National Initiative on Climate Resilient Agriculture

Impact of Technology Demonstrations for Climate Resilient Agriculture

Experiences of

KVK Valsad

(Gujarat)

R.F.Thakor, P.P.Rohilla
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Dated: December 5,2014

FOREWORD

Indian agriculture experiencing change in key climate variables, namely temperature, rainfall and humidity which has already started affecting agriculture and thus there is need to consider adaptive measures to cope with the climatic changes. The NICRA project launched by the ICAR aims to enhance resilience of Indian agriculture to climate change and climate variability through strategic research and technology demonstration. As many as 100 KVKs of the country are playing significant role in implementing technology demonstration component of the project. Gujarat vidyapith KVK Valsad is one of them.

I am happy to note that the GVPKVK is bringing out a publication entitled **Impact of Technology Demonstrations for Climate Resilient Agriculture - Experiences of KVK–Valsad (Gujarat)** that would be very useful to farmers, extension personnel, KVKs and NGOs working in the field of agricultural development. I complement the team of kvk and tribal farmers who are working with the project.

I appreciate the efforts of KVK-Valsad for bringing out the publication.

Dated: 05.12.2014

(Dr Y V Singh)

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PREFACE

Indian agriculture is a gamble with weather. Unfavorable weather conditions like delayed monsoon, intermittent dry-spells, prolonged droughts and extreme weather events such as; floods, cyclone, rise in temperature, extreme colds etc. are the major concerns to the farming community. National Initiative on Climate Resilient Agriculture (NICRA) a nation-wide project was launched in 2011 by Govt. of India to address the challenges posed by climatic change and climate - variability in different agro-climatic environments. NICRA deals with demonstration on an integrated package of scientifically proven technologies for adaptation of the crop and livestock production systems to climate variability. The technology demonstration component of the project is implemented in 100 Krushi Vigyan Kendra of the country under the technical guidance of CRIDA Hyderabad through Zonal Project directorate, Zone-VI, Jodhpur.

It gives me immense pleasure to note the striking achievements under NICRA project for the period 2010-2014 implemented by GVKVK Valsad-Gujarat. This document comprehensively covers scientific and technological achievements in the areas of natural resource management, crop production, livestock production, institutional interventions, agro forestry, custom hiring centers for farm mechanization.

I feel happy about dedicated efforts of the entire team of Krushi Vigyan Kendra, Valsad could make it possible to bring out the publication in the present form for which I express my sincere appreciation.

I am highly indebted to Dr.A.K.Sikka, DDG (NRM & Extn.), Dr. K.D. Kokate, Former DDG (Agril. Extn.), Dr B. Venkateswarlu, Former Director CRIDA, Dr S Dixit (Present ZPD, Zone-VIII), Dr. P.P. Rohilla, Nodal Officer, NICRA, ZPD, Zone-VI, CAZRI, Jodhpur and Dr.Y.G.Prasad Present NICRA, TDC Coordinator, CRIDA, Hyderabad for their support, encouragement and advice to KVK staff for all project activities carried out so far.

Dated: 02.01.2015

(Dr Anamik Shah)

CONTENTS

INTRODUCTION

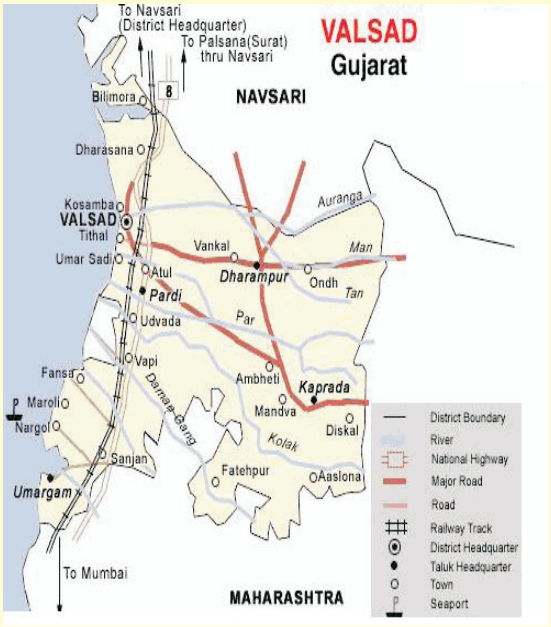
Agriculture production is already under pressure due to degrading natural resources base. During the past five decades, challenges in agriculture are being dealt through application of science and technology. Different technologies have been developed by the National Agricultural Research Education System. Though these technologies can't be termed as climate resilient until, these were applied in situations challenged by climate variability in different agro-climatic environments. A nation-wide project National Initiative on Climate Resilient Agriculture (NICRA), has been launched in 100 selected district during the year 2011 to address these challenges through technology demonstration components.

National Initiative on Climate Resilient Agriculture (NICRA) is a network project of the Indian Council of Agricultural Research (ICAR) aims to enhance resilience of Indian agriculture to climate change and climate variability through strategic research and technology demonstration. The project consists of four components viz. Strategic Research, Technology Demonstration, Capacity Building and Sponsored/Competitive grants. Central Research Institutes on Dry-land Agriculture (CRIDA) is coordinating the project throughout country. The technology demonstration component of the project is being implemented by KVKs and the centers of All India Coordinated Research Project on dry land Agriculture (AICRPDA). KVKs are playing a vital role in transferring various location specific climate resilient technologies to address the challenges from climate change. One hundred vulnerable KVKs from different parts of the country have been selected to implement the technology demonstration component of the project.

OBJECTIVES OF THE PROJECT

- To enhance the resilience of Indian agriculture covering crops, livestock and fisheries to climatic variability and climate change through development and application of improved production and risk management technologies.
- To demonstrates site specific technology packages on farmers' field for adapting to current climate risks.
- To enhance the capacity of scientists and other stakeholders in climate resilient agricultural research and its application.

DISTRICT PROFILE



Agriculture in Gujarat is a vital sector for the State's economy. Unsuitable climatic conditions in some part and rocky terrain with thin or no soils in others, have limited the area suitable for cultivation. The difficulty of drainage in costal areas has made a large part of the district agriculturally unproductive. The "**Golden Corridor of Gujarat i.e. Vapi to Tapi**" is where Valsad is located. It has become India's first integrated horticulture district. Agriculture of the district is mainly rainfed. Vaslad district is known for the production of world famous Alphanso mango variety.

Gujarat Vidyapith Krishi Vigyan Kendra (GVKVK) located at AMBHETI village has been implementing NICRA project since February, 2011. Valsad district is situated at the southern most tip of Gujarat. The district is characterized by heavy rainfall (2000 to 2200 mm), undulating topography with steep slopes and saline soils. About 54 % of the total population of the district is tribal and majority of the farmers (73%) are small and marginal farmers.

NICRA VILLAGE INFORMATION

Name of village	: Khutli
Taluka	: Kaprada
District	: Valsad (Gujarat)
Latitude and Longitude	: N 20˚24.972' E073˚10.354'
Distance from KVK	: 23 km
Distance from taluka place	: 25 km
No. of Farm families	: 349
Total population	: 1922
	(Male – 1002, Female – 920)
Total land in the village(ha)	: 568
Total cultivated area (ha)	: 277.38
Rainfed area (%)	: 59 % (201.5 ha)

Source of Irrigation(No.):

Open wells : 57

Bore wells : 85

Coverage of Lift irrigation : 85 farmers

Single phase domestic electricity connectiond : 256

Three phase Agriculture connections : 6

Families without electricity : 70

Infrastructure :

School : up to 7th standard

Dairy with pucca RCC Building

Pucca RCC Panchayat room

Pucca Road with good connectivity with taluka and district place

AGRICULTURE PROFILE OF NICRA VILLAGE

Tribal area of Khuntli village of Valsad district of Gujarat is characterized by fragmented land holdings, undulating topography with steep slope causing erosion during heavy monsoon season and water shortages startings from February every year. The village has having more than 90% tribal population. Soil of the village is black heavy textured with pH 7.43, low in organic carbon (0.33 to 0.40 %), medium in available phosphorus (30-40kg/ha) and high in available potassium (310-380 kg/ ha). The average annual rainfall of the village is about 1500-1800 mm.

Total cultivated area of the village is 277 ha out of which about 60% area is under rainfed and. Paddy *(kharif)* and chickpea *(rabi)* are the major field crops of the village. More than 65 % agriculture is rainfed. Dairy is the secondary occupation of the villagers. Normally farmers take up crop sowing in the month of July – August, but there a risk of heavy rains during this period. Sometimes due to heavy rains the seeds are not properly germinated due to which plant population is not maintained, resulting in economic losses to the farmers. Sometimes a risk of heavy rains with cyclonic effect causes heavy loss of the crop at maximum productive stage. Paddy is grown with onset of monsoon i.e. mid July to mid August in the village. Many farmers could not grow paddy timely due to lack of infrastructure (Animals, manpower). Since the area is receiving the highest rainfall (average rainy days 81) delay in sowing of paddy is a regular phenomenon. The villagers could not harvest paddy timely and also it has adverse effect on sowing of next crop during *rabi* season. Paddy yield is reduced due to late harvesting and the next sown crop (Gram) suffers from moisture stress resulting in poor germination and ultimately poor plant population which leds to reduction in yields.

Area & Production of Major Crops of NICRA Village

Crop	Area (ha)		Yield (q/ha)
	Irrigated	**Rain fed**	
Paddy	-	114	40.40
Sugarcane	15	-	726
Mango	17	-	152
Pigeonpea	-	22	8.9
Vegetables	21	13	267
Banana	51	-	413
Black gram	-	16	5.7
Total (ha)	114	165	-

Details of the Livestock

Livestock type	**Total no.**	**No. of livestock owners**	**Share of improved breeds (%)**	**Major livestock diseases**	**Extent of vaccination (%)**
Large animal	713	162	13	Nil	93
Small animal	563	53	0	Nil	-

MAJOR CLIMATE DETAILS OF NICRA VILLAGE KHUTLI

Khuntli is located in Gujarat heavy rainfall zone 1 at Latitude N 20˙24.972' Longitude E073˙10.354' . Average rainfall of the village is 2208 mm with minimum and maximum temperature 28^{0}C and 45^{0}C, respectively in summer. Soil of the village is medium black . Major climate variability challenges are erratic and uneven rainfall, high evapo-transpiration, high wind velocity, high temperature and frequent drought.

Analysis of the data regarding distribution of rainfall revealed that during the year 2011 and 2012 the rainfall received by the village was lower by 12 and 22 per cent, respectively than that of the normal average rainfall of past ten years. On the contrary, during 2013, high rainfall (2156mm) was received as against the normal average rainfall (2090mm). Change in rainfall pattern also was noticed during 2013; as the period of rainfall was extended to November month. Late rainfall at the time of paddy harvesting caused heavy damage to the crop.

Historical trends in rainfall		Decadal Average		
		1980-90	1990-2000	2000- 2010
No. of rainy days		82	84	82
No. dry spells during kharif Season	10 days	04	03	05
	15 days	02	3	03
	20 days	01	03	02
No. of ntensive rain-spells	> 60 mm per day	22	18	21

Distribution of rainfall in comparison with normal
(Last three years)

Month	Normal rainfall (mm) Based on min 10 yrs	Rainfall (mm)			Difference of rainfall in comparison with normal rainfall (mm)			% Deviation * i.e. (Actual – Normal X 100) / Normal
		2011	2012	2013	2011	2012	2013	
Jan.	0	0	0	0	0	0	0	0
Feb.	0	0	0	0	0	0	0	0
Mar.	0	0	0	0	0	0	0	0
Apr.	0	0	0	0	0	0	0	0
May	0	0	0	0	0	0	0	0
Jun.	388	125	28	578	-263	-360	190	49
Jul.	832	711	701	542	-121	-131	-290	-35
Aug.	569	611	536	316	42	-33	-253	-44
Sep.	242	342	329	128	100	87	-114	-47
Oct.	53	64	42	566	11	-11	513	967
Nov.	6	0	0	26	0	0	20	333
Dec.	0	0	0	0	0	0	0	0
Total	**2090**	**1853**	**1636**	**2156**	**-231**	**-448**	**66**	

** **Note :** Percent deviation is calculated on the base of actual rainfall data of 2013.*

Distribution of rainfall during 2013 in NICRA village

Day	Jun	Jul	Aug	Sep	Oct	Nov
1	0	8		4	0	0
2	0	10	22	5	0	0
3	0	12	14	6	0	0
4	0	15	3	3	0	0
5	0		0	5	0	0
6	0	11	0	6	0	0
7	0	5	10	7	0	0
8	0	2	20	15	10	0
9	106	110	25	17	13	0
10	7	20	32	6	6	0
11	15	5	25	12	0	0
12	30	0	26	5	0	0
13	8	0	30	37	0	0
14	0	40	15	0	5	0
15	5	20	5	0	0	0
16	110	5	5	0	6	0

Day	Jun	Jul	Aug	Sep	Oct	Nov
17	39	55	5	0	0	0
18	30	5	10	0	0	0
19	16	0	5	0	3	0
20	13	0	11	0	5	0
21	10	90	5	0	2	0
22	38	55	7	0	72	0
23	0	5	5	0	210	0
24	40	6	11	0	212	0
25	10	0	0	0	4	5
26	12	12	15	0	0	21
27	12	9	0	0	0	0
28	30	30	0	0	10	0
29	15	12	10	00	0	0
30	13	0	0	0	03	00
31	19	0	0	0	5	0
Total	**578**	**542**	**316**	**128**	**566**	**26**

Formation of Village Climate Risk Management Committee (VCRMC)

A gram sabha was called to discuss the different facets of the project. Out of 600 farmers, four hundred farmers of the village became stakeholders of the project. Each member contributed Rs 100 as a project member registration fee. The total contribution collected was through membership fees was Rs 40,000. The VCRMC composed of 13 (farmer and farm women) members, representing small medium and large farmers. In order to increase effectiveness of the project, five sub committees such as Custom hiring centre committee (5 members), crop demonstration committee (5 members), natural resources management committee (5 members), livestock management committee was also formed amongst the project beneficiaries. All these sub committees had been looking after the different activities and also assisted the VCRMC in planning and execution of the project activities at village level. Training of all committee members regarding climate resilient technology to be demonstrated on farmers field under capacity building is a regular phenomenon under this project.

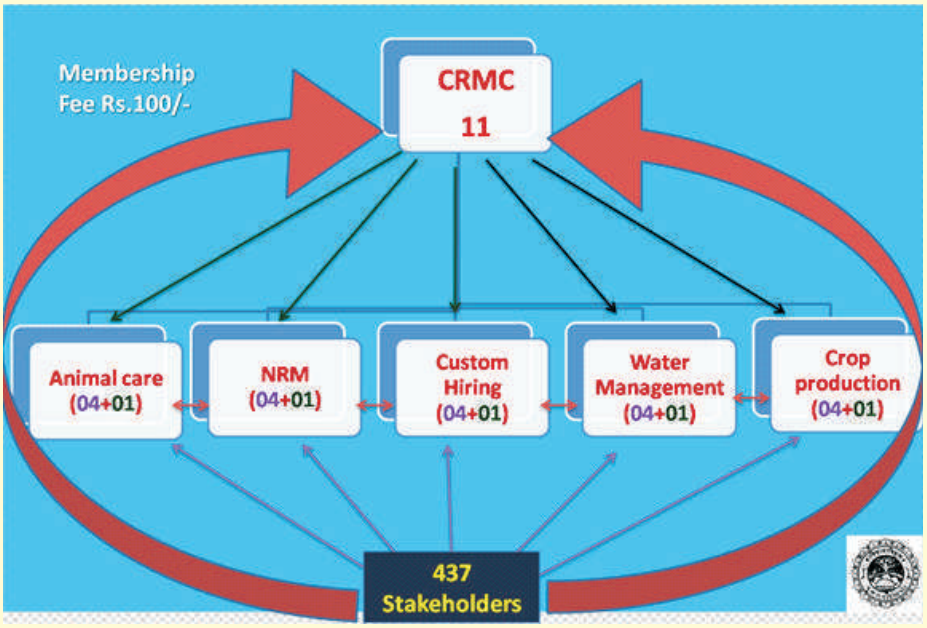
Meeting with members of panchayat

Transect Walk

Gram Sabha

Inauguration Function

INSTITUTIONAL ARRANGEMENT



Details of Village Climate Risk Management Committee (VCRMC)

Name of the VCRMC	Village Name	No. of Members	Bank details (as on 31-03-14)	
			A/C no.	Amount (Rs.)
NICRA-Khuntli Climate Risk Mg. Committee	Khuntli	11	86037409422	2,90,737

Year	Income Rs.	Details	Expenditure Rs.
2011-12	2,71,999	Construction charges	1,03,302
2012-13	2,28,019	Additional Demonstrations	3,64,668
2013-14	2,58,689	Balance with SBI bank	2,90,737
Total	7,58,707		7,58,707

Details VCRMC Members

1		Devubhai Ramubhai Jadav	President
2		Somabhai Bendiyabhai Birari	Member
3		Sukkarbhai Jivubhai Thorat	Member
4		Somabhai Bhimjibhai Gavali	Member
5		Ramanbhai Chhniyabhai	Member
6		Dhudhalbhai Kalubhai Shahari	Member
7		Iswarbhai Mangalbhai Jadav	Member
8		Gitaben Iswarbhai Pawar	Member
9		Santaben Uttambhai Kuwar	Member
10		Gitaben Lallubhai Shahri	Member
11		Uttambhai Barsubhai Birari	Member
12		Chhotubhai Lahnubhai Sahri	Member
13		Sankarbhai Budhabhai Mahakal	Secretary

Notes

Component- I

Natural Resources Management

Thematic Area : Natural Resource Management

1. Water harvesting through check dam and percolation tank

More than 68 per cent area of the village is rainfed. There is an acute shortage of water particularly during winter and summer months. The existing water harvesting structures are defunct due to lack of maintenance. Hence the priority was given to renovation of defunct check dam and contour trenching on slopy land.

Intervention

Deepening of old check dam was done with appropriate inlet and outlet. The total rain-water harvesting capacity of old structure could be increased to 11550m^3. This harvested water is being utilized for providing supplemental irrigation to various crops.

Desilting of two structures and renovation of defunct water harvesting structures was done to enhance the water harvesting capacity of the structures in collaboration with state department of irrigation (District Panchayat).

Defunct water harvesting structures

After renovation

Outcome

Groundwater levels in adjacent open wells located downstream of check dam and renovated water harvesting structures increased and ensured availability of water during summer. As many as 14 open wells have been recharged due to the renovated structures. This water enabled farmers to protect their crop during mid season drought. The harvested rainwater was used for providing life saving irrigation to vegetable crops. This enhanced the crop yield by 12 per cent and additional return of Rs10,000/ha was realized by the farmers. Cropping intensity was also increased. Vegetable cultivation was also promoted by harvested rainwater and irrigation from recharged wells. Farmers availed the facility of CHC in the village for hiring water lifting pump to irrigate the field crops. Efficient use of harvested water was ensured using HDPE pipes provided micro irrigation system.

Water harvesting by renovation of defunct rainwater harvesting structures in the village

2. Enhancing water use efficiency through micro irrigation system.

Majority of small and marginal tribal farmers lift water from the well and irrigate their fields by surface irrigation through channel. No micro irrigation system exists in the village. Sprinkler system is not popular among the farmers. To carry lifted water from source to field requires long field channel. Thus there is wastage of water in the form of percolation, evaporation and seepage.

Intervention

KVK popularized drip and sprinkler irrigation system following Public Private Partnership approach.

Efficient use of water through micro irrigation system

Outcome

During last two years about 85 ha of land has been covered under sprinkler irrigation with the involvement of 75 tribal farmers of the village. It is expected that about 25 ha area would be brought under irrigation. Large scale adoption of the sprinkler technology by the farmer will not only save water but labour as well. It prevents wastage of water through loss in convergence, evaporation and seepage It also reduce the cost of irrigation through saving fuel.

3. Trench cum Bunding

The Khuntli village is situated in Kaparada block. The soils are shallow and prone to moderate to severe soil erosion. Events of intense rainfall are increasing every year which further aggravats soil erosion.

Intervention

Trench cum bunding technology is suitable for *in-situ* conservation of soil and water. Trench cum bunding was demonstrated on 23394 running feet (rft) of 2'x1.5'covering 111 farmers. During intense rainfall events, most of the top soil from the field and excess runoff water was trapped in the trenches helped in safe disposal of excess rainwater. Three pucca augan (wasteweir) were constructed with a view to prevent soil erosion.

Slopy land

Trench-cum-bunding for resource conservation

Vegetative cover on bunds

Outcome

The plantation of trees like mango, cashew and drum stick was carried out on the slopy land treated with trench cum bunding. The slopy land was brought under cultivation by growing bottlegourd for assured income to farmers. A total of 10000 fruit plants were planted. This exercise has created awareness among the farmers about utilization of degraded lands by growing trees. The planting of fruit and forest tree species such as *Mangifera indica* (Mango), bamboo, cashewnut, etc. was taken up on degraded lands in the village. In order to ensure better survival rate, the planting was done on the bunds after digging trenches in the area.

4. Burning of crop residue (Rabbing)

The traditional slash and burn system which is locally known as *'adar'* is still in practice by the tribal farmers. The practices involves spreading of leaf litter and dry biomass of forest shrubs /trees in the field, burning it and mixing the ashes in the soil. Farmers believe that it will kill the harmful organisms in the soil and mixing of ash makes the soil fertile. The piece of land is then utilized for raising paddy nursery to produce healthy seedlings. However, the practice of burning crop residue generates large amount of carbon into the atmosphere and also encourages deforestation leading to conflicts with the forest department.

Intervention

In order to raise healthy seedlings of paddy, for the first time the soil solarisation technology using 75 micron thick plastic sheet was utilized under the project with a control plot of about 100 m^2 area (farmers practice). During the month of May, the FYM was mixed with soil and then lightly watered. The plastic sheet was then spread over it. After 20 days cover was removed and seeds of paddy were sown in the plot.

Burning of crop residue in field

Demonstration of soil solarization

Healthy crop

Outcome

In farmers practice only 60 per cent germination was observed in the nursery. Seedlings were weak and yellow in colour (Iron deficiency) with shallow root zone. Weed infestation was very high. However, in the treated plot (soil solarization using plastic+vermicompost/FYM) more than 85 per cent germination was observed. Seedlings were vigorous with very good root development. Weed infestation was also found less as compared to farmers' practices.

5. Soil health management

Due to natural slope or typical sub surface characteristics of hilly soil, the soil moisture status remains very low to support crop growth. Soils are shallow and are prone to moderate to severe soil erosion. The soils of the village are poor with organic carbon content of 0.2 to 0.3 per cent. Farmers grow banana, sugarcane, paddy by applying higher doses of nitrogenous fertilizer in order to have better crop growth. It not only increases the cost of cultivation but also deteriorates the soil health in long run.

Intervention

Apart from the NRM measures like trenching, bunding, demonstrations on vermicompost, biogas plant and liquid biofertilizers were conducted. Liquid biofertilizer – a product of NAU, Navsari was introduced in the village. Liquid formulation has longer shelf life is free from contamination, ensures better survival in soil and on seed. The quantity required per unit area is lesser compared to carrier based inoculants and can be stored easily in smaller space at ambient temperatures till 45° C. Liquid fertilizer is cheaper, eco-friendly and easy to use.

Low soil fertility

Capacity building and demonstration of liquid biofertilizer uses

Outcome

The application of liquid biofertilizers positively influenced the crop yield. Reduction in cost of cultivation in paddy, bottlegorud and brinjal was to the extent of 14.2, 9.3 and 25.1%, respectively. Net profit in paddy, bottlegourd and brinjal increased 17.4, 11.83 and 15.0%, respectively. In addition soil health and physical properties improved along with addition of vermicompost and liquid fertilizers.

Component- II

Crop Production

Thematic Area : Crop Production

1. Enabling paddy farmers to cope with waterlogged conditions

The region has paddy based cropping system. The baseline survey showed that majority of farmers of Khuntli village were growing high yielding varieties (HYV) of paddy of different private sector companies. It was also observed that late monsoon with moderate wind velocity at harvesting stage of paddy caused more damage to the crop due to as it lodging in the field resulting in heavy loss in productivity. This is because the varieties grown by the farmers are susceptible to water logging. Due to high humidity, the seeds that came into contact with soil germinated on the panicle itself. Even the quality of paddy straw also deteriorated, which was intensively used as fodder by the tribal growers.

Intervention

KVK demonstrated MTU 1010 variety which is high yielding, short duration, dwarf, resistant to water logging conditions and pests and diseases as well.

Lodging damage in paddy at harvesting stage

Seed germination on lodged panicles

Outcome

The average yield in of demonstration plots with MTU 1010 variety was recorded 4000 kg/ha as against the yield of 3100 kg/ha in case of susceptible variety. The cost of harvesting of paddy affected due to water logging was also high to the tune of Rs2000/ha. The technological interventions (Variety MTU 1010) gave higher yield under water logged conditions and thus average net profit to the tune of Rs18900/ha was realized by the farmers.

Field demonstration of MTU 1010 tolerant to water logged conditions at maturity

Economic Impact of Intervention

Variety	Avg. grain yield (kg/ha)	Avg. income from grain (Rs/ha)	Avg. straw yield (kg/ha)	Avg. income from straw (Rs./ha)	Avg. cost of harvesting -manually (Rs./ha)	Additional benefit Rs.
MTU1010 (Demo plot)	4040	40400	4083	10208	60 Labours@Rs120 =7200	43408
Other Susceptible Varieties	3105	24840	3189	7973	83 Labours@Rs120 =9960	22853
DIFFERENCE	935	15560	894	2235	2760	20555

2. Planting technique in bottle gourd

Bottle gourd is grown by the farmers on slopy lands during kharif. Normally farmers sow the crop in the month of July- August despite the risk of heavy rains during this period. Sometimes due to heavy rains the seeds fail to germinate leading to a low plant stand. Heavy rains also pose problem in gap filling which delays the crop. Other problems include: damage caused by the birds in early emergence stage of plants, heavy rains with cyclonic effect damage the trailing (mandap/pandal) structure and reduce the strength of GI wire due to corrosion in rainy season. All the above factors result in collapse of the mandap and cause heavy losses to the farmer at maximum productive stage.

Intervention

Farmers were trained to raise bottle gourd seedling in polythene bags (3x5cm) in community net house at the village transplants 15 days old seedlings under field conditions at appropriate time and provide support to the plants using bamboo stick to protect against high wind velocity. Farmers were advised to go for trails on the bamboo base mandap structure at the proper growth stage of plants supported with RCC pole at equal distance to protect the crop against heavy rain with high wind velocity.

Use of Bamboo

Poor Structure

Collapsed Structure

For netting of mandap, PVC rope was used instead of GI wire as it is more durable, cheaper, light in weight, reusable and having good stretching ability to bear the load of bottle gourd.

Community vegetable nursery

Cement pole support with stretchable rope

SN	Before intervention	After intervention
1	Poor Plant population in field condition	Optimum plant population
1	Bamboo structure alone could not resist against high wind velocity at full productive stage	Boundary with RCC pole provided extra strength to the bamboo structure thus and prevented collapse of structure and prevented crop losses
1	Early production was not possible due to late plantating in field (mortality due to heavy rain & bird damage leading to reduced plant population)	Seedlings grown in nursery in poly bags transferred to the field at appropriate stage gave uniform growth and early production
1	Increase in supply of produce in the market fetched lower rate (Rs 4-5/kg) due to surplus production	Maximum rate for produce @ Rs 12/ kg could earn more profits due to early production
1	GI wire for netting of mandap suffers from corrosion in rainy season shortening the life of structure.	Introduction of plastic rope which is light in weight with good stretching capacity provided longer life to the structure.

3. Polythene mulching in vegetable along with drip

Farmers of Khuntli village grow brinjal, chilly, tomato and bottlegourd crops all the year round. The area under the crop is increasing gradually. Heavy weed infestation during monsoon directly competes with main crops and suppress growth. Weeding operation is very difficult and cost intensive too. This leads to poor crop yield and increases cost of cultivation.

Intervention

A 40 micron polythene sheet was spread on the raised beds prepared for plantation of tomato. Twenty five days old seedlings of tomato cv. Avinash were transplanted by making holes in zigzag manner at a distance of 3x2.5 ft over the mulch sheet and provided drip irrigation.

Polythene mulching with drip irrigation system in tomato

Outcome

The mulching technique checked growth of weed and conserved moisture which enabled seedlings to grow faster and healthy as compared to control plants. Mulching also enabled less pest infestation and less water application. Optimum plant population was maintained in the vegetable field. The cost of manual weeding reduced to a great extent. This successful intervention generated keen interest and curiosity amongst vegetable growers. The farmers were also encouraged to use paddy straw as a mulch.

4. Protection of harvested paddy for deterioration

Delay in onset of monsoon, delayed the harvesting of paddy. Occurrence of rain in the last week of September coincides with paddy harvesting stage. More than 80 percent of paddy was badly affected. It causes lot of damage not only to the grain yield but also deteriorated the paddy straw quality, which serves as an important fodder for livestock. Due to high humidity, the harvested paddy that came into the direct contact with soil germinated and biomass (straw) was also affected by fungus.

Intervention

Tarpaulin sheets of 25x25ft size were provided to the paddy growers with a view to protect the harvested paddy in field to protect it from rain.

Multiferous use of plastic sheet by the beneficiaries

Outcome

Almost all the paddy growers protected their harvested paddy with tarpaulin sheets. It was also found useful to cover the threshing floor (by spreading it on the ground in the field by the farmers and also winnowing produce This practice is gaining popularity in the village and more farmers adopted this on their own.

Component- III

Livestock Interventions

Thematic Area : Livestock

1. Gobar-gas and vermicompost from farm waste

About 80 per cent of the tribal farm families depend directly on the forest produce for their fuel requirements, which exacerbates the effects of deforestation. Tribal women travel long distances to collect fire wood, which involves considerable drudgery and is a time consuming task. Burning of wood adds carbon to the atmosphere and contributes to warming. Farmers collect cow dung, dry it and prepare cow dung cake for fuel purpose.

Intervention

KVK introduced movable floating type biogas plant with a capacity of 2.0m^3 made up of HDPE material. The cow dung used for cake preparation is now being utilized to feed the biogas plant. Use of cow dung slurry to prepare vermi compost is a better option to convert farm waste to organic manure. Total 45 bio-gas plants were installed in the NICRA village. These were linked to vermicompost units. Specially designed movable vermibed unit of 12 x 4 x 2.5 ft was also provided as a demo unit.

Collection Of Firewood

Cowdung Cake Making from forest

Biogas plant for effective use of cow dung

Vermi compost preparation from biogas slurry

Outcome:

The intervention saved time and reduced farm women drudgery. The time thus saved is being efficiently utilized for livestock production and farm related activities by the women. All the biogas plants and vermicompost units are working successfully in NICRA village. Traditionally, cow dung cake has been used as fuel, today it is used to produce biogas. The vermicompost made from biogas slurry is rendered highly concentrated by bacteria which enhanced vermicomposting process. Majority of the farmers started utilizing vermicompost. A few farmers sold it to the forest department for income generation. The compost utilization reduced the dependency on chemical fertilzers and also improved soil health.

2. Balanced diet for improving milk production and health

Paddy is the major crop of the tribal community. Continuous use of poor grade paddy roughage causes infertility and poor milk production. The health status of cattle is very poor. Inter-calving period is also very long i.e. 16-18 months. Average milk production cost is high and thus net returns from dairy farming is very low.

Intervention

The livestock owning farmers were motivated to take up perennial fodder grass along with food crops. CO-4 fodder variety was demonstrated in NICRA village. In order to make low grade paddy straw it was treated with urea. It increased the nutritive value and palatability also. Diagnostic camps and vaccination camps were organized in collaboration with Vasudhara milk cooperative. In addition to the above, deworming of cattle was done regularly. AI was carried out with a view to improve local breeds. Mineral mixture was also provided to malnourished cattle.

Cattle diagnostic and vaccination camp

Urea treatment in paddy

Outcome

Bench mark survey indicated that the total milk collection of village was 200 liters/day in 2011. A series of activities undertaken under NICRA project resulted in the increase of the milk production by 13 per cent (300 lit/day). Infertility in cattle was observed to be reduced and total no. of milch animals also increased from 300 to 350 during last three years.

3. Empowering dairy farmers through green fodder production round the year

Paddy is the major crop of the tribal farming community. Famers use paddy straw as fodder for their livestock which is a poor grade roughages. Infertility and poor milk production is a common problem faced. The physique of the cattle is very poor. Inter-calving period is also very long i.e. 16-18 months. Average milk production cost is high. Thus, the earning from dairy farming is very low. Due to unavailability of water during post-rainy season there is no other alternative for green fodder production.

Intervention

Perennial fodder varieties viz, CO-1,CO-2,CO-3, and CO-4 having profuse tillering, anti-lodging, high crude protein content, broad green leaves, less water requirement, and less content of oxalate. These varieties have higher nutritive value and have been introduced with a view to provide green fodder throughout the year utilizing minimum available land and water. Planting material of perennial grass were provided to 185 farmers of NICRA village. They were also trained about the importance of balance feed to livestock using proper ratio of green and dry fodder.

Visit of demo unit

Supply of planting material

Luxurious growth

Outcome:

The intervention enabled farmers to have round the year production of green fodder. As many as 120 tonnes of green fodder harvested by the farmers. Feeding cattle with balanced diet, enriched paddy straw with urea treatment, mineral mixture supplement etc. had good impact on animal health and also reduced inter-calving period from 16 - 18 months to 14-16 months. Artificial insemination was also done covering 1353 cattle. As indicated by the milk cooperative of the village, milk yield increased to the tune of 150 lit/day. (earlier milk collection was 350 lit /day and after the interventions collection increased to 500 lit/day).

Promotion of green fodder production activity

Component- IV

Institutional Interventions

Thematic Area : Institutional Intervention

1. Resource conservation and enhanced crop productivity through custom hiring centre

Normally paddy is grown with the onset of monsoon i.e. Mid July to mid August. Since the area receiving higher rainfall, delay in sowing of paddy is a regular phenomenon. Farmers are unable to timely prepare the land for paddy transplantation due to lack of equipments.

Paddy yield is affected due to late harvesting and the next crop gram suffered from moisture stress resulting in poor germination and ultimately poor plant population leading to reduction in yield.

In order to address this problem a custom hiring centre was established in Khuntli village and is being managed by the Village Climate Risk Management Committee (VCRMC).

Intervention

The Custom Hiring Centre (CHC) equipped with modern farm machineries and implements like pump set, power tiller, reaper, brush cutter, winnowing fan, paddy thresher etc. was established by the villagers. The leader of the VCRMC donated a piece of his own land on which implement shed of about 400sq.ft. had been constructed to keep equipments. The equipments are hired by farmers as and when required by paying nominal hiring cost.

Currently an amount to the tune of Rs 1.64 lakhs has been deposited with CHC, which is being utilized to replace, maintain or to buy some new need based implements.

Custom hiring center

Implements for custom hiring by farmers

Outcome

Power tiller was found very useful and hired by small farmers for land preparation including incorporation of green manure, puddling and facilitated timely transplanting of paddy resulting in timely harvest of crop, which enabled farmers to grow the subsequent gram crop on conserved moisture for better production.

Use of winnowing fan narrowed down the gap between harvesting and winnowing. It saved labour and time for winnowing of paddy. Earlier the farmers used to winnow manually their paddy which was time consuming and labour intensive. The operation coincided with late rain which caused loss of harvested paddy. Timely operations could save labour Rs. 2800/ha and it reflected as an additional income. As many as 528 farmers utilized different CHC equipments during the last three years and generated a total revenue of Rs 7.96 lacks.

Puddling operations using power tiller

Pruning by brush cutter

Use of reaper for harvesting paddy

Revenue generated by VCRMC

S.N.	Equipment	No. of Equip.	Hrs. used	Users	Total Income
1	Power tiller	01	370	187	1,12,441
2	Diesel engine	01	559	18	12,343
3	Winnowing fan	27	–	322	27,000
4	Brush cutter	1	30	10	1,500
5	Reaper	1	12	12	3,462
6	Sprayer	03	10 days	10	200
7	Paddy thresher	02	27 days	22	6750
	Total	**36**		**528**	**1,63,696**

2. Community vegetable nursery

Farmers of Khuntli village grow brinjal, chilly, tomato bottle gourd crops all the year round. The area under vegetable crops is increasing gradually. Thus, there is a growing demand for vegetable seedlings of different crops. Due to heavy rain, farmers could not get enough time to prepare seedlings in nursery. Delay in transplanting due to unavailability of seedlings of suitable variety at appropriate time is very common. It has an adverse effect on vegetable production.

Intervention

Low cost shade-net house of about 200m^2 was constructed using locally available material and metallic wire for developing frame. Fifty per cent shade net and 40 mesh insect net was used to cover the side wall of the structure. The insect net was used to protect the seedlings from the pest attack. Raised beds of convenient length were prepared inside net house by thoroughly mixing soil: FYM in 2:1 ratio. The soil was also sterilized using plastic sheet.

Community nursery at village managed by group of farm women

Outcome

During last three years as many as 1,60,000 seedlings of preferred variety of chilly, brinjal, tomato and bottle gourd were produced and made available to the vegetable growers of the village. It generated a revenue of Rs 55,000. It enabled the vegetable farmers to grow preferred varieties at an appropriate time in order to earn higher profits.

3. Establishment of vegetable collection centre

Farmers of the village grow vegetable crops such as brinjal, tomato, bottlegourd, bitter gourd, etc during *rabi* season. Farmers travel 25-30 km distance to sell their produce in the nearby market, where forced selling is a regular phenomenon. Middleman charges are also very high. Thus the vegetable growers are getting very less returns.

Intervention

NICRA village climate resilient management committee has been awarded as the best VCRMC of the zone and has been awarded Rs.1.00 lakh by ICAR. From this prize amount a vegetable collection centre has been established in the centre of the village with a view to collect vegetables from the villagers. It was constructed on 400ft^2. A person has been appointed by the committee to maintain the records of vegetables collection from the individual farmers. Facilities like plastic crates and weighing machine were provided. Traders collect the vegetables in the village itself on cash basis on their own from the centre in the afternoon.

Outcome

Village vegetable collection center saved time and fuel cost of individual farmers. As many as 39000 kg of different vegetables collected at the centre during the last six months (Oct.-2013 to March-2014). Vegetable growers are getting more returns as there is no middleman. Sale of the produce is at absolute discretion of the growers, hence there is no forced selling. Farmers themselves weigh their produce, thus there are no chances of malpractice. Earlier farmers used to give 1 kg vegetable extra as gratis in addition to the net weight to the retailer. Vegetable collection centre is a boon to marginal farmers who grow on small parcels of land.

Collection of produce

Meeting of members

Transportation of produce

4. Paddy seed multiplication in NICRA village

Farmers of Khuntli village were growing HYVs of paddy of different private sector companies. Late monsoon with moderate to heavy wind velocity at harvesting stage of paddy caused lodging of the crop in the field resulting in heavy losses in paddy production. This is because the varieties grown by the farmers are susceptible to water logging. Farmers pay more towards purchase of hybrid seeds and depend on producing companies for seed supply.

Quality seed supply

Paddy seed production plot at village level

Intervention

KVK demonstrated MTU 1010 variety which is high yielding, short duration, dwarf, resistant to water logging conditions, pests and diseases as well. The variety performed very well in the field and gave higher return. In order to supply the seeds of preferred variety at the doorstep of the farmer at cheaper rate, seed multiplication programme was taken up in NICRA village involving 40 farmers and 20 ha. land. The seed plots were frequently monitored by the SMS of KVK.

Outcome

It is expected that about 40000 kg of seeds would be produced under the guidance of KVK. It will be collected by the VCRMC and provided to the farmers of the village at a reasonable price. Large area will be covered under water logging resistant variety which is likely to give higher returns to the paddy growers. It will be a first step towards village level seed self sufficiency. Successful seed production and supply will motivate paddy growers of adjacent villages.

CAPACITY BUILDING

Exposure Tour

Exposure Tour

Exposure Tour

On Campus Training

Off Campus Training

Vocational Training

EXTENSION ACTIVITIES

Launching of NICRA Project

Farmers Seminar

Diagnostic Visit

Field Day

Kisan Gosthi

Off Campus Training

Visitor's of NICRA project village

Name and Address of Visitor	Comments on performance
Dr. Y V Singh Zonal Project Director Zonal Project Directorate, Zone-VI, CAZRI, Jodhpur	Visited CHC, Checkdams & repaired checkdam, Bio gas unit and appreciated other interventions under the project and remarked that KVK deserves appreciation for such a good work in tribal area.
Dr. Sudarshan Ayengar VC-Gujarat Vidhyapith Ahmedabad-Gujarat	Visited demonstration Units under NICRA. Met VCRMC members, Exchanged the idea to promote climate resilient technology in the district. Appreciated the efforts made by KVK for the participatory approach in the tribal village.
Hon. Dr. Kamla Benival **Governor-Govt. Gujarat**	Progress and Impact of NICRA presented by VCRMC- Chairman
Dr. Rajendra Khimani Registrar-Gujarat Vidhyapith Ahmedabad-Gujarat	Visited all demonstrations under NICRA and was happy with way of working in the tribal village of the district.
ZMC Visit **Dr.Pratap Narayan** - Chairman **Dr. N D Yadav** - Head & PS-CAZRI **Dr.P P Rohilla** - PS- Zonal Project Directorate, Zone-VI, CAZRI, Jodhpur **Dr. Derashri** - Director of Extension Navsari Agriculture University	Visited different interventions under NICRA village and discussed with beneficiaries. Very much impressed with farmers and farm women's active participation in the project. All members of ZMC remarked that excellent work under NICRA is being carried out by the KVK.

DIGNITORIES VISIT

Hon. ZPD, Zone VI, Jodhpur

Hon. Member of Parliament, Valsad

Hon. Vice Chancellor, Gujarat Vidyapith

Hon. Registrar, Gujarat Vidyapith

CRIDA Repersentative

Department/NAU Scientist

Students from Foreign University

Researcher SP University, Vidyanagar

Zonal Monitoring Committee Members Visit

Zonal Monitoring Committee

Visit of CHC

Visit of Gobar Gas Unit

Visit of IFS Model

Visit of Net House

Interaction with farmers

RECOGNITION

Visit of Hon. Governor of Gujarat

Best CRMC, (Zone VI) Award by Hon. DG

Presentation at National Conference at Banglore

Issuance of Smart Farmer Certificate

RECOGNITION

Best NICRA KVK Award

Best NICRA KVK Award

Certificate of Appreciation

Best NICRA KVK Certificate

Multi-enterprise agriculture model :

Farmers of the Khuntli village follow paddy-gram crop rotation. Few farmers were growing vegetable crops. About 80 per cent of the total families depend directly on forest for their fuel requirements. Farmers collect cow dung, dry it, prepare cow dung cake and used it as fuel. Burning of wood adds carbon in the atmosphere which is hazardous to health. Livestock production is restricted to the domestic consumption purpose only. Continuous use of paddy straw as fodder aggravates infertility and poor milk production. Inter-calving period is also very long. Thus, the earning from dairy farming is very low. By and large in this village, non-viable single enterprise agriculture model with very poor management of available natural resources is being practiced.

Intervention

Under NICRA project many climate smart technologies, explained earlier were demonstrated on farmers' field with their active involvement. It has provided better livelihood options to the farmers. A multi-enterprise model based on integrated farming system and multiple water-use approach involving components of crops, dairying, horticulture, vegetables, gobar gas plant, soil health management, natural resource management, custom hiring centre etc. were developed to provide regular income, employment and livelihood to small and marginal tribal farmers with reduction in drudgery.

Outcome

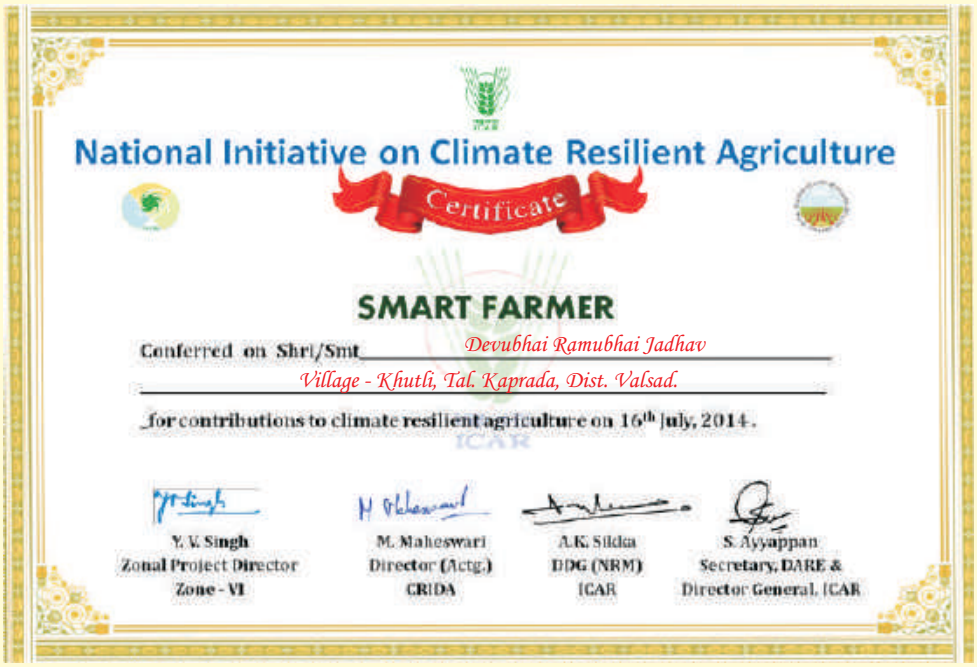
Benchmark survey indicated that the field crops (rice) gave a net income of 27000/ha, dairying Rs 19000, and vegetable Rs 21700/ha. Adoption of climate smart technologies improved the livelihood of the farmers. The enterprise-wise net income increased for field crop (rice) Rs. 22500/ha., dairying Rs. 29400 and vegetable Rs. 37000/ha.

Our co-partners in the process of development

- Gujarat Green Revolution Company
- Valsad District Cooperative Milk Producers Union Ltd.
- ANARDE Foundation
- Jasoda Narottam Public Charitable trust
- State Dept. of Irrigation, Valsad
- State Dept. of Forestry, Valsad
- Navsari Agricultural University, Navsari
- ATMA Project, Valsad

Smart farmer certification

Hundred farmers, who actively participated in the demonstration of various climate smart technologies on their farm were felicitated with smart farmer certificate by the Indian Council of Agriculture Research, New Delhi on its ICAR Foundation Day celebrated at Krishi Vigyan Kendra.


National Initiative on Climate Resilient Agriculture

Certificate

SMART FARMER

Conferred on Shri/Smt. Devubhai Ramubhai Jadhav

Village - Khutli, Tal. Kaprada, Dist. Valsad.

for contributions to climate resilient agriculture on 16th July, 2014.

Y. V. Singh, Zonal Project Director, Zone - VI

M. Maheswari, Director (Actg.), CRIDA

A.K. Sikka, DDG (NRM), ICAR

S. Ayyappan, Secretary, DARE & Director General, ICAR

Lesson Learnt

- The custom hiring of farm machinery provides a viable option to the small and marginal tribal farmers in timely completion of field operations and thereby reduction in total cost of cultivation and increase in profitability.
- Rain water harvesting through renovation of check dams, percolation tank, farm ponds and effective use of the harvested water through MIS improve the water use efficiency and brought more area under cultivation.
- Minimized fodder scarcity problems by growing perennial variety of fodder crops.
- Farm waste are converted into manure by large scale adoption of biogas plant and making vermicompost from the slurry.
- Area under the crop Rice, Vegetables, Fodder crops increased considerably due to increase in the availability of water and efficient utilization of water.
- Capacity building of the farmers and farm women through regular on and off campus training , interactive method demonstration, exposure tour , plays significant role in increasing awareness about climate smart technologies.
- Active participation of farmers at all the stages i.e. planning, implementation and execution of different activities under NICRA project resulted in to success.
- Increase in income per unit area by adoption of water logging resistant paddy variety and crop diversification through introduction of vegetable and spice crop.
- Integrated farming system model i.e. Farming + Dairying + Horticulture found more remunerative instead of mono enterprise model
- The problem of unavailability of seeds of water logging resistant can be overcome by seed village programme under NICRA.

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद
ICAR
Agrisearch with a human touch

National Initiative on Climate Resilient Agriculture

Gujarat Vidyapith
KRISHI VIGYAN KENDRA
AMBHETI, District : VALSAD, GUJARAT