil health management, composting, recharge of bore wells and open wells.

NRM Structures: Under the project, 3 community ponds were repaired/ renovated, 15 farm ponds were constructed, one check dam was constructed and one drainage channel was cleaned/desilted during the period 2011-16 (Table 121).

Table 121: Inventory of NRM structures

Structures/ Years of Construction	Category	2011-12	2012-13	2013-14	2014-15	Total
No. of farm ponds	Constructed	2	7	6	-	**15**
Community pond/tank	Repaired/ Renovated	1	1	1	-	**3**
No. of Check dams	Constructed	-	-	1	-	**1**
Drainage Channel	Cleaning/desilting	-	-	-	1	**1**

Community ponds: Renovation and repair of existing three community ponds in the village led to creation of an additional water storage capacity of 37425 m^3 of water and using this enhanced capacity 94 farmers could cultivate 172.1 ha area in each year (Table 122).

Table 122: Total water storage capacity created in the NICRA village

Name of structures constructed / repaired	Investment (Rs.)	No. of farmers benefitted	Water storage capacity (m^3)		Area under cultivation (ha)	
			Before	After	Before	After
					Kharif	
Ayiramkuttai	2082063	37	1185	22999	12.8	73.6
Senguttai		36	3516	6571	59.32	85.3
Periyakalingikuttai		21	3912	16468	9.4	13.2
Total		**94**	**8613**	**46038**	**81.52**	**172.1**

Farm ponds: Farm ponds of different dimension (m) of 14.02 × 10.36 × 1.52 to 22.86 × 16.76 × 1.82 were dug with a water storage capacity varying from 387 to 713 m^3 and all these ponds were lined with silpauline sheet. These ponds were also used as temporary storage ponds by filling the water from the borewell and utilizing irrigation through gravity. In the year 2012, 31.4 m^3 of water was harvested and using this water 1.4 ha area was brought under protective irrigation to groundnut, onion, sorghum and vegetable crops by giving 17 *kharif* and 28 *rabi* protective irrigations. In 2013, 117.31 m^3 of water was harvested in 7 farm ponds and 4.81 ha area was brought under protective irrigation to crops such as groundnut, onion, sorghum, vegetable crops, paddy, jasmine and pandhal crops giving 27 *kharif* and 62 *rabi* protective irrigation. In 2014, 81 m^3 of water was harvested in 6 farm ponds and 5.21 ha area was brought under protective irrigation (Table 123).

Table 123: Details of farm pond, lining material and their capacity

Farm ponds (No.)	Year	Type of lining material (if any)	Water storage capacity (m^3)	Amount of water stored (m^3)	Area brought under protective irrigation (ha)	Cultivation of crop with area (ha)	No. of Supplemental irrigation	
							Kharif	*Rabi*
2	2012	Silpauline Sheet	387 to 713	31.4	1.4	Groundnut (0.4), Sorghum (0.4), Onion (0.4), Vegetable crops Ribbed gourd and bottle gourd (0.2)	17	28
7	2013			117.31	4.81	Groundnut (1.5), Sorghum (1.5), Paddy (0.81), Onion (0.4), Vegetable crops Ribbed gourd and bottle gourd (0.2), Jasmine (0.4)	27	62
6	2014			81.54	5.21	Groundnut (1.21), Sorghum (3.0), Paddy (0.6), Onion (0.4)	18	55

Impact: Before NICRA, percolation water loss was 0.5 foot in 3 days of storage. After implementation of various NRM activities under NICRA, percolation water losses minimized to 0.5 foot in 15 days of storage with enhanced irrigation capacity by 50% under each farm pond.

Recharge of bore wells: Recharging of bore wells was implemented in NICRA village covering all the existing bore wells. After the implementation of recharging of wells and due to indirect effect of all other NRM activities under taken in the village the discharge rate in the bore wells has increased and defunct wells have started yielding water (Table 124).

Table 124: Recharging of borewell

Village	Before NICRA		After NICRA	
	No. of functional borewells	No. of defunct borewells	No. of functional borewells	No. of defunct borewells
Senguttai	39	1	40	Nil
Aayiramkuttai	96	23	119	Nil

Soil Management

Soil Health Card: Towards soil health management in the village, 138 soil samples were collected from each of the farm holding and analysed for all major, secondary and micro nutrients. Soil health cards with specific advisories for each of the major crops were issued to the farm holders. The average results as range are presented in Table 125.

Table 125: Summary of soil testing results

Particulars	Range	Mean	Remarks
pH (1:2)	4.17-8.32	8.05	Neutral
Electrical conductivity (dsm^{-1})	0.036-0.277	0.18	Normal
Organic carbon (%)	0.15-1.2	0.39	Low
Nitrogen (mg kg^{-1})	24.3-194.4	65.09	Low
Phosphorus (mg kg^{-1})	0.6-41.5	5.09	Low
Potassium (mg kg^{-1})	18-255	184.52	Medium
Sulphur (mg kg^{-1})	1.4-61.1	8.15	Low
Iron (mg kg^{-1})	5.2-208.9	5.85	Sufficient
Manganese (mg kg^{-1})	3.4-47.7	8.90	Sufficient
Zinc (mg kg^{-1})	0.25-1.84	0.29	Low
Copper (mg kg^{-1})	0.06-2.47	1.15	Sufficient

Prepatation of Compost: Five farmers were benefitted from vermicompost by producing 20 t and applied to an area of 4 ha.

Module II: Crop Production

This module consists of drought tolerant varieties, high yielding/short duration varieties, SRI method of paddy cultivation, integrated pest and disease management, multiplier onion, frost management in onion through mobile sprinkler, intercropping system, horticulture crops and pandhal /trellis system for cultivation of cucurbits.

Varietal demonstration

Sorghum (K-8): Nine demonstrations were carried out in 22.5 ha area in which sorghum cv. K-8 recorded higher yield of 1780 kg/ha and B:C ratio of 2.93 as compared to farmers practice (1225 kg/ha with B:C ratio of 2.38) in 2011-12 (Table 126)..

Impact: Drought tolerant sorghum cv. K-8 could provide increased grain yield and fodder yield as well as compared to existing sorghum (Co-4).

Table 126: Performance of improved drought tolerant sorghum (K-8)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	K-8	22.5	9	1780	30330	2.93
FP	Co-4	-	-	1225	21430	2.38

Black gram (Co-6): The demonstration of black gram was carried out in 37.8 ha area covering 18 participating farmers in 2014-15.

Black gram cv.Co-6 recorded higher yield of 843 kg/ha compared to farmers practice (718 kg/ha) and B:C ratio of 3.02 and 2.67, respectively (Table 127).

Table 127: Performance of high yielding, short duration black gram variety (Co-6)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	Co-6	37.8	18	843	38340	3.02
FP	T-9	-	-	718	30490	2.67

Impact: Short duration, YMV resistant variety Co-6 replaced the existing variety T-9 in the village

Green gram (Co-8): The demonstration of green gram was carried out in 5 ha area covering 7 participating farmers. The variety Co-8 recorded higher yield of 810 kg/ha compared to farmers practice with 738 kg/ha and B:C ratio of 2.64 and 2.50, respectively in 2014-15 (128).

Table 128: Performance of green gram variety Co-8 in 2014-15

Treatments	Variety	Area covered (ha)	No. of participating farmers	Yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	Co-8	5	7	810	40225	2.64
FP	Co-6	-	-	738	35400	2.50

Impact: Short duration, YMV resistant variety Co-8 produced 9.75 % higher grain yield and served as replacement to existing variety Co-6.

SRI method of paddy: SRI method of paddy cultivation was demonstrated by 10 farmers in 5 ha area by harvesting higher yield of 6440 kg/ha compared to farmers practice with 5855 kg/ha and B:C ratio of 2.91 and 2.18 respectively (Table 129).

Table 129: Performance of SRI method of paddy cultivation in 2014-15

Treatments	Variety	Area covered (ha)	No. of participating farmers	Yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	ADT-49	5	10	6440	63350	2.91
FP	ADT-45	-	-	5855	47525	2.18

Impact: New paddy variety ADT-49 produced gain yield of 6440 kg/ha under SRI system helped the farmers to get higher net returns from paddy cultivation as compared to conventional method of cultivation.

Integrated Pest and Disease Management

Multiplier onion: Forty demonstrations were carried out in 16 ha area on multiplier onion. The demonstration plots recorded higher yield of 22 t/ha compared to farmers practice with 20.3 t/ha and B:C ratio of 4.94 and 3.86, respectively in 2014-15 (Table 130).

Table 130: Integrated pest and disease management in multiplier onion

Treatments	Variety	Area covered (ha)	No. of participating farmers	Yield (t/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	Co.4	16	40	22.0	350468	4.94
FP		-	-	20.3	300000	3.86

Frost management in onion: Demonstration was carried out in 51 ha area covering 40 participating farmers. During November and December months farmers of NICRA village have adopted rope as well as mobile sprinkler method to prevent tip drying in onion due to dew drops. The demonstration plots recorded higher yield of 13 t/ha compared to farmers practice with 12.3 t/ha and B:C ratio of 3.17 and 2.31 respectively in 2014-15 (Table 131).

Table 131: Frost management in onion through mobile sprinkler (2014-15)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Yield (t/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	Valayapatti local and Co.4	51	40	13.0	213565	3.17
FP		-	-	12.3	167563	2.31

Demo: Removal of dew drop in onion leaf sheath through rope/mobile sprinkler

FP: Spray pesticide (Monocrophos or curacron @ 2ml/litre of water) for the management of tip drying in onion

Intercropping System

Groundnut + Pigeon pea intercropping system: Demonstration was carried out in 36.4 ha area covering 14 farmers on intercropping of groundnut + pigeon pea in 2014-15. The demonstrated system recorded higher yield of 1825 kg/ha of groundnut and 360 kg/ha of pigeon pea compared to farmers practice of sole groundnut crop yield of 1425 kg/ha with B:C ratio of 3.06 and 2.04, respectively (Table 132). Groundnut and pigeon pea intercropping system was found economically viable for rainfed condition and demonstrated varieties were found to be tolerant to drought.

Table 132: Groundnut variety (TMV-7) intercropping with pigeon pea (Co-7)

Treatments	Area covered (ha)	No. of participating farmers	Yield (kg/ha)	Intercrop yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	36.4	14	1825	360	72225	3.06
FP	-	-	1425	-	32725	2.04

Horticulture crops

Jasmine (*Gundu Malligai*): Demonstration was carried out in 1.6 ha area covering 20 farmers on jasmine crop in 2011-12. Well rooted Jasmine cuttings, foliar spray of micronutrients, proper pruning practices, drip irrigation and IPM practices demonstration recorded higher flower yield of 3900 kg/ha compared to farmers practice (2240 kg/ha) with B:C ratio of 4.41 and 3.38, respectively (Table 133).

Impact: This technology was up scaled by farmers of Vadavathur as well as nearby villages namely Valayapatti, Vadugapatti and Sevanthipatti.

Table 133: Performance of Jasmine variety gundu malligai (2011-12)

Treatments	Area covered (ha)	No. of participating farmers	Flower yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	1.6	20	3900	468719	4.41
FP	-	-	2240	236500	3.38

Seed propagated multiplier onion: Demonstration was carried out in 16 ha area covering 40 farmers in 2014-15. The demonstration plots recorded higher onion bulb yield of 20 t/ha compared to farmers practice with 16 t/ha and B:C ratio of 3.35 and 2.09, respectively (Table 134).

Table 134: Cultivation of seed propagated multiplier onion var. Co (On)5

Treatments	Variety	Area covered (ha)	No. of participating farmers	Onion bulb yield (t/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	Co (On)5	16	40	20	213174	3.35
FP	Valayapatti local and Co.4	-	-	16	124125	2.09

Pandhal/Trellis system for cultivation of cucurbits: The demonstration was carried out in 2 ha area covering 5 farmers 2014-15. The pandhal system recorded higher yield of 13.5 t/ha compared to conventional farmers practice with 8.9 t/ha and B:C ratio of 2.21 and 1.88, respectively (Table 135).

Impact: Using the harvested water through temporary water storage pond, an additional crop of cucurbitaceous vegetables namely ribbed gourd and bitter gourd were cultivated and the produce was sold by individual farmers at Uzhavar Santhai Namakkal at nominal rate of 10 to 15 rupees /kg.

Table 135: Cultivation of cucurbits in pandhal /trellis system

Treatments	Variety	Area covered (ha)	No. of participating farmers	Yield (t/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	Pali	2	5	13.5	110875	2.21
FP	PKM1 and Co1	-	-	8.9	62000	1.88

Hybrid Tomato: The demonstration was carried out in 2 ha area covering 5 participating farmer in 2014-15. Off-season cultivation of hybrid tomato under drip irrigation system was carried out from March to October (Table 136).

Hybrid tomato recorded higher yield of 63.8 t/ha compared to farmers practice with 15 t/ha and B:C ratio of 4.22 and 2.46 respectively.

Table.136: Performance of hybrid tomato cultivation

Treatments	Variety	Area covered (ha)	No. of participating farmers	Yield (t/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	Heem sohna	2	5	63.8	3,89,065	4.22
FP	PKM 1	-	-	15.0	71,300	2.46

Module III: Livestock and Fisheries

Under this module animal health camp and vaccination, local breed upgradation, animal nutrition, fodder enrichment and improved shelters for reducing heat stress in livestock were carried out.

Animal health camp and vaccination: Vaccination was given to 632 animals against FMD disease, 558 animals against PPR disease and 885 animals against ET disease in the NICRA village. As a result of this animal losses due to disease outbreak was prevented.

Local breed upgradation: Local breed up gradation was demonstrated by one farmer. From Ram – NARI, 34 Ewes were born.

Impact: Production performance of the native animals was enhanced through cross breeding with superior germ plasm.

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Animal nutrition and fodder enrichment: Mineral lick was provided for 20 goats and 3 cattles. The demonstrated farmers of cattles could get increased milk yield up to 0.5 l/day (Table 137).

Table 137: Animal nutrition and fodder enrichment

Activity	No. of participating farmers	Type of animals	No. of animals benefited	Economic impacts
Mineral lick	1	Goat	20	96 % conception rate
Mineral mixture	1	Dairy	3	0.5 l/day increase in milk production

Improved shelter: Improved shelter helps to overcome the climate stress. Improved shelter was demonstrated for 7 dairy animals, mud flooring for 58 sheeps, improved night shelters- cage type for 832 poultry birds, back yard poultry shed-cage type for 100 poultry birds, mud floor system for goat covering 6 farmers.

Impact: Improved shelter for dairy animals helped in increasing the production of milk from 7 l/day to 8 l/day. Improved night shelters and back yard poultry shed-cage type for for poultry birds helped in decresing the mortality rate from 13 % to 3 %, mud floor housing for goats helped in increasing the weight of animal from 18 to 22 kg (Table 138).

Table 138: Performance of improved shelter

No. of participating farmers	No. of animals	Type of animal	Type of housing	Type of material used (Locally available)	Cost of housing/ farmer (Rs.)	Economic impact	
						1*	2**
1	-	Fish	Farm pond	-	-	-	-
1	7	Dairy	Improved shelter	-	-	8 l/day	7 l/day
1	58	Sheep	Mud flooring	Asbestos sheet roof	40000	-	-
1	832	Poultry bird	Improved Night Shelters- Cage type	Roof covered with AC sheet	-	Mortality	Mortality
1	100	Poultry bird	Back yard poultry shed Cage type	Roof covered with AC sheet	-	3%	13 %
1	-	Goat	Mud floor system	Roof with metal sheet	40000	22 kg	18 kg

* With intervention **Without intervention

Module IV: Institutional Intervention

The module consists of institutional interventions either by strengthening the existing ones or initiating new ones relating to seed bank, fodder bank, commodity groups, custom hiring centre, capacity building and extension activities.

Custom Hiring Center: Under this intervention, 1128 farmers benefitted by cultivating 532.9 ha area using the various implemnets/ machines from the CHC in the village. Rent of the equipments varied from the type of the equipment. The total revenue generated from these implements during the year 2011-16 was Rs. 4,09,505/-. The year-wise details are presented in table 139.

Table 139: Performance of custom hiring center

Year	Area covered (ha)	No. of users implement	Revenue generated (Rs.)
2011-12	173.6	324	126690
2012-13	0	0	0
2013-14	83.9	183	131970
2014-15	92.4	238	104830
2015-16	183	383	46015
Total of 5 years	**532.9**	**1128**	**4,09,505**

Capacity Building: The KVK organised training programmes on different need based aspects with apparent objective of making the farmers of NICRA villages potential human resources and make their agricultural practices climate resilient.

A total of 42 capacity building programmes were conducted in different thematic area during the period 2011-16 under NICRA *viz*. Mushroom cultivation, Azolla production, Dairy cow feeding, Ornamental fish farming, Backyard poultry rearing, Fodder production, Preparation of value added dairy products, Diseases management in livestock, Inter cropping methods, Onion cultivation, nutrition pest and diseases management, Vegetable cultivation, Water management techniques, Jasmine cultivation, Nutrient management in vegetable crops, Vermicompost technology and Groundnut cultivation techniques. All together 566 farmers and 422 farm women of the village were participated in the HRD programmes. The thematic area-wise details are presented in table 140.

Table 140: Capacity building (HRD) programmes (2011-2016)

Sl. No.	Thematic area	No. of courses	No. of participating farmers		
			Male	Female	Total
1	Mushroom Cultivation	2	12	11	23
2	Azolla Production	2	67	72	139
3	Dairy Cow Feeding	1	19	19	38
4	Ornamental Fish Farming	1	5	5	10
5	Backyard Poultry Rearing	3	24	16	40
6	Fodder Production	4	25	11	36
7	Preparation of Value Added Dairy Products	5	20	67	87
8	Diseases Management in Livestock	4	66	53	119
9	Intercropping Methods	2	17	3	20
10	Onion Cultivation, Nutrition Pest and Diseases Management	10	206	119	325
11	Vegetable Cultivation	1	12	10	22
12	Water Management Techniques	2	34	9	43
13	Jasmine Cultivation	1	15	13	28
14	Nutrient Management in Vegetable Crops	1	8	4	12
15	Vermicompost Technology	1	8	5	13
16	Groundnut Cultivation Techniques	2	28	5	33
Total		**42**	**566**	**422**	**988**

Extension activities: In order to create mass awareness about the climate resilient technologies, large numbers of extension activities were organised by KVK under NICRA at KVK farm and in the NICRA village. The major extension activities organised are exposure visits, method demonstration, commodity groups, awareness and field days. All together 68 extension programmes were organised involving 1105 farmers and 407 farm women (Table 141).

Table 141: Extension activities (HRD) programs (2011-2016)

Sl. No.	Name of the activity	Number of courses	No. of participating farmers		Total
			Male	Female	
1	Exposure visit	10	79	43	122
2	Method demonstration	15	177	120	297
3	Commodity groups	24	263	81	344
4	Awareness	15	371	84	455
5	Field day	4	215	79	294
Total		**68**	**1105**	**407**	**1512**

KVK, NAGAPATTINAM

Village: Anaimangalam

Climatic Vulnerability

Anaimangalam village, Nagapattinam district is one of the drought prone villages, often inundated by flood during rainy seasons and sea water intrusion. The source of irrigation is only through canal. The village has been witnessing severe drought consistently. The paddy being the major crop get affected due to dry spell during *kharif* season. These conditions affect the growth, yield and productivity of other crops as well.

No. of households : 1060

Total cultivated area : 399 ha

Major soil types : Clay loam

Mean annual rainfall : 1874 mm

Major crops : Rice-Rice-Pulses
Rice-Rice-Sesame

Climate Vulnerability : Flood (Normal condition)
2012-13: severe drought

a) Rainfall trend of the district

Historical Trends in Rainfall		Decadal Average		
		1980-1990	1990- 2000	2000-2010
No. of rainy days		122	117	102
No. dry spells during *kharif* season	> 10 days	2	3	3
	> 15 days	1	1	1
	> 20 days	1	1	1
No. of intensive rain-spells	> 60 mm per day	16	14	14

1. Predominant varieties of major food crops in the village

Crop	Name of variety/ hybrid(s)	No. of farmers using improved varieties/ hybrids	Area under improved varieties/ hybrids (ha) in the village
Rice	ADT 36, 38, 39, 43, 45, TKM 9, CO 43, CR 1009, BPT 5204	300 (improved varieties), 10 (hybrids)	Variety - 350 ha, hybrids - 10 ha
Rice fallow pulses (Black gram)	ADT 3	75	50 ha
Sesamum	TMV 6	15	20 ha

(a) Cropping intensity (%): 70

(b) Horticulture: crops (fruits, vegetables, flower crops etc), area and productivity of each crop

Crop	Area (ha)	Yield (q/ha)	Name of variety/ hybrid(s)	Area under improved varieties/ hybrids (ha) in the village
Mango	10	45	Bengalura,Neelam	10
Coconut	6	840	East Coast Tall	6
Tomato	2	100	Local	2
Chillies	2	15	Local	2
Brinjal	1.5	110	Local	1

(c) Area under fodder cultivation (ha) and number of farmers growing green fodder:
2.0 ha, 10 farmers

(d) Major source(s) of irrigation: Open well, tube well, canal, ponds, village tanks *etc.*,

Source of irrigation	Area (ha) under irrigation
Canal	399

(e) Micro-irrigation: - Nil-

(f) Livestock:

Livestock type	Total number	No. of livestock owners	Share of improved breeds (%)
Small ruminants	52	350	-
Large ruminants	60	100	2%
Poultry	660	250	15%

(g) Milk productivity (liters/animal/day) cross bred: 7

Inland fisheries: Practiced or not? : Yes

Where practiced: Ponds/village tanks/farm ponds/any other (specify): All

(h) Quantity of fish production/year from different sources: 2t / ha / 6 months

2. Resource availability

Status of common pool resources (CPRs): Grazing lands, water bodies, any other

CPR	Area (ha) or No's	Current status* (before start of NICRA)
Grazing land (ha)	110	Non use
Water bodies (No)	12	Defunct

3. Natural Resource Structures (NRM) structures:

Name of NRM structure	No's	Storage Capacity (cu m)	No. of farmers benefited
Village tank	4	7500	550

*** Two protective irrigations at a depth of 5 cm per irrigations;**

4. Socio-economic status

(a) No. of households

Category	No.
General	110
OBC	155
SC	750
ST	50
Total	**1065**

Literacy rate (%): Male: 65 %, Female: 52 %

(b) Average family income from agricultural and allied activities

Category	No. of families	Annual Income (Rs/family)
Marginal	225	40000
Small	820	2000
Large	20	100000

Workers engaged in agricultural activities: 70 %

(c) Insurance coverage (numbers): Crop insurance/livestock insurance etc, specify: Not available

(d) Distribution of households

Thatched Houses	Huts	RCC Building	Govt. Colony	Total
225	52	25	60	362

(e) Demographic details

	Male	Female	Total/ overall
Total population	856	805	1661
Literacy	74%	62%	68%
Illiterate	26%	38%	32%

Actual weather of the village during project period

The climatic/weather data pertaining to Anaimangalam village during the project period are collected, analyzed and is as follows:

Actual rainfall details of Anaimangalam village

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells> 10-15 days (No.)	Dry spells> 15 days (No.)	Highest rainfall intensity events (> 60 mm) (No.)	Water inundation floods> 10 days (No. of events)	Rainfall (mm)		
								Khairf	*Rabi*	Summer
2011	1341.0	957.84	51	5	4	1	0	144.5	774.84	38.5
2012		1215.6	41	3	7	7	0	120.1	1062.8	32.7
2013		1034.34	46	1	5	2	0	31.5	941.14	96

Module I: Natural Resource Management

This module consists of interventions related to *in-situ* moisture conservation, water harvesting and recycling for supplemental irrigation, rejuvenation of community tanks etc.

NRM Structures: Five farm ponds were constructed in the NICRA village i.e Anaimangalam village during the year 2012-13 and 2013-14. One community pond/tank was repaired/ renovated during the year 2012-13. Cleaning/desilting of one drainage channel was carried out in 2012-13 (Table 142).

Table 142: Inventory of NRM structures

Structures	Category	2012-13	2013-14	Total
No. of farm ponds	Constructed	1	4	**5**
Community pond/tank	Repaired/ Renovated	1	-	**1**
Drainage Channel	Cleaning/desilting	1	-	**1**

An investment of Rs 3 lakh was made in the NICRA village to construct, repair and renovate water storage structures under the NICRA. As a result an additional water staorage capacity of 6395 m^3 was created (Table 143).

Table 143: Total water storage capacity created in the village

Name of village	Name of structures constructed / repaired	Investment (Rs.)	No. of farmers benefitted	Water storage capacity (m^3)		Protective irrigation potential created (ha)
				Before	After	
Anaimangalam	Farm pond	60,000	1	0	1197	0.04
Orkudi		60,000	1	0	1175	0.04
Anaimangalam		60,000	1	0	1175	0.04
Orkudi		60,000	1	0	1215	0.04
Poolangudi		60,000	1	0	1633	0.04
		3,00,000	5		6395	0.2

Farm ponds: Five farm ponds of different dimension (m) of 28.5 × 28 × 1.5 to 33 × 33 × 1.5 with a water storage capacity varying from 1175 to 1633.5 m^3, 4600 m^3 of water were constructed under the project in farmer participatory mode. The harvested water used to irrigated 0.2 ha area as protective irrigation. Cultivation of annual moringa, vegetable in kitchen garden, fodder grass, coconut seedlings on the bunds and inland composite fish culturing in the farm ponds was under taken by the farmers. On an average Rs.16,920/- was generated as additional income per year (Table 144).

Table 144: Details of farm pond and their capacity

No. of Farm ponds	Total Amount of water stored in farm pond (m^3)	Area brought under protective irrigation (ha)	Cultivation of crop with area (ha)	No. of Supplemental irrigation given in both season
5	4600	0.2	Kitchen garden, fodder grass, coconut seedlings and culturing of inland composite fish	70

Rejuvenation of community tanks: In Anaimangalam panchayath, community tank located at Poolangudi was desilted (4348 m^3) for the benefit of farmers of Poolangudi hamlet and water storage capacity has been increased. Around 150 farmers were benefitted from the community tank.

Impact: After desilting the community tank water storage capacity was increased from 2,300 m^3 to 34,788 m^3. The water stored in the community tank has been used for the cultivation of summer pulses and vegetables in kitchen garden.

Module II: Crop Production

This module consists of flood / drought / temperature tolerant varieties of rice, SRI, Direct drum seeding method of rice and horticulture crops demonstration in the farmers' field.

Flood/drought/temperature tolerant varieties

Rice varieties: The demonstration on flood tolerant rice variety (Swarna sub 1) was carried out in 14.4 ha area covering 36 farmer in 2012-13. The variety Swarna sub 1 recorded an yield of 5475 kg/ha compared to local variety (4750 kg/ha) with a B: C ratio of 1.83. Saline tolerant rice variety (TRY-3) was demonstrated in 15.6 ha area covering 39 farmers to sustain the production in the saline condition. The Cv. TRY 3 recorded a yield of 5350 kg/ha as compared to local variety with only 4750 kg/ha. The B: C ratio was 1.78 and 1.58 respectively in the demo and farmers variety (Table 145).

Table 145: Performance of flood / drought / temperature tolerant varieties

Technology demonstrated	Participating farmers (No.)	Area (ha)	Measurable indicators of output*		Economics of demonstration (Rs./ha)		Economics of Local (Rs./ha)	
			Demo (kg/ha)	Local (kg/ha)	Net Return	BCR	Net Return	BCR
Flood tolerant rice variety (Swarna sub 1)	36	14.4	5475 (15.3%)	4750	24750	1.83	17500	1.58
Saline tolerant variety (TRY-3)	39	15.6	5350 (12.6%)	4750	23500	1.78	17500	1.58

Impact: After the introduction of Swarna sub 1 rice variety through NICRA scheme, this variety was popularized by Department of Agriculture by providing seed of Swarna sub 1 variety to the farmers for cultivation in other villages of the district where flood and sea water inundation occurs.

Advanced rice nursery in *kharif* for timely planting: Demonstration of rice variety (ADT 38) was carried out in 3 ha area covering three farmers as advanced rice nursery in *kharif* season for timely planting in 2012-13. This technology recorded a yield of 5240 kg/ha compared to local variety 4850 kg/ha with conventional practice. Rice variety (ADT 38) recorded 8.04% increase in yield with this technique when compared to local variety.The B: C ratio was 1.6 and 1.58 respectively in the advanced nursery and conventional practice (Table 146).

Table 146: Advanced rice nursery in kharif for timely planting

Technology demonstrated	Participating farmers (No.)	Area (ha)	Measurable indicators of output*		Economics of demonstration (Rs./ha)		Economics of Local (Rs./ha)	
			Demo (kg/ha)	Local (kg/ha)	Net Return	BCR	Net Return	BCR
Advanced rice nursery in *kharif* for timely planting	2	3	5240 (8.04%)	4850	17975	1.6	17500	1.58

SRI and Direct drum seeding method: The SRI demonstration was carried out in 4 ha area covering 6 farmers. The SRI technology recorded an higher yield of 6400 kg/ha when compared to local variety and conventional method of cultivation (5100 kg/ha). The B: C ratio was 1.92 with SRI and 1.58 with conventional method of cultivation. Direct drum seeding demonstration was carried out in 2.5 ha area covering three farmers. This method recorded a higher yield of 5430 kg/ha when compared to local variety and conventional method of broadcasting technique (5260 kg/ha). The B: C ratio was better with drum seeding (Table 147).

Table 147: Performance of water saving paddy cultivation methods

Technology demonstrated	Participating farmers (No.)	Area (ha)	Measurable indicators of output*		Economics of demonstration (Rs./ha)		Economics of Local (Rs./ha)	
			Demo (kg/ha)	Local (kg/ha)	Net Return	BCR	Net Return	BCR
SRI	6	4	6400 (25.5%)	510	27600	1.92	17500	1.58
Direct drum seeding	3	2.5	5430 (3.2%)	5260	18870	1.63	17500	1.58

Impact: After introduction of SRI and direct drum seeding rice cultivation through NICRA scheme, this type of cultivation became popular among the farmers of the village because of 40% less water requirement, labour saving, 50% less seed rate and reduced cost of cultivation over conventional method.

Horticulture crops

Tomato and Brinjal varieties: Improved variety of tomato PKM-1 was demonstrated in 6.25 ha area covering 10 farmers in 2012-13. The demonstration recorded a yield of 28 t/ha compared to local variety

22 t/ha with a B: C ratio of 2.33 and 1.62 respectively. Similarly brinjal variety PLR-2 was demonstrated in 12.5 ha area covering 10 farmers has recorded a higher yield of 25 t/ha when compared to local variety with 21 t/ha and a B: C ratio of 2.81 and 2.37 respectively. Improved varieties of Tomato (PKM 1) and brinjal (PLR 2) gave 27.3 and 19% increased yield over local varieties respectively and became popular among the farmers in the village (Table 148).

Table 148: Performance of tomato and brinjal varieties

Technology demonstrated	No. of participating farmers	Area (ha)	Measurable indicators of output		Economics of demonstration (Rs./ha)		Economics of Local (Rs./ha)	
			Demo (t/ha)	Local (t/ha)	Net Return	BCR	Net Return	BCR
Tomato(PKM 1)	10	6.25	28 (27.3%)	22	260000	2.33	59000	1.62
Brinjal (PLR 2)	10	12.5	25 (19%)	21	145000	2.81	85000	2.37

Module III: Livestock and Fisheries

Under this module animal health camps, vaccination,use of community lands for fodder production during droughts/floods and improved shelters for reducing heat stress in livestock were demonstrated.

Animal health camp and Vaccination: Animal health camp and vaccination was carried out by covering 225 cattles and small ruminants. This has improved the health and milk yield of the animals.

Fodder production: Napier grass was grown in 1.5 ha area benefitting 10 farmers in the village. This fodder crop is helping the farmers to produce quality green fodder during lean seasons. The paddy straw enrichment and pulse haulm storage were the other fodder storage techniques demonstrated in the village.

Fisheries in farm ponds: Fish culture was carried out in farm ponds covering 14 farmers in the village. 570 kg weight of fish was harvested from each farm pond in 6 months period.

Module IV: Institutional Intervention

This module consists of institutional interventions either by strengthening the existing ones or initiating new ones relating to seed bank, fodder bank, commodity groups, custom hiring centre, capacity building and extension activities for the benefits of farmers.

Custom Hiring Center: Under this intervention, 14 farmers benefitted by covering 8.5 ha area using the implements/machines from the CHC. Rent generated from the CHC was Rs. 5,600/- in 2011-13. Through custom hiring centre timely availability of machines was ensured to the farmers in the village.

Capacity Building: The KVK organised training programmes on different need based aspects with apparent objective of making the farmers of NICRA villages potential human resources and make their agricultural practices climate resilient.

A total of 16 capacity building programmes were conducted in different thematic areas during 2011-16 *viz*. Agricultural meteorology, IPM, Hi tech horticulture, Soil fertility management, Fish culture, Livelihood management for farm women, Increasing milk production, Organic agriculture, Exposure visit on animal husbandry, Exposure visit on crop production technology for horticulture and forage crops and Exposure visit on farm mechanization. A total of 547 farmers including 424 male farmers and 123 farm women were participated in these HRD programmes (Table 149). These capacity building programmes improved the knowledge of the farmerson agriculture and allied enterprises.

Table 149: Capacity building (HRD) programmes organized (2011-2016)

Sl. No.	Thematic area	No. of Courses	No. of participating farmers		
			Male	Female	Total
1	Agricultural Meteorology	1	70	25	95
2	IPM	2	22	5	27
3	Hi Tech Horticulture	1	35	10	45
4	Soil Fertility Management	3	47	8	55
5	Fish Culture	2	40	5	45
6	Livelihood Management for Farm Women	1	30	15	45
7	Increasing Milk Production	1	25	10	35
8	Organic Agriculture	2	35	15	50
9	Exposure visit on Animal Husbandry	1	50	-	50
10	Exposure visit on Crop Production Technology for Horticulture and Forage crops	1	35	15	50
11	Exposure visit on Farm Mechanization	1	35	15	50
Total		**16**	**424**	**123**	**547**

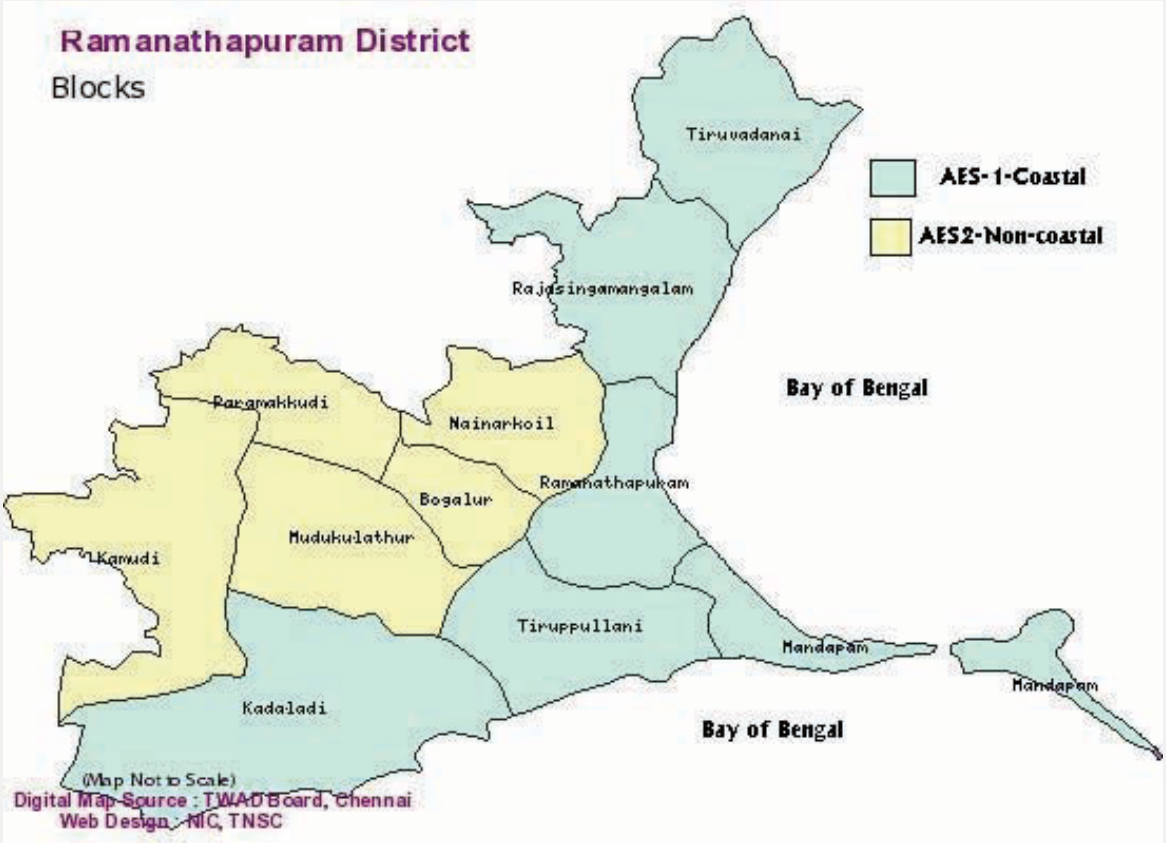
Extension Activities: In order to create mass awareness about the climate resilient technologies, large numbers of extension activities were organised by KVK under NICRA at KVK farm and in the NICRA village. The details of major extension activities organised were Agro advisory services, Field days, Mass campaign, Diagnostic visits, Exposure visits, Method demonstration, and Group discussion. All together 41 extension programmes were organised and about 460 farmers and 65 farm women have participated in these programmes (Table 150).

Table 150: Extension activities organized (2011-2013)

Sl. No.	Name of the activity	Number of programmes	No. of participating farmers		
			Male	Female	Total
1.	Agro advisory services	15	65	5	70
2.	Field day	5	70	20	90
3.	Mass campaign	10	30	5	35
4.	Diagnostic visits	2	50	-	50
5.	Exposure visits	1	80	5	85
6.	Method demonstration	2	60	5	65
7.	Off campus trainings	1	35	5	1
8.	Group discussion	5	70	20	5
Total		**41**	**460**	**65**	**401**

KVK, RAMANATHPURAM

DISTRICT PROFILE



Ramanathapuram district is situated in the southeast corner of Tamil Nadu state falls in the rain shadow region and thereby is a highly drought prone and most backward in development. It is surrounded by Pudukottai district in the North, Sivagangai and Virudunagar district in the Northwest and West, Tirunelveli, Thoothukudi and Gulf of Mannar on the South, Palk Strait on the East. The unique feature of this district is the longest coastal line measuring about 271 km accounting for nearly 1/4th of the total length coastal length of the State.

NICRA Villages: Kalari, Melamadai and Kombuthi of Ramanathapuram District

Climatic vulnerability

Drought is the major climatic challenge in the cluster village. Agriculture in this cluster village is mainly dependent on the north-east monsoon and the available water in the Kalari tank.

Name of the village	Kalari	Melamadai	Kombuthi
District	Ramanathapuram	Ramanathapuram	Ramanathapuram
No. of households	150	280	200
Total cultivated area	405 ha	310 ha	180 ha
Major soil type	Sandy loam and clay loam	Sandy loam and clay loam	Sandy loam and clay loam
Mean annual rainfall	850 mm	850 mm	850 mm
Major crops	Paddy and chilli	Paddy and chilli	Paddy, chilli and cotton

Kalari

Melamadai

Kombuthi

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a) Rainfall trend of the district

Historical Trends in Rainfall		Decadal Average		
		1990-2000	2000- 2010	2010-2015
No. of rainy days		414	416	278
No. dry spells during *kharif* season	> 10 days	77	75	21
	> 15 days	51	50	16
	> 20 days	36	37	0
No. of intensive rain-spells	> 60 mm per day	29	48	11

1. Predominant farm enterprises

(a) Cropping pattern:

(i) Major cropping systems:

- Rainfed paddy cultivation followed by chilli / cotton
- Paddy, cotton and chilli

(ii) Area and productivity of major crops:

Crop	Kalari		Melamadai		Kombuthi	
	Area (ha)	Yield (kg/ha)	Area (ha)	Yield (kg/ha)	Area (ha)	Yield (kg/ha)
Paddy	309	3750	245	3815	138	3910
Cotton	30	1250	15	1150	13	1125
Foxtail millet	26	950	-	-	-	-
Finger millet	18	750	10	725	15	710
Sorghum	5	1500	-	-	-	-

(b) Predominant varieties of major food crops in the village

Crop	Name of variety/ hybrid(s)	No. of farmers using improved varieties/ hybrids	Area under improved varieties/ hybrids (ha)
Rice	Anna-4, ADT-45, NLR 34449 – Improved varieties	Melamadai – 25 farmers Kombuthi – 68 farmers	Melamadai – 40 ha area Kombuthi -125 ha area

(c) Cropping intensity (%) : 100

(d) Horticulture: Crops, area and productivity of each crop – Kalari village

Crop	Area (ha)	Yield (q/ha)	Name of variety/ hybrid(s)	Area under improved varieties/ hybrid (ha)
Chilli	66	1575	Local	-
Brinjal	23	7000	Local	-
Tomato	10	6500	PKM1 & Private Hybrids	5
Cluster bean	7	3000	Pusa Naubahar	5.5

Horticulture: Crops, area and productivity of each crop – Melamadai village

Crop	Area (ha)	Yield (q/ha)	Name of variety/ hybrid(s)
Chilli	35	1615	Local
Brinjal	12	350	Local

Horticulture: Crops, area and productivity of each crop – Kombuthi village

Crop	Area (ha)	Yield (q/ha)	Name of variety/ hybrid(s)
Chilli	40	1575	Local
Brinjal	15	340	Local

*There is no other horticultural crop is being cultivated at above said NICRA villages.

(e) Area under fodder cultivation (ha) and number of farmers growing green fodder

Kalari	0.5 ha and 1 farmer
Melamadai	1ha and 2 farmers
Kombuthi	0.5 ha and 2 farmers

(f) Major source(s) of irrigation

Village	Source of irrigation	Area (ha) under irrigation
Kalari	Rainfed tanks	4
Melamadai	Rainfed tanks -2 Farm ponds-3	10 5
Kombuthi	Rainfed tanks -2	10

(g) Micro-irrigation

Micro-irrigation	Area (ha)	No. of farmers
Drip	1	5

(h) Livestock

Livestock type	Total numbers	No. of livestock owners	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Small ruminants	759	72	5	Foot and mouth	40	20-30
Large ruminants	65	15	-	-	-	-
Poultry	560	52	-	-	-	-

(i) Milk productivity (litres/milch animal/day)

- **Cross breed :** 10
- **Indigenous :** 5

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(j) Inland fisheries: Practiced or not?: Yes – in community farm ponds

Quantity of fish production/year from different source : 0.2ha – 200 kg fish

(k) Other enterprises: Nil

2. Resource availability

(a) Status of common pool resources (CPRs): Nil

(b) NRM structures

Name of NRM structure	Numbers	Storage capacity (cu.m)	Number of farmers benefited	Protective irrigation potential*	Status (Defunct/ effectively used)
Farm pond	3	1350	24	3	Effectively used
Open well	2	-	10	2	
Check dam	3	200	Mass	3	

**two protective irrigation at a depth of 5 cm per irrigation*

(c) Status of farm mechanization before start of NICRA:

Tractor: 01, power tiller: 02, Seed drill: 01

3. Socio-economic status

(a) No. of households

Category	Kalari	Melamadai	Kombuthi
General	13	-	-
OBC	67	175	145
SC	70	105	55
Total	**150**	**280**	**200**

(b) Literacy rate (%): Male: 75 – 78 %, Female: 60 - 70%

(c) Land holding pattern

Category	Kalari	Melamadai	Kombuthi
	No. of families	No. of families	No. of families
Marginal	120	45	125
Small	23	75	18
Large	7	5	7

(d) Workers engaged in agricultural activities (%): 88

(e) Insurance coverage (numbers): Crop insurance/livestock insurance *etc.*,

Type of insurance	No. of farmers
Livestock	35

Actual weather of the village during project period

The climatic/weather data pertaining to Kalari village during the project period has been collected, analyzed and is as follows:

Year	Normal rainfall (mm)	Total rainfall (mm) (Jan-Dec)	Rainy days (No.)	Dry spells> 10-15 days (No.)	Dry spells> 15 days (No.)	Highest rainfall intensity events (> 60 mm) (No.)	Water inundation floods> 10 days (No. of events)	Rainfall (mm)		
								Khairf	*Rabi*	Summer
2011	817.11	850	60	0	0	0	0	113	576	161
2012		664.5	49	6	3	3	0	0	565.5	99
2013		494	64	6	5	2	0	0	398	71
2014		786	81	6	4	5	0	30	596	160
2015		919.25	84	3	4	1	0	99	556.25	264

Module I: Natural Resource Management

This module consists of interventions related to *in-situ* moisture conservation, water harvesting and recycling for supplemental irrigation, soil health management, compost and check dams.

NRM Structures: Six farm ponds and one check dam were constructed in 2011-12 and in 2014-15, 3 community pond/tank were repaired/ renovated, cleaning/desilting of two drainage channels was carried out in 2012-12 and 2013-14 and 18 micro irrigation systems adopted in the year 2014-15 (Table 151).

Table 151: Inventory of NRM structures

Structures/Years of Construction	Category	2011-12	2012-13	2013-14	2014-15	2015-16	Total
No. of farm ponds	Constructed	3	-	-	3	-	**6**
Community pond/tank	Repaired/ Renovated	1	-	-	2	-	**3**
No. of Check dams	Constructed	1	-	-	-	-	**1**
Drainage Channel	Cleaning /desilting	-	1	1	-	-	**2**
Others (Specify)							
Micro irrigation systems (use of Mini portable sprinkler units for supplemental irrigation in dry chilli and pulses)		-	-	-	18	-	**18**

Farm ponds: Five farm ponds of different dimension (m) ranging from 28.2 × 21.2 × 2.0 to 35.6 × 21.6 × 1.8 with a water storage capacity varying from 1187 to 1380 m^3 were constructed in the village under the project. About 3674 m^3 of water was harvested and 12.42 ha area was brought under protective irrigation for rice and chilli crops. The crop production and net income of the farmers has increased by giving supplemental irrigation to late *rabi* season to summer crops.

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Soil Management

Soil Health Card: About 290 soil samples from all the farm holdings in the NICRA operational area were collected and analysed for major, secondary and micro nutrients. All the farm holder have been issued with the soil health card with crop specific advisories on soil fertility management. The summary of results for the village as range are presented in table 152.

Table 152: Summary of results of soil testing across the village

Particulars	Range	Mean	Remarks
pH (1:2)	4.17-8.32	6.245	Medium
Electrical conductivity (dsm^{-1})	0.036-0.277	0.1565	Medium
Organic carbon (%)	0.15-1.2	0.675	Medium
Nitrogen ($mg\ kg^{-1}$)	24.3-194.4	109.35	Low
Phosphorus ($mg\ kg^{-1}$)	0.6-41.5	21.05	High
Potassium ($mg\ kg^{-1}$)	18-255	136.5	High
Calcium ($mg\ kg^{-1}$)	75-2150	1112.5	Medium
Magnesium ($mg\ kg^{-1}$)	72-580	326	Medium
Sulphur ($mg\ kg^{-1}$)	1.4-61.1	31.25	Medium
Iron ($mg\ kg^{-1}$)	5.2-208.9	107.05	Medium
Manganese ($mg\ kg^{-1}$)	3.4-47.7	25.55	Medium
Zinc ($mg\ kg^{-1}$)	0.25-1.84	1.045	Low
Copper ($mg\ kg^{-1}$)	0.06-2.47	1.265	Low

Module II: Crop Production

This module consists of seed hardening techniques in paddy, gypsum application and daincha in paddy under nutrient management.

Nutrient Management

Seed hardening technique: The demonstration of seed hardening technique was carried out in 25.6 ha area covering 8 participating farmers. Paddy (ADT 45) variety treated with 1% KCL recorded an higher yield of 4950 kg/ha compared to local variety 3795 kg/ha with a B: C ratio of 2.94 and 2.23 respectively. The additional net income of Rs. 11,325/ha was obtained as profit by adopting a seed hardening technique and supplemental irrigation with MPS practices in 2011-12 (Table 153).

Table 153: Performance of KCL-as a seed hardening technique, supplemental irrigation with MPS

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	ADT 45	25.6	8	4950	32675	2.94
FP	local	-	-	3795	21350	2.23

Gypsum application and paddy with daincha: Paddy variety ADT 45 with gypsum application recorded a higher yield of 5445 kg/ha as compared to farmers practices (without gypsum application) 45.12 kg/ha with a B: C ratio of 1.62 and 1.39 respectively. Rice with daincha recorded the higher yield of 5690 kg/ha as compared to rice without daincha recording only 4250 kg/ha with a B: C ratio of 1.69 and 1.31 respectively. Application of gypsum increased the yield of the paddy crop by 20.7 % and paddy with diancha by 33.9 % (Table 154).

Table 154: Performance of gypsum application and rice with daincha in paddy crop (2011-12)

Treatments	Variety	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo : With Gypsum application	ADT 45	5445	18291	1.62
FP : Without Gypsum application		4512	10373	1.39
Demo : Rice with Daincha		5690	19033	1.69
FP : Rice without Daincha		4250	8250	1.31

PPFM spray in Melamadai village, Thirupulani block: In Ramanathapuram district paddy is the major crop cultivating nearly 1,17,000 ha. The district received only 86-149 mm of rainfall during September - November and due to failure of North –East monsoon, severe drought was observed in Ramanathapuram district in 2014-15. Among the Eleven blocks, the area under paddy cultivation in Thirupulani block was nearly 5653 ha. To save the crop from drought and to reduce the moisture stress, PPFM spray (200 ml /acre) twice was carried out in Thirupulani block (Table 155).

Impact: The farmers were satisfied about the technology and requested to provide PPFM at subsidy cost through State Department Agriculture.

Table 155: PPFM spray in Melamadai village, Thirupulani block

Sl.No.	Village	No. of farmers	Area covered (acre)
1	Pukkulam	30	29.5
2	Kalari	14	24
3	Malankudi	13	19
4	Kulapatham	13	16
5	Kannangudi	16	19
6	Mallal	12	16.75
7	Panaikulam	6	8.5
8	Melacheethai	3	2
9	Ekkakudi	13	18.75
10	Kothankulam	11	20.75
11	Melamadai	24	19
12	Kombudhi	27	26
13	Alangulam	19	30
	Total	**189**	**249.25**

Module III: Livestock and Fisheries

Under this module use of community land for fodder production during droughts/floods, Animal nutrition and fodder enrichment, Supplementation of mineral and vitamin mixture during lean period and improved shelter are the activities demonstrated in NICRA villages.

Fodder production: Cumbu Napier was grown in 0.19 ha area covering 6 farmers. The green fodder is being fed to the milch animals and getting higher milk yield and returns.

Animal nutrition and fodder enrichment: Supplementation of mineral and vitamin mixture during lean period was carried out for 3 Eves and 1 Buck benefitting 3 farmers in the year 2011-12 and in 2014-15 and 105 cattles in 2014-15 beneffiting 55 farmers. The weight of the animals has been increased.

Improved shelter: Slatted floor housing was constructed for 4 goats for one farmer in 2011-12 and fish culture was carried out in farm pond of one farmer. The weight of the goats has been increased from 2 to 3.2 kg/month when compared to conventional rearing.

Module IV: Institutional Intervention

The module consists of institutional interventions either by strengthening the existing ones or initiating new ones relating to seed bank, fodder bank, commodity groups, custom hiring centre, training programmes under capacity building and extension activities for the benefit of farmers.

Custom Hiring Center

Under this intervention, 423 farmers benefitted by covering 435.64 ha area with the implements/machines hired from the CHC. The revenue generated from these implements during the year 2012-16 was Rs. 70,902/- (Table 156). This has helped the farmers to avail the required equipments/machines at reasonable hire charges in the village itself to complete the farm operation in time and at low cost.

Table 156: Performance of custom hiring center for farm implements and machinery

Year	Area covered (ha)	No. of farmers using implement	Revenue generated from CHCs (Rs)
2011-12	0	0	0
2012-13	1	5	2500
2013-14	188.8	391	50800
2014-15	4.84	19	700
2015-16	241	8	16902
Total of 5 years	**435.64**	**423**	**70902**

Capacity Building

The KVK organised training programmes on different need based aspects with apparent objective of making the farmers of NICRA villages potential human resources and make their agricultural practices climate resilient.

A total of 65 capacity building programmes were conducted in different thematic area during the year 2011-16 under NICRA *viz*., Agricultural meteorology, IPM, Hi tech horticulture, Soil

fertility management, Fish culture, Livelihood management for farm women, Organic agriculture, Exposure visit on animal husbandry, Exposure visit on crop production technology for horticulture and forage crops and Exposure visit on farm mechanization. A total of 1777 farmers including 1057 male farmers and 720 farm women have benefitted from these programme (Table 157).

Table 157: Capacity building (HRD) programmes (2011-2016)

Sl. No.	Thematic area	No. of Courses	No. of participating farmers		
			Male	Female	Total
1	Agricultural Meteorology	10	194	111	305
2	IPM	6	97	51	148
3	Hi Tech Horticulture	9	113	106	219
4	Soil Fertility Management	6	77	63	140
5	Fish Culture	1	16	8	24
6	Livelihood Management for Farm Women	15	281	233	514
7	Organic Agriculture	2	44	18	62
8	Exposure visit on Animal Husbandry	1	23	2	25
9	Exposure visit on Crop Production technology for Horticulture and Forage crops	7	140	55	195
10	Exposure visit on Farm Mechanization	8	72	73	145
Total		**65**	**1057**	**720**	**1777**

Extension Activities: In order to create mass awareness about the climate resilient technologies, large numbers of extension activities were organised by KVK under NICRA at KVK farm and in the NICRA village. The major extension activities organised are Agro advisory services, Field day, Diagnostic visits, Exposure visits, Method demonstration and Group discussion. All together 255 extension programmes were organised in which 2290 farmers and 1258 farm women have participated.

Table 158: Extension activities organized under NICRA (2011-2016)

Sl. No.	Name of the activity	Number of programmes	No. of participating farmers		
			Male	Female	Total
1	Agro advisory services	60	56	29	85
2	Field day	4	129	52	181
3	Diagnostic visits	116	603	339	942
4	Exposure visits	15	216	149	365
5	Method demonstration	15	448	241	689
6	Off campus trainings	25	475	275	750
7	Group discussion	20	363	173	536
Total		**255**	**2290**	**1258**	**3548**

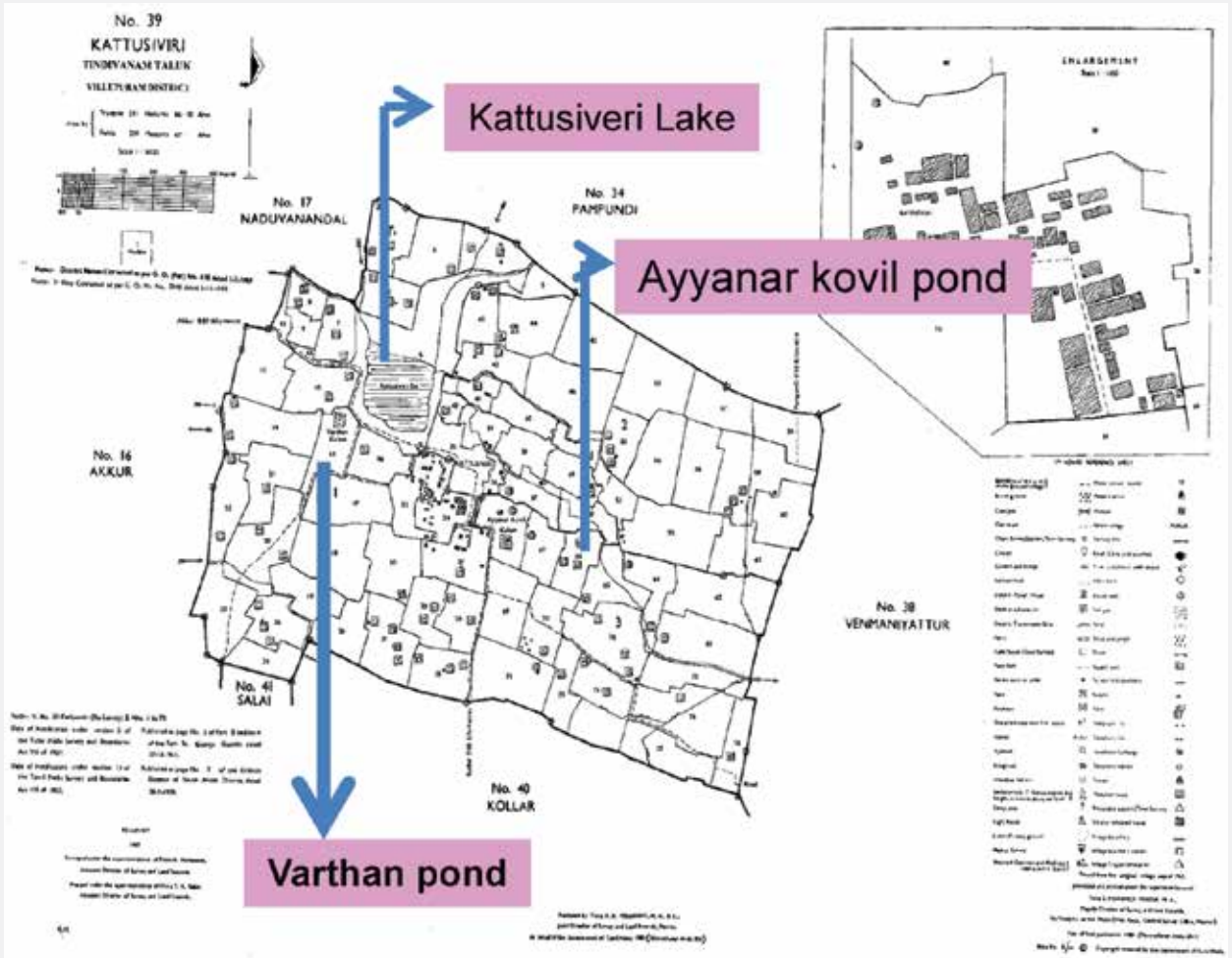
KVK, VILLUPURAM

Villages name: Kattusiviri, Naduvananthal, Agoor and Pampoondi cluster of villages

Climatic vulnerability

Villupuram district is basically agrarian and has bimodal pattern of rainfall. The district is prone for cyclical drought. The NICRA village is selected by the KVK is a true representative of the district. The village has wetland, garden land and dry land systems. The village is noted for erratic monsoon. Bulk of precipitation is received in the North East monsoon as has been for the district. The village suffers due to intense heat during summer. The crops raised during *kharif* and summer face intermittent drought. Due to the effects of temperature, the livestock suffer heavily during summer.

Name of the village	:	Kattusivri, Naduvanathal, Agoor and Pampoondi
District	:	Villupuram
No. of households	:	1468
Total cultivated area	:	836.7 ha
Major soil types	:	Sandy clay loam
Mean annual rainfall	:	1067 mm
Major crops	:	Paddy, groundnut and sugarcane
Climatic vulnerability:		Drought



a) Rainfall trend of the district

Historical trends in rainfall		Decadal average		
		1980-90	1990-2000	2000-2010
No. of rainy days		49.0	51.0	53.0
No. of dry spells during *kharif* season	10 days	1.0	1.0	2.0
	15 days	1.0	1.0	1.0
	20 days	1.0	1.0	1.0
No. of intensive rain spells	> 60 mm per day	1.0	4.0	2.0

1) Predominant farm enterprises

a) Major cropping systems: Sugarcane,paddy,groundnut or pulses grown in rotation

b) Area and productivity of major crops:

Crop	Area (ha)	Yield (q/ha)
Paddy	214.1	47.2
Sugarcane	106.9	957.0
Groundnut	244.0	246.8
Black gram	29.4	6.1

c) Predominant varieties for major food crops in the village

Crop	Name of variety/ hybrid(s)	No. of farmers using improved varieties/ hybrids	Area under improved varieties/ hybrids (ha)
Paddy	White ponni, ADT-37	170	124
Groundnut	VRI-2,TMV-13	125	90
Black gram	VBN-3, VBN-6, VBN-7	57	29

d) Cropping intensity (%) : 71

e) Horticulture: Crops, area and productivity of each crop

Crop	Area (ha)	Yield (q/ha)	Name of variety / hybrid(s)	Area under improved varieties/ hybrid (ha) in the village
Mango	5.2	33.6	Bangalora, Banganapalli	1.2
Brinjal	11.0	60.12	Ujala, Bhavani	4.0
Jasmine	8.7	50.8	CO-1, CO-2	3.0
Artemisia	1.0	10.0		
Tuberose	105.0	60.0	Suvasini	25.0

f) Area under fodder cultivation (ha) and number of farmers growing green fodder: 9 ha and 70 farmers.

g) Major source(s) of irrigation:

Source of irrigation	Area (ha) under irrigation
Open well	492.8
Ponds	58.0
Village tank	22.1

h) Micro-irrigation:

Micro irrigation	Area (ha)	No. of farmers
Drip	29.2	43
Sprinkler	5	5

i) Livestock:

Livestock type	Total No.	No. of livestock owners	Share of improved breeds	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Small ruminants	1720	281	Nil	PPR	6	3
Large ruminants	1505	197	55	FMD	53	12
Poultry	6400	273	100	Ranikhet	100	8

j) Milk productivity (litres/milch animal/day): 8

k) Inland fisheries: Practiced or not?: 1 No

l) Other enterprises: Sheep rearing

2) Resource availability

a) Status of common pool resources (CPRs):

CPR	Area (ha) or Numbers	Current status* (before start of NICRA)
Grazing land	519.4	Effectively used
Water bodies (no.)	891	

b) NRM structures:

Name of NRM structure	No's	Storage Capacity (m^3)	No. of farmers benefited	Protective Irrigation potential* (ha)	Status (Defunct/ effectively used)
Farm pond	15	127635.18	16	71	Effectively used
Village tank	13	8475.52	24	89	
Open well	451	2270	485	674	

c) Status of farm mechanization before start of NICRA:

Tractor: 12, Power tiller: 02, Seed drill: 01

3) Socio-economic status

a) No. of households

Category	Number
General	36
OBC	1345
SC	58
ST	29
Total	**1468**

b) Literacy rate (%): Male: 84, Female: 66.75

c) Land holding pattern:

Category	No. of Families
Marginal (<1 ha)	175
Small (1-2.5 ha)	899
Large (>5 ha)	209

d) Workers engaged in agricultural activities (%) : 86

e) Insurance coverage (numbers): Crop insurance/livestock insurance *etc*:

Type of insurance	No. of farmers
Crop	60

Actual weather of the village during project period

The climatic/weather data pertaining to Kattusiviri village during the project is as follows:

Year	Normal rainfall (mm)	Total rainfall (mm) (Jan-Dec)	Rainy days (No.)	Dry spells> 10-15 days (No.)	Dry spells> 15 days (No.)	Highest rainfall intensity events (> 60 mm) (No.)	Water inundation floods> 10 days (No. of events)	Rainfall (mm)		
								Khairf	*Rabi*	Summer
2011	1058.0	936.5	45	4	8	2	0	428	373.5	135
2012		957.5	48	5	8	2	0	352	595	10.5
2013		1158.1	53	3	6	2	0	731.8	362.75	63.5
2014		1095.75	51	5	7	2	0	502	459.5	134.25
2015		1262.5	55	5	4	5	1	322.5	940	0

Module I. Natural Resource Management

This module consists of interventions related to *in-situ* moisture conservation, water harvesting and recycling for supplemental irrigation, soil health management, crop mulching, compost and renovation of community tanks.

NRM Structures: Five farm ponds were constructed in Kattusiviri village of Villupuram district in the year 2011-12 and one community tank was renovated in the year 2014-15 under NICRA project (Table 159).

Table 159: Inventory of NRM structures

Structures/Years of Construction	Category	2011-12	2014-15	Total
No. of farm ponds	New	5	-	**5**
Recharging of injection wells	New	5	-	**5**
Community tank	Renovated	-	1	**1**

Farm ponds: Five farm ponds were constructed with the dimension of 30 × 28 × 2 m. The water storage capacity of the farm pond was 1680 m^3 and an area of 5 ha was brought under protective irrigation during 2011-2015 (Table 160). Water could not be stored for longer time due to high seepage loss and the stored water was utilized only for three months during *rabi* season.

Impact: Farm pond collects and stores the excess runoff water which led to increased water level to a minimum of 2.9 m and a maximum of 5.6 m in surrounding open wells. The average cropping intensity has been increased by 43 % because of the farm pond. An additional annual income of Rs.24,000/- was also realized through fish culture from each farm pond.

Table 160: Details of farm pond and their capacity

No. of Farm ponds	Year	Total Amount of water stored in farm pond (m^3)	Area brought under protective irrigation (ha)	Cultivation of crop with area (ha)	No. of Supplemental irrigationgiven in *rabi* season
5	2012	4000	2	Groundnut -0.8	4
				Paddy -1.2	6
5	2013	4000	0.4	Paddy -0.2	3
				Sugarcane -0.2	1
4	2014	4000	0.6	Paddy-0.4	3
				Sugarcane-0.2	1
4	2015	4000	2	Paddy -1.6	8
				Groundnut – 0.4	4

Broad Bed and Furrow: During the year 2012-13, 2013-14, 2014-15 and 2015-16, seventy farmers were benefitted by adopting broad bed furrow method in vegetable crops such as bhendi, bottle gourd and snake gourd covering an area of 11.5 ha. Broad bed furrow technology has recorded higher yields when compared to farmers practice (Table 161). Broad bed furrow retained more water for longer period and which led to less moisture stress during non rainy days. During 2015-16 vegetable area under broad bed and furrow method has been extended up to 10 ha in NICRA village.

Table 161: Impact of broad bed furrow on soil and moisture conservation and yield of crops

Year	Participating farmers (No.)		Area covered (ha)		Crop yield (kg/ha)				Percent increase in yield over control	Cost of intervention per hectare (Rs.)
					I T		C			
	I T	C	I T	C	Crop	Yield (kg/ha)	Crop	Yield (kg/ha)		
2012-13	5	5	2	2	B	13695	B	12820	6.83	7000
2012-13	10	10	1	1	BG	39442	BG	36970	6.69	6200
2013-14	10	10	3	3	B	13716	B	12928	6.10	7400
2013-14	15	15	1.5	1.5	SG	37832	SG	35772	5.76	6400
2014-15	10	10	2	2	BG	36000	BG	34050	5.51	6600
2015-16	20	20	2	2	BG	34200	BG	31800	7.01	6600

I T: Broad bed furrow, C: Without Broad bed furrow, BG: Bottle gourd, SG: Snake gourd, B:Bhendi

Crop mulching: Crop mulching was demonstrated by 30 farmers in Kattusiviri village with an area coverage of 4 ha. This technology has recorded higher yield when compared to farmers practice. Adoption of polythene mulching in vegetable crops conserve the soil moisture and controls the weed growth. Thereby 3 irrigations and 2 weedings were reduced. An average yield increase of 36.64 % was achieved (Table 162).

Table 162: Effect of crop mulching on moisture and organic carbon content

Crop	No. of participating farmers		Area covered (ha)		Crop yield (kg/ha)		Increase in yield (%)
	I T	C	I T	C	I T	C	
Brinjal (PLR2) : 2014-15	10	10	1	1	28000	16000	75.00
Bitter gourd (Co1): 2014-15	10	10	1	1	13000	10500	23.81
Chillies: 2015-16	10	10	2	2	10000	9000	11.11

IT: Crop mulching, C: Control

Brinjal: The demonstration of brinjal Cv.PLR 2 was carried out in 2 ha area covering 20 farmers with drip cum fertigation. The technology recorded an higher yield of 23524 kg/ha when compared to farmers practices (Sevanthampatti local variety-20128 kg/ha) with a B:C ratio of 3.70 and 3.19, respectively (Table 163). By adopting this technology farmer extended 1 acre of cropping area with judicious use of water and fertilizer. Lesser weed competition was observed in drip installed field.

Table 163: Drip irrigation and fertigation in brinjal (2012-13)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	PLR-2	2	20	23524	137314	3.70
FP	Local	-	-	20128	110546	3.19

Chilli: The demonstration was carried out in 1.05 ha area covering 3 farmers. Chilli cv. Co-4 with drip cum fertigation did not perform superiod to the farmers practice of private hybrids. The demo recorded 10533 kg/ha as compared to private hybrid13540 kg/ha with a B: C ratio of 2.66 and 2.83, respectively (Table 164).

Table 164: Drip irrigation and fertigation in chilli (2012-13)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	Co-4	1.05	3	10533	92093	2.66
FP	Private hybrid	-	-	13540	122527	2.83

Soil Health Card as monitoring tool: Nearly 1200 soil samples were collected from all the farm holdings in the NICRA cluster of villages, analysed for major, secondary and micro nutrients. All the farm holders have been issued with the soil health cards with crop specific advisories for the soil fertility management. The average results for the village as range values are presented in table 165.

Table 165: Summary of results of soil testing across the village

Particulars	Range	Mean	Remarks
pH (1:2)	4.17-8.32	7.19	Neutral
Electrical conductivity (dsm^{-1})	0.036-0.277	0.4	Normal
Nitrogen (mg kg^{-1})	24.3-194.4	118.2	Low
Phosphorus (mg kg^{-1})	0.6-41.5	21.9	Medium
Potassium (mg kg^{-1})	18-255	246.8	High

Preparation of compost: Sixteen farmers demonstrated vermi compost unit by producing 32.91 tonnes and applied to an area of 65.83 ha.An average production of 2 tonnes of vermicompost per individual was achieved and satisfied their own demand which reduced the cost of cultivation by Rs.4000/-. Application of vermicompost improved the soil structure and added nutrition to the plants.

Rainwater Management

Renovation of community tanks: Desilting, channel clearing (400 m) and formation of baby pond (80x40x1.55m) in Kattusiviri community tank was done which benefitting 175 farmers and water storage was increased from 0.74 Mcft to1.86 Mcft (Table 166).

Impact: Water storage capacity of the community tank has been increased to 1.12 Mcft. Cropping intensity has been increased by 38 % in Kattusiviri village. Water table level was increased up to 6 ft in nearby open wells (62 No's) within 1.5 km radius. The water stored in baby ponds was utilized as drinking water for cattle during summer season.

Table 166: Total water storage capacity created in the NICRA village

Name of structures constructed / repaired	Investment (Rs.)	No. of farmers benefitted	Water storage capacity (m^3)		Protective irrigation potential created (ha)	Area under cultivation (ha)		Cropping intensity (%)
			Before	After		Before	After	
						Rabi		
Desilting, channel clearing of community pond and formation of baby pond	6,55,000	175	0.74 Mcft	1.86 Mcft	23.2	5	23.2	38

Module II. Crop Production

This module consists of drought tolerant varieties, short duration varieties, advancement of planting dates, intercropping system, nutrient management, broad bed furrow method and drip fertigation.

Introduction of drought tolerant variety

Paddy (Anna-4): The demonstration was carried out in 15 ha covering 38 farmers. The drought tolerant paddy variety Anna-4 has recorded a higher yield of 4087 kg/ha when compared to farmers practices (ADT 39). The year-wise results are presented in table 167.

Table 167: Performance of drought tolerant paddy variety Anna 4

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2011-12	Demo	Anna 4	10	25	4037	50932	2.51
	FP	ADT 39	-	-	3144	33800	2.02
2012-13	Demo	Anna 4	1	5	4120	51560	2.53
	FP	ADT 39	-	-	3258	36080	2.09
2013-14	Demo	Anna 4	4	8	4104	51640	2.51
	FP	ADT 39	-	-	3250	34860	2.02
Total / Average	**Demo**	**Anna 4**	**15**	**38**	**4087**	**51377**	**2.52**
	FP	**ADT 39**	-	-	**3217**	**34913**	**2.04**

Groundnut (TMV-13): The demonstration was carried out in 6 ha area covering 22 farmers in 2012-13 to 2014-14.

The drought tolerant groundnut variety TMV-13 has recorded a higher yield of 1172 kg/ha when compared to farmers practice(961 kg/ha) with a B: C ratio of 1.64 and 1.37, respectively (Table 168).

Table 168: Performance of drought tolerant groundnut variety TMV-13

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2012-13	Demo	TMV-13	1	5	1392	31722	1.84
	FP	Local	-	-	1068	16214	1.43
2013-14	Demo	TMV-13	2	5	1022	16598	1.48
	FP	Local	-	-	868	9708	1.29
2014-15	Demo	TMV-13	3	12	1102	20780	1.61
	FP	Local	-	-	946	13542	1.40
Total / Average	**Demo**	**TMV-13**	**6**	**22**	**1172**	**23033**	**1.64**
	FP	**Local**	**-**	**-**	**961**	**13155**	**1.37**

Sesame (TMV (Sv) 7): The demonstration was carried out in 4 ha area covering10 farmers. The drought tolerant sesame variety TMV (Sv) 7 has recorded a higher yield of 722 kg/ha when compared to farmers' practices (647 kg/ha) with a B: C ratio of 2.36 and 2.15, respectively in 2012-13 (Table 169).

Table 169: Performance drought tolerant sesame

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	TMV (Sv) 7	4	10	743	21700	2.40
FP	Local cultivar	-	-	621	16040	2.10

Impact: Introduction of drought tolerant paddy variety Anna 4, groundnut variety TMV-13 and sesame (TMV-7) performed well in Kattusiviri village under drought condition and recorded higher yield than local varieties. At present 30 per cent of the groundnut area was occupied by TMV-13 drought tolerant variety.

Introduction of short duration varieties

Black gram (VBN 5): The demonstration was carried out in 5.6 ha area covering14 farmers. The short duration black gram cv.VBN-5 recorded a higher yield of 465 kg/ha when compared to farmers practices of VBN-2 (420 kg/ha) with a B:C ratio of 1.18 and 1.09, respectively in 2011-12 (Table 170).

Table 170: Performance of short duration black gram variety (VBN-5) resistant to YMV

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	VBN-5	5.6	14	465	3466	1.18
FP	VBN-2	-	-	420	1710	1.09

Black gram (VBN-6): The demonstration was carried out in 14 ha area covering 70 farmers. The short duration black gram cv.VBN-6 recorded marginally higher yield of 688 kg/ha when compared to farmers' practice of VBN-2 (677 kg/ha) with a B: C ratio of 1.77 and 1.75, respectively (Table 171).

Table 171: Performance of short duration and YMV resistant black gram variety VBN-6

Year	Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
2012-13	Demo	VBN 6	4	20	700	11250	1.47
	FP	VBN 2	-	-	600	7470	1.33
2013-14	Demo	VBN 6	2	10	739	17640	1.92
	FP	VBN 2	-	-	672	14560	1.76
2014-15	Demo	VBN 6	8	40	737	17066	1.87
	FP	VBN 2	-	-	640	12710	1.66
Total / Average	**Demo**	**VBN 6**	**14**	**70**	**725**	**15319**	**1.75**
	FP	**VBN 2**	**-**	**-**	**637**	**11580**	**1.58**

Black gram (VBN-7): The demonstration was carried out in 4 ha area covering 20 farmers. The short duration black gram cv.VBN 7 recorded a higher yield of 725 kg/ha when compared to farmers' practice of VBN-2 (637 kg/ha) with a B: C ratio of 1.75 and 1.58, respectively in 2014-15 (Table 172).

Table 172: Performance of short duration and YMV resistant black gram (2014-15)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	VBN-7	4	20	650	13332	1.70
FP	VBN-2	-	-	623	12464	1.67

Green gram (VRM (Gg) 1): The demonstration was carried out in 4 ha area covering 20 farmers. The short duration green gramvariety VRM (Gg)-1 recorded a higher yield of 791 kg/ha when compared to farmers' practice of VBN-1 (665 kg/ha) with a B: C ratio of 2.19 and 1.86, respectively in 2012-13 (Table 173).

Table 173: Perfromance of short duration green gram (VRM (Gg) 1) resistant to mosaic and stem borer (2012-13)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	VRM (Gg)-1	4	20	820	18550	1.82
FP	VBN-1	-	-	630	9000	1.50

Pigeon pea (CORG 7): The demonstration was carried out in 4 ha area covering 10 farmers in 2014-15. The short duration pigeon pea cv.CORG-7 recorded a higher yield of 731 kg/ha when compared to farmers' practices of cultivating VBN-1 (669 kg/ha) with a B: C ratio of 2.25 and 2.13, respectively (Table 174).

Table 174: Performance of short duration pigeon pea variety CORG-7

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	CORG-7	4	10	731	24354	2.25
FP	VBN-1	-	-	669	21268	2.13

Impact: In pulses, short duration varieties *viz.,* blackgram (VBN 6 and VBN 7), green gram (VRM (Gg) 1) and pigeon pea(CORG 7)were widely adopted as a remunerative crop varieties. Adoption of short duration variety helped to escap terminal drought and avoids crop loss.

Advancement of planting dates

Paddy (ADT-49): The demonstration was carried out in 2 ha area covering 5 farmers in 2014-15. Advancement of planting by 10 days with paddy cv. ADT-49 recorded a higher yield of 5044 kg/ha when compared to farmers' practice of normal planting date with ADT-39 (4088 kg/ha) with a B: C ratio of 3.07 and 2.51, respectively (Table 175).

Impact: In paddy, advancement of planting date by 10 days during Samba recorded lesser incidence of stem borer. Hence, the yield increased by 956 kg / ha in ponni. At present 45 per cent of the paddy farmers advance their sowing and planting date during Samba season.

Table 175: Advancement of planting dates of *rabi* crops in areas with terminal heat stress

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	ADT-49	2	5	5044	70670	3.07
FP	ADT-39	-	-	4088	51620	2.51

Varietal evaluation

Groundnut (Co-6): The demonstration was carried out in 1ha area covering 5 farmers in 2014-15. The drought tolerant groundnut cv.Co-6 recorded a higher yield of 1284 kg/ha when compared to farmers' practice of growing local variety (1033 kg/ha) with a B: C ratio of 1.87 and 1.53, respectively (Table 176).

Table 176: Introduction of drought tolerant groundnut variety Co-6

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	Co-6	1	5	1284	29880	1.87
FP	Local varieties	-	-	1033	17892	1.53

Bottle gourd (PLR-2): The demonstration was carried out in 1ha area covering 10 farmers in 2014-15. The bottle gourd cv. PLR-2 recorded a substantially higher yield of 28000 kg/ha when compared to farmers' practice of cultivating private hybrids (16000 kg/ha) with a B: C ratio of 2.30 and 1.70, respectively (Table 177). This demonstration gave a suitable alternative to private hybrids in the village.

Table 177: Introduction of bottle gourd variety PLR-2 (2014-15)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Vegetable yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	PLR-2	1	10	28000	87400	2.66
FP	Private hybrid	-	-	26500	78250	2.44

Bitter gourd (Co-1): The demonstration was carried out in 1ha area covering 10 participating farmers in 2014-15. The bitter gourd cv. Co-1 recorded a yield of 12282kg/ha, which was found superior to farmers' practice of cultivating private hybrids (9388kg/ha) with a B: C ratio of 2.25 and 1.75 respectively.In Kattusiviri village area has been increased to 5 ha under bitter gourd variety Co-1 during 2015-16 (Table 178).

Table 178: Introduction of bitter gourd variety Co-1 (2014-15)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Vegetable yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	Co 1	1	10	12282	68276	2.26
FP	Private hybrid	-	-	9388	40096	1.75

System of Rice Intensification (SRI)

White Ponni: The demonstration was carried out in 0.51 ha area covering three farmers in 2013-14. The paddy cv. Ponni under SRI method of cultivation recorded a higher yield of 4217 kg/ha when compared to farmers practices with ADT-39 variety (3600 kg/ha). The B: C ratio was also superiod with demo (2.00) as compared to farmers' practice (1.49) (Table 179). Alternate wetting and drying in SRI system recorded more number of tillers and was less prone to lodging. White ponni variety performed well under SRI method and currently 55 % of the paddy farmers following SRI technology.

Table 179: Performance of SRI cultivation of white ponni

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	Ponni	0.5	3	5650	42300	2.0
FP	ADT 39	-	-	4780	23850	1.49

Intercropping System

Groundnut (TMV-13) +Pigeon pea (CORG 7): The demonstration was carried out in 50 ha area covering 50 farmers. The intercropping of groundnut + pigeon pea system has recorded a yield of 1102 kg/ha and 253 kg/ha respectively when compared to farmers practice of sole groundnut recording only 946 kg/ha with a B: C ratio of 2.05 and 1.40, respectively (Table 180). The farmers have obtained additional revenue from the intercrop of pigeon pea.

Table 180: Introduction of short duration pigeon pea as intercrop (2014-15)

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Intercrop yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	TMV-13 and CORG-7	50	50	1102	253	35960	2.05
FP	TMV-13	-	-	946	-	13542	1.40

Nutrient Management

Black gram: Demonstration on application of pulse wonder in black gram (VBN 3) was carried out in 2.4 ha area of 12 farmers in 2014-15. The technology recorded a higher yield of 720 kg/ha when compared to farmers practice with the B: C ratio of 1.80 (Table 181). Application of pulse wonder in black gram during flowering stage recorded higher pod set and 16 % higher yield when compared to farmer practice. Now, the NICRA pulses growing farmers widely adopted this technology for yield enhancement.

Table 181: Introduction of pulse wonder in black gram

Treatments	Variety	Area covered (ha)	No. of participating farmers	Seed yield (kg/ha)	Net returns (Rs./ha)	Benefit cost ratio
Demo	VBN-3	2.4	12	720	15936	1.80
FP	VBN-2	-	-	601	10770	1.56

Demo: Pulse wonder application **FP: without any application**

Module III. Livestock and Fisheries

Under this module animal health camp, vaccination, use of community lands for fodder production, animal nutrition and fodder enrichment are the activities carried out from 2012-2016 in NICRA villages.

Animal health camp and vaccination: Vaccination was given to 123 animals against PPR disease in 2012-13, 394 animals against PPR and FMD disease in 2013-14 and 300 animals against PPR disease in 2014-15 and 500 birds were vaccinated against RDVK in 2015-16.

Fodder production: Napier grass (CoCN 4) was grown in 0.4 ha area benefitting 2 farmers. The green fodder yield of about 6 t/ha/season was obtained by each farmer and there was an increase in milk (4.3 l/day) by feeding this fodder when compared to without intervention (3.3 l/day) in 2011-12. Maize, fodder cowpea, stylo, agathi, cenchrus, horse gram, fodder sorghum and desmanthus were the other fodder crops grown in 12.2 ha area benefitting 358 farmers in 2012-13. In 2013-14 mixed fodder production was carried out in 11.8 ha area. Azolla was produced in 20 units yielding 4.44 t /year in 2012-13 and in 6 units in 2014-15. In 2014-15 fodder maize was grown in 1.4 ha area. Anjan grass, stylosanthes and desmanthes were grown in 5.6 ha area in 2015-16. Over all these interventions enhanced production of green fodder and milk production in the village (Table 182).

Table 182: Fodder production

Year	Crop	Area (ha)	No. of participating farmers	Green fodder yield (t/ha/season)	Milkyield (liters/day)	
					1*	2**
2011-12	Napier	0.4	2	6	4.3	3.3
2012-13	Maize	0.5	13	9	4.3	3.5
2012-13	Fodder cow pea	2	50	45	-	-
2012-13	Stylo	2.5	65	75	-	-
2012-13	Agathi	2	100	180	-	-
2012-13	Cenchrus	1.5	40	48	-	-
2012-13	Horse gram	1.2	35	10	-	-
2012-13	Fodder sorghum	2	50	80	-	-
2012-13	Desmanthus	0.1	3	4	-	-
2013-14	Mixed cropping	11.8	-	250-300	-	-
2013-14	Azolla	20 units	-	4.44 t/year	-	-
2014-15	Fodder maize	1.4	-	35	4	3
2015-16	Anjan Grass	2.5	25	19 t/year		
2015-16	Stylosanthes	2.5	25	25t/ year		
2015-16	Desmanthes	0.6	8	102 t/year		
2015-16	Azolla	6 units	-	-	-	-

*** With intervention** ****Without intervention**

Animal nutrition and fodder enrichment: Supplementation of mineral and vitamin mixture was carried out for 19 cattle of 10 farmers in 2011-12, feed supplementation was carried out for 400 cattle of 153 farmers in 2012-13. There was an increase in 12.5-25 % in milk production in 2012-13.Feeding of salt lick was carried out for 400 goats and achieved 5-10% increase in milk production in 2013-14. Mineral mixture supplementation was carried out for 300 and 157 cattle respectively in 2013-14 and 2014 -15 and an average increase of milk yield by 250-400 ml/day was achieved. Feeding of TANUVAS GRAND for low yielding cattle was demonstrated during 2015-16 (Table 183).

Impact: Animal nutrition and fodder enrichment helped in increasing the milk production, meat yield of nandanan IV chicken and the mortality of poultry bird was completely stopped.

Table 183: Animal nutrition and fodder enrichment

Year	Activity	Participating farmers (No.)	Type of animals	No. of animals benefited	Economic impacts
2011-12	Supplementation of mineral and vitamin mixture	10	Goat	19	-
2012-13	Food supplements	153	Cattles	400	12.5-25 % increase in milk production
2013-14	Salt lick	-	Goat	400	5-10% increase in milk production
2013-14	Mineral mixture	-	Cattle	300	-
2014-15		-	Cattle	157	-
2015-16	TANUVAS GRAND	550	Cattle	125	5% increase in milk yiled Occurrence of SARA –Nil
2015-16	RDVK Oral pellet vaccine	20	Nandanam- 4 Chicken	500	Mortality- Nil
2015-16	Cages for Backyard Poultry farming	8	-	8	Mortality - Nil
2015-16	Nandanam IV Chicken	20	Nandanam - 4 Chicken	-	Egg yield/bird/year –140 Meat weight/bird –2.26 kg

Module IV. Institutional Intervention

The module consists of institutional interventions either by strengthening the existing ones or initiating the new ones relating to seed bank, fodder bank, commodity groups, custom hiring centre, capacity building and extension activities for the benefits of farmers.

Custom Hiring Center: Under this intervention, 104 farmers benefitted by covering 46 ha area under mechanization using the implements/machines from the CHC. Rent of the equipments varied from the type of the equipment. The revenue generated from these implements during the year 2012-16 was Rs.17325/- (Table 184). By availing farm implements from NICRA custom hiring centre, Kattusiviri farmers taken up their farming activities timely.

Table 184: Performance of custom hiring center for farm implements and machinery

Year	Area covered (ha)	No. of farmers using implement	Revenue generated from CHCs (Rs)
2011-12	0	0	0
2012-13	8.8	19	0
2013-14	10	17	4425
2014-15	0	0	0
2015-16	27.2	68	12900
Total of 5 years	**46**	**104**	**17325**

Seed Bank: The farmer and rural youth in NICRA village are engaged in seed production activity especially in groundnut (TMV-13), blackgram (VBN 6) and greengram (Co 8). These are getting higher profit than conventional grain production farmers in the village. The local seed demands are being fulfilled by the seed bank activity besides ensuring timely availability of seeds to farmers in the village itself.

Capacity Building

The KVK organised training programmes on different need based aspects with apparent objective of making the farmers of NICRA villages potential human resources and make their agricultural practices climate resilient.

A total of 112 capacity building programmes were conducted in different thematic area during the period 2011-16 under NICRA *viz.* Crop management, Employment generation, Nutrient management, Farm implements and machineries, Fodder and feed management, Live stock management, Natural resource management, Soil health and Nutrient management, Pest and disease management and Crop diversification. A total of 2099 farmers including 1470male farmers and 629 farm women have participated in these HRD Programmes (Table 185).

Table 185: Capacity building (HRD) programmes organized under NICRA (2011-2016)

Thematic area	No. of Courses	No. of participating farmers		
		Male	Female	Total
Crop Management	21	337	170	507
Employment Generation	14	144	88	232
Nutrient Management	2	35	7	42
Farm Implements and Machineries	12	97	15	112
Fodder and Feed Management	4	23	8	31
Live Stock Management	13	187	96	283
Natural Resource Management	22	354	110	464
Soil Health and Nutrient Management	8	85	36	121
Pest and Disease Management	14	181	80	261
Crop Diversification	2	27	19	46
Total	**112**	**1470**	**629**	**2099**

Extension Activities

In order to create mass awareness about the climate resilient technologies, large number of extension activities were organised by KVK under NICRA at KVK farm and in the NICRA village. The type of extension activities organised are Agro advisory services, Field days, Mass campaign, Diagnostic visits, Exposure visits, Method demonstrations and Group discussions. All together 415 extension activities were organized during the period 2011-2016. A total of 4808 farmers including 3394 male farmers and 1459 farm women have taken part in these activities (Table 186).

Table 186: Extension activities organized under NICRA (2011-2016)

Sl. No.	Name of the activity	Number of programmes	No. of participating farmers		
			Male	Female	Total
1	Agro advisory services	111	117	33	150
2	Field day	11	180	99	279
3	Mass campaign	22	564	359	923
4	Diagnostic visits	63	114	45	159
5	Exposure visits	11	185	61	246
6	Method demonstration	43	423	128	506
7	Off campus trainings	112	1470	629	2099
8	Group discussion	42	341	105	446
Total		**415**	**3394**	**1459**	**4808**

KERALA

KVK, ALLEPPEY

NICRA Village: Muttar

Climatic Vulnerability

Water logging, acidity and salinity.

Village and resources

The major occupations of the people of the village are agriculture, livestock, poultry and duck rearing. Rice is the main crop in the area followed by coconut, banana and vegetables. Due to flood and unseasonal rains, raising of only one crop of paddy is possible in the village. The demographic details of the village show that 58.5 % of the farmers are having marginal land holdings with an annual income of rupees one lakh.

No. of households : 2743

Total cultivated area : 940 ha

Major soil types : Clayey Alluvial soils, Clay soils

Mean annual rainfall : 2809 mm

Major crops : Coconut, Paddy, Banana, Vegetables

Climate vulnerability : Water logging, acidity and salinity

Average family income from agricultural and allied activities

Category	No. of families	Annual income (Rs/family)
Landless	20 (0.74%)	12000
Marginal (< 1 ha)	1575 (58.50%)	109181
Small (1-2 ha)	648 (24.06%)	110348
Medium (2-10 ha)	450 (16.70%)	239632

The village is located at the eastern part of Kuttanadu region sharing the boundary with Thalavadi, Payippad, Peringala, Veliyanadu and Ramankary villages (Fig.1). Basic details of the village are presented in table.

Basic details of the village

Number of households	2743
Total cultivated area	970 ha
Major soil types	Clayey Alluvial soils, Clay soils
Mean annual rainfall	2809 mm
Major crops grown	Coconut, Paddy, Banana, Vegetables

The major production systems in the village are based on paddy, coconut, dairy, poultry and fisheries. Paddy cultivation is done in 750 ha consisting of 28 groups of paddy fields known as padasekharams. The average productivity of paddy was 4.66 t/ha, which is higher than the district average. This is mainly due to the deposition of fertile soil from the uplands during monsoon season. The major crops in the area are coconut, banana and vegetables. The details of area and production were given in the table.

Area and productivity of major crops

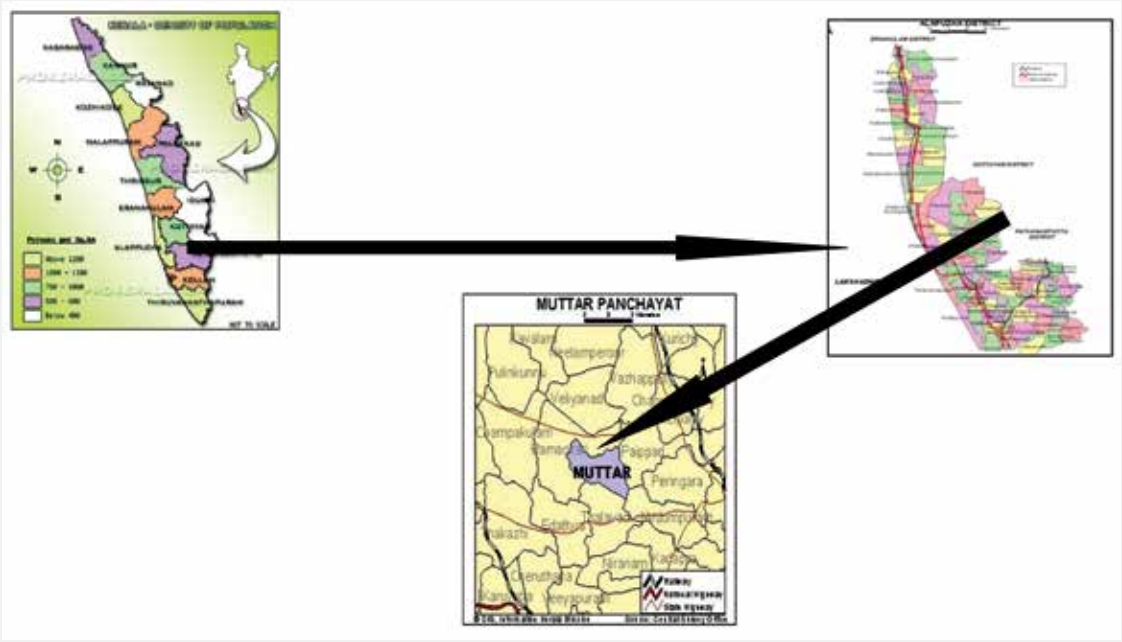
Crop	Area (ha)	Yield (q/ha)
Paddy	750	46.6
Banana	40	149
Coconut	150	8350 nuts/ha
Vegetables		
i) Cowpea	8	120
ii) Cucurbits	2	48

Muttar village is rich in animal population also. The major allied enterprises in the village are dairy, poultry, buffalo and goatary. The details of livestock available in the village are given in table. Inland fisheries are also practiced by the farmers in the small ponds of homesteads.

Details of livestock in Muttar village

Livestock type	Total number	No. of livestock owners	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)
Small ruminants	500	211	80	Enteritis, Endoparasites	Nil
Large ruminants	489	161	95	Mastitis, Anorxia	88-89
Poultry	12000	562	90	Duck Plague, Pasterelosis, Ranikhet disease	50
Buffallo	18	13	70		Nil
Rabbits		264	100	Fungal disease	Nil

The entire village has a network of canals for dewatering during the monsoon period. This canal water is used for irrigation during summer season for crops.



Location of the project village

Rain fall pattern: The project area receives monsoon rainfall from both South-West and North –East monsoon periods. June, July, September and October months receives maximum rainfall. The historical rainfall trends shows that there was more than 130 rainy days with intensive rainy days of 7-11. The historical rain fall trend is given in table.

Trend in the rainfall pattern of Muttar village

Historical trends in rainfall		Decadal average	
		1990-2000	2000- 2010
No. of rainy days		151	134
No. of dry spells during *kharif* season	> 10 days	14	11
	> 15 days	7	5
	> 20 days	5	5
No. of intensive rain-spells	> 60 mm per day	11.0	8.0

Actual weather of the village during project period

The climatic/weather data pertaining to Muttar village during the project period are collected, analyzed and is as follows:

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells >10-15 days (No.)	Dry spells >15 days (No.)	Highest rainfall intensity events (> 60 mm) (No.)	Water inundation floods> 10 days (No. of events)	Rainfall (mm)		
								Khairf	*Rabi*	Summer
2011	2928.3	2473.8	119	7	2	3	2	353.5	1232.9	887.4
2012		1898.4	87	3	1	5	2	279.2	1189	430.2
2013		2614	122	0	4	9	3	1956.7	336.1	321.2
2014		2327.9	120	1	3	10	2	105.4	1573	649.5
2015		2484.6	113	3	1	3	2	394.8	1112.5	977.3

Module I. Natural Resource Management

This module consists of interventions related soil health management and compost.

Soil Health Management

Soil Health Card as monitoring tool: Soil samples from both situations upland (145 samples) and wetland (55 samples) were collected and analysed for all the major, secondary and micro nutrients and soil helath cards were provided to all the farm holdings with advisories to each of the major crops. The range of values in each systems is given in the table 187.

Table 187: Summary of results of soil testing across the village (200 soil samples were analyzed)

(i) Upland (145 Samples)

Particular	Range	Mean	Remarks
pH (1:2)	3.79 - 7.30	5.05	Acidic
Electrical conductivity (dsm^{-1})	0.01 - 1.58	0.03	Low
Organic carbon (%)	0.19 - 5.76	0.81	Medium
Nitrogen ($mg\ kg^{-1}$)	7.15 – 214.4	30.22	Low
Phosphorus ($mg\ kg^{-1}$)	0.18– 92.05	9.38	Medium
Potassium ($mg\ kg^{-1}$)	2.7 –324	32.25	Low
Sulphur ($mg\ kg^{-1}$)	0.06 – 0.55	0.33	Low
Iron ($mg\ kg^{-1}$)	2.26 – 44.04	27.09	High
Manganese ($mg\ kg^{-1}$)	00.08 – 15.12	3.32	High
Zinc ($mg\ kg^{-1}$)	0.18 – 2.88	0.70	Medium
Copper ($mg\ kg^{-1}$)	0.03 - 3.60	0.57	Low
Boron ($mg\ kg^{-1}$)	0.02 - 0.10	0.06	Low

(ii) Wetland/ paddy lands (55 Samples)

Particular	Range	Mean	Remarks
pH (1:2)	3.46 - 6.20	4.65	Strongly acidic
Electrical conductivity (dsm^{-1})	0.05 - 1.37	0.25	Low
Organic carbon (%)	0.55 – 2.76	2.04	High
Nitrogen ($mg\ kg^{-1}$)	20.34 – 102.63	76.03	Low
Phosphorus ($mg\ kg^{-1}$)	0.13 – 3.39	2.28	Low
Potassium ($mg\ kg^{-1}$)	3 – 67.20	18.40	Low
Sulphur ($mg\ kg^{-1}$)	0.06 – 0.55	0.32	Low
Iron ($mg\ kg^{-1}$)	17.593 – 35.88	33.06	High
Manganese ($mg\ kg^{-1}$)	1.73 – 6.87	5.51	High
Zinc ($mg\ kg^{-1}$)	0.19 – 0.99	0.95	Low
Copper ($mg\ kg^{-1}$)	0.39 – 1.78	1.15	Low
Boron ($mg\ kg^{-1}$)	0.03 – 0.99	0.45	Low

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Composting

Large scale composting of aquatic weeds using EM solution for crop production

Paddy cultivation is possible in the village only during one season (November- March) and during the remaining period paddy fields are water logged leading to the multiplication and accumulation of aquatic weeds like water hyacinth. For preparing the paddy fields for cultivation, these weeds are to be cleared every year. As part of NICRA, technology demonstrations were conducted in convergence with MGNREGS for converting/recycling these collected weeds to compost by using EM solution. The semi dried water weeds were heaped in beds of size 5 x 2 x 2 m (20 m^3) with alternate layers of weeds and cow dung, sprinkled with EM solution. Composting was completed by 45 days. The compost thus prepared was utilised for the cultivation of banana and vegetables by the women SHGs.

Impact: The technology had a significant impact in the region which converted a menace into wealth. During 2014-15, Muttar Panchayath was the only one in the district where the removal of aquatic weeds was allowed as an activity under MGNREGS as it was effectively converted into compost. Based on this, the district agency has initiated projects under MGNREGS for the effective recycling of the removed aquatic weeds in other panchayaths also.

Table 188: Impact of composts to ecosystem

Year	No. of participating farmers	Quantity of compost produced (t)	Application of compost - Area covered (ha)
2014-15	100	25	45.1
2015-16	350	65	117.1

Recycling of organic residues for energy generation and crop production using portable biogas units

Dairy farming is one of the major allied enterprises in Muttar village having an animal population of about 500 dairy cattle and 489 goats. Most of the dairy farmers owned only marginal land holdings (less than 0.1 ha) and economic utilization of organic wastes like cow dung and left over feed materials for crop production is not possible. Hence, a technology demonstration was conducted on the use of portable biogas units for recycling the residues for energy generation integrated with crop production utilizing the slurry. Portable biogas plants of one cubic liter capacity was demonstrated to 58 farmer partners during 2011-16. The slurry obtained from the portable biogas unit was utilized for crop production by the partner farmers.

Major benefits of the demonstration were

(1) Saving in LPG use for cooking (Av.2 hrs/day/unit)

(2) Effective recycling of organic wastes

(3) Additional production of banana, vegetable and/or fodder grass

(4) Less use of chemical inputs

(5) Organic production of homestead crops

(6) Reduction in the emission of green house gases

Impact : The technology of converting organic wastes to biogas was very successful and spread among the farmers of the district. Several local self government bodies included portable biogas units in their schemes and many units were installed in different parts of the district. This created awareness about the cleanliness of surrounding and importance of safe to eat vegetable production in homesteads in addition to biogas production.

Module II. Crop Production

This module consists of introduction of high yielding short duration variety of paddy with integrated crop management and mechanization, site specific integrated nutrient management, integrated pest and disease management, intercropping system, poly bag cultivation of tissue culture banana, rain shelter cultivation of vegetables to overcome flooded situations and mushroom production.

Varietal demonstration

Paddy (Prathyasa): Paddy variety 'Prathyasa' (105-110 days duration) was demonstration in 1.8 ha area covering 41 farmers during the year 2011-12. This variety performed better than farmers existing varieties in the village under integrated crop management technology followed as under:

Nutrient Management

Site specific integrated nutrient management

- ✓ Fifty five soil samples were collected from the paddy fields at the time of land preparation covering all the 41partner farmer's fields.
- ✓ The soil samples were analyzed for the pH, EC, macro and micro nutrients.
- ✓ Based on the soil analysis, application of lime was recommended @ 600 kg/ha in two splits, first as basal and second as top dressing at 30th day after sowing.
- ✓ Recommendations for N, P and K were given for individual fields based on soil test.
- ✓ Seed treatment with biofertilizers viz., **Azospirillum** and **Phosphobacterium** were taken up @ 2.5kg/ha for reducing the application of chemical fertilizer.
- ✓ Leaf Colour Chart (LCC) was used for scheduling nitrogenous fertilizer application.

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Integrated Pest and Disease Management

IPDM in Paddy: Prathyasa variety recorded an average grain yield of 6.9 t/ha with a net income of Rs. 61800/ha and B: C ratio of 2.48 (Table 189). The higher yield was attributed to the ICM practices followed for the crop.

Table 189: Biometric and yield observations and economics of Prathyasa variety

Parameter	Prathyasa	Check
Plant height (cm)	93.85	72.6
No. of plants/m^2	157	240
No. of productive tillers/m^2	675	720
Panicle length (cm)	22.5	19.5
No of grains/panicle	175	145
100 gram wt (g)	3.02	2.8
Yield (t/ha)	6.9	5.61
Cost of cultivation (Rs./ha)	41700	39455
Gross income (Rs./ha)	103500	84150
Net income (Rs./ha)	61800	44695
B:C ratio	2.48	2.13

Integrated Pest and Disease Management in Coconut: Like in other parts of the state, the major pest and disease problems faced by the coconut farmers in the village were incidence of leaf rot disease and red palm weevil attack. Hence, a technology demonstration on the integrated management of these pest and diseases was undertaken. **1078 infected coconut palms** (178 palms during first year and 900 palms in second year) were identified by involving the members of coconut producers' society in the village. Farmers were trained in identifying the affected palms based on symptoms and thereby adopting timely management measures. Coconut climbers in the village were trained and engaged for crown cleaning and treating the palms against leaf rot disease and applying prophylactic measures against rhinoceros beetle and red palm weevil.

Activities conducted

- ✓ Group meeting of coconut farmers for identification and treating of infected palms
- ✓ Trainings on IPDM in coconut
- ✓ Method demonstrations on the following items were conducted in a participatory mode

  i) Crown cleaning – Coconut crowns were cleaned twice a year during pre and post monsoon period to prevent the leaf rot disease. The dried coconut leaves, spathe and other dried parts were removed

  ii) Removal of leaf rot affected spindle – the affected portions of the spindle were removed to avoid further spread of the disease

iii) Leaf axil filling – the innermost leaf axils were filled with neem cake – sand mixture in equal proportion as a prophylactic measure against Rhinoceros beetle.

iv) Chemical application – 2 ml hexaconasole in 300 ml water was applied in the affected portions

Among the treated palms the disease incidence was reduced considerably from 14.24 % to 4.4 %. Total cost of application was Rs.40/palm and the return after one year was Rs.100/palm through additional nuts.

Resource conserving and eco friendly technologies for climate resilience in paddy cultivation:

(Mechanization, Site specific integrated nutrient management and Eco-friendly Integrated Pest and Disease Management)

(i) **Mechanization:** In order to highlight the use of machineries in paddy cultivation, the use of drum seeder was demonstrated for seeding in comparison to broadcasting usually followed by farmers. The seed requirement in eight row wet land paddy seeder (Drum seeder) was about 50 kg/ha where as in direct sowing the seed requirement was 150 kg/ha.

(ii) **Site specific integrated nutrient management:** Soil test based dolomite and fertilizer application was adopted.

(iii) **Eco-friendly Integrated Pest and Disease Management:** Seed treatment and foliar application of *Pseudomonas*, Use of trichocards, fish amino acid etc.were adopted.

These demonstrations had been spread over an area of 118.2 ha in 5 years with the participation of 161 farmers (Table 190). The technologies are also getting spread to the adjoining villages through farmer to farmer contacts and different parts of the district through the demonstrations of Department of Agriculture and ATMA with the technical support of KVK.

Table 190: Details of demonstration for five years

Year	Location	Area (ha)	Number of partners
2011-12	10 different locations	18	41
2012-13	Kalayankary padasekharam	13.2	22
2013-14	Mulavanakary padasekharam	13	13
2014-15	20 different locations	30	38
2015-16	20 padasekharams	44	47
Total		**118.2**	**161**

The crop performed better in all aspects of growth and economic grain production leading to substaially higher returns to the farmers under technology demonstration. The results are presented in table 191.

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Table 191: Growth and yield performance of demonstrations from 2012-13 to 2014-15

Parameter	2012-13		2013-14		2014-15	
	Demo	Check	Demo	Check	Demo	Check
Plant height (cm)	99.1	90.6	102.25	84.63	103.2	95.9
No. of plants/m^2	50	250	50	220	50	228
No. of productive tillers/m^2	792	650	756	660	779	627
Panicle length (cm)	21.1	20.3	20.4	19.75	21.6	19.6
No of grains/panicle	208	174	154	133	189.5	151.5
100 gram wt (g)	2.75	2.61	2.4	2.3	2.52	2.33
Yield (t/ha)	5.76	4.5	7.13	6.75	6.76	5.98
Cost of cultivation (Rs./ha)	45009	47900	44575	50663	56928	64556
Gross income (Rs./ha)	97918	76500	135280	128250	127848	113620
Net income (Rs./ha)	52909	28600	90705	77587	71635	48093
B:C ratio	2.17	1.59	3.03	2.53	2.28	1.76

Table 192: Quantity and cost of inputs for demonstration and check (per ha)

Sl. No.	Item/Particulars	Demonstration		Check	
		Quantity (kg/ha)	Cost (Rs.)	Quantity (kg/ha)	Cost (Rs.)
1.	Seeds	30	1200	150	6000
2.	Lime	600	6000	100	1000
3.	Fertilizers				
i	Factomphos	250	4725	250	4725
ii	Urea	37.5	201	100	536
iii	Potash	25	423	80	1352
4.	Bio agents				
i	Pseudomonas	2 l solution + 3.5 kg powder	945	1.5 kg powder	105
ii	Trichocards	30 cards	1500	-	-
5.	Chemical pesticides				
i	Ekalux	Nil		750 ml	412
ii	Karate	Nil		625 ml	625
6.	Weedicides	200 ml	1634	300 ml	2450
7.	Fungicides	Nil		1000 ml	650
	Total		**16628**		**17855**

Impact: These demonstrations could make a significant impact in the paddy farmers of Kuttanad region in terms of reduced use of seeds, fertilizers and plant protection chemicals, leading to reduced green house gas emission and environmental pollution, and enhanced climate resilience in addition to the higher net profit obtained from paddy cultivation as detailed in the table 193.

Table 193: Impact of resource conserving and eco-friendly technologies on input use/economics of paddy cultivation

Sl. No.	Item	Technology adoption	Conventional farming	Savings in cost due to adoption	
				(Rs/ha)	Total (118 ha)
1	Seeds (kg/ha)	30	125	3800	4,48,400
2	Fertilizer (kg/ha) (Urea/ Factomphos/ Potash)	312	430	1264	1,49,152
3	Harvest time (hrs/ha)	3.8	7.6	6460	7,62,280
4	**Net Profit (Rs/ha)**	**86163**	**55715**	**30448**	**35,92,864**

Intercropping System

Intercropping short duration cassava in coconut gardens to overcome water logging: Vellayani Hraswa, a short duration cassava (5-6 month's duration) released by Kerala Agricultural University was demonstrated in 38 partner farmers plots in an area of 1.3 ha. The yield of the demonstration plots were higher compared to the local check and the farmers were satisfied with the short duration variety. The results are presented in table 194.

Table 194: Growth, Yield and Economics of short duration cassava variety (Rs. /ha)

Variety	Area covered (ha)	No. of Participating farmers	Duration (Months)	Yield (t/ha)	Net Return (Rs. /ha)	BCR
Vellayani Hraswa	1.3	38	5.5	21.9	127236	2.35
Local	-	-	8	12	44486	1.59

Rain shelter cultivation of vegetables to overcome flooded situations: The vegetable crops performed well in the rain shelters and the farmers got a satisfactory yield. An average yield of 109.4 kg was obtained per unit from 40 poly bags in a year (Table 195). The farmers were able to cultivate safe to eat vegetables around the year even in the flooded conditions during the monsoon ensuring the nutritional security. The farmers were convinced much about the cultivation of vegetables in rain shelters.

Table 195: Yield and economics of rain shelter cultivation

Farmer Name	Treatments	Variety	Seed yield (kg/unit)	Net returns (Rs./ unit)	Benefit cost ratio
Jojan George	Demo	Bhendi, Tomato, Chilli, Brinjal, Cowpea, Spinach, Cabbage, Cauliflower	150	1350	1.48
Maniyamma	Demo	Bhendi, Tomato, Chilli, Spinach, Kanthari	125	1905	1.75
Salimma Luke	Demo	Tomato, Chilli, Cabbage, Cauliflower, Bhendi	65	1950	2.26
Suresh Kumar	Demo	Cowpea, Bhendi, Tomato, Brinjal, Chilli, Cabbage, Cauliflower	120	1900	1.81
Georgekutty	Demo	Tomato, Chilli, Bhendi, Spinach, Brinjal	85	1000	1.50
Construction of rain shelter (cost of poles, VU sheets, coir, poly bags, potting mixture, labour charges *etc.*,				Rs. 6886	
Operational cost/year (seedling cost, fertilizers and manures, plant protection, labour *etc.,)*				Rs. 2250	

Impact: Because of the wide publicity given through popular articles and meetings with line departments, more than 50 rain shelter units were constructed in the districts with the support of department of agriculture, ATMA and State Horticulture Mission.

Poly bag cultivation of tissue culture banana: The demonstration plots recorded a yield of 45 t/ha with a B: C ratio of 2.49 compared to local check of 34 t/ha and BC ratio of only 1.66. Farmers were convinced about the poly bag planting, in which the banana crop escapes the flood during the initial growth period. Moreover the tissue culture plants will get more attention in initial growth period. The results of the demonstrations are presented in table 196.

Table 196: Poly bag cultivation of tissue culture banana for overcoming flood during initial growth stages

Year	Treatments	Area covered (ha)	No. of Participating farmers	Yield (t/ha)	Net income (Rs./ ha)	BCR
2013-14	Demo	25	50	45.0	503262	2.49
	Check	-	-	34. 0	252787	1.66

Mushroom production and marketing for income generation: The paddy crop being a major crop of the village, paddy straw is available in sufficient quantities. Cultivation of mushroom on the paddy straw was found to be a better way of utilization of available paddy straw and the farmers could obtain a reasonable income in addition to the nutritional security and self employment. The farmers jointly marketed their produce in one brand name as – "Muttar fresh" mushroom. There was a production of 2.7 t mushroom/year. The gross return from a unit of 15 beds/ month was Rs.2250 with a B: C ratio of 2.2.

Outcome

- ✓ Employment generation of 1275 man days/year
- ✓ Production of 2.7 tons mushroom/year
- ✓ Quantity of paddy straw used – 4.5 t/year
- ✓ Vermi compost production from spend mushroom waste- 5 -6 q / year
- ✓ Mushroom spawn production -125 pkts /month with a B:C ratio of 2.2

Module III. Livestock and Fisheries

Under this module integrated duck and fish farming, animal health camp and vaccination, use of community lands for fodder production during droughts/floods, local breed upgradation, animal nutrition and fodder enrichment and improved shelter are the activities carried out in the NICRA villages.

Integrated duck and fish farming: Introduced the integrated duck-fish farming system at homestead level as a viable option for sustainable livelihood and food security. Low cost duck sheds were erected at the edges over the ponds with PVC pipes and locally available materials. 25 units were established in homestead ponds. A unit accommodated 20 ducks and fingerlings at 75 Nos./cent. Production of 4300 eggs/year from a unit of 20 ducks and 125 kg fish/unit of 10 cents with a net return of Rs.20397 /- and B:C ratio of 1.86 could be achieved through this activity.

Animal health camp and vaccination: Animal health camp and vaccination was carried out in Alleppey, in which 233 farmers benefitted from automatic vaccinator for duck and poultry, use of disinfectant solution to prevent diseases and animal health camp (Table 197).

Impact: Mortality in the duck rearing units significantly reduced by the vaccination programmes conducted by KVK using automatic vaccinator.

Table 197: Animal health camp and vaccination

Activity	No. of participating farmers	No. of animals/birds treated	Other dept. associated	Vaccination against disease	Remarks
Automatic vaccinator for Duck and	20	Ducks - 40000		Duck Plague	Mortality rate of ducks reduced to 7.5 % against 20-50 % in normal cases.
Poultry	80	Poultry-800	-	Pasteurelosis and Ranikhet	Mortality reduced from 53% to 13%. Empowered 12 women farmers to use this for own purposes as well as providing service to others.
Use of Disinfectant solution to prevent diseases	43	95	-	FMD and mastitis	Incidence of FMD and mastitis was not reported from the cow shed after using disinfectant solution
Animal Health Camp	90	130	Milma		Provided treatment for infertility and distributed medicines and mineral mixture

Fodder production: Fodder production was carried out in the NICRA village. Napier grass was grown in 0.65 ha area covering 27 farmers and yielded green fodder of about 700 t / ha /season.

Local breed upgradation: Local breed up gradation was carried out in the NICRA village in which 25 farm women were benefitted from Gramapriya - poultry breed.

Impact: Owing to the different interventions in poultry, the average no of bird stock per unit increased from 9.2 to 22 and the mortality rate was reduced from 53 % to 13% from 2011-12 to 2014 – 16. The average egg production increased by 231% (2684 from 810/per year/unit). Each household could obtain a net return of Rs.3682/- annually compared to Rs.432/-before. Thus, these interventions resulted in almost self sufficiency of egg production and a decent income to the families of Muttar village with minimum investments and efforts

Animal nutrition and fodder enrichment: Animal nutrition and fodder enrichment was carried out in the NICRA village. Rumen bypass fat was given to cattle and there was 26.29 % increase in milk production per lactation. Paddy straw enriched and made block was given to cattle and there was 2.08 % increase in milk

production per lactation. Feeding management and disease control programme in livestock was carried out for 33 cattle covering 23 farmers and milk production was increased by 3.87 %.

Impact: Animal population and milk production in the village increased (91 litres per day from 15 farmers to more than 200 litres per day from 25 farmers) as a result of the technology interventions and facilitation for marketing by reviving the defunct milk marketing society during 2012 with the support of Milma and Dairy Development Deptartment.

Improved shelter/housing for dairy, poultry and goatery: Improved shelter was introduced for dairy, poultry and goatery to escape from flooded situations. Model dairy units were established in the village with automatic drinking system to ensure the availability of freshwater throughout the day and rubber mat (cow mat) to reduce stress and thereby increasing the milk production. 9 dairy farmers were benefitted. In poultry, improved cages were introduced with slatted floor on GI pipes made of wire mesh and tin sheet which could escape flood. 70 farmers were benefitted from poultry housing. In goatery, the traditional sheds were replaced with well aerated improved cages made out of low cost wooden reapers erected 1m above the ground. 14 farmers were benefitted (Table 198).

Impact: Due to the improved shelters the farmers started rearing poultry and goat throughout the year. Cages on raised platform protected the birds from flood and good aeration resulted in low disease incidence. The grama panchayath have taken initiative for spreading the successful technology by approving a project for providing improved poultry cages to 20 farmers of the village.

Table 198: Improved shelter

No. of participating farmers	No. of animals	Type of housing	Remarks
9	18	Model dairy unit	4.33 % increase in milk production
70	1050	Housing for poultry	Mortality was reduced from 53 to 13 %
14	74	Housing for Goatary	Mortality reduced and net income increased from Rs.7540 to Rs.18783

Module IV. Institutional Intervention

The module consists of institutional interventions either by strengthening the existing ones or initiating new ones relating to seed bank, fodder bank, commodity groups, custom hiring centre, collective marketing group, introduction of weather index based insurance and climate literacy through a village weather station, capacity building and extension activities.

Custom Hiring Center: Under this intervention, 200 farmers benefitted by covering 149.18 ha area under mechanization using the implements and machines from the CHC. Rent of the equipments varied from the type of the equipment. The revenue generated from these implements during the year 2011-16 was Rs. 84,700/- (Table 199).

Table 199: Performance of custom hiring center for farm implements and machinery

Year	Area covered (ha)	No. of farmers using implement	Revenue generated from CHCs (Rs)
2011-12	19.4	36	7450
2012-13	23.18	40	17000
2013-14	31.4	37	41800
2014-15	31	39	14700
2015-16	44.2	48	3750
Total of 5 years	**149.18**	**200**	**84700**

Capacity Building: The KVK organised training programmes on different need based aspects with apparent objective of making the farmers of NICRA villages potential human resources with socially and financially comfortable and make their agricultural practices climate resilient.

A total of 44 capacity building programmes were conducted in different thematic area during the year 2011-16 under NICRA *viz.* Crop production, Livestock and fisheries, Farm mechanization, IPM in coconut, Feeding management, improved shelter for poultry and Mushroom production in which 461 farmers and 528 farm women were participated (Table 200).

Table 200: Capacity building (HRD) programmes organized (2011-2016)

Sl. No.	Thematic area	No. of Courses	No. of participating farmers		
			Male	Female	Total
1	Crop Production	18	237	144	381
2	Livestock and Fisheries	19	151	315	466
3	Farm Mechanization	1	10	0	10
4	IPM in Coconut	3	50	20	70
5	Feeding Management	1	7	13	20
6	Improved Shelter for Poultry	1	2	18	20
7	Mushroom Production	1	4	18	22
Total		**44**	**461**	**528**	**989**

Extension Activities: In order to create mass awareness about the climate resilient technologies, large number of extension activities were organised by KVK under NICRA at KVK farm and in the NICRA village.

The type of extension activities organised were exposure visits, method demonstrations, animal health camps, field days, group discussions etc. All together 18 extension programmes were organised for about 303 farmers and 142 farm women. The details are presented in table 201.

Table 201: Extension activities organized under NICRA (2011-2016)

Sl. No.	Name of the Activity	Number of programmes	No. of participating farmers		
			Male	Female	Total
1	Exposure visit to value addition unit	1	0	6	6
2	Method Demonstration on Automatic vaccinator	1	2	18	20
3	Animal health camp	1	32	8	40
4	World milk day celebration	1	22	16	38
5	Field day of the demonstration of ICM in paddy	1	70	23	93
6	Exposure visit of selected demonstration partners (2 days programme)	1	20	2	22
7	Exposure visit of ATMA farmers to project area from Cherthala block	1	29	8	37
8	Exposure visit of ATMA farmers to project area from Haripad block	1	10	9	19
9	Method demonstration on mushroom cultivation	1	0	6	6
10	Group discussion on TC banana cultivation and rain shelter cultivation	2	34	13	47
11	Interaction of DDG (Extn), ZPD (Zone VIII),and Director, CPCRI with demonstration partners	1	43	17	60
12	Poultry vaccination (76 poultry)	1	0	9	9
13	Vaccination for ducks (172 Ducks)	1	9	0	9
14	Method demonstration on EM compost for *insitu* composting	1	10	0	10
15	Method demonstration on trichocards	1	6		6
16	Exposure visit of goat farmers	1	2	3	5
17	Technology week at KVK	1	14	4	18
Total		**18**	**303**	**142**	**445**

SUCCESS STORIES

KVK Belgavi-I

Success of introduction of new variety of pigeon pea (TS-3R)

1.	**Name of the farmer**	:	Shri. Shankar Ramappa Jangali	
2.	**Address**			
	i) Village	:	Yadagud	
	ii) Post	:	Yadagud	
	iii) Tehsil	:	Hukkeri	
	iv) District	:	Belagavi	
	v) State	:	Karnataka	
3.	**Contact details**	:	Mobile: 09538234606	
4.	**Details of the farm (size, location, water availability *etc.*,)**	:	8 Acres,Yadagud village, water sources available for both *kharif* and *rabi* season (6 acres) and summer (2 acres) from open well	
5.	**Membership in Self-Help Group, Producers Cooperative / Company, Cooperative Society, *etc.*, (give details)**	:	Member of NICRA and Yojana Sangha Self Help group	
6.	**Names of the central sector / State Schemes utilized by the farmer and the period**	:	State Department of Sericulture scheme utilized by the farmer during 2014 for plantation of mulberry in an area of 1 acre	
7.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	:	NRM activities : Strengthening of existing bunds, Waste weires, New variety of pigeon pea TS-3R	
8.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*,)**	:	**Improved /Present Production technologies:** **Crop: Pigeon pea** Seeds(TS-3R)- 5 kg *Rhizobium*-0.2 kg PSB-0.2 kg Sulphur-6.0 kg HNPV - 100 LE Methomyl - 240 gm Thiamethoxam-80 gm H. Traps – 4 Nos. H. Lures - 12	**Traditional/Past production Practices:** **Crop: Pigeon pea** Use of local variety (Gullyal) with long duration (180-190 days). No seed treatment with biofertilizer, sulphur, yield reduction due to pod borer and pod fly, improper nutrient management and lack of knowledge on importance of soil test based fertilizer application
	i) Productivity per hectare	:	13.12 q/ha	10.25 q/ha
	ii) Cost of production (Rs./ha)	:	13,750	12,125
	iii) Net income (Rs./ha)	:	64,970	49,375
	iv) Price realized (Rs. /ton)	:	60,000	60,000
	v) Natural resources saved / conserved like soil, water *etc.*,)	:	Soil and water	Erosion of soil and water runoff
	vi) Product quality improvement	:	Improvement in seed weight, uniform seed size and good quality marketing seeds	-

9.	**Factors contributing to success**	**:**	▪ Use of wilt resistant and moisture stress tolerant variety ▪ Seed treatment with bio fertilizers ▪ Sulphur application ▪ Proper management of pest and diseases ▪ Provision of protective irrigation ▪ Soil and water conservation
10.	**Any other relevant information**	**:**	▪ Seed treatment with 2 % CaCl2 ▪ Maintenances of optimum plant population ▪ Nipping of top portion of plant at 50 DAS ▪ Foliar spray with 0.2 % Boron at 50 % flowering stage

Impact: Productivity of pigeon pea has increased upto 28% over farmers' practice by adoption of improved technologies, like medium duration variety of TS-3R, seed treatment with *Rhizobium* and PSB and calcium chloride for drought tolerant and quick germination. Application of sulphur helped in increasing seed weight. The adoption of above said technologies contributed for increased yield and income. Besides, the farmer used NICRA components like strengthening of existing bunds and waste weirs for avoiding soil and water run off losses effectively. He conserved soil and water very efficiently and achieved open well recharge. Farmer has gained additional net income of Rs. 15,595/ha over local check. Before NICRA project this farmer was cultivating only 6 acres area but after NICRA project implementation he could cultivate up to 8 acres area with extra net income.

KVK Chickballapur

Improved Agricultural Practices: Groundnut (*Kharif*), Tomato (*Rabi*) and Cucumber (Summer)

1.	**Name of the farmer**	**:**	Padal Nanjudappa S/o. Pallappa
2.	**Address**	**:**	
	i) Village	**:**	S. Raghuttahalli
	ii) Post	**:**	S. Raghuttahalli
	iii) Tehsil	**:**	Chintamani
	iv) District	**:**	Chikkaballapura
	v) State	**:**	Karnataka
3.	**Contact details**	**:**	09980930596
4.	**Details of the farm (size, location, water availability *etc.*,)**	**:**	2 ha, S. Raghuttahalli village, Bore well/ two farm ponds/open well
5.	**Membership in Self-Help Group, Producers Cooperative / Company, Cooperative Society, *etc.*, (give details)**	**:**	Member of VCRMC of NICRA
6.	**Names of the central sector / State Schemes utilized by the farmer and the period**	**:**	Constructed farm ponds under NICRA project in the year 2011-12 and State Agriculture Department scheme -Krishi Bhagya purchased mini tractor under subsidy in the year 2015-16

7.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	:	• Drip irrigation in 1 ha • Soil and water conservation (SEB) in 0.80 ha. • IPM in all crops (Pheromone traps/ neem oil / application of neem and pongamia cake) • INM in all crops (*In-situ* green manure/ compost and FYM / split application fertilizers / fertigation / mulching)	
8.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*)**	:	**Improved /Present production technologies**	**Traditional / Past production Practices**
			Groundnut (*Kharif*)	
	i) Productivity per hectare	:	13.75 q	12.45 q
	ii)Cost of production (Rs./ha)	:	21,250	21,675
	iii)Net income (Rs./ha)	:	33,750	25,635
	iv)Price realized (Rs. / ton)	:	40,000	38,000
	v) Natural resources saved / conserved like soil, water *etc.*,)	:	Soil, water conservation through SEB work/ farm pond	-
	vi) Product quality improvement	:	Increase in oil content/increase in kernel size and shape management	-
			Tomato (*Rabi*)	
	i) Productivity per hectare	:	27.50 t	22.50 t
	ii) Cost of production (Rs./ha)	:	1,87,500	1,92,850
	iii) Net income (Rs./ha)	:	6,37,500	4,37,150
	iv) Price realized (Rs./ ton)	:	30,000	28,0000
	v) Natural resources saved / conserved like soil, water *etc.*,)	:	Soil, water conservation through SEB work/ farm pond/ Drip irrigation	Drip irrigation
	vi) Product quality improvement	:	Good colour / increase size and shape/ keeping quality	-
			Cucumber (Summer)	
	i) Productivity per hectare	:	17.85 t	15.60 t
	ii) Cost of production (Rs./ha)	:	82,500	88,200
	iii) Net income (Rs./ha)	:	1,31,700	83,400
	iv) Price realized (Rs. /ton)	:	12,000	11,000
	v) Natural resources saved / conserved like soil, water *etc.*,)	:	Soil, water conservation through SEB work/ farm pond/ Drip irrigation	-
	vi) Product quality improvement	:	Increase in tenderness/ yield/ good color and size	-
9.	**Factors contributing to success**	:	Regular contact with line department / KVK Scientist/ Good utilization of Govt. scheme	

Impact: NICRA interventions on conservation of soil and water had assured timely irrigation for horticultural crops namely cucumber and tomato and *in-situ* water conservation in groundnut resulted in an additional income of Rs. 2.56 lakhs to the farmer during 2015-16. By availing the subsidy from the State Department and investing his own earnings he could purchase a tractor and also renovated his dwelling house.

Mr. Padal Nanjudappa with his pond, groundnut field and tomato field

Mr. Padala Nanjundappa with his newly purchased farm tractor

Improved Agricultural Practices: Pigeon pea (*Kharif*), Onion (*Rabi*) and Tomato (Summer)

1.	**Name of the farmer**	**:**	Umadevi W/o R.V. Munireddy
2.	**Address**	**:**	
	i) Village	**:**	S. Raghuttahalli
	ii) Post	**:**	S. Raghuttahalli
	iii) Tehsil	**:**	Chintamani
	iv) District	**:**	Chikkaballapura
	v) State	**:**	Karnataka
3.	**Contact details**	**:**	09972553885
4.	**Details of the farm (size, location, water availability etc.)**	**:**	2 ha (0.6 ha on lease), S. Raghuttahalli, two bore wells / one open well.
5.	**Membership in Self-Help Group, Producers Cooperative / Company, Cooperative Society, *etc.*, (give details)**	**:**	SHG-Sthri Shakthi Sangha- S. Raghuttahalli Member of Taluk Agriculture Produce Cooperative Marketing System, Chintamani
6.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	**:**	• Drip irrigation in 1.20 ha • Soil and water conservation (SEB) in 0.80 ha. • Application of tank silt to 1.20 ha. • Integrated pest management in all horticulture crops (Pheromone traps/ Neem oil/application of neem and pongamia cake) • INM (*in-situ* green manure / compost and FYM / split application fertilizers / fertigation / mulching) • Summer ploughing

7.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*,)**	**:**	**Improved /Present production technologies**	**Traditional / Past production practices**
			Pigeon pea (*Kharif*)	
	i) Productivity per hectare	**:**	13.37 q	12.00 q
	ii) Cost of production (Rs./ha)	**:**	16,250	17,500
	iii) Net income (Rs./ha)	**:**	40,673	30,500
	iv) Price realized (Rs. / ton)	**:**	42,500	40,000
	v) Natural resources saved / conserved like soil, water *etc.*,)	**:**	Soil, water conservation through SEB work	
	vi) Product quality improvement	**:**	Increase yield due to better geometry, increase in seed size and shape	-
			Onion (*Rabi*)	
	i) Productivity per hectare	**:**	26.30 t	23.80 t
	ii) Cost of production (Rs./ha)	**:**	81,250	87,500
	iii) Net income (Rs./ha)	**:**	2,86,950	2,17,140
	iv) Price realized (Rs. / ton)	**:**	14,000	12,800
	v) Natural resources saved / conserved like soil, water *etc.*)	**:**	Soil, water conservation through SEB work/ Drip irrigation	Drip irrigation
	vi) Product quality improvement	**:**	Good colour / increase size and shape/ keeping quality	-
			Tomato (Summer)	
	i) Productivity per hectare	**:**	26.80 t	22.10 t
	ii) Cost of production (Rs./ha)	**:**	2,07,500	2,16,200
	iii) Net income (Rs./ha)	**:**	5,96,500	4,02,600
	iv) Price realized (Rs. / ton)	**:**	30,000	28,0000
	v) Natural resources saved / conserved like soil, water *etc.*,)	**:**	Soil, water conservation through SEB work/ Drip irrigation/ contour cultivation	-
	vi) Product quality improvement	**:**	Increase in tenderness/ yield/ good color and size	-
8.	**Factors contributing to success**	**:**	Regular contact with line department/ KVK Scientist/ Good participation to agricultural training programmes.	
9.	**Any other relevant**	**:**	UAS, Bengaluru has awarded Mrs. Umadevi as Chikkaballapura District **BEST FARM WOMAN** for the year 2014-15 during Krishimela 2014	

Impact: The impact of NICRA interventions such as *in-situ* conservation of soil and water, inter cropping and *in-situ* green manuring have improved both soil condition and yield of vegetable crops, namely onion and tomato. The soil analysis before and after green manuring in vegetable crops revealed marginal improvement in soil organic carbon content and better soil N content. She has also taken up drumstick cultivation of *Var. Bhagya* in an area of 0.06 ha. An additional income of Rs. 2.74 lakhs was realized from the above crop management practices.

Mrs. Umadevi involved in cultivation of onion and tomato

Mrs. Umadevi in her drumstick garden

Improved Agricultural Practices: Finger millet (*Kharif*), Cotton seed production (*Rabi*) and Tomato (summer)

1.	**Name of the farmer**	**:**	Balannna S/o. Chinnappa
2.	**Address**	**:**	
	i) Village	**:**	S. Raghuttahalli
	ii) Post	**:**	S. Raghuttahalli
	iii) Tehsil	**:**	Chintamani
	iv) District	**:**	Chikkaballapura
	v) State	**:**	Karnataka
3.	**Contact details**	**:**	09632025125
4.	**Details of the farm (size, location, water availability *etc.*,)**	**:**	1.60 ha, S. Raghuttahalli, one Bore well/ one farm ponds/one open well
5.	**Membership in Self-Help Group, Producers Cooperative / Company, Cooperative Society, *etc.*, (give details)**	**:**	Member of VCRMC of NICRA Member of Karnataka State Seed Corporation, Chintamani
6.	**Names of the central sector / State Schemes utilized by the farmer and the period**	**:**	Purchased tractor leveler from Agriculture Department under subsidy during the year 2011-12, Tractor drawn five tyne plough in the year 2014-15

7.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	:	• Drip irrigation in 0.80 ha • Soil and water conservation (SEB) in 0.60 ha. • Tank silt application to 1.60 ha. • IPM in all crops (Pheromone traps / Neem oil / application of neem and pongamia cake). • INM (*In-situ* green manure / compost and FYM / split application fertilizers / fertigation/ mulching)	
8.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*,)**	:	**Improved /Present production technologies**	**Traditional / Past production practices**
			Finger millet (*Kharif*)	
	i) Productivity per hectare	:	24.88 q + 7.20 t fodder	22.65 q + 6.5 t fodder
	ii)Cost of production (Rs./ha)	:	21,500	22,650
	iii) Net income (Rs./ha)	:	32,708	24,778
	iv) Price realized (Rs. / ton)	:	16,000	15,200
	v) Natural resources saved / conserved like soil, water *etc.*,)	:	Soil, water conservation through SEB work	-
	vi)Product quality improvement	:	Increase in yield	-
			Cotton seed production (*Rabi*)	
	i) Productivity per hectare	:	11.25 q seed + 15.00 q fur	10.75 q seed + 13.50 q fur
	ii) Cost of production (Rs./ha)	:	2,25,000	2,40,500
	iii) Net income (Rs./ha)	:	4,23,750	3,77,750
	iv) Price realized (Rs. /ton)	:	5,50,000	5,50,000
	v) Natural resources saved / conserved like soil, water *etc.*,)	:	Soil, water conservation through SEB work/ drip irrigation	Drip irrigation
	vi) Product quality improvement	:	Increase in seed yield	-
			Tomato (Summer)	
	i) Productivity per hectare	:	25.10 t	22.34 t
	ii) Cost of production (Rs./ha)	:	72,850	76,700
	iii) Net income (Rs./ha)	:	5,04,450	4,25,950
	iv) Price realized (Rs. / ton)	:	23,000	22,500
	v) Natural resources saved / conserved like soil, water *etc.*,)	:	Soil, water conservation through SEB work/ drip irrigation	dDrip irrigation
	vi) Product quality improvement	:	Increase in shelf life/ yield/ good color and size	-
9.	**Factors contributing to success**	:	Regular contact with line department / KVK Scientist	

Impact: Various community water conservation interventions had led to improvement in water yield of the existing borewell of the farmer. Using improved water output from the borewell and adopting *in-situ* soil and water conservation practices this farmer could take up cultivation of commercial crops namely cotton seed production and tomato crop production. An additional income of Rs. 1.32 lakhs was earned and the same was utilized to replace the old tractor with a new one.

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Mr. Balananna in Finger millet field and tomato garden

Cotton seed production plot of Mr. Balanna

KVK Davanagere

Mulching offers win-win situation

1.	**Name of the farmer**	**:**	Mr.Raju S/o. Basavarajappa
2.	**Address**	**:**	
	i) Village	**:**	Siddanuru
	ii) Post	**:**	Angodu
	iii) Tehsil	**:**	Angodu hobli
	iv) District	**:**	Davanagere
	v) State	**:**	Karnataka
3.	**Contact details**	**:**	-
4.	**Details of the farm (size, location, water availability *etc.*,)**	**:**	Land holding : 1.5 acres Location : Siddanuru thannda Main source of water availability is rain
5.	**Membership in Self-Help Group, Producers Cooperative / Company, Cooperative Society, *etc.*, (give details)**	**:**	Member- PACS (Co-operative)

6.	**Names of the central sector / State Schemes utilized by the farmer and the period**	:	State Department of Agriculture, Krishi Bhagya in 2015-16
7.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	:	Farm pond, Nursery, Arecanut, Mulching with sugarcane trash
8.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*,)**	:	**Improved /Present production technologies**
	i) Productivity per hectare	:	Utilizing the saved water with mulching *rabi*/summer cotton crop was taken up in December, 2012 and harvested nearly 10 q from 1.5 acre. An additional income of around Rs.30,000 from cotton was obtained and after mulching practice, the net income from arecanut has reached Rs.60, 000/- from 2 acre
	ii) Cost of production (Rs./ha)	:	
	iii) Net income (Rs./ha)	:	
	iv) Price realized (Rs. / ton)	:	
	v) Natural resources saved / conserved like soil, water *etc.*,)	:	
	vi) Product quality improvement	:	

Impact: By looking at this method of mulching with sugarcane trash, two farmers have started this practice in their arecanut gardens. The sugarcane farmers have started charging for the trash at Rs.2000/ tractor load. From our intervention, the burning of trash had stopped and ecofriendly activities like mulching, water saving, composting have now come into practice.

Mulching of sugarcane trash in arecanut

Success of adoption of climate resilient technologies

1.	**Name of the farmer**	:	Thippesh Naik S/o. Peekya naik
2.	**Address**		
	i) Village	:	Siddanuru
	ii) Post	:	Angodu
	iii) Tehsil	:	Angodu hobli
	iv) District	:	Davanagere
	v) State	:	Karnataka
3.	**Contact details**	:	-
4.	**Details of the farm (size, location, water availability *etc.*,)**	:	Land holding : 1.6 hectares Location : Siddanuru thannda Water availability main source is rain

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5.	**Membership in Self-Help Group, Producers Cooperative / Company, Cooperative Society, *etc.,* (give details)**	:	Vice President of Village Climate Risk Management Committee
6.	**Names of the central sector / State Schemes utilized by the farmer and the period**	:	State Department of Agriculture, Krishi Bhagya in 2015-16
7.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	:	Farm Pond, Finger millet (ML-365) seeds and Improved production technology practices. Provided the information for different crops such as Maize, Maize+ Pigeon pea, Groundnut + Pigeon pea, Avare
8.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*,)**	:	**Improved / Present production technologies**
	i) Productivity per hectare	:	• Sown maize across the slope and restored the available moisture. • Took pigeon pea as intercrop in maize. Cultivated pulse crop, field bean and groundnut in his available farm land, mainly for domestic consumption. His total earning from his farm was around Rs. 2, 24,400 /-.
	ii) Cost of production (Rs./ha)	:	
	iii) Net income (Rs./ha)	:	
	iv) Price realized (Rs. /ton)	:	
	v) Natural resources saved / conserved like soil, water *etc.,)*	:	
	vi) Product quality improvement	:	
9.	**Factors contributing to success**	:	Provided critical irrigation to crops like finger millet and groundnut utilising farm pond water. Quality seed material and timely suggestions helped in getting good yield of both grains and fodder from finger millet.

Impact: Around 20 farm ponds have been constructed under this project for better utilization of the available water during the rainy season. These farm ponds have provided supplemental irrigation to the agricultural crops during dry spells and helped in saving the crops and crop yield. Others farmers in the village after seeing the results have come forward to take up the construction of farm ponds in their lands. A few farmers have approached the State Department of Agriculture for farm pond construction under Krishi Bhagya Yojana. Now, around 30 farm ponds are existing in the village and farmers are cultivating the short duration crops for economical utilization of rain water harvested in the farm pond.

Rain water harvested in farm ponds

Enrichment of dry fodder for increasing yield in dairy animals

1.	**Name of the farmer**	**:**	Chandrashekharaiah S.M. S/o. Rudraiah	
2.	**Address**			
	i) Village	**:**	Siddanur	
	ii) Post	**:**	Anagodu	
	iii) Tehsil	**:**	Angodu	
	iv) District	**:**	Davanagere	
	v) State	**:**	Karnataka	
3.	**Contact details**	**:**	99640-10272	
4.	**Details of the farm (size, location, water availability *etc.*,)**	**:**	2 acres of dryland at Siddanur village (rainfed situation)	
5.	**Membership in Self-Help Group, Producers Cooperative / Company, Cooperative Society, *etc.*, (give details)**	**:**	Member in Co-operative Milk Society and also a member in NICRA, VCRMC	
6.	**Names of the central sector / State Schemes utilized by the farmer and the period**	**:**	Nil	
7.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	**:**	He is keeping 4 cross breed cow dairy unit and maintaining the unit scientifically. Growing improved varieties of fodder crops and using fodder cutting machine, hand operated milking machine and adopted the dry fodder enrichment technology from the NICRA project	
8.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*,)**	**:**	**Improved /Present production technologies**	**Traditional / Past production practices**
	i) Productivity per hectare	**:**	24	16
	ii) Cost of production (Rs./ha)	**:**	16	23
	iii) Net income (Rs./ha)	**:**	216	32
	iv) Price realized(Rs. / ton)	**:**	6480	960
	v) Natural resources saved / conserved like soil, water *etc.*,)	**:**	Due to the introduction of both leguminous and non-leguminous fodder crops has helped in preserving the soil fertility	Growing only one type of fodder crop (Napier) which was deteriorating soil fertility
	vi) Product quality improvement	**:**	Improvement in milk quality observed (Fat, CLR & keeping quality)	There were complaints regarding the quality of milk. Low fat and SNF
9.	**Factors contributing to success**	**:**	Use of improved quality fodders along with minerals and vitamins supplements has helped in better livestock health and better production	
10.	**Any other relevant**	**:**	Use of mineral and vitamins supplement in dry fodder enrichment has helped in better voluntary intake and improved production. Wastage of fodder was minimized to the maximum extent possible	

Impact: Enrichment of poor quality dry fodders, its conservation and utilizing for feeding dairy animals was taken up with more than 50 farmers in the village. The method of enrichment is an easy, less time consuming for the preparation and giving better results when fed to animals in terms of voluntary dry fodder intake, increased milk production and better quality milk. Around 12 farmers have adopted this technology and saving the cost on milk production and reducing the wastage of dry fodder.

KVK Tumkur-II

Utilization of farm pond water (protective irrigation) for groundnut production

1.	**Name of the farmer**	**:**	Kemparaju S/o. Thimappa	
2.	**Address**	**:**		
	i) Village	**:**	D.Nagenahalli	
	ii) Post	**:**	Anupanahalli	
	iii) Tehsil	**:**	Koratagere	
	iv) District	**:**	Tumakuru	
	v) State	**:**	Karnataka	
3.	**Contact details**	**:**		
4.	**Details of the farm (size, location, water availability *etc.*,)**	**:**	3.0 acre, Survey Number: 36	
5.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	**:**	• Farm pond: 40 l x 12 b x 3 h (m) • Water Storage capacity : 2224 m^3 • Stone embankment • Diversion channel : 140 m • *Melia dubia* planting: 30 Nos.	
6.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*,)**	**:**	**Improved /Present production technologies**	**Traditional / past production practices**
	i) Productivity per hectare	**:**	Groundnut -1400 kg	Groundnut- 1000 kg
	ii) Cost of production (Rs./ha)	**:**	13,000	13,000
	iii) Net income (Rs./ha)	**:**	23,400	13,000
	iv) Price realized (Rs. / ton)	**:**	26,000	26,000
	v) Natural resources saved / conserved like soil, water *etc.)*	**:**	Water	-
	vi) Product quality improvement	**:**	Good quality	-
7.	**Factors contributing to success**	**:**	Critical irrigation, Soil moisture	

Impact: Kemparaju S/o. Thimmappa of D.Nagenahalli of Tumakuru District has 3 acre farm land and grows finger millet, groundnut and maize crops. He faced water scarcity during dry spells and low yield of the crops. The KVK Hirehalli, Tumakuru under NICRA Project has constructed one farm pond of size 40×12×3 m^3 with water storage capacity of 1440 m^3 in his farm and made diversion channel of 140 m to divert the runoff into farm pond. One check dam was constructed in his farm to check the runoff. Due to the availability of water in the farm pond his open well got recharged.

The farmer had grown groundnut using the harvested rain water for cwritical irrigation (4 times) during dry spells. The yield of the groundnut has increased from 10,000 kg/ha to 14,000 kg/ha with critical irrigation. The net income has increased from Rs.13,000 to Rs,26,000 per ha.




Growing of groundnut by using farm pond water

Growing of drought tolerant finger millet (GPU-28) in leveled land with live bunds (Agave and *Melia dubia)*

1.	**Name of the farmer**	**:**	Papanna S/o. Kemparamaiah
2.	**Address**	**:**	
	i) Village	**:**	D.Nagenahalli
	ii) Post	**:**	Anupanahalli
	iii) Tehsil	**:**	Koratagere
	iv) District	**:**	Tumakuru
	v) State	**:**	Karnataka
3.	**Contact details**	**:**	-
4.	**Details of the farm (size, location, water availability etc.)**	**:**	2.0 acre, Survey Number: 96
5.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	**:**	• Land leveled : 2 acre • Live bunds with Agave and *Melia dubia*:1.0 acre • Drought tolerant finger millet (GPU-28)

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6.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*,)**	**:**	**Improved /Present production technologies**	**Traditional / past production practices**
	i) Productivity per hectare	**:**	Finger millet - 2450 kg	Finger millet - 1900 kg
	ii) Cost of production (Rs./ha)	**:**	21,000	20,300
	iii) Net income (Rs./ha)	**:**	14,950	7,900
	iv) Price realized (Rs. / ton)	**:**	15,000	15,000
	v) Natural resources saved / conserved like soil, water *etc.*,)	**:**	Soil	-
	vi) Product quality improvement	**:**	Good yield	-
7.	**Factors contributing to success**	**:**	Soil moisture, Soil loss reduction	

Impact: Papanna S/o. Kemparamaiah of D.Nagenahalli of Tumakuru district has two acre farm land and grows finger millet and groundnut. The farmer had moderate slope farm and faced the soil erosion problem. He also faced low yield of the crops. The KVK, Hirehalli, Tumakuru under NICRA Project has leveled his farm and laid trenches and bunds across the farm. The soil erosion had reduced and soil moisture retention has increased. To cope up with yield loss he was provided with improved finger millet variety GPU-28.

The farmer had grown finger millet variety GPU-28 and the yield has increased from 1,900 kg/ha to 2,450 kg/ha as compared to local finger millet and the net income has increased from Rs.7,900 to Rs,14,950 per ha.

Growing of drought tolerant finger millet (GPU-28) in leveled land

Growing of tomato in leveled land by using farm pond water for a protective irrigation

1.	**Name of the farmer**	**:**	Venkatappa S/o. Giriyappa
2.	**Address**	**:**	
	i) Village	**:**	D.Nagenahalli
	ii) Post	**:**	Anupanahalli
	iii) Tehsil	**:**	Koratagere
	iv) District	**:**	Tumakuru
	v) State	**:**	Karnataka

3.	**Details of the farm (size, location, water availability *etc*.,)**	:	2.0 acre, Survey Number: 120	
4.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	:	• Farm pond: 10 l x 10 b x 2 h • Water storage capacity : 200 m^3 • Land leveling : 1 acre	
5.	**Details of results obtained due t o the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc*.,)**	:	**Improved /Present production technologies**	**Traditional / past production practices**
	i) Productivity per hectare	:	Tomato - 45000 kg	Tomato - 36000 kg
	ii) Cost of production (Rs./ha)	:	70,000	68,000
	iii) Net income (Rs./ha)	:	3,80,000	2,92,000
	iv) Price realized (Rs. / ton)	:	10,000	10,000
	v) Natural resources saved / conserved like soil, water *etc*.,)	:	Soil and water	-
	vi)Product quality improvement	:	Good yield	-
6.	**Factors contributing to success**	:	Soil moisture, Soil loss reduction, Critical irrigation	

Impact: Venkatappa S/o. Giriyappa of D.Nagenahalli village has two acre of dryland with slight slope. The land is low in fertility where he normally cultivated one crop during *kharif* season. Due to high variability in southwest monsoon, he had difficulty in meeting his family requirement. Under NICRA Project, his one acre land was leveled and divided into compartments. Besides, a farm pond measuring 10 m x 10 m x 2 m with water storage capacity of 200 m^3 was dug out to harvest the runoff.

The farmer cultivated tomato in leveled farm and used harvested rain water in farm pond for irrigation. The soil moisture has increased and soil loss had been brought down due to leveling and compartment intervention. The yield of the tomato with leveling intervention has increased from 68,000 kg/ha to 70,000 kg/ha as compared to no leveling and his net income has increased from Rs.2, 92,000 to Rs.3,80,000/ha.

Growing of tomato by using farm pond water as a protective irrigation

Growing of drought tolerant finger millet (ML-365) with trench cum bunding

1.	**Name of the farmer**	**:**	Ramanjunaiah S/o. Kemaparamaiah	
2.	**Address**	**:**		
	i) Village	**:**	D.Nagenahalli	
	ii) Post	**:**	Anupanahalli	
	iii) Tehsil	**:**	Koratagere	
	iv) District	**:**	Tumakuru	
	v) State	**:**	Karnataka	
3.	**Details of the farm (size, location, water availability etc.)**	**:**	2.0 acre, Survey Number: 96/1	
4.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	**:**	• Land leveled : 1.0 acre • Trench cum bunding : 1.0 acre • *Melia dubia* planting : 200 Nos • Dry land horticulture trees : Tamarind, Mango, Cashew • Drought tolerant finger millet (ML-365)	
5.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*,)**	**:**	**Improved /Present production technologies**	**Traditional / past production practices**
			Trech cum bunding	Without Trech cum bunding
	i) Productivity per hectare	**:**	Finger millet (ML-365) : 2840 kg	Finger millet (ML-365) : 2070 kg
	ii) Cost of production (Rs./ha)	**:**	22,500	21,800
	iii) Net income (Rs./ha)	**:**	20,100	9,250
	iv) Price realized (Rs. / ton)	**:**	15,000	15,000
	v) Natural resources saved / conserved like soil, water *etc.*,)	**:**	Soil, Organic carbon	-
	vi) Product quality improvement	**:**	Good yield	-
6.	**Factors contributing to success**	**:**	Soil moisture, Soil loss reduction	

Impact: Ramanjinaiah S/o. Kemaparamaiah of D.Nagenahalli village of Tumakuru District has two acres of dryland and grows finger millet, groundnut and maize crops. He faced low crop yield and poor soil moisture.To overcome these problems, KVK Hirehalli has laid trenches and bunds across the farm. The farmer has planted 200 *Melia dubia* seedlings in trenches.

The farmer has also planted tamarind, mango and cashew seedlings under NICRA Project. Now the soil moisture holding capacity of his farm has increased. To overcome low yield problem he was provided with drought tolerant and high yielding finger millet variety ML-365.

The farmer had grown finger millet ML-365. The yield has increased from 2070 kg/ha to 2840 kg/ha compared to local finger millet. The net income has increased from Rs. 9050 to Rs. 20,100 per ha.

Growing of drought tolerant finger millet (ML-365)

Growing of groundnut in leveled land with trench cum bunding

1.	**Name of the farmer**	**:**	Nagarajaiah S/o. Narayanappa	
2.	**Address**	**:**		
	i) Village	**:**	D.Nagenahalli	
	ii) Post	**:**	Anupanahalli	
	iii) Tehsil	**:**	Koratagere	
	iv) District	**:**	Tumakuru	
	v) State	**:**	Karnataka	
3.	**Details of the farm (size, location, water availability etc.)**	**:**	5.0 acre at Survey No.: 97	
4.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	**:**	• Land leveled : 2.0 acre • Trench cum bunding : 3.0 acre • *Melia dubia* planting: 100 Nos. • 600 Nos. dryland horticulture trees : Amla, Tamarind, Mango, Cashew • Growing of finger millet(ML365), pigeon pea (BRG-2)	
5.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*,)**	**:**	**Improved /Present production technologies**	**Traditional / past production practices**
			Trench cum bunding	Without trench cum bunding
	i) Productivity per hectare	**:**	Ground nut-1200 kg	Ground nut-800 kg
	ii) Cost of production (Rs./ha)	**:**	13,000	11,000
	iii) Net income (Rs./ha))	**:**	18,200	9,800
	iv) Price realized (Rs. / ton)	**:**	26,000	26,000
	v) Natural resources saved / conserved like soil, water *etc.*,)	**:**	Soil, Water	-
	vi) Product quality improvement	**:**	Good yield	-
6.	**Factors contributing to success**	**:**	Soil moisture, Soil loss reduction	

Impact: Nagarajaiah S/o. Narayanappa of D.Nagenahalli of Tumakuru Disitrict has five acres of dryland and grows field crops such as finger millet, groundnut and maize. He has undulate land and faced soil erosion and low soil moisture problem. To overcome this problem land was leveled in 2 acres and trenches and bunds were laid across 3 acres. The farmer has also planted amla, tamarind, mango and cashew seedlings under NICRA Project. He also successfully adopted improved crop varieties of finger millet ML-365 and pigeon pea BRG-2.

The farmer had grown groundnut. The yield has increased from 800 kg/ha to 1300 kg/ha. The net income has increased from Rs.9800 to Rs.18200 per ha.



Groundnut in leveled land with trench cum bunding

Growing aerobic paddy (MAS26) by using sprinkler system

1.	**Name of the farmer**	**:**	Mudlappa S/o. Thimmappa	
2.	**Address**	**:**		
	i) Village	**:**	D.Nagenahalli	
	ii) Post	**:**	Anupanahalli	
	iii) Tehsil	**:**	Koratagere	
	iv) District	**:**	Tumakuru	
	v) State	**:**	Karnataka	
3.	**Details of the farm (size, location, water availability *etc.*,)**	**:**	2.5 acre at Survey No.: 21	
4.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	**:**	• Construction of check dam 20 lx6 bx1.5h (m) • Storage capacity: 180 m^3 • Check dam heightening • Recharge of open well and bore wells • Growing of finger millet (ML365), pigeon pea (BRG-2) during delayed monsoon • Aerobic paddy (MAS 26) • Sprinkler irrigation • Tomato triple disease resistant – Arka Samrat • Land leveling : 1.0 acre • Tank silt application	
5.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*,)**	**:**	**Improved /Present production technologies**	**Traditional / past production practices**
			Sprinkler system	Without sprinkler system
	i) Productivity per hectare	**:**	Aerobicpaddy(MAS-26)-3200kg	Paddy- 2600 kg
	ii) Cost of production (Rs./ha)	**:**	17,500	17,200
	iii) Net income (Rs./ha)	**:**	30,500	11,400
	iv) Price realized (Rs. / ton)	**:**	15,000	11,000
	v) Natural resources saved / conserved like soil, water *etc.*,)	**:**	Soil, Water	-
	vi) Product quality improvement	**:**	Good yield	-
6.	**Factors contributing to success**	**:**	Soil moisture, Soil loss reduction, critical irrigation	

Impact: Mudlappa S/o. Thimmappa is a farmer of D.Nagenahalli of Tumakuru district. He has three acre farm land and grows finger millet, groundnut, maize and tomato crops. The farmer faced water scarcity and low soil moisture content due to which he was getting low yield. The KVK Hirehalli under NICRA project desillted the check dam and increased the water storage capacity, which led to his open well and bore well got recharged. Now, he uses the water for critical irrigation using sprinkler. One acre of land was levelled and applied with tank silt. This increased the soil moisture. Now he grows finger millet (ML-365), pigeon pea (BRG-2) during delayed monsoon and water saving aerobic paddy (MAS-26) and triple disease resistant tomato (Arka Samrat) during normal monsoon.

The farmer had grown aerobic paddy MAS-26 and increased the yield from 2600 kg/ha to 3200 kg/ha compared to local paddy. The net income has increased from Rs.11,400 to Rs.30,500 per ha.

Growing of aerobic paddy by using sprinkler

Growing of improved variety pigeon pea (BRG-2)

1.	**Name of the farmer**	**:**	Lokesh S/o Venkataramaiah	
2.	**Address**	**:**		
	i) Village	**:**	D.Nagenahalli	
	ii) Post	**:**	Anupanahalli	
	iii) Tehsil	**:**	Koratagere	
	iv) District	**:**	Tumakuru	
	v) State	**:**	Karnataka	
3.	**Details of the farm (size, location, water availability *etc.*,)**	**:**	5.0 acre at Survey Nos.: 106, 125, 13	
4.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	**:**	• Construction of farm pond 15 l x 10 b x 2 h m • Storage Capacity: 317 m^3 • Water storage structure • Recharge of open well and bore wells • Growing of finger millet (ML365), pigeon pea (BRG-2) during delayed monsoon • Aerobic paddy- MAS 26 • Sprinkler irrigation • Land leveling : 1.0 acre • Tank silt application	
5.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*,)**	**:**	**Improved /Present production technologies**	**Traditional / Past production practices**
	i) Productivity per hectare	**:**	Pigeon pea (BRG-2) : 1150 kg	Pigeon pea (Local): 950 kg
	ii) Cost of production (Rs./ha)	**:**	22,700	22,100
	iii)Net income (Rs./ha)	**:**	23,300	15,900
	iv) Price realized (Rs./ ton)	**:**	40,000	40,000
	v) Natural resources saved / conserved like soil, water *etc.*,)	**:**	Soil, Water	-
	vi) Product quality improvement	**:**	Good yield	-
6.	**Factors contributing to success**	**:**	Soil moisture, Soil loss reduction, critical irrigation	

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Impact: Lokesh S/o. Venkataramaiah is a marginal farmer in D.Nagenahalli of Tumakuru district. He has three acre farm land, one open well, one bore well and grows finger millet, groundnut, maize and flower crops. He faced water scarcity during dry spells and low yield of the crops. The KVK, Hirehalli, Tumakuru under NICRA Project has constructed one farm pond of size 15x10x2 m^3 with water storage capacity of 317 m^3. Now, he has adopted sprinkler irrigation and uses water for critical irrigation. One acre of land was levelled and trenches and bunds were laid across farm which brought down the soil erosion and increased the soil water holding capacity. He grows finger millet (ML-365), pigeon pea (BRG-2) during delayed monsoon.

The farmer had grown pigeon pea BRG-2. The yield has increased from 950 kg/ha to 1150 kg/ha compared to local pigeon pea. The net income has increased from Rs.15, 900 to Rs.23,300/ha.

Growing of pigeon pea by using farm pond water

KVK Namakkal

Efficient utilization of water stored in temporary storage pond

1.	**Name of the farmer**	:	Mrs. B. Dhanalakshmi W/o. T .Balusamy
2.	**Address**	:	
	i)Village	:	Jambumadai
	ii)Post	:	Vadavathur
	iii)Tehsil	:	Erumapatti
	iv) District	:	Namakkal
	v) State	:	Tamil Nadu
3.	**Contact Details**	:	09786820627
4.	**Details of the farm (size, location, water availability *etc*.,)**	:	Total land area: 3 ha garden land **Water availability:** • Number of open well: one (Depth 70 feet) defunct • Number of bore wells: 3 Nos. (Total depth: 500 feet) • Availability of water : 300 feet (Only during rainy season)
5.	**Membership in self- help group Producers Cooperative / Company, Cooperative Society, *etc.*, (give details)**	:	Member in Mullai self- help group developed by KVK, Namakkal under NICRA scheme (functioned at Jamumadai from 2012)

6.	**Names of the central sector / state schemes utilized by the farmer and the period.**	:	National Innovations in Climate Resilient Agriculture (NICRA) from 2011 to 2015	
7.	**Technologies / Good Agricultural Practices / facilities / Benefits obtained with details**	:	Benefits obtained under NICRA scheme 1. Temporary water storage pond lined with 200 GSM HDPE sheet. Size :72x55x6 feet (672 m^3) 2. Groundnut seed suitable for rainfed condition: 200 kg. 3. Fruit saplings (Pomegranate, Guava, Amla, Acidlime). 4. IPDM kit for small onion.	
8.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.,)***	:	**Improved/Present production technologies**	**Traditional /Past production practices**
			1. Efficient utilization of water stored in temporary water storage pond. 2. Drought tolerant groundnut variety Co.6 cultivation. 3. Cultivation of fruit crops. 4. Implementing integrated pest and disease management practices in small onion.	1. Flood irrigation 2. Cultivation of local variety of groundnut. 3. Pest and disease management in onion through chemical.
	Season of cultivation and area	:	Small onion : November to February in 2.5 ha Red sorghum :June to September in 1.5 ha Groundnut : July to October in 1 ha Small onion: May to August in 1 ha	
	i)Productivity per hectare	:	Small onion : 14.2 t Red sorghum: 2.5 t Groundnut : 1.2 t	Small onion : 6.8 t Red sorghum: 1.4 t Groundnut: 1 t
	ii) Cost of production (Rs./ ha)	:	Small onion: 1,25,000 Red sorghum: 12,500 Groundnut:37,500	Small onion : 1,14,000 Red sorghum : 8,700 Groundnut : 31,600
	iii) Net income (Rs./ ha)	:	Small onion : 1,59,000 Red sorghum : 62,500 Groundnut : 22,500	Small onion : 22,000 Red sorghum : 33,300 Groundnut : 18,400
	iv) Price realized (Rs. / ton)	:	Small onion : 20,000 Red sorghum : 30,000 Groundnut : 50,000	
	v)Natural resources saved /conserved (like soil, water *etc.,*)	:	• Water is saved through temporary water storage pond.	
9.	**Factors contributing to success**	:	• Evapotransipration and percolation loss minimized: 15 cm in 15 days interval. • Water is pumped through compressor pump from bore wells and it can be filled in 5 days in summer and 2 days in rainy season. • Irrigation through temporary water storage pond by gravitational force to crops throughout the year. • Irrigation frequency: Once in 10 day's interval during summer and once in a week during rainy period.	
10.	**Any other relevant**	:	Nil	

Impact: Smt. B.Dhanalakshmi, Jambumadai village of Namakkal District having seven acres of land and cultivating paddy, sorghum, groundnut, pulses and onion crop through bore well water. KVK, Namakkal has introduced the technology of temporary water storage ponds (size of 72 x 55 x 6 ft with 672 cu.m) lined with HDPE 200 GSM UV irradiated plastic sheets through NICRA scheme to reduce water loss (seepage and percolation). Under the scheme new drought resistant varieties of black gram (VBN 6), groundnut (TMV.13 and Co.6) and sorghum (Co.30) were demonstrated. After acquiring the knowledge on seed production, she cultivated black gram in 0.5 acres, groundnut in 1 acre and sorghum in 2.5 acres with recommended practices and critical irrigation was given using water stored in temporary water storage farm pond. She could harvest a seed yield of 160 kg of black gram, 1150 kg of sorghum and 700 kg of groundnut. Using this seed, a total of 23 farmers were benefitted with coverage of 55 acres with quality seed.

Due to plastic lining water loss (seepage and percolation) was reduced. Water loss was only 2 cm per day in lined farm pond where as in unlined pond it was 15 cm per day. Through this intervention moisture stress was avoided in cultivated crops and resulted in year round cultivation. Seeing the success of this farmer, nineteen farmers in the same village have adopted this technique of lining temporary storage ponds with HDPE 200 GSM UV irradiated sheets on their own.

Utilization of farm pond water as a protective irrigation

KVK Ramanathapuram

Rice and chilli cultivation using Mini Portable Sprinkler (MPS) from farm pond

1.	**Name of the farmer**	**:**	K.Pandi S/o. Koorikilavan
2.	**Address**	**:**	
	i) Village	**:**	Kalari
	ii) Post	**:**	Kalari
	iii) Tehsil	**:**	Thiruppulani
	iv) District	**:**	Ramanathapuram – 623 503
	v) State	**:**	Tamil Nadu
3.	**Contact details**	**:**	-
4.	**Details of the farm (size, location, water availability *etc*.,)**	**:**	Size: 28.20 x 21.20 x 2.00 m at Kalari village. Water storage capacity: 988 m^3
5.	**Membership in Self-Help Group, Producers Cooperative / Company, Cooperative Society, *etc.*, (give details)**	**:**	Member of Self-Help Group functioning at their village
6.	**Names of the central sector / State Schemes utilized by the farmer and the period**	**:**	NICRA scheme from ICAR - KVK, Ramanathapuram during the period 2013-2014. He utilized the funds to construct the farm pond. The stored water was utilized to cultivate paddy and chilli crops

7.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	:	The crops like rice variety Anna (R) 4 and mundu type chilli were cultivated during the rabi season. Utilized farm pond water to irrigate rice and chilli crops as supplemental irrigation to mitigate the drought. He has harvested paddy and chilli crops successfully without any crop loss	
8.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*,)**	:	**Improved /Present production technologies**	**Traditional / past production practices**
	i) Productivity per hectare	:	Rice : 3.0 t	Rice : 1.8 t
	ii) Cost of production (Rs./ ha)	:	Rice : Rs. 35000 - 40,000 /ha Chilli – 60,000 / ha	Rice: Rs. 10,000 to 15,000 / ha Chilli: Rs. 55,000 / ha
	iii) Net income (Rs./ ha)	:	Rice: Rs. 25,000 to Rs. 30,000 Chilli: Rs. 90,000	Rice: Rs. 15,000 to Rs. 16,000 Chilli : Rs. 70,000
	iv) Price realized (Rs. / ton)	:	Rice: Rs. 15,000 /t Chilli: Rs. 16,000/t	Rice : Rs. 10,000 to 12000 /t Chilli: Rs. 13,000 / t
	v) Natural resources saved / conserved like soil, water *etc.*,)	:	During North East Monsoon period i.e. October to December rain water was harvested and stored in the water storage capacities like farm ponds, water storage tanks *etc.*,	During North East Monsoon period water was harvested at their field and utilized up to the period of availability. After 100 days, crops were affected severe drought and yield loss was more
	vi) Product quality improvement	:	The rice variety ADT 45 is a good adoptable variety to Ramanathapuram district, but it is a long duration crop. But Anna (R) 4 variety is drought tolerant variety, short duration and high yielding variety.	-
9.	**Factors contributing to success**	:	The Rainfall under kalari village is less than average. He has cultivated ADT 45 rice variety and lost the entire crop due to terminal drought. After the farm pond construction, Anna (R) 4 rice variety to mitigate terminal drought using farm pond water as supplemental irrigation was under taken. He also successfully cultivated mundu chilli (local variety) using farm pond water.	
10.	**Any other relevant**	:	He has cultivated Anna (R) 4 rice variety in *rabi* season. He has constructed farm pond and cultivated 3 acres of land by utilizing the stored water and cultivated one more crop as fallow crop *viz*., cotton (semi dry variety) and got the additional income in 5 months period.	

Impact: The rainfall of the Kalari village of Thirupullani block of Ramanathapuram district received is less than the average rainfall of Ramanathapuram district (average rainfall is 850 mm) and hence there was a severe drought. The farmers were intended to have alternate source of irrigation. They were educated about the farm ponds and same was implemented in the village. After NICRA this farmer has constructed farm pond (Size: 35.6x21.6x1.8m) having a water storage capacity of 13.84 lakh litre. Using this water he could cultivate and harvest rice variety Anna (R) 4 and mundu type chill crops successfully without any crop loss. He could earn Rs.20, 000/- from mundu chilli cultivation alone in one year.



Rice and chilli cultivation using Mini Portable Sprinkler (MPS) from Farm Pond water

KVK Villupuram

Natural Resource Management – Succès of Farm Pond

1.	**Name of the farmer**	:	Mr. G.Elumalai	
2.	**Address**			
	i)Village	:	Kattusiviri	
	ii) Post	:	Kattusiviri	
	iii) District	:	Villupuram	
	iv) State	:	Tamil Nadu	
3.	**Contact details**	:	09965015377	
4.	**Details of the farm (size, location, water availability *etc.*,)**	:	3 acres of garden land with one open well	
5.	**Names of the central sector/state Schemes utilized by the farmer and the period**	:	NICRA– 2013	
6.	**Technologies / Good Agricultural practices / facilities / benefits obtained with details**	:	Water conservation and storage through farm ponds and utilization of water for crops cultivation.	
7.	**Details of result obtained due to the adoption of technologies (season wise crops grown techniques adopted, results achieved *etc.*,)**		**Improved / Present production technologies (Farm Pond)**	**Traditional / past production practices**
	i)Productivity per hectare	:	Paddy: 105 q	Paddy: 60.5 q
	ii)Cost of Production (Rs./ha)	:	126310	60,500
	iii)Net income (Rs./ha)	:	1,69,940	51,500
	iv)Price realized (Rs. Per quintal)	:		
	v)Natural resources saved conserved like soil, water *etc.*,	:	Water	
8.	**Factors contributing to success**	:	Farm pond effectively harvests and stores the excess runoff water which led to increased water level to a minimum of 2.9 m and a maximum of 5.6 m in the nearby open wells through ground water seepage.	

Impact: Water stored and received as surplus through the farm pond was used for irrigating paddy (2 times) and sugarcane (1 times) as supplemental mode. Introduction of fish culture in his farm pond gave an additional income to Mr.Elumalai.

Success of short duration variety- Black gram (VBN Bg 6)

1.	**Name of the farmer**	:	Mr. Ananthan	
2.	**Address**	:		
	i)Village	:	Kattusiviri	
	ii) Post	:	Kattusiviri	
	iii) District	:	Villupuram	
	iv) State	:	Tamil Nadu	
3.	**Contact details**	:	09597721582	
4.	**Details of the farm (size, location, water availability *etc.*,)** :	:	5 acres of garden land with one open well	
5.	**Names of the central sector/state Schemes utilized by the farmer and the period**	:	NICRA-2015	
6.	**Technologies / Good Agricultural practices / facilities / benefits obtained with details**	:	**Crop Production** • Yellow Mosaic virus resistant short duration black gram-variety - VBN Bg 6 was grown during *kharif* season due to late on set of monsoon by 1 month. • This short duration crop was able to perform good with no incidence of YMV • Higher yield of 8.5q/ha was obtained than the traditional practice	
7.	**Details of result obtained due to the adoption of technologies (season wise crops grown techniques adopted, results achieved *etc.*,)**		**Improved / Present production technologies**	**Traditional / past production practices**
			Black gram (VBN 6)	Black gram (local variety)
	i)Productivity per hectare	:	8.5q	6.6q
	ii)Cost of Production (Rs./ha)	:	23,300	23,000
	iii)Net income (Rs./ha)	:	40,918	27,618
	iv)Price realized (Rs. Per quintal)	:	7,600	7,600
8.	**Factors contributing to success**	:	• Adoption of YMV resistant short duration black gram variety (VBN Bg 6) paved a way to escape from drought with higher yield. • The application of insectides for the control of YMV was reduced. • The crop stand was good with more number of pods per plant (70 pods / plant).	

Impact: Mr. Ananthan got an additional income of Rs. 13,300 per season by adopting short duration black gram (VBN 6) variety.

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Natural Resource Management – Success of Broad bed furrow method of planting in bottle gourd

1.	**Name of the farmer**	:	Mr. U. Sekar	
2.	**Address**	:		
	i)Village	:	Kattusiviri	
	ii) Post	:	Kattusiviri	
	iii) District	:	Villupuram	
	iv) State	:	Tamil Nadu	
3.	**Contact details**	:	09787879997	
4.	**Details of the farm (size, location, water availability *etc*)**	:	8 Acres of garden land with one open well	
5.	**Names of the central sector/state Schemes utilized by the farmer and the period**	:	NICRA - 2015	
6.	**Technologies / Good Agricultural practices / facilities / benefits obtained with details**	:	Broad bed furrow method of planting bottle gourd to conserve *in-situ* moisture ensured the farmer to raise good crop during July to October with rainfall of 350 mm. Irrigation requirement was reduced in BBF method when compared to normal method of planting.	
7.	**Details of result obtained due to the adoption of technologies (season wise crops grown techniques adopted, results achieved *etc.*,)**		**Improved / Present production technologies**	**Traditional / past production practices**
			Broad Based Furrow	Without Broad Based Furrow
	i)Productivity per hectare	:	370 q	318 q
	ii)Cost of Production (Rs./ha)	:	53,250	48,800
	iii)Net income (Rs./ha)	:	94,750	78,400
	iv)Price realized (Rs. Per quintal)	:	400	400
	v)Natural resources saved conserved like soil, water *etc.*,	:	Water	-
8.	**Factors contributing to success**		• Broad bed furrow method conserves soil moisture and protect the plants during dry spells • Irrigation interval was prolonged due to moisture conservation • Higher yield was obtained with this improved technology	

Impact : Crop cultivation under broad bed furrow method gave around 14% higher yield to the farmer.

KVK Alleppey

Resource conserving and ecofriendly management practices for the paddy in Kuttanad

1.	**Name of the farmer**	**:**	Mr.P A Thomas
2.	**Address**	**:**	Srampickal Puthenpurayil
	i) Village	**:**	Muttar
	ii) Post	**:**	Muttar – 689 574
	iii) Tehsil	**:**	Kuttanad
	iv) District	**:**	Alappuzha
	v) State	**:**	Kerala
3.	**Contact details**	**:**	Phone: 04772219740, Mobile: 09995858156 email: patsrampickal@gmail.com
4.	**Details of the farm (size, location, water availability *etc.,*)**	**:**	Irrigated: 1.7 acre Rainfed: 5.5 acre in Muttar village
5.	**Membership in Self-Help Group, Producers Cooperative / Company, Cooperative Society, *etc.,* (give details)**	**:**	• Member in Service Co-operative Society • Member and Secretary of Padasekhara samiti (Registered paddy farmers group in the state) • Member and Secretary of Nelmuth Farmers club (Assisted and financed by NABARD and Federal Bank Muttar)
6.	**Names of the central sector / State Schemes utilized by the farmer and the period**	**:**	• Technology demonstration component of NICRA from 2011. • Agriculture Departmental schemes of the State Government through Krishi Bhavan
7.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	**:**	ICAR-KVK developed a package of technologies through farmer's participatory mode for resource conserving and eco friendly management practices for the paddy crop in Kuttanad region of Alappuzha district. The package consists of the following technologies • Soil test based dolomite/lime application to correct the soil acidity • Sowing of paddy seeds using drum seeders for reducing the quantity of paddy seeds • Eco friendly disease management by seed treatment and foliar application using pseudomonas • Eco friendly pest management by placing trichocards at 15 days intervals. The package helps in better management of crop by optimizing plant population, spacing and eco friendly pest and disease control.

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8.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*,)**	**:**	**Improved /Present production technologies**	**Traditional / Past production practices**
	i) Productivity per hectare	**:**	7 t	5.5 t
	ii) Cost of production (Rs./ ha)	**:**	42,750	70,997
	iii) Net income (Rs./ ha)	**:**	1,07,750	47,253
	iv) Price realized (Rs./ ton)	**:**	21,500	21,500
	v) Natural resources saved / conserved like soil, water *etc.*)	**:**	By adopting soil test based fertilizer recommendations, excess pollution due to the leaching of chemicals and pollution in soil and water resources were saved. Application of dolomite for correcting soil acidity resulted in the reduction of fertilizer use by 30%. Adopting of eco friendly pest and disease management practices resulted in 100% reduction in the use of pesticides.	Indiscriminate use of chemical fertilizers and pesticides leads to the leaching of chemicals and thereby polluting the soil and the water bodies.
	vi) Product quality improvement	**:**	Improvement in both quantity and quality of the product; The management practices improved the grain filling and weight thereby resulting in better yield.	Poor grain filling and weight of the grains which resulted in poor yield.
9.	**Factors contributing to success**	**:**	The resource conserving and eco friendly management practices like drum seeding and soil test based dolomite and fertilizer application and IPDM through *pseudomonas* and tricho cards lead to reduction in cost of cultivation, prevented lodging of the crop and overall better yield to farmers.	
10.	**Any other relevant**	**:**	The adoption of package of technologies resulted in 25 % reduction in the cost of cultivation and 27 % increase in yield. Based on the success, these technologies were spread to the entire village.	

Impact: Mr. P A Thomas adopted the resource conserving and eco friendly management practices in paddy cultivation in his 5.5 acre land from 2011 onwards. By adoption of this technology package, the yield of paddy increased by 25-30 % and the success made him a role model among the paddy farmers. The success of Mr. P. A. Thomas inspired 13 other farmers of his *padasekharam* (polder) to adopt the package of management practices in paddy cultivation in an area of 12 ha during 2013-14. And as result of this widespread adoption of scientific practices, the *padasekharam* was nominated from Alappuzha district for the *Nelkathir* Award for the best *padasekharam* of Kerala State. In addition, he shared his experience in many

farmers' meets which motivated many farmers from different parts of the district to adopt this technology package. By these efforts, more than 161 farmers from all the 28 *padasekharams* in Muttar panchayath adopted these eco friendly technologies.

These demonstrations could make a significant impact in the paddy farmers of Kuttanad region in terms of reduced use of seeds, fertilizers and plant protection chemicals, leading to reduced green house gas emission and environmental pollution, and enhanced climate resilience in addition to the higher net profit obtained from paddy cultivation. The farmers widely accepted the cost reduction technologies like drum seeding and dolomite application which could resolve the two main threats to the paddy crop in the region *i.e.,* acidity and lodging due to overpopulation owing to heavy seed rate. This practice could reduce the cost of cultivation in terms of fertilizer reduction and saving the harvesting time.

Resource conserving and eco friendly management practices for the paddy crop

Climate resilient practices for backyard poultry rearing

1.	**Name of the farmer**	**:**	Mr.Jomon Xavier
2.	**Address**	**:**	Thundiyil, Mithrakkeri
	i) Village	**:**	Muttar
	ii) Post	**:**	Mithrakkeri
	iii) Tehsil	**:**	Kuttanad
	iv) District	**:**	Alappuzha
	v) State	**:**	Kerala
3.	**Contact details**	**:**	9847492107
4.	**Details of the farm (size, location, water availability etc.)**	**:**	Rainfed : 53 cent (0.21 ha)
5.	**Membership in Self-Help Group, Producers Cooperative / Company, Cooperative Society, *etc.,* (give details)**	**:**	• Coconut Producers Society (CPS) • SHG promoted by Changanasserry Athoroopatha Social Service Society Board and member of Service Co-operative Society
6.	**Names of the central sector / State Schemes utilized by the farmer and the period**	**:**	• Technology Demonstration component of NICRA - Climate resilient practices for poultry rearing from 2011

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7.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	:	Climate resilient practices for backyard poultry rearing which includes: • Housing of poultry in slatted floor to overcome the flood conditions • Use of Automatic vaccinator • Introduction of improved breeds for higher egg production • Cultivation of Azolla as a nutrition rich feed supplement • Egger nursery • Layer ducks • Quail for meat purpose	
8.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*)**	:	**Improved /Present production technologies**	**Traditional / Past production practices**
	i) Productivity per Unit/year	:		
	a) Backyard poultry (35 birds)		10950 eggs	20 Desi birds
	b) Egger nursey		175 layer chicks/batch (10 batches)	3000 eggs
	c) Ducks (250 ducks/2 batches / year)		Sale of 400 ducklings, 100 layer ducks	NIL
	d) Quail (250 birds/2 batches / year)		Sale of 200 quails for meat purpose and 300 as layers	
	ii) Cost of production per Unit (Rs./year)	:		
	a) Backyard poultry (35 birds)		Rs. 84,500	
	b) Egger nursery		Rs. 21,900	
	c) Ducks (250ducks/2batches/year)		Rs. 27,550	
	d) Quail (250birds/2batches/year)		Rs. 2,750	
	iii) Net income per Unit(Rs./year)	:		
	a) Backyard poultry (35 birds)		Rs. 32,850	
	b) Egger nursery		Rs. 45,500	
	c) Ducks (250ducks/2batches/year)		Rs. 33,225	
	d) Quail (250birds/2batches/year)		Rs. 16,750	
	iv) Price realized (Rs. Per Unit)	:		
	a) Backyard poultry (35 birds)		Rs. 54,750	
	b) Egger nursery		Rs. 1,30,000	
	c) Ducks(250ducks/2batches/year)		Rs. 60,775	
	d) Quail(250birds/2batches/year)		Rs. 19,500	
	v) Natural resources saved / conserved like soil, water *etc.)*	:	Nil	
	vi) Product quality improvement	:	The quality of the egg (overall size of the egg, yolk size and color of the yolk) improved because of the protein rich azolla feed supplement.	Poor quality of the egg with reduced size of the egg, yolk and yolk color

9.	**Factors contributing to success**	:	• Improved cage and vaccination reduced the mortality level from 56% to 13% • The improved cage increased the stock size of the bird • As a result of interventions made from the NICRA project he started an egger nursery. Day old chicks were purchased and maintained for a period of 45 to 60 days by giving proper vaccination. This activity is more viable and fetched good income.
10.	**Any other relevant**	:	More number of farmers in the village were benefitted by his egger nursery and the population of poultry birds and eggs were increased in the village.

Impact: Though Mr. Jomon Xavier was a known poultry farmer of the village he faced many constraints in his farming due to the monsoon flood. He adopted the climate resilient practices like housing of poultry in modified poultry cages with slatted floor to overcome the flood conditions, use of automatic vaccinator, and improved breeds of poultry demonstrated by NICRA in his back yard poultry farming. These technologies not only benefitted him personally but also created a positive energy among the poultry farmers of the area. Many farmers of the village acquired the improved poultry cage by paying 50% partner contribution. The farmers also had the difficulty in getting good quality breeds with proper vaccination. The egger nursery started by Sri Jomon solved this problem by supplying good quality layer chicks after proper vaccination which in turn reduced the mortality rate of chicks in the area. Many farmers from the nearby area visited his demonstration unit to understand the management practices followed by him. All this practices increased the poultry population and egg production in the area.

The success story of Sri. Jomon Xavier and the technology demonstrations of Krishi Vigyan Kendra as a ppart of NICRA had a considerable influence on the poultry farmers especially the women farmers of the village. With the introduction of the poultry cages, backyard poultry rearing has become a major enterprise and they were able to get a steady income from backyard poultry rearing throughout the year including the flood period. It not only ensured economic stability but their social status also was improved. Farmers started to construct similar cages on their own and it has spread to the entire village and the nearby villages.

Climate resilient practices for backyard poultry rearing

Portable biogas units for recycling the residues and energy generation integrated with crop production utilizing the slurry

1.	**Name of the farmer**	**:**	Mr.Jojan George	
2.	**Address**			
	i) Village	**:**	Muttar	
	ii) Post	**:**	Muttar	
	iii) Tehsil	**:**	Kuttanad	
	iv) District	**:**	Alappuzha	
	v) State	**:**	Kerala	
3.	**Contact details**	**:**	9947305409	
4.	**Details of the farm (size, location, water availability *etc.*,)**	**:**	2 acres	
5.	**Membership in Self-Help Group, Producers Cooperative / Company, Cooperative Society, *etc.*, (give details)**	**:**	• Member of Nelmuth Farmers club, Muttar • Member Vegetable and Fruit Promotion Council Keralam (VFPCK) • SHG promoted by Changanasserry Athoroopatha Social Service Society	
6.	**Names of the central sector / State Schemes utilized by the farmer and the period**	**:**	• Technology Demonstration under NICRA (2011-16) • Agriculture Department schemes of the Kerala State through Krishi Bhavan and ATMA • VFPCK schemes for banana and vegetable cultivation	
7.	**Technologies / Good Agricultural practices / facilities / Benefits obtained with details**	**:**	Portable biogas units for recycling the residues and energy generation integrated with crop production utilizing the slurry. Major benefits of the demonstration were (1) Saving in LPG use for cooking (2) Effective recycling of organic wastes (Av. 2.8 t/yr/unit) (3) Organic production of banana, vegetable and fodder grass (4) Reducing the use of chemical inputs like fertilizers & pesticides (5) Reduction in the emission of green house gases	
8.	**Details of results obtained due to the adoption of technologies (Season wise crops grown techniques adopted, results achieved *etc.*,)**	**:**	**Improved /Present production technologies**	**Traditional / Past production practices**
	i) Productivity per hectare	**:**	49500 kg	34500 kg
	ii) Cost of production (Rs./ha)	**:**	3,51,250	4,07,500
	iii) Net income Rs./ha)	**:**	3,41,750	75,500
	iv) Price realized (Rs. / ton)	**:**	14,000	14,000
	v) Natural resources saved / conserved like soil, water *etc.*,)	**:**	The use chemical fertilizers reduced	-
	vi) Product quality improvement	**:**	The overall growth of the banana plant is good and taste and keeping quality of banana also increased.	Keeping quality of the fruits are poor

9.	**Factors contributing to success**	**:**	Good quality slurry obtained from the potable biogas units and improved the overall growth of the crop thereby increases the yield and income of farmer
10.	**Any other relevant**	**:**	The technology of recycling organic wastes through portable bio-gas plants were spread to the entire village and the district. The neighboring Panchayaths have prepared projects for spreading the technology among farmers for organic recycling.

Impact: Sri. Jojan George was a partner in the technology demonstration on 'Recycling of organic residues for energy generation and crop production using portable biogas plants'. In addition to the availability of biogas for cooking, he successfully utilized the slurry obtained from the biogas plant for the production of tissue culture banana plants. His success in crop production motivated the other farmers to adopt the technology of recycling the wastes through portable biogas plants by giving a contribution of 50%. In the initial years the biogas units were provided mainly to the dairy farmers to avoid the dumping of dung leading to greenhouse gas emission, but from the next year onwards by seeing the advantage of the slurry as good organic manure many farmers bought the plant for getting the slurry also along with biogas. Thus the technology of converting organic wastes to biogas through portable biogas plants was very successful and spread among the farmers of the district.

Several local self government bodies included establishment of portable biogas units in their development schemes and more than 2500 units were installed in different parts of the district. This created awareness about the cleanliness of surroundings and possibility of organic crop production in homesteads in addition to biogas production.

Recycling of organic residues for energy generation and banana production using the slurry obtained from the biogas plant