Transformation of Farming Community through KVK Technologies in Valsad District

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GUJARAT VIDYAPITH

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FOREWORD

The Indian Council of Agricultural Research has established a net work of 642 Krishi Vigyan Kendras (KVKs) in the country. The role of KVKs lie in facilitating the technology assessment and demonstration for its application and capacity development. Krishi Vigyan Kendras are emerging as a center for integrating various efforts of technology dissemination at the district level and address the agricultural issues in local and national perspective.

The Council sanctioned a KVK in district Valsad, Gujarat in 1992 under the administrative control of Gujarat Vidyapith (A Deemed University). The KVK is serving for tribal farming community for more than two decades for agricultural development of the district.

I am happy that the Chief Scientist and Head of the KVK and his team have made sincere efforts to document the impact of various activities undertaken by the Kendra in tribal dominated district of Gujarat.

I congratulate the authors in their endeavor and hope that the publication will be useful to all stakeholders associated with KVK network.

Date : 20.10.2015

(A. K. Singh)

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PREFACE

Krishi Vigyan Kendras (KVKs) are the knowledge and resource centres of National Agricultural Research System of ICAR providing agro-advisory and technology backstopping to all stake holders including farming community. The zone VI has 67 KVKs situated in two states namely Rajasthan and Gujarat. KVK located in Valsad district of Gujarat is among them working under the auspices of Gujarat Vidyapith (A Deemed University) founded by Father of Nation Mahatma Gandhiji in 1920. The KVK at Ambheti is serving tribal farming community for more than two decades towards agricultural development of the district and development of skill of farmers, farm women and rural youth by organizing long term vocational training programmes. This KVK has made remarkable contribution in transfer of technologies like introduction of new varieties of paddy, sugarcane, vegetables, use of liquid bio fertilizers, fodder crops. It also involved in introduction of farm machinery, livestock production related technologies in the tribal areas. The KVK at Ambheti has proved that if KVK is blended with a Gandhian philosophy aimed at rural India, can make led to empower tribal & underprivileged in a big manner and it has in fact galvanized their economic activities.

It is my privilege to thank Dr. S. Ayyappan, Secretary DARE and DG, ICAR, Dr. A.K.Singh, DDG (Agri. Ext.) ICAR and Dr. P. P. Rohilla, Director, ATARI, Zone-VI, ICAR for their encouragement and suggestions for documentation and publication of success of KVK.

I am happy that the Chief Scientist and head of KVK and his team have made very sincere efforts to document the impact of various activities undertaken by the Kendra and publishing a bulletin giving details of work done and compilation of success stories.

I congratulate the authors in their endeavour and hope that the publication will be useful to all those associated with KVK network.

Date: 03.11.2015

(Anamik Shah)

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MESSAGE

I am glad to learn that Krishi Vigyan Kendra Valsad is bringing out a publication entitled,"Transformation of Farming Community through KVK Technologies in Valsad District" giving details of impact of multifarious activities carried out in tribal areas during last 22 years. The KVK has played a crucial and leading role in enhancing the production and productivity of agriculture and allied fields by technological backstopping through training of farmers, farm women, rural youth and extension functionaries of the district. KVK Valsad has done commendable work on seed and seedling production, vermi compost production, grafted mango production, fruit fly trap production, perennial fodder planting material production and supplied to the farmers of the district.

Looking towards the excellent work done on various components under National Innovations in Climate Resilient Agriculture (NICRA) project, KVK- Valsad has been awarded as "Best VCRMC" during the year 2013-14 and also the "Best NICRA KVK"under Zone VI during the year 2014-15 by the Indian Council of Agricultural Research, New Delhi.

The efforts put forward by the Chief Scientist and Head Dr. R. F. Thakor and his teammate in documentation of the success is highly appreciable. I do believe that the document will be useful for the extension scientist and policy makers concerned with the transfer of technology in particular and agricultural development in general.

Date: 19.11.2015

(P. P. Rohilla)

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I am extremely grateful to Dr. Yudh Vir Singh, former Zonal Project Director of zonal project directorate, zone VI for his invaluable guidance and kindly editing of this manuscript. Dr. Singh had given us generous support during his tenure and motivated us to transform community through innovative extension programme of the council. His behaviour with KVK staff of zone was marvelous and he had given due respect to all of us like his younger brothers. I hope he will help us in future too by valuable words and deeds. I am thankful to the ICAR and DDG (AE) for extending all kind of support to fulfill the mandate of KVK.

My sincere thanks are also to our vice chancellor and registrar to get this publication in this shape for according all kind of facilities. I would also like to thank my colleagues Dr. B. M. Mehta, Dr. N. M. Chauhan, Dr. P. K. Sharma, Dr. V. K. Garg, H. N. Patel and S. U. Zala for giving me support and feedback.

I acknowledge the help received from colleagues and friends at different stages of this work. I also extend my sincere thanks to Director, ATARI, zone VI, Sh. Narpat singh and auxiliary staff of KVK for their stint less advice and help.

Date : 19.11.2015

(R. F. Thakor)

CONTENTS

1. INTRODUCTION

Krishi Vigyan Kendra is an innovative science based institution committed to train farmers, farm women, rural youth and extension functionaries besides transfer of latest relevant technologies in the district through conducting front line demonstration of newly released or pre released high yielding varieties, technologies and inputs and plan to carry out On Farm Research (OFR) or On Farm Testing (OFT) to verify, validate and refine location specific technologies generated by the national agricultural research system for its wider adoption among farmers. The activities of which were initially confined to training, Front Line Demonstration and On Farm Testing have been further extended to identification of indigenous technology and also production and supply of various inputs on instructional farm and also implementation of climate resilient agricultural technologies.

It is also called as front line transfer of technology project of the Indian Council of Agricultural Research, New Delhi. It emphasized on capacity building of small and marginal farmers through skill oriented vocational training which ultimately develop confidence among them about use of the technology on their farm to increase production and also become economically self reliant through gainful employment.

Our country is facing two major challenges: i) low agricultural production and ii) under and unemployment. KVK being the important link between the research and extension system can play pivotal role in addressing both the challenges by planning and implementing number of extension activities meant for agricultural development.

The first KVK, on a pilot basis, was established in 1974 at Pondicherry under the administrative control of Tamilnadu Agricultural University, Coimbtore. At present the strong network of 642 KVKs across the country from Leh in North to Kanyakumari in South and Lohit in East to Kutch in West act as knowledge and resource centre of agricultural technologies for supporting initiatives of public, private and voluntary sector in improving the agricultural economy of the district and nation to achieve food security and employment. KVKs are best positioned to convert the information into knowledge. It emerging as the knowledge hubs. KVKs have proved their capabilities to handle emerging challenges in agriculture and allied sectors.

2. PROFILE STRUCTURE OF VALSAD DISTRICT

Valsad district is located in South-Eastern part of Gujarat. It is bounded on North by Navsari district, on the South –East by Maharashtra state and by Arabian sea in West. It has a total geographical area of 2,94,412 ha. The geographical boundaries of the district extend from 20.07 to 21.00" North Latitudes and from 72.43 to 73.00" East Longitudes. The district is surrounded by the districts Navsari (Gujarat) in north, Thana (Maharastra) in South, Nasik (Maharastra) in East and Arabian sea in West.

Administratively the district is divided in to six blocks covering 433 villages. The conspicuous features of the district are the undulating topography (hilly) with steep slopes. The district is drained and watered by four rivers namely, Damanganga, Kolak, Par and Ambica. The total forest area of the district 87,648 ha is about 29.77 % of the total geographical area. The forest belongs to fuel type, medicinal type such as Kher (*Acasia catechu*) and valuable timber type such as Teak wood (*Tectona grandis*), Sadad (*Terminalia tomentosa*), Sal (*Shorea robusta*), etc.

Demographic Profile

The population of district according to 2011 census is 17,05,678 persons of which 8,87,222 male and 8,18,456 females. The population density as per the census report is 579 persons per sq. km. The total population of Valsad district includes 9,02,794 persons of Schedule tribes and 38,237 persons of Schedule caste forming 52.93 % and 2.24 % of the total population, respectively. Out of the total population, 62.74 % resides in rural and 37.25 % in urban areas. Literacy rate of the district is 68.63 %. Literacy rate of male is 73.88 % and female literacy rate is 62.93 %. A total of 1,22,839 farmers in the district constitute 76820, 22923 and 23096 marginal, small and big farmers, respectively.

Climate and Rainfall

The district falls under Agro climatic zone I (South Gujarat heavy rainfall zone) of Gujarat. The average annual rainfall of the district ranges between 2200 to 2500 mm, spread over an average of 87 rainy days in a Year. The maximum temperature ranges between 35˚ to 41˚ C during April – May. The lowest temp (8.1˚ to 8.6˚ C) observed during Dec-January.

Agro Ecological Situation of Valsad District

Valsad district as a whole falls in South Gujarat Heavy Rainfall Zone-I which consists of two distinct agro-ecological situations viz; AES I and II. AES-I comprises of Dharampur and Kaprada talukas while AES-II comprises of Valsad, Pardi, Umargam and Vapi talukas of Valsad district.

Name of Agro-ecological situations	Physiography	Brief features
AES-I Sub-mountain undulating	Sub-mountain undulating rain fed, medium black to black, hilly laterite soils	Tribal area, forest land, medium black to black, hilly laterite soils, rain fed, highest rainfall , well irrigated, paddy, cashew, mango main crops. Socio-economically farmers are poorest.
AES-II Central sub-coastal plain	Central Sub-coastal Plain, tube well irrigated and limited canal facilities, medium black to black, saline and alluvial soils	Tribal and big farmers are in almost equal proportion, highest irrigation, medium rainfall, paddy, mango, sapota, sugarcane and vegetables, highest fishermen, industrialization, urban areas highest in the district. Socio-economically farmers are most affluent

Geographical Location of Valsad District

Agricultural Profile

Of the total 2,94,412 ha area, 1,65,330 ha (56.15 %) is under cultivation. Paddy and sugarcane are the important crops. Other crops such as fruit crops (mango, sapota, banana, cashew nut), vegetables (brinjal, chilly, okra, cucurbits) and pulses (pigeon pea, black gram, gram and Indian bean) are also common. Alphanso variety of mango popularly known as "VALSADI HAFUS" is world famous for their unique taste. The soil of the district in general is shallow to medium black with poor fertility status and having low moisture retention capacity. There is a wide variation in the district in terms of composition of soil. It can broadly be classified in to three categories viz.

1) Medium black, saline soil in coastal belt –Western part
2) Medium black to black soil - Central Part
3) Hilly, shallow, undulating land – Eastern part

Saline soil occupied 1,10,421 ha. followed by hilly laterite soil 95,590 ha. The main sources of irrigation are open well, bore well, canal and rivers. Damanganga irrigation project is the only major canal irrigation project of the district. Of the total cultivated area 37.35 % (61751 ha) is irrigated while 62.65 % (103579 ha) is rain fed.

LAND UTILIZATION OF VALSAD DISTRICT

Sr. No	Particulars	Area (ha)	Percent
1	Geographical area	2,94,412	100
2	Forest land	87,648	29.77
3	Barren and uncultivable land	6504	2.21
4	Land put to non agricultural use	19246	6.54
5	Permanent pasture and grazing land	2249	0.76
6	Cultivable waste land	11486	3.90
7	Current fellows	1940	0.66
8	Net area sown	165330	56.16

3. HOST INSTITUTION AND THE KVK

The host institution - Gujarat Vidyapith was founded by Mahatma Gandhi in 1920. The Vidyapith is engaged in upliftment of down trodden poor rural people. Vidyapith has undertaken various activities like education programmes for eradication of illiteracy, eliciting skill of rural artisans as to their profession and undertaking various rural support activities through its already established Gram Seva Kendras besides providing education in various fields. The host institution has been a deemed university since 1963 under section 3 of the UGC act, 1956. The Gujarat Vidyapith has been running eight Rural Service Centres (Gram Seva Kendras) for implementing various activities to increase the socio-economic status of rural people.

Indian Council of Agricultural Research has sanctioned three KVKs under the auspices the Gujarat Vidyapith –located at Ambheti (Dist. Valsad), Randheja (Dist. Gandhinagar) and Dethli (Dist. Kheda). Krishi Vigyan Kendra –AMBHETI has started its functioning in September, 1992.

The main aims of the KVK are to train farmers, farm women and rural youth as well as extension workers of the state dept./NGOs and to demonstrate the latest agricultural technologies to the farmers with a view to reduce the time lag between the technology generation and its adoption. KVK Ambheti has an instructional farm of about 20 hectares. The whole farm is divided in to different demonstration units such as Crop production, Horticulture, Agro forestry, Vegetable production, Vermi compost, Nursery and Dairy demonstration unit.

Mandates of KVK

1. Conducting the "On Farm Testing" for identifying technologies in terms of location specific sustainable land use systems.
2. Organize training to update the extension personnel with emerging advances in agricultural research on regular basis.
3. Organize short and long vocational training courses in agriculture and allied vocations for the farmers and rural youth with emphasis on "Learning by Doing" for higher production on farmers and generating self employment.
4. Organize the front line demonstration on various crops for generating production data and feedback information.

Thrust areas

- Increase productivity of paddy, sugarcane and pulses.
- Increase area and productivity of horticultural crops.
- Increase awareness about scientific management of milch animals.
- Popularize the techniques of soil and water conservation .
- Income generation activities for rural youth through skill oriented vocational training for generating employment in rural areas.
- Popularize integrated approach for the control of pests and diseases.

INFRASTRUCTURE

- Soil and water testing laboratory
- Plant health clinic
- Automatic weather station
- Net house
- Green house
- Farmers hostel
- Seed storage
- Museum
- Library
- Threshing floor

DEMONSTRATION UNITS

- Vegetable seedling nursery
- Fruit crop nursery
- Dairy unit
- Vermicompost unit
- Agroforestry unit
- Drip irrigation system unit
- Crop museum- sugarcane, paddy, mango, sapota, vegetables, agro-forestry
- Fodder unit
- Vegetable nursery
- Azolla production unit
- Seed production –paddy/sugarcane

DEVELOPMENT OF DEMONSTRATION UNITS AT KVK

Demonstration unit	Financial assistance (Rs)	Source of funding
Fruit and vegetable preservation	37000	Tribal Sub Plan
Medicinal plants unit	1,00,000	Medicinal Plants Board
Leaf cup making unit	11000	Tribal Sub Plan
Net house	37000	Dept. of Horticulture
Agro forestry	----	Dept. of Forest
Dairy unit	2,00,000	Tribal Sub Plan
Vermicompost unit	60,000	National Horti. Mission
Nursery unit with net house	3,00,000	National Horti. Mission
Green house	1,70.000	National Horti. Mission
Drip irrigation unit	40,000	GGRC
Fodder unit	–	KVK
Biocompost unit	–	KVK

INFRASTRUCTURE & DEMONSTRATION UNITS

Administrative Building

Soil Water Testing Lab

Plant Health Clinic

Dairy Unit

Green House

Nursery

Vermi Compost Unit

Automatic Weather Station

Vegetable Nursery

Azolla Unit

Fodder Unit

Gangama Circle Unit

SALIENT ACHIEVEMENTS OF KVK

- Awarded " Best NICRA KVK AWARD" in Zone VI for the development of model NICRA village demonstrating climate smart technological intervention.
- The Village Climate Resilient Management Committee of the Khuntali village is awarded as " Best VCRMC" cash prize worth Rs.1,00,000.
- Skill oriented long duration vocational training programmes for rural youth particularly which includes Nursery management, Tractor & Power tiller driving and maintenance, Oil engine and Electric motor repairing and maintenance were successfully organized.
- Vocational training programmes for rural women empowerment which includes Leaf cup/ Paper dish making, tailoring, fruit & vegetable preservation, bamboo articles, foot mat preparation, sewing, imitation jewelry preparation etc. were organized. Many of the trainees are earning sizable additional income.
- Produce and supply the seed material of improved varieties of paddy, sugarcane, brinjal, tomato, chilly, cabbage, sweet potato, mango grafts. It has replaced the poor yielded variety and increased production.
- Kendra has popularized its product i.e. Fruit fly traps for mango and cucurbit vegetables among tribal farmers. It had not only improved the quality of produce but also lower down the cost.
- First time introduced perennial fodder grass cultivar BNH-10, Co-1, Co-2, Co-3 and Co-4 in the district. It had covered about 35 hectares of land.
- Under breed improvement programme, 4352 animals treated by KVK scientist alone with success ratio of about 30 per cent.
- Popularize organic farming by educating tribal farmers on the aspects -vermi compost, liquid bio fertilizers, use of bio pesticides, eco friendly traps, etc.
- Generated revolving fund of Rs. 72,00,000/- up to 31st March, 2015.
- Analyse more than 7700 soil and water samples and issued soil health cards.
- Regularly publishes news letter.

4. MAJOR TECHNOLOGICAL INTERVENTIONS

1. Crop Production
2. Horticulture
3. Crop Protection
4. Soil Health and Fertility Management
5. Livestock Production and Management
6. Women Empowerment
7. Agriculture Engineering
8. NICRA Project
9. Extension Activities
10. Extension - Development and Linkages

4.1 CROP PRODUCTION

(1) Optimum Seed rate in Paddy

Tribal paddy growers were using higher seed rate i.e. 30 – 40 Kg as against recommended dose of 10-12 kg for transplanting one acre of land. They were planting 8-10 seedlings per/ hill. It causes over plant population, increase incidence of pests and diseases and ultimately gave poor yield. KVK demonstrate the optimum seed rate technology through FLD. Majority of the paddy growers are now applying recommended dose of the seed rate, transplanting only 2-3 seedlings per hill and thereby save around Rs. 5000/- per hectare.

Transplanting method

Transplanted paddy field

(2) Planting Techniques in Sugarcane

Sugarcane growers of the district grow sugarcane by overlapping method (one set to another in line) using three eye bud sets which required 10-12 tones of seed material per hectare. The average cost of seed material of sugarcane is Rs. 2500 per tone. Thus, individual farmer was investing about Rs.25,000 to 30,000/- for planting material for one hectare of land. KVK had demonstrated the technology of two eye bud set with end to end method of planting of sugarcane. This method requires only 5 to 6 tones of planting material per hectare. Thus, the cost of seed material reduced up to 50 % per hectare. About 60 % of sugarcane growers have adopted the planting technique. It saves Rs.12000 to 15000/- per hectare.

Method demo on planting technique

Profuse tillering of sugarcane

(3) SRI in Paddy

The traditional method of rice cultivation requires more water. Tribal farmers transplant 25 days old seedlings and 8-10 seedlings per hill in Kyari land when there is standing water of about 4-5 cm. It was difficult for the upland rice farmers to grow nursery with healthy seedlings. Due to poor soil fertility yellowing of seedlings (iron deficiency) was most commonly observed in nursery. KVK started the SRI on experimental basis. Selected farmers undergone skill training on SRI method of rice cultivation along with extension functionaries at KVK instructional farm. After that Front Line Demonstration were laid out on SRI method on the field of selected trained farmers. Following Farmer–led-farmer approach, around 1000 farmers had adopted the technology in the district and harvested 29-30 per cent more yield with efficient use of water than that to conventional method. Many farmers had also adopted the SIRA (Sawants Integrated Rice Agro) technology popularized by the Kendra aiming at reduction in cost of fertilizer by applying pallets of fertilizer in lieu of granular fertilizer.

Practical training on SRI technique

(4) Introduction of HYVs

Paddy, sugarcane, finger millet are the important crops of the area. In the early years of KVK, farmers were using traditional varieties of crops such as paddy (Taichung-1, Kada, IR-28), sugarcane (Co-671, Co-86032), green gram (K-851), finger millet (local), indian bean (local). All these varieties were having poor yield potentials. They were not much aware of the availability of the improved seed and production potentials. KVK had successfully introduced new varieties and convinced farmers to adopt HYVs of different crops through training and demonstration. Today tribal farmers are growing latest varieties such as paddy (MTU-1010, GR-7, GAR-13, GNR-4) sugarcane (Co-5071, Co-5072), green gram (Meha), finger millet (Guj. Nagli 4 & 5), indian bean (NPS-1), etc. on considerable area and harvesting more profit.

Varietal demonstration on paddy

Introduction of Meha variety of green gram

(5) Seed Multiplication of Paddy and Sugarcane

Lack of knowledge and unavailability of good quality seeds are the major problems in tribal area. In order to supply the quality seeds of high yielding varieties of paddy and planting material of sugarcane, the programme of seed multiplication was undertaken on Kendra's farm in collaboration with sugar factory and State Agricultural University. The seed produced were supplied to the farmers with a view to bring more and more areas under improved variety replacing the variety having poor yield potential grown by the farmers since long. By the end of the year 2014-15, more than 79 tones of pure seeds of different varieties of paddy and 935 tones of planting material of recommended varieties of sugarcane were supplied to the farmers of the district. Along with paddy and sugarcane, seeds of pulses such as gram, green gram were also produced and provided to the farmers. Table 1 shows the statistics on production of seed of paddy and sugarcane in the district.

Paddy seed production plot

Distribution of paddy seed

(6) Seed Village Programme

Unavailability of the quality seeds is one of the problems faced by the tribal farmers. Farmers have to pay more towards purchase of seeds that way large amount of revenue drained from the villages to seed producing companies. In order to produce the seeds of recommended variety at the doorstep of the farmer they have been trained on various aspects of seed multiplication such as selection of variety, disease free seeds, rouging of off type plants, safe storage of seeds etc. The seed multiplication programme was also under taken in gram, greengram and paddy crops at farmers field. The seed plots were frequently monitored by experts from KVK Valsad and plant breeders of SAU. Many farmers associated with the activity in the district. The programme was also taken up in Navsari and Dangs district in co-ordination with Centre for Environment Education (CEE) and Jashoda Narottam Charitable Trust.

Storage of seed at village level

Table 1 : Details of Seed Production of Paddy & Sugarcane by KVK

Year	Paddy		Sugarcane	
	Qty sold (qt)	No. of farmers	Qty sold (qt)	No. of farmers
2001-02	19.15	123	585	31
2002-03	54.10	342	660	37
2003-04	64.79	421	480	35
2004-05	68.54	556	798	17
2005-06	79.70	586	1340	50
2006-07	72.11	484	1500	30
2007-08	46.52	360	680	39
2008-09	19.00	258	936	41
2009-10	43.99	299	750	51
2010-11	40.05	167	166	14
2011-12	64.98	883	216	20
2012-13	75.71	853	570	15
2013-14	94.47	780	327	13
2014-15	46.96	450	345	25
Total	790.07	6562	9353	418

Varieties Multiplied Under Seed Production Programme

Paddy

GR 3	JAYA
GR 4	MTU 1010
GR 7	GNR 4
GR 11	PUNJAB 12
GAR 13	BPT 5204
NAUR 1	

Sugarcane

CoN 95132	CoN 05072
CoN 03131	CoN 07072
CoN 05071	CoN 8001
CoN 91132	Co 86032

4.2 HORTICULTURE DEVELOPMENT

(1) Mango Rejuvenation

Mango is an important crop of the district covered 46 % of the total area of cultivation of fruit crops in Gujarat. Area under mango cultivation is increasing but the productivity is low. Preponderance of old, senile, unproductive trees and poor management practices of old orchard are the important reasons for low productivity. Kendra had made vast efforts to popularize technologies related to rejuvenation of old and senile mango orchard in collaboration with National Horticulture Mission (NHM), Agricultural Technology Management Agency (ATMA) and agriculture department of State Govt. Pruning of tree makes the orchard spacious and open with more sunlight which, ensures increased photosynthetic efficiency, resulting into higher sustainable production over long period. The KVK had also promoted intercropping with pulse (Indian bean) and turmeric crop in prunned orchard to get additional income.

Heavy prunning of mango trees

Rejuvenation in old orchard

(2) Crop Diversification

Sugarcane is an important crop of the district. Sick sugar industries, fall in the prices of sugarcane, delayed payment by sugar mill, increase in cost of production due to monocropping and inefficient management by sugar mill has compelled the farmers to go for cultivation of short term profitable vegetable crops. In order to meet the higher demand of seedlings of HYVs, a nursery unit of about 0.4 ha land was developed on instructional farm for production and supply of healthy vegetable seedlings. Various extension activities were also organized to diffuse the production technology of vegetable crops. Till date more than 90 lacs seedlings of HYVs of vegetable crops i.e. brinjal, tomato and chilly were produced and sold to more than 12000 farmers. It has increased the production and income of tribal farmers. Vegetable cultivation proved to be the best livelihood options for economic security of farming community.

Introduction of HYVs in brinjal

Bittergourd cultivation on sloppy land

Details of production and supply of seedlings of various vegetable crops are shown in the table 2.

Table 2 : Details of Production and Supply of Vegetable Seedlings by KVK

Year	Vegetable seedlings			Total seedlings	No. of beneficiary	No. of village covered
	Brinjal	Tomato	Chilly			
2001	7350	1000	1700	10050	13	03
2002	69145	35205	18215	122565	196	22
2003	107405	23270	60240	190915	379	42
2004	176790	28950	33445	239185	391	50
2005	280500	47350	65000	392850	731	58
2006	580140	117790	76530	774460	1244	88
2007	845655	135390	164265	1145310	1496	96
2008	1079990	105760	111880	1297600	1539	67
2009	806600	80600	112800	1000000	1380	53
2010	986900	104500	108600	1200000	1500	66
2011	364730	68900	94080	527710	690	82
2012	497070	98900	117290	713260	661	72
2013	477985	53900	131175	663060	1125	123
2014	580000	25000	130000	735000	700	120
Total	6860260	926515	1225190	9011965	12045	942

(3) Varietal Introduction in Mango and Vegetables

Farmers were growing local varieties having poor yield potentials. Seeds of HYVs were not available in the local market. Seeds of HYVs were very costly therefore small farmers could not afford the same. Kendra had made available seedlings of different varieties of vegetable crops at the doorstep of the farmers and thus, the area under vegetable cultivation had increased manyfold. Kendra had also established mother nursery of mango accredited as grade **"B"** nursery by the NHB. It had produced 19185 grafts of many new varieties such as Amrapali, Sonpari, Vanlaxmi, etc. in addition to Alphanso and Kesar and supplied to the farmers. It had increased area under new varieties of mango as well as vegetable crops in the district. Table 3 shows the details of production and supply of mango grafts by KVK.

Mango mother stock nursery

Farmers procuring vegetable seedlings

Table 3 : Details of Production and Supply of Mango Grafts by KVK

Year	No. of mango graft	No. of farmers
2007-08	2100	35
2008-09	2500	45
2009-10	2500	45
2010-11	2820	26
2011-12	4500	68
2012-13	2732	71
2013-14	2033	136
Total	19185	426

(4) Planting Technique in Mango (High Density Planting)

Old plantations of mango in the district accommodated only 100 plants per hectare as the distance between two plants maintained by the farmer was about 10 meters. The unproductive branches created shadow in the field and do not allow sunlight below canopy area. Thus majority of the orchard remained unproductive. KVK introduced close distance planting of mango at 5 meters. It increased no of plants four times i.e. 400 plants per hectare which enabled farmers to harvest more yield in the initial years.

High density plantation in mango

(5) Protected Cultivation

KVK played significant role to popularize the protected cultivation technology among the tribal farmers by organizing training programmes, seminars and exposure tours. Kendra was also actively involved in capacity building of district extension functionaries. As many as 150 low cost green house/ shed net house were erected in the district with the financial assistance of state government. Many farmers had produced capsicum, cucumber, gerbera crops in the net house and earned good income.

Practical training on protected cultivation

Farmers's exposure to greenhouse

(6) Rural Youth Training

The district is having good potential for horticultural development and therefore capacity building of rural youth for entrepreneurship development is of utmost important. KVK organized thirteen long term skill oriented vocational training of 5 to 8 days duration on grafting techniques in mango and nursery management -vegetable seedling raising. Two gardener training programme each of six month duration (residential programme) sponsored by National Horticulture Mission (NHM) were also organized. Some of the trained rural youth started their own nursery and few of them worked as skilled labour with private nurseries and farm earning Rs.6000-8000 per month.

Skill training on gardening

Practical training on grafting technique

(7) Post Harvest Technology

Mango and vegetable growing tribal farmers of the district were fetching poor market price because of poor handling of the produce. i.e. use of gunny bags, bamboo basket, no grading etc. KVK trained the farmers on post harvest technology for improving quality of fruit and vegetables.

Grading and packing of bottlegourd

Post harvest handling of vegetables

Now, farmers adopted the technique of grading and packing of produce like bottle gourd wrapped with soft paper and polyethylene bags. Mango growers used improved cutter for harvesting, plastic crates instead of gunny bags and bamboo basket for proper handling of fruits and vegetables while transporting to market. Kendra had supplied about 8000 plastic crates on subsidized rate to the farmers under the scheme of state department of Horticulture.

(8) Promotion of Agroforestry

Valsad is predominantly the forest area. The forest belongs to fuel type, medicinal type such as Kher *(Acasia catechu)* and valuable timber type such as Teak wood *(Tectona grandis)*, Sadad *(Terminalia tomentosa)*, Sal *(Shorea robusta)*, Saru *(Casurina equisatifolia),* etc. Agro-forestry is a suitable system to change the poor fertile degrades soil in to productive one. KVK had developed demo unit of teak wood and casurina plantation on instructional farm and trained the farmers with a view to promote agro-forestry in the region . Kendra also introduced plantation of clonal casurina plants which gave faster growth , straight wooden logs without branching ultimately gave higher prices.

4.3 CROP PROTECTION

(1) Management of Fruit Fly in Mango

Attack of fruit fly on the mango fruits is the one of the acute problem faced by the mango growers since long. The oriental fruit fly *(Bactrocera dorsalis)* is a very destructive pest of fruit in this area. It does not reduce the volume of produce but also deteriorated fruit quality resulting into economic losses to the mango growers. The tribal mango growers were not aware of fruit fly pest, its nature of damage and its management. They were applying pesticides which were costly and unsafe to environment. Spray of pesticides on the big canopy of mango tree was very drudgeries task. Thus majority of the tribal mango growers do nothing to solve the problem resulting in poor production in terms of both quantity and quality. KVK introduced technology of fruit fly trap using methyl eugenol as sex pherommone.

KVK initiated the awareness programme through mass demonstration of the technology on farmers' fields. Village level workers and other extension functionaries were also trained by KVK regarding preparation and use of fruit fly trap in fruit crops. As a result as many as 18-20 % farmers adopted this cheaper and eco friendly technology on their farm. KVK started production of trap for wide spread of the technology and till date supplied more than 18000 traps to the farmers at affordable price.

Male flies attracted by trap

Fruit fly trap developed by KVK

(2) Management of Fruit Fly in Cucurbit Vegetables

The area under cucurbit crops like bottlegourd, bittergourd, ridgegourd, smoothgourd, etc. increased during last decade due to high profitability of cucurbit vegetables in Dharampur and Kaprada block of the district. The attack of fruit fly in these crops caused considerable quantitative and qualitative loss in yield. KVK launched awareness programme for the farmers on integrated management of fruit fly through training and demonstration and popularized the eco friendly technique of Cu lure fruit fly trap. KVK started the production of traps at the kendra to made it easily available to the growers.

Demonstration of trap in cucurbit vegetable

Training on fruit fly management

Details of fruit fly traps supplied by the KVK during last 12 years are shown in table 4.

Table 4 : Details of Fruit Fly Traps Supplied by KVK

Year	No. of traps	Area (ha)	No. of farmers
2003-04	700	70	62
2004-05	500	50	50
2005-06	300	30	61
2006-07	270	27	51
2007-08	500	50	39
2008-09	500	50	61
2009-10	7894	789	397
2010-11	1500	150	168
2011-12	1771	177	197
2012-13	1271	128	134
2013-14	1439	144	157
2014-15	1973	197	146
Total	18618	1862	1523

(3) Integrated Pest Management in Paddy

Paddy is an important crop of the district. Stem borer and hoppers are the important pests of the paddy causing yield losses. Kendra focused on diffusing eco-friendly low cost IPM technology in adopted villages. The zero cost technology of control of stem borer i.e. cutting of tips (2-3 cms) of seedling while transplanting paddy in the main field, maintain optimum plant population by planting 2-3 seedlings /hill. had been widely adopted by the farmers. It reduced the cost of cultivation by 10-12 percent.

Training on IPM technologies

IPM demo plot of paddy

(4) IPM in Vegetables and Pulses

Brinjal, tomato, chilly, bottlegourd and bittergourd are now the major vegetable crops in Valsad district. The pest and diseases cause severe damage to these crops due to favourable weather condition. Majority of farmers were applying higher doses of chemical pesticides. To reduce the hazardous effects of chemicals, KVK had popularized the following eco friendly techniques for pest and diseases management in vegetables and pulses.

- Use of sex pheromone traps for fruit borer, pod borer and fruit fly.
- Use of bio pesticides viz., NPV, Beuvaria bassiana, neem oil as biological control of pest in vegetables and pulses.
- Use of bio pesticides viz., Trichoderma virdie, Tricho xp, Pseudomonas for wilt disease management .
- Use of yellow sticky traps for management of sucking pest.
- Use of recommended pesticides with recommended doses for pest management.

Demo on IPM technologies in brinjal

(5) Plant Health Clinic (PHC) Analysis Based Advisory

The KVK had established well furnished Plant Health Clinic to diagnose the pest and diseases. The farmers of district had availed the facilities provided by KVK. Till date, more than 618 samples were diagnosed by the PHC benefiting 1051 farmers of the district. The farmers were also advised to adopt the eco-friendly measures to control pest and diseases. KVK scientists had also provided doorstep advisory services as and when required on short notices. Details of diagnostic services provided by KVK scientists are reflected in table 5.

Sample diagnosis at PHC

Advisory service by KVK

Table 5 : Details of Diagnostic Services by KVK

Year	No. of Service	No. of farmers	No. of villages
2005-06	58	107	17
2006-07	62	131	23
2007-08	66	95	25
2008-09	42	60	16
2009-10	37	84	18
2010-11	58	118	28
2011-12	42	113	18
2012-13	62	104	30
2013-14	89	114	38
2014-15	102	125	51

4.4 SOIL HEALTH AND FERTILITY MANAGEMENT

(1) Introduction of Azolla in Paddy

Paddy, a major staple food of tribes of Valsad is cultivated on nutritionally poor medium black shallow soil with steep slopes often provide low yield. Farmers started growing high yielding varieties of paddy highly responsive to nitrogenous fertilizer. Application of high nitrogenous fertilizers though increased the yield but it deteriorated soil health and ground water quality owing to nitrates. Considering above facts KVK had successfully introduced application of Azolla bio-fertilizer in paddy. A large number of farmers had adopted this technology which had not only reduced cost of fertilizer but also minimized the weeding cost.

Azolla demonstration in paddy

Training on Azolla productiont at KVK

(2) Use of Liquid Bio Fertilizers

Revolutionize changes occurred in the cropping pattern, tribal farmers started growing vegetable crops, sugarcane, banana, sweet potato etc. which increased the consumption of chemical fertilizer on nutritionally poor soils. Excessive use of environmentally unsafe fertilizers led to increase the cost of cultivation. KVK introduced liquid bio fertilizer as an alternative to chemical fertilizer. Kendra had organized number of trainings with interactive method demonstration on various aspects of liquid bio fertilizers.

Method demo on application of LBF

Seed treatment with LBF

About 165 hectares of land was covered under demonstration in the district. As many as 1050 litres liquid biofertilizers i.e. Azotobactor, Azospirillum, PSB and Rhizobium developed by Navsari Agriculture University were provided to the farmers of the district. More and more farmers had come forward to use liquid bio fertilizers with partial reduction of chemical fertilizer in different crops such as finger millet, brinjal, green gram, chilly, etc.

(3) Soil and Water Sample Analysis Based Advisory

Kendra established soil and water testing laboratory during March 2007. So far 4062 soil samples and 3666 water samples have been analyzed. Based on the analytical report, farmers were advised to use right type and right dose of fertilizer at right time by right method to maintain soil health. The farmers were also advised to use Integrated Nutrient Management practices. KVK laboratory had also provided services to the farmer beneficiaries of other agencies in the district such as Gujarat Green Revolution Company, (GGRC), NGOs, Department of forest, Gujarat Land Development Corporation (GLDC), etc. Data shown in the table 6 reflected the progress since 2007.

Sample analysis at STL

Method demo on sample collection

Table 6 : Details of Soil and Water Sample Analyzed at KVK

Year	Soil Samples			Water Samples		
	No. of Samples	Villages covered	Amount realized (Rs.)	No. of Samples	Villages covered	Amount realized (Rs.)
2007-08	647	35	26950	558	31	21300
2008-09	419	134	20950	360	134	16200
2009-10	678	65	33900	640	62	28800
2010-11	721	86	41860	706	86	34635
2011-12	562	68	33720	417	68	20850
2012-13	474	73	28440	453	73	22650
2013-14	309	56	18540	286	49	14300
2014-15	252	169	15120	246	43	12300
Total	4062		219480	3666		171035

(4) Promoting Organic Farming Through Vermicompost

KVK had established commercial vermi compost production unit with the financial assistance of Tribal Sub Plan during the year 2008. The unit provides strong support to train and motivate the farmers regarding organic farming. KVK provides the vermi culture *(Eudrelus eugenie)* and expertise to the farmers, Self Help Groups, Farmers Interested Groups, different organizations, various departments i.e. agriculture, horticulture, farmers training centre etc. and Krishi Vigyan Kendras of the Zone-VI to promote this activity.

Training on vermicompost

Farmer developed vermicompost unit

The unit produced about 2,85,000 kgs of vermicompost and about 2385 kgs of vermiculture at the instructional farm. KVK also identified the farmers having biogas plants, trained them regarding vermicompost preparation to make use of biogas slurry.

Since 2007, production of vermi culture and vermi compost reflected in table 7 had shown the progress made by KVK in improving the soil health and promoting organic farming.

Table 7 : Details of Vermiculture and Vermicompost Production at KVK

Year	Vermiculture Qty. (Kg)	Vermicompost Qty. (Kg)	No. of Farmers
2007-08	195	20000	06
2008-09	40	25000	08
2009-10	167	20000	16
2010-11	520	40000	115
2011-12	400	80000	20
2012-13	584	80000	112
2013-14	325	5000	84
2014-15	154	15000	54
Total	2385	285000	415

4.5 LIVE STOCK PRODUCTION AND MANAGEMENT

(1) Introduction of HYVs of Perennial Grass

Green fodder availability round the year, one of the major constraint on undulating hilly tracts, had affected the health of livestock and milk production in Valsad district. Hence, majority of tribal cattle owners fed their cattle with paddy straw which is low grade roughages. Concentrated mixture feed available in the market are highly expensive and beyond the reach of resource poor farmers. The physique of the cattle were very poor. Inter calving period were also very long i.e. 16-18 months. The cost of milk production gone high. Thus, the earning from dairy farming was very low. KVK had introduced perennial multicut fodder grass(Napier hybrid) having profuse tillering, non lodging, high crude protein content, broad green leaves, less water requirement and less content of oxalate. It has higher nutritive value too. During preceding decade as many as 35 hectares of land of 2998 farmers had been brought under these varieties, which gave green fodder round the year.

Varietal demo on perennial grass

Farmers visit of demo plot

Table 8 : Year Wise Supply of Perennial Grass

Year	No. Perennial grass toussecks	Area under demonstration (ha.)	Farmers	Villages
2003-04	1445	0.15	31	02
2004-05	3250	0.33	25	05
2005-06	3700	0.37	42	06
2006-07	5000	0.50	24	07
2007-08	3750	0.37	47	04
2008-09	23600	2.36	236	23
2009-10	4300	0.43	78	11
2010-11	5200	0.52	66	8
2011-12	12000	1.20	112	9
2012-13	15000	1.50	195	16
2013-14	25000	2.50	314	36
2014-15	241000	24.00	1828	98
Total	343245	34.23	2998	225

2) Breed Improvement

Livestock production is another main occupation of tribal farmers of Valsad after crop cultivation. However the productivity of indigenous breed is very low. Therefore, diffusion of AI techniques among livestock owners play vital role not only in improving their existing traditional breed but also increase milk production in forth coming generation. The KVK is actively involved in breed improvement activity during last decade. The Kendra encouraged farmers to breed indigenous cows with improved one (particularly HF and Jersey) through artificial insemination (AI) for improving the productivity of the existing livestock resources. To support this, an artificial insemination (AI) centre was established at KVK to provide door-to-door artificial insemination services in surrounding villages since 2002-03. The centre had also used semen doses supplied by the Vasudhara dairy. Capacity building of para- vet workers appointed by the milk cooperatives in different blocks and member farmers of village level milk cooperatives of district have been regularly done by the KVK. As a result about 4352 animals of which 2707 HF cross cows, 615 desi cows crossed with 100% Jersy, 505 jersey cross cows and 522 buffaloes were treated under this technique.

Cattle camp organized by KVK

AI service by KVK

Table 9 : Details of AI technology Adopted by Livestock Owners

Sr. No	Year	H F Cross	Desi cow cross with 100% Jersy	Jersy cross	Buffalo	Total
1	2003	69	41	0	18	128
2	2004	77	33	0	14	124
3	2005	268	70	18	83	439
4	2006	278	88	22	74	462
5	2007	349	97	88	81	615
6	2008	385	99	121	75	680
7	2009	316	90	44	13	463
8	2010	233	42	33	53	361
9	2011	215	19	61	34	329
10	2012	212	11	52	36	311
11	2013	201	14	43	31	289
12	2014	104	11	23	10	151
TOTAL		2707	615	505	522	4352

3) Renewable Energy (Biogas Plant)

About 80 per cent of the tribal farm families depend directly on the forest produce for their fuel requirements. Collection of firewood is highly drudgeries task for tribal women. Burning of wood adds carbon to the atmosphere which is health hazardous. KVK had introduced movable floating type biogas plant with a capacity of 2.0 m^3 made up of HDPE material, (non corrosive) which is more suitable to this heavy rainfall area. A total of 45 bio-gas plants were installed in a model village (Khuntli), which have been linked with vermicompost units. Regular production of vermicompost is proved beneficial to their farm lands. The cow dung which was earlier utilized for cake preparation is now being utilized to feed the biogas plant. Slurry was used in preparing vermicompost. The vermicompost used in soil improved soil health and increased the production of crops, vegetables and fruit crops.

Biogas unit at KVK

Promotion of biogas technology

4) Heat Synchronization in Livestock

Infertility in cows and buffaloes is a major problem in the district. KVK initiated the activity of synchronization of heat in cows and buffaloes in villages of Valsad district. The Co-Synch protocol makes heat detection and can yield pregnancy rates similar to breeding after detecting oestrus. KVK has conducted On Farm Testing on this. Very encouraging results were obtained. During last three years, pregnancy diagnosis was positive in 26 animals(72%), negative in 4 animals(11%) and 6 (17%) animals became cyclic out of 36 treated animals. The technology will be much useful to the cattle owners in long run.

Balance feeding

Synchronization of heat treatment

4.6 AGRICULTURE ENGINEERING

(1) Micro Irrigation System

Majority of small and marginal tribal farmers lift water from the well and irrigate their fields by surface irrigation through channel. To carry lifted water from source to field requires long field channel. Hence, there was wastage of water in the form of evaporation, deep percolation and seepage etc. No micro irrigation system was existed earlier in the area. KVK popularized drip and sprinkler irrigation system following Public Private Partnership (PPP) model. The Gujarat Green Revolution Company (GGRC) contributed 75 percent as subsidy to promote the activity. During last five years, about 285 ha of land had brought under sprinkler irrigation with the involvement of 375 tribal farmers of the district. Large scale adoption of this technology by the farmer had not only saved water but also reduced the cost of irrigation through saving energy and bring more area under cultivation.

MIS demo unit at KVK

Training on MIS

(2) Participatory Irrigation Management

Village Ambheti had a total of 750 ha command area under canal irrigation system of which only 110 ha land could be irrigated in close vicinity of canal beginning. Farmers of that area were over irrigating crop which caused leaching of nutrient and wastage of water in the form of deep percolation. As a result the tail ender farmers were not able to get water for their crops. On the other hand excessive irrigation affected the crop yield due to water logging. KVK took an initiative and formed a Participatory Irrigation Cooperative- First of its kind in Valsad district. Now, forty farmers are the members of this cooperative. They are managing the distribution of water, repairing and maintenance of canal, timely payment of irrigation charges, etc. Now cooperative had covered approximately 210 ha of land to irrigate their crops following effective irrigation scheduling and water management practices. Now 29 more cooperatives have been formed in other villages of down stream canal command area where water will be rationalized as per crop and climate need to each and every farm.

Awareness on PIM

Renovation of canal

3) Rural Youth Vocational Training

Illiteracy, scattered settlement, small holdings, are the major hurdles in development of tribal area. As a result rural youth facing the problem of unemployment are involved in unsocial activities leading to unrest in society. This can be tackled effectively if capacity building of the tribal youth done through imparting skill oriented vocational training in different farming based vocations. It is one of the important mandates of this Kendra. KVK had organized many programmes as under.

a) Oil Engine Repairing

Two training programmes of one month duration on diesel engine repairing were conducted by the Kendra in which 32 rural youths had participated. Of which, eight are working independently in their village and are getting additional income of Rs 4000-5000 per month.

Skill training on oil engine repairing

b) Electric Motor Rewinding

A training course on electric motor rewinding of 4 months duration was organized in which 15 rural youths had participated. Amongst them, three have started their job as an associate of the professional technician in nearest town and are getting salary of Rs. 5000-6000 per month whereas 2 have started the business in their own village. Both of them are earning Rs. 4200 per month in addition to farming income.

c) Tractor & Power Tiller Driving, Repair and Maintenance

The area under farm mechanization had increased day by day due to unavailability of farm labour in agriculture. The tribal farmers have not enough knowledge about tractor, power tiller and its implements. Kendra had organized long term training programme on tractor and power tiller driving, repairing and maintenance with a view to train rural youth. After successful completion of training programme, KVK had also assisted them to get the job work at different places.

Vocational training on tractor driving and maintenance

Training on power tiller maintenance

4) Custom Hiring Center

Majority of the small and marginal tribal farmers are resource poor hence, cannot afford mechanization in agriculture. Delay in carrying out various farm operations ultimately resulted in low production. To assist the farmers with essential farm implements, a custom hiring centre was opened by the Kendra on experimental basis. A total of 120 farmers of the village became member of the custom hiring centre. The formed committee deals with fixing of hiring charges, collection of charges, maintenance of the equipments and record keeping, etc.

The centre is equipped with modern farm machineries and implements like diesel pump set, power tiller, reaper, brush cutter, winnowing fan, etc. In remote hilly tribal area of Valsad, where farmers are socio economically backward with small holdings, custom hiring centre was proved an important participatory approach in performing all kind of agricultural activities timely.

Custom hiring center at village

Puddling in paddy by power tiller

Power tiller was found very useful for land preparation including incorporation of green manure, puddling and facilitated timely transplanting of paddy, timely harvesting of crop, which enabled farmers to grow the subsequent pulse 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 had utilized different CHC equipments during the last three years and generated a total revenue of Rs. 7.96 lacs.

Harvesting of paddy by reaper

Threshing of paddy

4.7 WOMEN EMPOWERMENT

If women are economically empowered they can contribute in raising the income of families for better livelihood. They are to be trained on alternative forms of informal credit, training, employment management, skill development and social security. For empowerment of tribal women KVK had organized many programmes as under....

(1) Vocational Training for Rural Youth

Some of the vocational training programmes for women farmers are explained as under :

a) Leaf cup / Leaf Plate Making

The criteria behind selection of vocational training on leaf cup and leaf plate making is that the Valsad district is a forest area and the leaf of Khakhra *(Butea Monosperma L)* tree is abundantly available. A leaf cup making machine costing Rs.7500 was purchased by the KVK. After completion of training, trainees were linked with District Industrial Centre for getting loan to purchase machine.

Training on leaf plate making

Training on leaf cup making

Of the 223 trained women 46 availed loan from the bank and purchased leaf cup making machine and started making of leaf cup. Those who could not able to purchase machine were engaged in leaf dish preparation. Tribal women are now earning Rs. 3500 per month as an additional income.

b) Mango Pulp Preservation

Tribal farmers grown mango on the border of the small piece of land. No space for storage, over ripening of fruit, small marketable lot, different varieties, untimely rain were the main reasons for forced selling of mango at low rates in local market. It fetched very low return for them.

Training on mango pulp preservation

KVK organized intensive training programmes on post harvest technology (PHT) and value addition in mango in collaboration with State Dept. of Horticulture and Dept. of Community Food and Nutrition Extension unit on regular basis. Tribal sub plan had provided financial assistance for procurement of necessary equipments for training. Kendra had provided automatic pulper machine to the trainees on rotational basis, as it reduced drudgery and save time for extraction of pulp. Each of them on an average filled 200-300 bottles of pulp of different varieties of mango. An additional income of Rs. 10000 from the vocation had improved the livelihood status of the tribal women through this venture.

c) Sewing

KVK organized 90 days skill training programme for the groups of rural women. All the basics of sewing, cutting, design of dress, blouse, bag etc were the component of skill training. The trainees were provided certificate by the KVK so that they can obtain loan for the machine. KVK also organised meeting with bank officer, officers of District Industrial Centre so that tribal women can avail maximum advantage of the various developmental schemes of government. As many as 300 tribal women are being trained in this vocation and most of them earning Rs.1200-1400 /month.

Training to SHGs

Training on sewing work at KVK

(2) Nutritional Garden

Large population of tribal women and children are suffering from anaemia and nutritional deficiency in the tribal belt of Valsad district. Training programme on establishing nutritional garden and management was organized by KVK. A successful model developed by Malpani trust, Devas (MP) known as Gangama Circle was popularized in the district by KVK. Through this model one can grow as many as 22 to 25 vegetable crops in a year from the small piece of the land. District Institute of Education and Training (DIET) had played significant role in transfer of this technology to 135 villages of the district. District collector had taken keen interest in the activity and appreciated the efforts of KVK and DIET. With a growing access of vegetables on daily basis, there is a visible change in food consumption pattern and health of tribal people.

Gangama Circle - kitchen garden model

4.8 NATIONAL INNOVATIONS ON CLIMATE RESILIENT AGRICULTURE PROJECT

National Innovations on Climate Resilient Agriculture (NICRA)- a nation-wide project was launched in 2011 by Govt. of India to address the challenges caused by the climatic 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 system to climate variability. The technology demonstration component of the project had been implemented in 100 KVKs of the country under the technical guidance of CRIDA, Hyderabad through Zonal Project Directorate.

Under the NRM head, Kendra had demonstrated technologies such as water harvesting through check dam and percolation tank, enhancing water use efficiency through micro irrigation system, in-situ conservation of soil and water by trench cum bunding and soil solarisation with the active participation of villagers.

Water harvesting structures

High yielding, short duration, dwarf and water logging resistant cultivar of paddy, planting technique in bottle gourd, SIRA technology in paddy, polyethylene mulching in vegetable using drip, introduction of sweet potato and liquid bio fertilizers, perennial grass fodder, automatic supply of drinking water for cattle, urea enriched paddy straw, silage, synchronization protocol in livestock, biogas plant, vermicompost preparation, etc. technologies were demonstrated on farmers field under the heads of crop demonstration and livestock development. The beneficiaries contributed up to 50 percent in different activities under taken. As many as 45 biogas plants having capacity of 2.0 m^3 have been installed in model village run successfully.

Crop demonstration

Bio gas unit at NICRA village

A Custom hiring centre, Vegetable collection centre and Community vegetable nursery were established in adopted village under institutional arrangement head.

ZMC visit - CHC

Vegetable collection centre

A multi-enterprise model based on an 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 in order to provide regular income, employment and livelihood to small and marginal tribal farmers with reduction in drudgery. The various climate smart technologies demonstrated under the project exhibited very good impact on improvement of livelihood of the farmers. The village became a satellite model village in the district. The demonstration units developed in the village served as a training hub for the visiting farmers and extension functionaries of the district.

Adoption of the climate smart technologies by the farmers of the village had positive impact on their income. The Bench mark survey indicated that the field crop (rice) gave a net income of Rs. 17000/ha, dairying Rs. 19000 and vegetable Rs. 21700/ha.

With the adoption of climate smart technologies, the enterprise-wise net income increased from field crop (rice) Rs. 23500/ha, dairying Rs. 29400 and vegetable Rs. 37000/ha. It improved their livelihood besides food security under adverse climatic challenges.

The slurry of biogas plants have been efficiently used for preparation of vermicompost. As many as 50 families are involved in preparation of vermicompost.

Multi-enterprise model

Vermi composting

4.9 EXTENSION APPROACHES

Bench Mark Survey/ Participatory Rural Appraisal (BMS/PRA)

Bench mark survey of 25 villages randomly selected from the five blocks was conducted during early years to know the socio economic and agricultural status of the district. Based on the analysis of the data, the thrust areas were identified. During 2001-02 onwards the methodology of Participatory Rural Appraisal was adopted to collect the information. A data base of about 45 villages of six blocks of Valsad district had been maintained by the Kendra.

Self Help Groups (SHGs)

Self Help Groups are self managed groups of poor women which primarily came in to existence to mobilize financial resources through their own saving and lend the same amongst themselves to meet the credit needs of their members. KVK helped in forming 25 SHGs comprising more than 425 tribal women, trained them in different vocations such as leaf cup/dish making, bamboo articles making, vegetable fiber articles making, sewing and imitation jewelry preparation, etc. and linked them with the financial institutions for obtaining loan.

Resource Persons Training

Kendra in coordination with NGOs, Milk Cooperatives, state departments and local panchayati raj institutions have identified progressive farmers and trained them on latest agricultural technologies. Farmer couple training programme on livestock production, para vet workers training, training to teachers associated with the eco club etc. have created good impact in the community.

Model Village

The Khuntali village of Kaparada block developed as a model village wherein different climate smart technologies are being demonstrated. It served as satellite model village for the visiting farmers and extension functionaries of the district.

Para Vet Workers Group

Livestock is an integral part of tribal agriculture production system. Local breed, scarcity of green fodder, malnutrition, infertility, poor physiques, combined with the poor access of the health care services due to large geographical hilly area are major hurdles in the development of this sector. KVK formed a group of para vet workers engaged by Vasudhara dairy and trained them on regular basis. They cater the needs of livestock owners of the district on various issues like AI, animal health care, fertility improvement and post harvest management of milk and milk products, etc. to earn additional income under animal/livestock venture.

4.10 EXTENSION – DEVELOPMENT LINKAGES

This Kendra had established linkages with different agencies in conducting training, extension, demonstrations. Besides KVK had also made liaison with line departments for implementation and transfer of technologies through different activities.

State Agricultural University

KVK has established functional relationship with the research institute of ICAR such as Central Research Institute for Dry land Agriculture (CRIDA), Directorate of Rice Research, Navsari Agricultural University and its Regional Research Stations for technology back up. The scientists of these research centers are frequently invited as an expert to participate in the different extension activities organized by the Kendra. Inputs /technologies developed by the university are also provided to this KVK to demonstrate the technology to farmers. KVK staff had also assisted in organizing and conducting Krishi Mahotsava in Valsad district for last 10 years. They are actively involved in finalization of annual action plan i.e. FLD, OFT, training etc. KVK staff are also deputed for training organized by the university/ICAR.

Tribal Sub Plan (TSP)

The Tribal Sub Plan having numbers of developmental activities. KVK has developed very good functional relationship with the TSP. The department provide whole hearted support in strengthening the Kendra's activities by developing infrastructure such as dairy demonstration unit, establishment of fruit processing and preservation unit, vermicompost unit at KVK. These units are involved in transforming farming community to become nationally competitive in raising the production and improving quality of products.

Agricultural Technology Management Agency (ATMA)

KVK scientists played an important role in the finalization of the technology to be transfered to the farmers by the department. KVK is a nodal agency to train all the farmer beneficiaries of the district selected by the ATMA. Joint diagnostic visit of at least five villages in a month, monthly meeting with the BTT members, exposure visit to KVK are the regular phenomenon. KVK is one of the member of governing board of the ATMA and District coordination committee to formulate and plan their programmes. Thus, there is a functional linkages with the department.

State Department of Horticulture

Valsad became India's first integrated horticulture district. To harness the potential in a coordinated manner, an Agri. Export Zone was approved for mango and vegetables covering the seven districts of Gujarat, Valsad is one of them. KVK organized many specialized activities with financial support of the department and transferred many innovative technologies such as supply of seedling in poly bag, raise bed nursery, in situ plantation of mango, close distanced mango plantation, vegetable production on PPP mode, plantation of vine crops across the slope, use of plastic crates for safe transportation of produce, etc. on the farmers field. Through KVK network, large mass of the tribal farmers residing in remote areas took advantages of different developmental schemes of NHB, NHM and State Government. KVK created infrastructure like green house, shed net house, medicinal plant units, small nursery unit, etc. with the financial assistance of department.

State Department of Agriculture

KVK has conducted regular pre-seasonal (Kharif and Rabi) training programmes for the district extension functionaries working with the department. Kendra also provided technical expertise for different extension activities of department and assisted in preparation of C-DAP, SREP and technical programmes like training, Krishi mela, shibir, demonstration and Krishi Mahotsav, etc.

State Department of Irrigation

Water is scarce commodity in the hilly area. For efficient use of available water by the tribal farmers, Kendra for the very first time brought the concept of Participatory Irrigation Management in coordination with department of irrigation. Today as many as 29 such cooperatives are operating in the district.

Gujarat Green Revolution Company (GGRC)

Micro irrigation system is a proven technology for making the efficient use of limited irrigation water. It does not only prevents evaporation losses, seepage losses, save labour and time but also brought more areas under irrigation. Kendra had popularized this technology amongst thousands of tribal farmers following PPP approach. GGRC- a state government undertaking company provide 75% financial assistance to the tribal farmers.

Valsad District Co-operative Milk Producers Union Ltd (Vasudhara Dairy)

Vasudhara dairy has been the main source of development of dairy enterprise in the district. It has a milk plant with a capacity to handle 3 lakh litres of milk per day, however it processes 2.46 lakh litres of milk per day presently. Looking to the breed population, the existing A.I. and Veterinary aid service facilities are quite inadequate in the tribal district. KVK organized para vet workers training, breed improvement programme through A.I., feed management round the year and green fodder production programme for the betterment of tribal livestock owners.

Rural Technology Institute (RTI) and District Industrial Centre (DIC)

With a view to transfer appropriate technology amongst tribal women, KVK has formed many SHGs to provide them skill training in different vocations such as leaf cup and leaf dish making, bamboo article preparation, sewing, bhindi fiber article making, foot mat making, etc. RTI located in the district supports the Kendra in terms of deputing resource person, equipment procuring for training, stipend to the trainees, etc. On the other hand DIC had approved the loan proposal of the trainees trained by the KVK. Both the agencies play vital role in tribal women empowerment.

All India Radio

AIR plays significant role in diffusion of the message to large mass of tribal farmers stayed at remote places. KVK developed good linkages with AIR Daman and AIR Vadodara. More than 40 talks on different subjects were delivered by the scientists of KVK.

Non Government Organisation (NGO)

Kendra has developed functional linkages with many NGOs of the district such as Jashoda Narottam Trust (JNT), Acil Navsarjan Rural Development Foundation (ANARDE), Bhartiya Agro Industries Foundation (BAIF), Atul Rural Development Foundation (ARDF), Astitva, Utkarsh Mahila Association (UMA), Centre for Environment Education (CEE), etc. working for the development of agriculture in the district.

EXTENSION ACTIVITIES

PRA Survey

Training

Farmers Field School

On Farm Testing

Field Day

Kisan Goshthi

Technology Week

Agri. Exhibition

Farmers Exposure

Farmers Seminar

Women in Agri. Day

Farm Innovator Day

5. SUCCESS STORIES

Increasing Productivity of Paddy in Tribal Belt of South Gujarat

Paddy is the major staple food of the tribal communities of the Valsad district. The area under rainfed paddy in the district is about 51547 hectare producing 163404 tones. The productivity is around 3170 kg/ha remain static since last many years. This is mainly because majority of the tribal farmers are cultivating conventional varieties (Taichun native – 1 and Kada) of paddy. Conventional varieties are early maturing, having coarse grain with dull husk colour and highly susceptible to water logging as the rain coincide with maturity of paddy at later stage. Paddy growers are using higher seed rate i.e. 30 – 40 Kg for transplanting one acre of land as they produce seed of their own. They were planting 8-10 seedlings / hill resulting in over plant population and lower yield. It also increases the cost of cultivation because harvesting takes much time. Farmers were using impure seed, as they produce it on their farm without taking much care. Average yield of paddy (conventional varieties) is about 2200 - 2400 Kg/ha under good management practices. Market value of the conventional varieties is less ranging between Rs. 11-12 /Kg because of coarse grain and unpleasant colour of husk. The farmers having assured irrigation facilities or low land kyari expressed their desired to have high yielding variety with late maturity to avoid damage by rains to crop at the maturity time. On the contrary, farmers growing paddy under rainfed condition expressed their desire to have high yielding early mature variety.

Considering the above facts KVK had initiated the programme of multiplication of seeds of high yielding varieties of paddy on instructional farm with a view to popularize high yielding varieties by supplying pure seeds to the farmers on regular basis and thereby increase the production and productivity of paddy. Field trials of the HYVs were conducted on instructional farm of Kendra to screen the best varieties from seeds of different varieties supplied by SAU. Field days and farmers days were also organized on KVK farm as well as on demo plots on farmer's field. This had created awareness among tribal farmers about the use of HYVs of paddy. During last fourteen years KVK produced 79 tones of seed of different HYVs of paddy and supplied to 6562 farmers.

Demo plot at KVK

Field with HYV GAR-13

Farmers visit to demo plot

KVK had successfully introduced HYVs of paddy such as GR-3, GR-4, GR-7, GAR-13, MTU 1010 and Jaya in this area since establishment of KVK in the district. The seed replacement rate is around 69 per cent. About 4000 ha of land had been covered under HYVs of paddy replacing conventional varieties. Average yield of paddy per unit area has increased by 32 per cent. Cultivation cost reduced by means of reducing seed rate and maintenance of optimum plant population. Earlier farmers were using 30-40 Kg seed rate for transplanting of one acre of land. Now with adoption of HYVs they are using 10-12 Kg of seeds for the transplanting same area. Farmers are getting higher yields and more profit from the unit area as improved varieties fetches little higher prices as compared to local varieties because of slender grains. More than 15 farmers have started multiplication of seeds on their own farm under the supervision and guidance of KVK scientist. It is presumed that the area under HYVs would be increased at a faster rate in coming years. This in turn will helps in changing socio-economic status of the tribal farmers of this area. Comperative economics of varities is shown in table 10. Fig 1 reflects the progress in production and supply of paddy seed by KVK..

Table 10 : Comparison of High Yielding Varieties v/s Conventional Varieties

Parameter	High yielding varieties	Conventional varieties
Av. yield	3170 Kg/ha	2400 Kg/ha
Av. market price	Rs. 12-13 /Kg	Rs.11-12 /Kg
Total cost of cultivation	Rs.19000/ha	Rs.21000 / ha
Av. Income	Rs.39625 / ha	Rs. 27600 / ha
Net profit	Rs. 20625 / ha	Rs. 6600 / ha

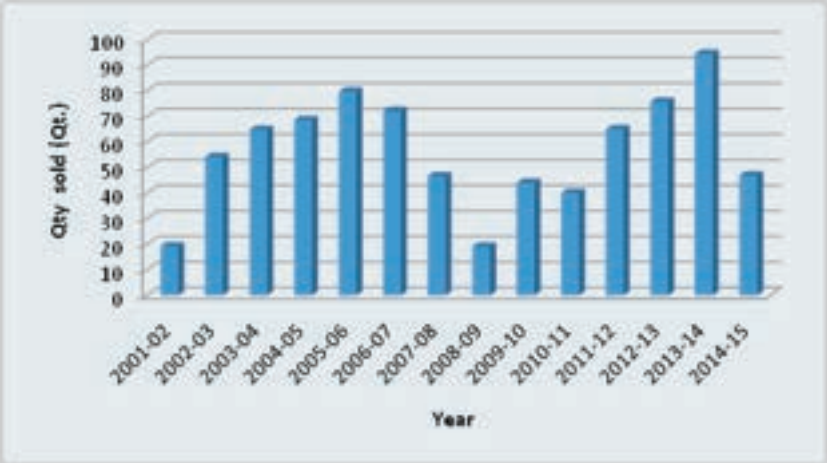


Fig 1 : Production and Supply of Paddy Seed by KVK

Promoting Vegetable Cultivation in Hilly Tribal Belt of South Gujarat

The Valsad district composed largely with tribal communities depends primarily on agriculture for their livelihood supplemented by income from seasonal employment in nearest industrial town. The main crops of the district are – paddy, sugarcane, gram and vegetables-brinjal, chilly, tomato and bottle gourd. Cultivation of vegetable crops in Kaparada block is very poor and only few farmers were growing sole vegetable crops. The area under sugarcane cultivation had increased at faster rate since 1999 but with the sick sugar industry and fall in the prices of sugarcane, delayed in the payment by sugar mill, increase in the cost of production because of mono cropping, compelled the farmers to shift for short term profitable vegetable crops like brinjal, bottlegourd etc. SMS of KVK come to know that farmers use local variety having poor yield potential. Since the seeds of the HYVs were costly small and marginal farmers cannot afford. Seeds of hybrid varieties are also not available in the local market and hence they purchase poor quality seedlings prepared by the local vendors. Uneven market lot of the produce of various varieties, poor handling of produce i.e. gunny bags and bamboo basket, no grading of the produce and high commission charges by middleman were the major constraints faced by the brinjal growers.

KVK took initiatives and emphasized on production and supply of good quality brinjal seedlings since it identified as a major problems faced by the growers. Seeds of nine prominent HYVs were collected based on the feedback of the growers, officials of the state depart. The pricing factor was also considered while selecting varieties from multiplication. Out of nine, three varieties namely DPR, PPR and Kalpataru were identified for raising seedlings as they performed well in the climatic condition prevailing in the district.

Intensive training programmes and demonstration on important aspects of production technologies of brinjal crop such as raising good quality seedlings, pest management, fertilizer and irrigation management , storage and transportation etc. was planned. A nursery unit of about 0.4 ha land for raising seedlings of selected varieties was developed at instructional farm. A net house with a total area of approx. 108 sq. m was also erected at total cost of Rs.36,000 with the financial assistance from Tribal Sub Plan with a view to produce quality seedlings during heavy monsoon as well as summer season. The comparative analysis on improved and local variety is reflected in the table 11.

Table 11 : Comparison between Improved Variety and Local Variety

Parameter	Improved variety	Local variety
Av. cost of cultivation	35,000 Rs/ha	31,000 Rs/ha
Av. yield	20,000 Kg/ha	17,000 Kg/ha
Av. market price	Rs. 8 / Kg	Rs. 6/ Kg
Total gross income	1,60,000 Rs/ha	1,02,000 Rs/ha
Total net income	1,25,000 Rs/ha	71,000 Rs/ha

Overall Impact of the Project

- Average increase in the net income of the brinjal growers as a result of adoption of improved variety along with partial adoption of the recommended technology goes up to Rs.54,000/ha.
- Change in the cropping pattern paddy-pulse change into paddy followed by brinjal
- It will help in maintaining the health status of soil.
- Sugarcane occupied the land for about 24-30 months. Delayed in payment and low productivity has resulted in low income. Brinjal proved to be the best short duration cash cropping place of sugarcane.
- About 515 ha of land had been covered under HYVs of Brinjal.
- Mobility of the tribal farmers had also increased.
- The information department had prepared (10 minutes) story of this activity and displayed on TV programme called **ZARUKHA.**

Fig 2 reflects progress on production and supply of vegetable seedling since 2001.

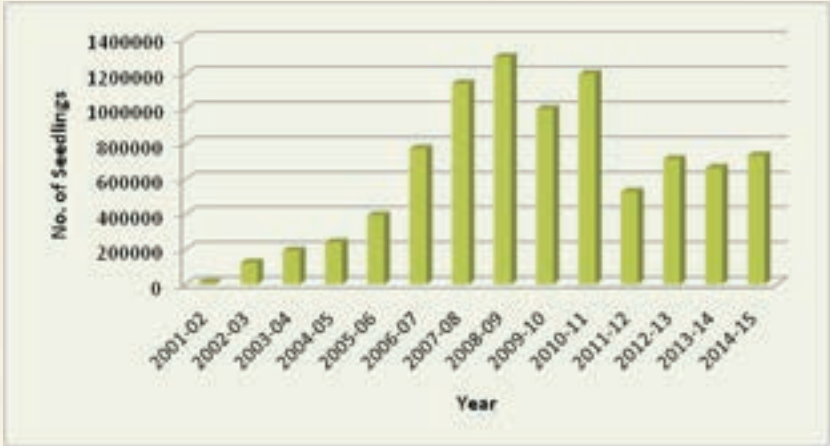


Fig 2 : Production and Supply of Vegetable Seedlings

Seedling production in protected cultivation

Seedling production in net house at KVK

Adoption of HYVs of Perennial Grasses by the Tribal Farmers

Development of Animal Husbandry (AH) enterprise is very poor in the district. This is because of hilly area, shortage of water, poor fertile soils, shortage of fodder and migration of the people for seasonal job etc. Milk production is lowest in the district. Many govt. and Non govt. agencies such as Valsad district milk producers union ltd. (Vasudhara dairy), BAIF are working for the development of the livestock enterprise to provide additional and steady income to the tribal farmers.

Kendra has developed dairy demonstration unit to provide skill oriented training to the live stock owners of the district. The training aspects covered criteria of selection of cross bred animal, feeding management, health care and management of milch animals, etc. A fodder demonstration unit of 1.5 acres of land also developed on instructional farm to grow different high yielding varieties of perennial grasses. The demo unit also serves as mother plant nursery and become a source of inspiration to farmers for perennial grass cultivation. Farmers were provided planting material to try it out on their farm. Kendra is continuously supplying planting materials to the farmers in order to increase the area of improved perennial grass varieties (Co-1, Co-2, Co-3, Co-4, BNH-10) found suitable under water stress condition and poor fertile soil. It is observed that farmers were growing this fodder on the field channel but now many farmers have started growing these varieties as sole crop as it supply green fodder round the year with less water requirement. It also saves cost of cultivation as it is perennial crop remain in the field for 3 years. As compared to the cereals straw (paddy) it has got high nutritive values and thus helpful to cure the deficiencies developed as a result of malnutrition caused by the poor feeding. Now 47 villages had covered under the improved high yielding varieties of perennial grasses and 405 farmers have adopted it on their farm as a sole crop. It is also expressed by the demo farmers that, they have been continuously supplying this planting materials to their relatives farmers of neighboring villages also. Considerable area has been brought in different villages under this crop.

Demo plot at KVK


Planting material supplied to farmers


Farmers visit to demo plot

Breed Improvement of Cattle through Artificial Insemination

Gujarat is the fifth largest producer of milk in India. The tribal farmers of Valsad district of Gujarat are practicing with livestock production as second occupation next to agriculture. Thus, diffusion of AI techniques among livestock owners play vital role not only in improvement of their existing traditional breed but also for increasing milk production in forth coming generation.

The KVK working in Valsad district of Gujarat is actively engaged in breed improvement activity for last one decade in this tribal dominated area. The Kendra encouraged farmers to breed indigenous cows with improved breeds, particularly Jersey through artificial insemination (AI) to improve the productivity of the existing livestock resources. This was done in order to combine the hardy characteristics of indigenous cattle (namely tolerance to poor nutrition, heat stress and tropical disease challenge) with higher milk-producing qualities and hence the higher income potential of the improved breeds. To support this, an artificial insemination (AI) centre was established at KVK - Valsad to provide door-to-door artificial insemination service in surrounding villages since 2002-03.

The centre had used semen doses supplied by the Vasudhara dairy. Capacity building of paravet workers appointed by the milk cooperatives in different blocks and member farmers of village level milk cooperatives of district are regularly done by the KVK. The trained rural youth (paravet worker) are getting self employment through this activity at village level.

As a result of continuous efforts many farmers come forward and adopted AI techniques for improvement in breed. As a result during last ten years more than 2000 farmers of 115 villages of three blocks of the district had adopted this technology for more than 4352 animals of which 2707 HF cross cows, 615 Desi cows crossed with 100% Jersy, 505 jersey cross cows and 522 buffaloes were treated under this technique. The success ratio is 30 %. About 50 paravet workers act as catalytic change agents in the villages. Each of them earn Rs.5000/- per month. They became an integral part of the development system.

Cattle camp in village

Diagnostic service

Paravet workers training at KVK

Fruit Fly Trap : A Boon to the Tribal Mango Growers

Mango is an important horticulture crop of the district. The area under mango cultivation shows increasing trends but the productivity remain static. Quality of the mango is another aspect needs to be addressed. Mango growers are facing acute problem of attack of fruit fly in the ripening stage of mango. The fruit fly, *Bactrocera correrctus* and *Bactrocera dorsalis (Hendel)*, is a very destructive pest of fruit in this area. The female adult puncture the fruit and lay eggs into it and the larva (maggots) emerging from the eggs cause damage to the pulp of fruits. As a result brown rotten patch appears on the fruit surface. Infested fruit finally falls on the ground. Thus, it does not only reduce the volume of produce but also deteriorate mango fruit quality, resulting into great economic losses. Use of chemical for the control of fruit fly creates problem of residual effect of chemicals on fruit. Even exporters not allow farmers to use such chemical. Hence, sex pheromone is very useful, eco friendly and cheaper tool to control fruit fly in mango orchards. The tribal mango growers were applying pesticides which are expensive and non eco-friendly. Spray of pesticides on the big canopy of mango tree is very drudgery. Even use of the foot spray pump does not work efficiently to reach the height of old tree. Higher dose of pesticides cause residual effect on mango fruits. Thus, majority of the tribal mango growers do nothing to solve the problem resulting in to poor production in terms of both quantity and quality.

Fruit fly trap developed by the research scientist using sex pheromone. Methyl Eugenol is one kind of sex pheromone which attracts the male fruit fly towards female for mating/ sexual purpose. The sponge/ card board piece (plywood block) dipped in the solution containing methyl eugenol and dichlorvos (76% EC) is kept in the trap. The trap is designed in such a manner that methyl eugenol attracts the male fruit fly through the hole provided on each side of the trap and dichlorvos kills them by its fumigant effect. Due to control of male fruit fly, the female fly remains unfertile which ultimately reduce the fruit fly population in next generation.

Damage caused by fruit fly

Discussion on technology

Adoption of technology

Figure 3 shows the fruit fly traps supplied by KVK since 2003-04.

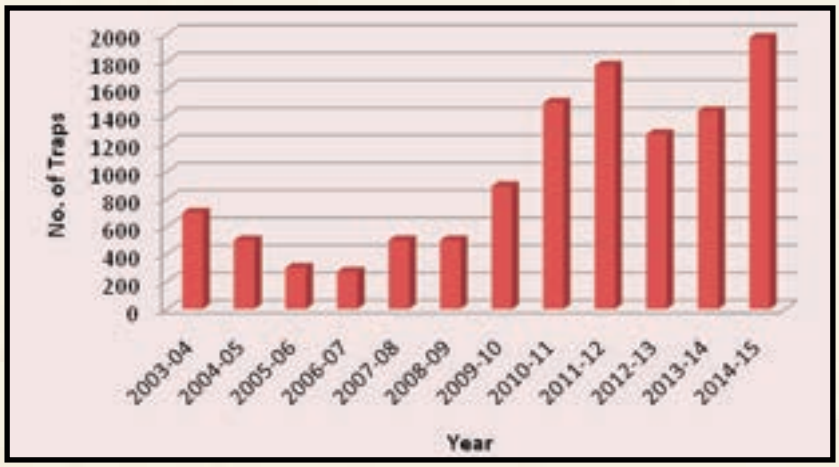


Fig 3 : Fruit Fly Traps Supplied by KVK

Extension methodologies used by KVK to transfer and promote the technology

KVK had initiated the awareness programme through mass demonstration of the technology on farmers field in adopted villages. Different extension teaching methods such as Field demonstration, Training, Seminar on IPM, Group discussion , Diagnostic service etc. are used to transfer and promote the technology . Kendra has published colourful pamphlet describing technology with illustration and provided to farmers. KVK has also encouraged and trained the farmers to prepare the traps from locally available resources like empty plastic water bottle (1 litre), cotton plug, etc.

Selected resource persons of the adopted villages were also trained and laying down demonstrations on their field in collaboration with state dept. of Horticulture and State Agricultural University.

Advantages of the technology

It reduce the use of pesticides and hence, eco friendly. Trap can be prepared from locally available resources such as plastic bottle and sponge by the farmers. Very easy to handle the trap. It can be used repeatedly. Adoption of this technology reduces cost of pesticides of about Rs. 3500/- per ha. It also saves about Rs. 2000/- in labour charges required for spraying.

Acceptance of the technology by the mango growers

It is estimated that fruit fly in this area causes up to 40 % loss in mango. The mass adoption of fruit fly trap which is an eco friendly cheaper technology (Rs.35/trap) saves the loss caused due to falling off premature fruits, leads to increase about 25-30% marketable yield and thereby increase in net income.

It also ensure quality production of fruits without any residual effect. About 10 % of the total area in the district under mango cultivation has been brought under this technology. In collaboration with State department and SAU, KVK provided about 18600 traps for wider adoption amongst the tribal mango growers of the district during last 12 Years. KVK had started the production of trap and supply to the farmers on reasonable rate. These traps had proven good impact on mango growers and the demand of trap is increasing day by day.

Increase Irrigation Efficiency by Large Scale Adoption of Drip Irrigation system

The geological formation of Valsad district is hard rocks and alluvial formation. The ground water in this area is tapped for agricultural uses by farmers. The alluvial formation has been formed in central and northern parts of the district. The quality of ground water is suitable for irrigation throughout the district except the coastal belt. Apart from rainfed areas, the other sources of irrigation are surface and ground water. All the blocks (talukas) in the district have been categorized as “safe”, with exploitation of utilizable ground water being less than 65 per cent. Since the maximum sustainable level of ground water development is 90 per cent, there is much scope for development. The net irrigation area in the district from all sources is 61751 ha. Dug wells , Canals, Irrigation ponds and Tube wells/Bore wells are the sources of irrigation.

KVK has popularized sprinkler irrigation system following Public Private Partnership approach. Kendra had created awareness among small and marginal tribal farmers of this area. They have been trained by the KVK scientist regarding use of the sprinkler irrigation system in field condition. Gujarat Green Revolution Co. Ltd has sanctioned loan to the selected farmers and provides sprinkler set with PVC made delivery pipes on subsidized rate. Farmers contributed about 25 per cent of the total cost of the sprinkler system set.

About 285 ha of land has been covered under MIS with the involvement of about 375 tribal farmers of three blocks of the district. Large scale adoption of this technology by the farmers will not only save water but labour as well. It saves wastage of water through evaporation and seepage of water from the canal. That can be used for irrigation of crop through sprinkler and drip irrigation system.

Practical training on MIS

Farmers field with MIS

Efficient use of water through MIS

Impact of Liquid Bio fertilizers in Crop Production

With increasing awareness about new agricultural technology amongst farmers, they started growing of high yielding varieties of various crops which are highly responsive to the fertilizer. Injudicious use of the chemical fertilizer in long run created ill effect on the soil health. Under such circumstances liquid bio fertilizers proved to be the best alternative of the chemical fertilizer.

Liquid formulation technology developed by Navsari Agriculture University, Navsari found more advantageous than the carrier inoculants. Liquid formulation having longer self life, contamination is almost nil, better survive in soil and on seed, high export potential, quantity required per unit area is too minimum than carrier based inoculants and can be stored easily in smaller space at 45^{0}C temperature. KVK started to aware tribal farmers about importance of liquid bio fertilizers for soil health and encourage them to adopt the cheapest alternative of costly chemical fertilizers. Kendra had conducted about 13 trainings on importance of liquid bio fertilizers for sustainable crop productivity. Method demonstrations on how to use liquid bio fertilizers had also been conducted on farmer`s field and on KVK campus.

For encouraging tribal farmers of district to adopt liquid bio fertilizers, on basis of principle "seeing is believing" KVK- Valsad, had conducted multi locations field demonstrations on 165 ha of land covering 312 farmers on different crops viz. paddy, finger millet, brinjal, bottlegourd and bittergourd. The results of frontline demonstration showed that the yield of crops positively influenced by application of liquid bio fertilizers with reduction of average cost of cultivation.

Till today about 1050 liters liquid biofertilisers i.e. Azotobactor, Azospirillum, PSB and Rhizobium has been distributed by KVK to the farmers of district.

Interactive demo

Application of LBF

Practical on farmers field

6. CASE STUDIES

1) Rejuvenation of Old and Senile Mango Orchard

Name & Address : Shri Rajesh R. Shah
Village :Kanadu/Fansa , Ta.-Umargam, Dist.-Valsad
(Gujarat) Pin :396140
Mob : 98252 51012
Age : 51 years
Education : SSC
Other Information : Land 25 ha, Orchard Mango –3000 trees
Krishi Rishi Award – 2006
Sardar Patel Award - 2009

Area under mango cultivation in Valsad district is increasing but the productivity is considerably low. Preponderance of old, senile, unproductive trees and poor management practices of old orchard are the important reasons for low productivity.

Mr. Rajesh Shah was unsatisfied with his 400 mango trees of about 50 years old. Once he decided to sell it out and purchase new land for orchard. He was advised by the Kendra regarding rejuvenation of old orchard. He was succeeded in rejuvenation of his old and senile mango orchard.

First he assign numbers to each tree and then identified the branches to be removed which were old, attacked by the pest/disease, bend from the trunk to lower side and covered with shadow of the adjustant trees. He marked the branches which were to be kept for future canopy development at approx. 5.5 to 6.0 mt distance above ground. He started heading back in July-August by using sharp cutter. He had cut the branch from underside to avoid risk from bark splitting. After this, he removed all the pruned wood from the orchard to avoid risk of pest infection from the garbage. After this practices he fertilized and irrigate each pruned tree as per recommendation.

He was so delighted when he saw profuse emergence of new shoots on pruned branches. He observed that shoots emerged from the pruned trees were healthier and had more yield potential, started bearing fruits from the third year of pruning, easy to manage the operation, facilitates additional income from the intercrops. Thus, ensures increased photosynthetic efficiency, resulting into higher sustainable production over long period. He was succeed in rejuvenation of his old this and servile mango orchard. Looking to his contribution in this activity he has been awarded with Sardar Patel Award in 2009.

Removal of centre shoot

Heavy pruning

Profuse flowering in pruned tree

2) Bittergourd Add Sweetness in Farming of Tribals

Name & Address : Shri Chetabhai Dashubhai Dodaka
Village :Nandganv, Ta.- Kaparada
Dist.-Valsad (Gujarat)
Mob : 96388 05621
Age : 41 years
Education : Illiterate
Other Information : **Land :** 1 ha, **Crop** : Bittergourd

Nandganv is a tribal dominated village located in Kaparada block of Valsad district. The land of the village that includes wasteland, common grazing land and the reserve forest land with shallow red muram type low fertile soils. Moisture retention capacity of the soils are very poor though the village received about 2000 mm rainfall/annum. The declining of yield levels of crops under rainfed condition causes migration of men folk for most part of the year.

Once, Chetabhai attended a farmer scientist interaction organized by KVK in village Nandganv. This interaction left the deep impression on his mind for earning by utilizing rain water on uncultivable and sloppy fallow land. The day after interaction he personally contacted KVK to discuss about efficient utilization of his own land especially during Kharif.

KVK scientist advised for bittergourd cultivation during monsoon and suggested to attend training programme on vein crops cultivation practices. After training he was convinced that to grow bitter gourd in early monsoon on rain water will be the best option. As adviced by KVK scientist, he dugout pits at proper distance and kept it open till onset of monsoon. He then filled up pits with mixture of FYM and soil and sown seeds of Bittergourd (variety Kohinoor). He also used liquid bio fertilizer and Cu-lure traps in the field which reduced cost of production. He earned good profit and also gained experience of bitter gourd cultivation. Since then he never look back. Last year he earned approximately Rs.80000/- as against cost of Rs. 10000/- only. Mr. Chetabhai's success inspired many farmers of surrounding ten to twelve villages to cultivate bitter gourd during kharif season. During monsoon season only few vegetables are available in the market hence bittergourd farmers get good market price.

Varietal demo plot

Across slope plantation

Field day

3) Aerial Micro Tube IrrigationSystem in Mango Graft Nursery

Name & Address : Patel Dhirubhai Bhangyabhai
Village : Rohina, Ta. : Pardi, Dist. Valsad
Mob.: 99790 33464
Age : 58 years
Education : Std. 3
Other Information : Land : 4.5 acre , Mango graft nursery -3.0 acre,
Vegetable nursery – 0.25 acre, Mango orchard 1.0 acre

Mr. Dhirubhai Patel, leading nursery owner of the district annually produced 27000-30000 mango grafts. He developed automatically operated aerial micro tube irrigation system to reduce the cost of irrigation as well as to mitigate the problem of unavailability of skilled labour for irrigating every grafts, daily and timely. For easy operation he divided his whole nursery in to sub blocks. In each block, he installed a valve with a view to control the flow of water from main line for every 2500 to 3000 grafts. Only 6 minute water supply could irrigate all the grafts of one block at a time. By adopting rotation method he could maintain the equal water supply to each grafts regularly. Only one HP electric motor was sufficient to irrigate 30000 grafts within 1 or 1.2 hrs. through the aerial micro tube irrigation system. In this system 16 mm black lateral lines were hanging on the mango mother plants. The small micro tube (1.2 micron) pieces of approximately 1.5 to 2.0 feet were attached with laterals on each mother plants. The number of micro tubes attached with lateral varying from 5 to 20 depending on the branches ready on mother plant for grafting at the time. Excess micro tubes can be kept closed by inversely tying its end .

The cost for irrigation for mango grafts in nursery was reduced five to six times by adopting this system compared to traditional irrigation by manual labour. He could save Rs.6,28,400 during last 5 years by adopting this system. Valsad district is the hub of mango, supplying grafts of different varieties in many parts of state. Many nursery owners of the district adopted the technique of automatically operated aerial microtube irrigation system in their nursery under the guidance of Mr. Dhirubhai Patel and makes the profession more profitable.



View of aerial micro tube irrigation in mango nursery

(4) Vermicompost

Name & Address : Mr. Rajeshbhai Durlabhbhai Patel
Village: Dungari, Ta: Valsad,
Dist : Valsad, Gujarat
Mob: 93279 66435
Age : 43 years
Education : Diploma (Mechanical Eng.)
Other Information : Land : 4 ha, Organic Farming,
ATMA Best Farmer Award 2010-11

Once Mr. Rajesh D Patel attended the farmers shibir on organic farming organized by KVK. After completion of programme, he interacted with the SMS of KVK on different issues related to how to improve productivity of his farm. He admitted that his soils are poorly fertile and thus applying higher doses of chemical fertilizers. This not only increased the cost of cultivation but also deteriorated the soils. However situation started changing when he enrolled his name for three days long on campus training programme on vermicompost preparation in 2008-09.

After completion of the training programme, he started small unit of vermicompost preparation on his farm under the guidance of KVK scientists. Initial success of unit inspired him to expand production unit. Today he is having 0.60 ha land under the unit producing 7500 quintals of vermicompost per annum. He is the leading vermicompost producer of the district. He is earning Rs.25,00,000/ year from this business. He opined that because of continuous application of vermicompost, productivity of his farm also improved. He became the resource person for the other farmers. The entire produce is being used by farmers of the district to convert inorganic farming in to organic one.

He sold vermi compost under the brand name 'DHARATI AMRUT' vermi compost. He procured FYM from other livestock owners of adjoining villages who migrated from other parts of the state. As own produce Vermi compost he use it in abundant quantity in his farm for production of chilli, mango, brinjal and in nursery for production of mango grafts and hybrid vegetable seedlings in plastic trays. He became a successful vermi compost entrepreneur of the district and act as a guide for many govt. and non govt. agencies.



Farmers visit to “Dharti Amrut” unit - A farmers lead farmer approach

(5) System of Rice Intensification (SRI) Boost in Paddy Production

Name & Address : Shri Shankarbhai Limjibhai Patel
Village :Ambach , Ta.-Pardi, Dist. Valsad
Mob : 99259 45711
Age : 66 years
Education : PTC, B.A.,B.Ed.
Resource : Land : 5 ha, Orchard Mango –250 trees
Other Information : President of FIG , Resource person for SRI technology, ATMA Best Farmer Award 2010

KVK organized three days peripatetic training on SRI method for the very first time in the district to train the extension functionaries of the district with a view to spread the technology among paddy growers. As many as 35 extension functionaries such as Dy. Director, Assistant Directors. District Agriculture Officers, Village level workers had participated in it. Few progressive farmers of the district were also invited to participate in the programme. Shri Shankarbhai Patel, retired teacher was one of them. Interactive demonstration on raising seedling, transplanting of seedlings, water management, etc were the integral part of the training. The results of demo units were also discussed after harvesting.

During next year few farmers of the district started with SRI method. Shri Shankarbhai Patel, also practiced the SRI method of paddy cultivation under the guidance of KVK on a piece of land. Being a literate person he maintained all the records. He analysed the data of both the plot i.e. traditional method vs SRI method. He was convinced with the SRI technology that it not only saves water, fertilizer, labour but also increase the yield by 40 percent over traditional method.

Initially the farmers of the village criticizing him when performed operations in little different manner. Today the situation is totally different. Mr. Patel produced 6000 kg paddy per ha which gave Rs. 20000 more additional income as compared to traditional method of paddy growing. He acts as a resource person in the district for SRI technology to the concerned farmers and stake holders. Under his leadership about 600 farmers of the district started SRI method of paddy cultivation.

Practical training at farmer field

Adoption of technology

6) Azolla- A Wonderful Experience of Natural Fertilizer in Rice Cultivation

Name & Address : Mr. Bharatbhai Dubalbhai Patel
Village : Arnala, Ta. Pardi,
Dist. Valsad (Guj.)
Mob.: 99797 96280
Age : 53 years
Education : Primary
Other Information : Land : 2.0 ha.

Sri Bharatbhai Dubalbhai Patel was using large amount of chemical fertilizers for the cultivation of paddy to increase yield. But excess use of chemical fertilizers, displaying their ill-effects such as destroying micro-organisms and friendly insects, making the crop more susceptible to the attack of diseases, reducing the soil fertility. He spent more money every year for costly chemical fertilizers which increased cost of production and narrowed down the profit.

Azolla is a free floating aquatic fern fixes atmospheric nitrogen and excrete organic nitrogen in water during its growth and increases yield of paddy with suppression of weed growth. Mr. Patel participated in method demonstration and training programmes on the cultivation of Azolla at KVK. He collected fresh Azolla inoculum from Azolla nursery and broadcasted in the transplanted rice field on 7th day after planting @ 500 kg/ha, maintained water level at 5-7.5cm and incorporated it. A second bloom of Azolla developed 8 weeks after transplanting which may be incorporated again.

Mr. Bharatbhai Patel said "When I raised paddy with the use of chemical fertilizers I had to spend about Rs.15,000 per acre with production of 1120 kg $ac.^{-1}$ yield. But now, with the use of azolla as green manure, reduced the cost of fertilizers and weeding cost by suppression of weed growth up to 30-35 per cent and increased paddy yield up to 27 percent (1422 kg $ac.^{-1}$)."

Mr. Patel share his experience with fallow farmers of the village. Today a group of the farmers adopted this zero cost technology in their paddy field.

KVK scientists discuss with farmers

Method demo of azolla cultivation

Azolla applied paddy field

(7) Mango Pulp Preservation Promotes Sustainable livelihood for Tribal

Name & Address : Smt. Kusumben Kalidas Patel
Village : Ambheti, Ta.: Kaparada,
Dist.: Valsad, Gujarat, Pin :396191
Mob.: 97272 94461
Age : 42 years
Education : SSC
Other Information : Land : 0.4 ha, President of Gurukrupa SHG

Tribal farmers grown mango on the border of the small piece of land. No space for storage, over ripening of fruit, small marketable lot, different varieties, etc. Were the main reasons for forced selling of mango in local market. It fetches very low return for them.

KVK organized training programmes of eight days duration on different aspects of mango pulp preservation in which 16 rural women had participated. Some of them started the activity at their home. Non availability of corking machine was the major problem. In absence of the corking machine, they had sealed the bottle using wax which allows air inside resulting into fungal attack. It was a drudgeries and time consuming task to peeling off fruits and extract pulp from large quantity of mango fruits. In order to short out the problems, Kendra had prepared pulper machine with stainless steel body having capacity of extracting 50-60 kg pulp per hour. Then advanced training was organized at KVK to impart skills regarding selection of fruits, cleanliness of fruits, extraction of pulp using machines, boiling of pulp, quantity of preservative, sealing of bottle using corking machine. Kendra had provided automatic pulper machine to the trainees on rotational basis. Each of them on an average filled 600-800 bottles of pulp of different varieties of mango.

Mrs. Kusumben had alone filled more than 1000 bottles of mango pulp of different varieties every year. She is earning Rs.45000-55000 per year from this business. KVK has organized six such training programmes. Thus, additional income from the vocation had improved the livelihood status of the tribal women. Many women had started mango pulp presarvation as vocation under her guidance and improve their economic and social conditions.

Members of SHG practicing with mango pulp preservation

(8) Leaf Dish Making: Better Livelihood Option

Name & Address : Smt. Sadhnaben Rameshbhai Patel
Village: Dhodhadkuva, Ta.: Kaparada,
Dist.: Valsad, Gujarat, Pin : 396191
Mob.: 97122 66261
Age : 36 years
Education : SSC
Other Information : Land : 0.6 ha
President of Saikrupa Self Help Group

Dhodhadkuva—a village of Valsad district is predominantly inhabited by tribal communities. The village is characterized by hilly terrains and high rainfall with severe soil erosion. The declining agricultural productivity has forced tribal families to seek some alternate off-farm activities to earn more with limited available resources. KVK, Valsad observed the felt needs of tribal women. Mostly farm women were engrossed to work at their doorsteps during leisure time. KVK, Valsad and Rural Technology Institute guided the women for Self Help Group (SHG) formation. KVK organized some trainings and exposure visits. As the village is a part of forest area, leaves of Khakhara tree (*Butea monosperma*) are easily available.

KVK imparted the need based and skill oriented trainings on collection, storage and selection of leaves for dish/cup preparation, operating of machines and packing & marketing of products. SHG members decided to opt the leaf cup/dish preparation activity, which they learned during the exposure visit. Within short period, group of 20 members enrolled as *"Saikrupa SHG".* SHG started with member fee of Rs.20 and regular monthly deposit of Rs.50 per member. Twelve members of SHG started joint venture. The group had earned Rs.2,58,800 during the span of three years. The average annual income of SHG is Rs.86,266. This activity was undertaken during winter season for 3 to 4 hours a day, and for 4 to 5 days in a week, apart from their routine work (only four months). Inspired from this, two more SHGs have been formed. Trained group members are also acting as trainers for others SHGs in the village and adjoining villages. Many of the group members had upgraded their vocation from leaf cup / dish to paper cup/ paper dish preparation as it found more returnerative.



Interactive training at KVK on leaf cup / dish preparation

9) Tailoring –Option for Better Income

Name & Address : Smt. Nimishaben Jasvantbhai Patel
Village : Sukhala, Ta.: Kaparada,
Dist.: Valsad, Gujarat
Mob.: 78745 74122
Age : 36 years
Education : M.A.
Other Information : Land : 0.40 ha
President of Shivshakti Mahila Mandal

The tribal communities of Valsad district depend primarily on agriculture for their livelihood. Majority of them work as labour force for seasonal agricultural work. Therefore, they have to migrate to nearby town for wages during lean period. Majority of dropouts school girls have performed household activities. During informal meeting of KVK experts with the villagers of Sukhala village, it was observed that, unlike the men, it was very difficult for the girls and women to go away from home for income generation. KVK helped these women to form a SHG named "*Shivshakti Mahila Mandal*" consisting 20 members.

KVK had organized skill oriented training programme for SHG members. All the basics of sewing, cutting, designing of blouse, bag etc., were the component of training. KVK expert also guided them about opening the account in bank, maintenance of registers, credit to the members etc. KVK approached the officer of Dena bank and convinced to approve the credit at subsidized rate. Sixteen trainees have purchased machine from bank loan. They were working for about 3 to 4 hours daily for 18-20 days in a month. All the members of the group are earning monthly income of Rs.2500 to 3000 and they have repaid the full amount of loan. Total saving of the group is around Rs.1,50,000.

As a result of continuous effort of KVK, 50 machines have been provided free of cost to the trainees under Manav Kalyan Scheme of Gujarat Government. Trained group members have also acted as trainers to the other SHGs. Few of them joined the industrial units as skilled worker and are earning upto Rs. 2200-2500 per month. Under the dynamic leadership of Nimishaben about 60 women improved their livelihood.



Members of SHG practicing with sewing work

PUBLICATIONS


TECHNICAL LITERATURE

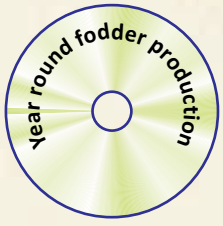









DIGITAL LITERATURE IN GUJARATI



रातें कितनी ढल चुकी, सितारों से पूछो।
लहरें कितनी मिट चुकीं, किनारों से पूछो।
पानी कितना बह चुका, नदियों से पूछो।
टेक्नोलॉजी क्या-क्या निकल चुकी,
KVK से पुछो।

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