ICAR NIASM Technical Bulletin No.10
Tribal Sub Plan Programme

A Step Towards Improving Livelihood of Tribal Farmers Through Integrated farming






भाकृअनुप-राष्ट्रीय अजैविक स्ट्रैस प्रबंधन संस्थान
(समतुल्य विश्वविद्यालय)
मालेगांव, बारामती – 413 115, पुणे, महाराष्ट्र, भारत
ICAR-National Institute of Abiotic Stress Management
(Deemed to be University)
Malegaon, Baramati - 413 115, Pune, Maharashtra, India

ICAR-NIASM Technical Bulletin - 10
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(Indian Council of Agricultural Research)
Malegaon, Baramati - 413 115, Pune, Maharashtra, India

March, 2017

Published by
Dr. N. P. Singh
Director
ICAR-National Institute of Abiotic Stress Management
Malegaon, Baramati - 413 115, Pune, Maharashtra, India

Authors
KK Krishnani
NP Kurade
DP Patel
AL Kamble
RL Meena
Neeraj Kumar
AV Nirmale
PS Minhas
NP Singh

Citation
A step towards Improving Livelihood of Tribal Farmers Through Integrated Farming, Technical bulletin No.10, 2017, ICAR-National Institute of Abiotic Stress Management, Malegaon, Baramati - 413 115. Pune, Maharashtra (India).

Contact details
Director
ICAR-National Institute of Abiotic Stress Management
Malegaon, Baramati - 413 115, Pune, Maharashtra, India
Phone: 02112-254057/58; Fax: 02112-254056
Email: niamdirector@gmail.com, director.niasm@icar.gov.in
Web: www.niam.res.in

Printed at :

Flamingo Business Systems
19, Laxminagar Commercial Complex No. 1
Shahu College Road, Pune 411 009
020-24214636, 9049400137 • Email : flamingo.b.s@gmail.com, srgupta.tej@gmail.com

Organizational Setup of TSP Implementation Committee

Dr NARENDRA PRATAP SINGH
DIRECTOR, ICAR-NIASM

Dr. KISHORE K KRISHNANI
CHAIRMAN

MEMBERS

Dr. NITIN P KURADE
PRINCIPAL SCIENTIST
(VETERINARY PATHOLOGY)

Dr. D P PATEL
PRINCIPAL SCIENTIST
(PLANT PHYSIOLOGY)

Dr. ANKUSH L.KAMBLE
SCIENTIST
(AGRICULTURAL ECONOMICS)

Dr. NEERAJ KUMAR
SCIENTIST
(FISH NUTRITION)

Dr. RANG LAL MEENA
SCIENTIST
(AGRONOMY)

Dr. A.V. NIRMALE
CHIEF TECHNICAL OFFICER
(ANIMAL SCIENCE)

Preface

The nomadic tribes of Maharashtra are spread over large areas, mainly on hilltops. These tribes have a rich heritage of culture that is distinctly different from other social groups. The major occupation of tribal community is Agriculture. The land holding of this community is very small and fragmented. So the economic condition of most of the rural tribal community is said to be poor. At the same time, agriculture inputs and new information about agriculture are to be reached optimally to these areas. Considering such situation in tribal area NIASM has been working at Navapur tehsil and Nandurbar district of Maharashtra. The grass root constraints were decided by undertaking baseline surveys and group discussions. By focusing these constraints and available resources Tribal Sub Plan (TSP) Implementation committee has decided to work with moto "Implementation of Improved agriculture technology interventions in Field crops (rice and sugarcane), Horticultural crops (Banana, Dragon fruit, Onion, other vegetables), Livestock and Poultry, Fisheries and integrated agri-aquaculture/Integrated farming for livelihood improvement of Tribal farmers. Various training programmes, field demonstrations, farmers/group meets, and exposure visits were organised by TSP implementation committee, which has positive effect on livelihood of tribal farmers by adopting the knowledge and experience shared by the committee during the entire work. Also tribal farmers got additional benefits through successfully implementation of backyard poultry, goatery and dairy units. The experience of working with tribal farmers has given an opportunity not only to the tribal farmers but also to us to interact with them. This has definitely enhanced their knowledge and experience that was a great success of sincere efforts of TSP Implementation Committee.

We express our deep sense of gratitude to all those individuals and institutions for extending their help and cooperation in implementing TSP programme successfully. Not only the scientists and experts of the ICAR and Non-ICAR institutions, assistance and cooperation extended by MPKV (Rahuri), MSSC (Mahabeej), and KVK (Baramati, Babhaleshwar) deserves special mention. We are thankful to our dedicated team Shri Shrikant Karale (YP-I-TSP), Shri Kishan Gavit, Vilas Vasave and Mr Chandu Gavit who have worked tirelessly in the field and were behind the conduct of various field demonstrations and organization of various HRD programmes.

TSP Implementation Committee

Foreword

Indian tribal people play a key part in constructing the cultural heritage of India. They occupy a major part in the history of India as they are considered as the true habitants of India. The tribal people are scattered in different parts of India and they form a considerable number of the population of India. The traditional and cultural distinction of each tribal community has made them distinguishable from each other and their cultural and traditional heritage add colour and variation to the Indian culture as a whole and form a compact culture. Indian tribal people reside in approximately fifteen percent of the country`s area.

There is a need to address the farmers about importance of complementary agribusiness enterprises like backyard poultry, livestock and fishery, besides doing the farming. In addition, proper marketing for improving their livelihood is also required. Tribal agriculture is characterised by low technology and low input resources and therefore, the nature of agricultural productivity of various crops in the tribal areas is not high. For overcoming these lacunas, Tribal Sub Plan (TSP) on behalf of ICAR New Delhi National Institute of Abiotic Stress Management, Malegaon constituted TSP implementation committee to take an initiative towards the livelihood improvement of tribal farmers through sustainable integrated farming. Committee has worked with a moto to assist the sustainable development of livelihood of tribal farmers by improved technology interventions in Field Crops, horticultural crops, Livestock and poultry, Fisheries and integrated agri-aquaculture. The entire TSP implementation committee has worked very hard and they really deserve appreciation for their sincere efforts.

The important activities related to implementation of improved technology interventions in integrated farming in terms of field and horticulture crops, dairy, goatery, poultry and fish farming and integrated agri-aquaculture, by NIASM in tribal villages of Navapur tehsil have been documented in this technical bulletin. Information on livelihood improvement of tribal farmers is also provided. I am sure that this information will be a very useful and practical guide to all those involved with implementations of various community development programmes, especially in tribal areas.

Director

Executive Summary

ICAR-National Institute of Abiotic Stress Management, Baramati has implemented improved technology interventions in field crop, horticulture, livestock, poultry, fisheries and integrated farming in various villages of Navapur Tehsil in Nandurbar District for improving the livelihood of resource poor farmers as part of Tribal Sub-Plan (TSP). Training programmes pertaining to technology interventions in rice, banana, fodder crops, farm pond preparation and integrated agri-aquaculture were conducted on 8th July 2015 at Visarvadi, where farmers from Chitwi, Vadsatra, Devlipada, Neemdarda, Bandharpada and other nearby villages participated and in another training programme on 9th July 2015 at Navapur, farmers from Jamtalav, Gadad, Bokaljhar, Mugdhan and nearby villages participated. In both the training programmes, informative lectures related to technology interventions in rice, banana, fodder crop; farm pond preparation; integrated farming (agri-aquaculture) were delivered by the TSP team and interactive sessions were also held with the participants. Rice certified seeds of improved variety Indrayani and Phule Samruddhi, Gliricidia saplings and fertilizers were distributed to farmers of various villages (Gadad, Bokaljhar, Chitwi, Devlipada, Vadsatra, Neemdarda, Bandharpada, Mughdhan, Bhardu, Nagzari and Karanji Bk). During meetings held with various group of farmers, detailed information related to treatment of rice seeds and raising of healthy rice nursery were given to the farmers. Plantation of Gliricidia was promoted among the farmers elected for rice crop intervention as live fences, which can also be used as green leaf manure for crop production and animal forage.

Virus-free tissue culture banana plants and fertilizers were procured and distributed to identify farmers at Chitwi and Vadsatra villages. During meetings held with the farmers, detailed information related to the pit preparation, application of FYM, neem cake and methods for preventing insects were disseminated to the farmers.

Information related to advantages of having farm ponds, renovation of existing farm ponds and integrated farming (agri-aquaculture) have successfully been disseminated to the participated farmers. Indian major carp (IMC) fingerlings were stocked in farm/fisheries ponds at Karanji, Bhomadipada, Borepada, Jamtalav, Chowky and Chitvi. Water quality parameters such pH, DO and ammonia were measured. Integrated farming (Agri-aquaculture) in terms of cultivation of rice and banana and aquaculture of IMC has successfully been demonstrated at Chitvi village. Research on fish ponds led to the optimal water quality and plankton primary productivity. Availability of fish seeds from nearby hatcheries was encouraging farmers to adopt agri-aquaculture.

Farmers at Gadad and Jamtalav villages have also been identified for dairy farming, backyard poultry and fodder interventions. Root slips of Hybrid nappier "PhuleJayawant" were procured and demonstration plots were established. These farmers were provided with buffalo. Farmers of Navapur Taluka and Nandurbar District have been selected for intervention of backyard poultry farming and goat farming and were provided with dual purpose Vanaraja birds along with cages and osmanabadi goats.

Farmers field days on "rice crop" and "fish culture" were organized on 3-4 November 2015 for higher productivity and income for tribal farmers from Navapur villages. Integrated agri-aquaculture and Participatory demonstration of "Four point rice production technology" have successfully been implemented. Training programme on "Backyard Poultry Farming" was organized on the 18th December 2015 and 19th March 2016. Two exposure visits were conducted on improved technology interventions in field & horticulture crops, livestock & poultry, & integrated Agri-IMC aquaculture for livelihood improvement of Tribal farmers on 3-4 March 2016 and 28-30 March 2016. Farmers along with TSP team visited KVK Bhabhleshwar, MPKV Rahuri, KVK and NIASM Baramati. Thereafter, farmers participated in interactive session conducted at NIASM and expressed their happiness with the wide exposure related to integrated farming received during this exposure visit.

TSP implementation committee team under the guidance of Director, NIASM, visited Navapur for reviewing on-going TSP activities. Training programme on "Nutritional management in livestock and fisheries for livelihood improvement of tribal farmers" were conducted at Visarwadi and Navapur on 17-18 September 2016. Farmers from various villages of Navapur (Nagzari, Waghalpada, Pimpran, Kolada, Savarat, Gadad, Jamtalav, Karanji, Bardipada, Chitavi, Deolipada, Vadsatra, Tilasar, Mahalkadu, Bharadu, Kanhala, Mugdhan, Pimpla, Karanjibk, Bokalzhar, Bhavare, Ampada, Rayngan, Bandharpada, Chauky) participated in training programmes. Dr. NP Singh, Director, NIASM, addressed the farmers about importance of complementary agribusiness enterprises like backyard poultry, livestock and fishery, besides doing the farming. He also emphasized the need of proper marketing for improving their livelihood. He asked farmer to grow vegetables and fruits in the backyard of their house, supplementary to meet their daily requirement. During training, farmers were guided on "Parasitic diseases and deworming in livestock" "Nutritional Management in Livestock", "Fish Farming" and "Integrated agri-aquaculture" by the team. Thereafter, farmers participated in interactive session and expressed their happiness with the wide exposure received during the training programmes and huge beneficial impacts of ongoing TSP activities related to successful implementation of integrated farming and agri-aquaculture in the Navapur villages.

Participatory demonstration of "Four point rice production technology" and "Water efficient crop production technology in sugarcane" have successfully been implemented on the 2 &3rd November 2016. Exposure visit related to Group base cultivation and marketing of baby corn was organised on the 7 & 8th February 2017. Training programme related to backyard poultry farming was conducted on the 14th February, 2017, where back yard poultry cages and Vanaraja birds along with other poultry inputs were distributed to Tribal farmers. On the 15th February 2017, exposure visit related to precision farming and micro-irrigation systems, agro-products and cultivation of tissue culture plants were organised. On the 6-8, 9-11, 20-22 and 23-25 March 2017, four exposure visits related to goat farming training campaign were conducted at KNP College of Veterinary Sciences, Shirval. In addition, an exposure visit for aqua-farmers at KVK-Navasari and training programme on fish feed preparation was conducted on 25-26 March 2017.

Inputs required for implementation of improved technology interventions in field & horticulture crops, livestock & poultry and fisheries such as farm implements, certified seeds of improved varieties, fodder root slips, fertilisers, compost production units, fish fingerlings, Mahsana

buffaloes, osmanabadi goats, dual purpose chicks, other required inputs and soil health cards were distributed to tribal farmers. Several training programmes/field days/exposure visits were conducted. Information related to “Four point rice production technology”, “Water efficient crop production technology in sugarcane”, “Gliricidia plantations as live fences and green leaf manure”, "Micro-irrigation systems", "Precision farming", "Seed production and cultivation of high yielding late kharif and rabi onion varieties with better storage", "Cultivation of virus free tissue culture banana plants and suckers", “High yielding dairy & backyard poultry farming”, “Goat farming”, “Advantages of having farm ponds for fish culture”, “Farm pond preparation and renovation of existing ponds”, “IMC aquaculture”, “Integrated agri-aquaculture”, “Fish feed preparation”, “Integrated farming”, “Agricultural soil health assessment and soil health cards based fertilizers applications” were disseminated. Improved technology interventions led to higher production/marketable yield of rice (6-10 tonnes/ha), Sugarcane (40-75 tonnes/acre), onion (25-68 tonnes/ha), banana (15,000-27,000 kg/acre), baby corn (4 tonnes/acre), milk (Av. 108 - 188 Litres/month), and fish (> 2000 kg/ha). Improved technology interventions in goat farming as backyard enterprise and dragon fruit cultivation as kitchen gardening are also being undertaken for livelihood improvement of tribal farmers.

Contents

1. Introduction

Tribal Sub Plans were devised for expeditious development of Scheduled Tribes since 1974-75. It comprises of State Plan and Central Plan components. TSP of State Plan constitutes more than two thirds of the total outlay. It is a multi-pronged strategy which includes support for education, health, sanitation, water supply; livelihood, physical infrastructure etc. This is carried out through various schemes/programmes of concerned Central Ministries and the State Governments. The Ministry of Tribal Affairs supplements these efforts through filling critical gaps. Grants are released for improving the quality of Administration in Scheduled Areas and for the welfare of Schedule Tribes under Article 275(1) of the constitution.

Special Central Assistance to Tribal Sub Plan (SCA to TSP)

Funds are provided to the 23 TSP States, as an additive to the Tribal Sub Plan component of the State Plan, with major focus on imparting modern skills to enhance employability including traditional skills; sustainable income generating livelihood like improved varieties of traditional crops, Horticulture, Dairy development, Backyard poultry, Fisheries, Sericulture etc.

The tribal situation in the country presents a varied picture. Some areas have high Tribal concentration while in other areas, the tribal form only a small portion of the total population. There are some tribal groups, which are still at the food gathering stage, some others practice shifting cultivation, yet other may be pursuing primitive forms of agriculture.

The Constitution of India provides for a comprehensive framework for the socio-economic development of Scheduled Tribes and for preventing their exploitation by other groups of society. A detailed and comprehensive review of the tribal problem was taken on the eve of the Fifth Five Year Plan and the Tribal sub-Plan strategy took note of the fact that an integrated approach to the tribal problems was necessary in terms of their geographic and demographic concentration, if a faster development of this community is to take place. Accordingly, the tribal areas in the country were classified under three broad categories:

1. States and Union Territories having a majority scheduled tribes population.
2. States and Union Territories having substantial tribal population but majority tribal population in particular administrative units, such as block and tehsils.
3. States and Union Territories having dispersed tribal population.

In the light of the above approach, it has been decided that tribal majority States like Arunachal Pradesh, Meghalaya, Mizoram, Nagaland and U.Ts. of Lakshadweep and Dadra &Nagar Haveli may not need a Tribal sub-Plan, as the entire plan of these

States/Union Territories was primarily meant for the S.T. population constitutioning the majority. For the second category of States and Union Territories, Tribal Sub-Plan approach was adopted after delineating areas of tribal concentration. A similar approach was also adopted in case of States and Union Territories having dispersed tribal population by paying special attention to pockets of tribal concentrations, keeping in view their tenor of dispersal. To look after the tribal population coming within the new tribal sub-Plan strategy in a coordinated manner, Integrated Tribal Development Projects are conceived during Fifth Five Year Plan and these have been continued since then. During the Sixth Plan, Modified Area Development Approach (MADA) was adopted to cover smaller areas of tribal concentration and during the Seventh Plan, the TSP strategy was extended further to cover even more smaller areas of tribal concentration and thus cluster of tribal concentration were identified.

Since TSP strategy also has twin objectives namely Socio-economic development of Schedule tribes and protection of tribal against exploitation, the Govt. of India in Aug., 1976 had decided to make the boundaries of Scheduled Areas co-terminus with TSP areas (ITDP/ITDA only) so that the protective measure available to Sch. Tribes in Sch. Areas could be uniformly applied to TSP areas for effective implementation of the development programmes in these areas. Accordingly, the TSP areas have been made co-terminus with Sch. Areas in the State of Bihar, Gujarat, H.P., Maharashtra, Madhya Pradesh, Orissa and Rajasthan. The basic objective of Tribal Sub-Plan is to channelize the flow of outlays and benefits from the general sectors in the Central Ministries/Departments for the development of Scheduled Castes and Schedules Tribes at least in proportion to their population, both in physical and financial terms.

Objectives

- Human resource development by enhancing their access to education and health services,
- Bridging the gap between ST population and others by accelerating the development of STs and securing them:
- Enhanced quality of life by providing basic amenities in tribal areas/localities including housing;
- Substantial reduction in any poverty and unemployment, creation of productive assets and income generating opportunities
- Enhanced capacity to avail opportunities, gain rights and entitlements and improved facilities at par with other areas
- Protection against exploitation and oppression.

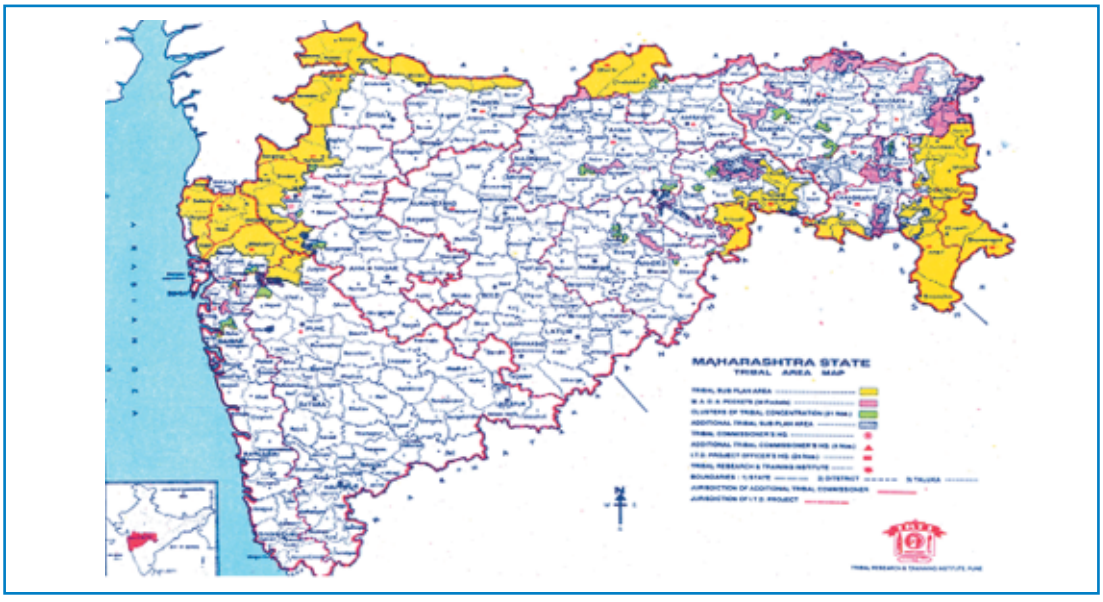
Consequent upon the implementation of the recommendations of Task Force constituted under the Chairmanship of Member, Planning Commission for review of

the operational guideline implementing of Tribal Sub-Plan (TSP), the Competent Authority in the Indian Council of Agricultural Research has approved the creation/setting up of a 'Tribal Sub-Plan (TSP) Cell at ICAR Headquarters. This cell shall function under the overall supervision of the Liaison Officer, who would also be the Nodal Officer for ensuring effective and meaningful implementation of the Tribal Sub Planfor Scheduled Caste and Scheduled Tribe. While the allocation of funds for Tribal Sub-Plan under Plan outlay shall be the responsibility of the PIM Section of the Council, the TSP Cell would be responsible for proper monitoring of Tribal Sub-Plan funds and also for looking after the interests of Scheduled Tribes in the Council with the clear objective of bridging the gap in socio-economic development of the Scheduled Tribes.

Accordingly TSP implementation committee ICAR - National Institute of abiotic stress management, Malegaon, Baramati has purposefully selected Navapur Tehsil of Nandurbar District for livelihood improvement of tribal farmers through improved technology interventions in field crops, horticultural crops, livestock, poultry, fisheries and integrated agri-aquaculture. In order to focus each and every aspect of objectives, TSP implementation multi-disciplinary committee under the guidance of Dr N.P. Singh, Director, ICAR-NIASM has been constituted with Dr. K.K. Krishnani as a Chairman TSP implementation committee, and committee members-Dr. N.P.Kurade,Dr. D.P. Patel, Dr. A.L. Kamble, Dr. R.L.Meena, Dr. Neeraj Kumar, and Dr A.V. Nirmale. These are the pillars of the bridge between the tribal farmers and improved livelihood through sustainable agricultural development.

2. Socio-economic profile of the work

As compared to other states in India, Maharashtra is one of the top economic performers with respect to per capita income which is 1.6 times that of all India. The relatively high per capita income in the state, however, conceals the enormous urban-rural contrast and the regional disparities in per capita income. Only six districts, three in the Konkan region (Mumbai, Thane, Raigad), in addition to Pune, Kolhapur and Nagpur had per capita income above state average. The remaining districts have per capita income below state average. Thus, about 80 percent of districts in the state have per capita income below state average and in case of many of them it is below National average and it is in these districts that agriculture is the main economic activity. About 20 out of 34 districts, i.e. 59 percent of the districts, have more than 70 percent of their workforce in the agricultural sector while 29 districts i.e. 85 percent of the districts have more than 60 percent of the workforce in agriculture. These percentages are more than the National average. This explains the importance of the agricultural sector in the economic and social fabric of Maharashtra as majority of the labour force still depends on agriculture as their primary source of livelihood. Further, in nearly half the Districts, the share of agricultural labourers is more than that of cultivators.



Map of Tribal Area of Maharashtra

Identified Tribal Area: Navapur Taluka of Nandurbar District

Nandurbar district is the 4th largest Tribal District of Maharashtra. The population of the district is 16.48 lakhs of which 69.00 per cent population is Tribal. The District has now been declared as most backward and undeveloped District of Maharashtra. The District comprises of six Taluka's viz., Nandurbar, Navapur, Taloda, Shahada, Akkalkuwa and Akrani. As a whole, the District is divided into two river

basins viz., Tapi and Narmada. Tapi river flow from East to West in the District. The Tapi river basin in the southern part is fertile plain. Narmada flow through Satpuda Mountain ranges a very few hilly part of the District lies in Narmada basin.

Most of the cultivators grow cotton, banana, sugarcane paddy, maize, soybean, sunflower, chilly, Tur, black gram, green gram under irrigated and rain-fed situation, during kharif season and rabijawar, wheat, gram and safflower, sunflower, groundnut during rabi season, irrespective of taking into account agro ecological situation. Due to introduction of Bt. cotton and technological intervention by agricultural department, the involvement of innovative farmers increased in overall farming system of the District. It is seen that farmers are in need of not only technology but also other needs viz., high yielding quality seeds, timely credit supply and marketing facilities. At present the proportion of irrigation is only 18.36 per cent. Most of the medium minor and other irrigation projects are in progress or nearly in completion stage. Increasing the cropping intensity as well as judicious use of irrigation are the basic needs to increase productivity of water. Amongst other allied activities animal husbandry, dairy and fishery are the major subsidiary occupations for small and marginal farmers and landless labours of the District. Therefore, concentrated efforts are required to generate further income of farmers from these subsidiary occupations.

Topography and Agro Climatic Characteristics

The Nandurbar District is situated in upper side of Tapi basin at North-West direction of the Maharashtra state. The area of the District extends with Tapi river 116 km to 120 km and width about 57 to 116 km. Nandurbar District is a part of Deccan plateau in general oval in shape. Considering undulating topography, weather, rainfall pattern and land geographically District is divided into 3 parts first part comes in ranges of Satpuda having tribal population including Akkalkuva, Taloda and Akrani Talukas. Second part covering whole Nandurbar and Shahada Tahsils comes under the basin on river Tapi. Navapur taluka at the south west direction come in third part having area under Sahyadri ranges.

Agro-ecological situation of Nandurbar District

Sr. No.	Agro-ecologicalsituation	Approximately area covered per cent	Taluka's
1	Scarcity Zone	42.04	Nandurbar, and Taloda, Akkalkuwa and Akrani Taluka
2	**Western Ghat Zone**	**19.40**	**Navapur**
3	Sub-mountain Zone	25.70	Whole Akrani and northern parts of Akkalkuwa.
4	Western Maharashtra Plan Zone	12.86	Taloda and Shahada

Rainfall pattern

The average rainfall of Nandurbar district is 872 mm. However rainfall patterns are different in each Agriculture Ecological Situation (AES). During 2009, 2010, 2011, 2012 and 2014 rainfall received is less than District average. It is also observed that in the month of July and August,District received up to 70 % rainfall of District average.

Land use capability classification in Navapur Tehsil (C-DAP Nandurbar: General description of the NandurbarDistrict , Chapter II,Page 13)

Sr. No.	Taluka	Classification								
		Class	Area (ha.)	Class	Area (ha.)	Class	Area (ha.)	Class	Area (ha.)	Total
1	Navapur	II	10117	III	22350	IV	24463	VI	22249	79179

Land holding pattern of Navapur Tehsil (C-DAP Nandurbar: General description of the Nandurbar District, Chapter II,Page 18)

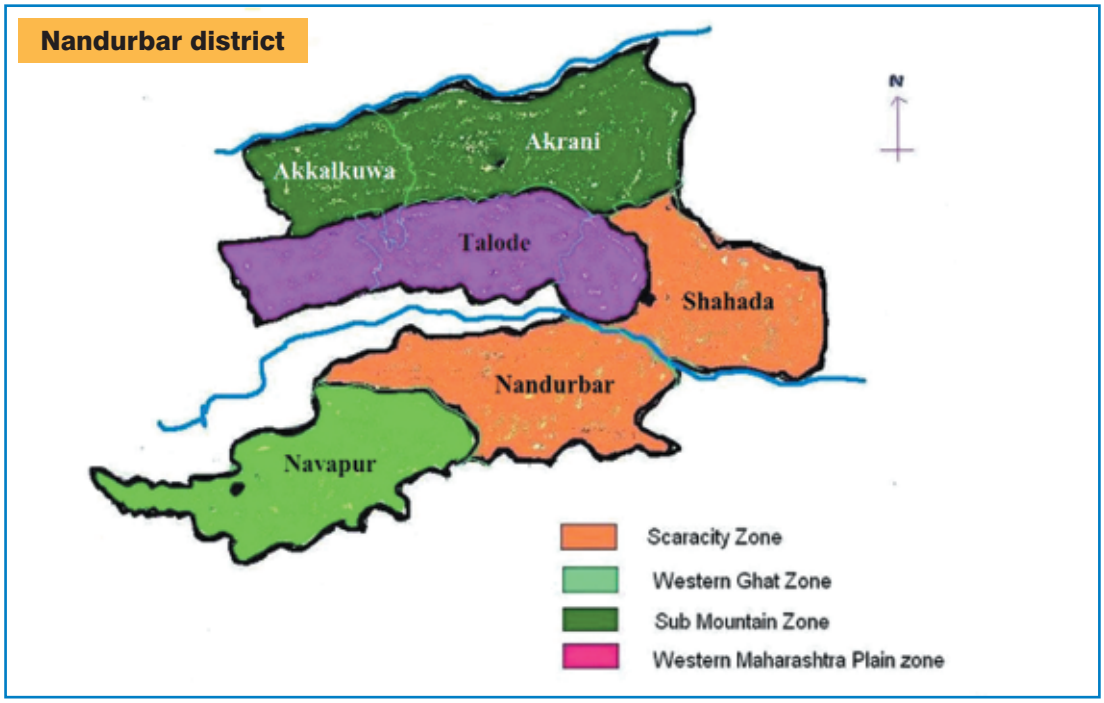
Sr. No.	Taluka	0.0 to 1.00		1.00 to 2.00		2 to above		Total		Average size/ holding
		No. of Holders	Area (ha.)	No.of Holders	Area (ha.)	No.of Holders	Area (ha.)	No.of Holders	Area (ha.)	
1	Navapur	8153	5714	13423	19046	9861	35022	31437	59782	1.9

Agricultural practices in Tribal Area

Crops and cropping pattern

Normal area under *kharif* crop is 252300 ha. *Kharif* season is the most predominant season. *Kharif* jawar, cotton, Bajara, paddy are the main crops. Whereas tur, green gram, black gram, sunflower and groundnut are second important crops. Maize and soybean is fast emerging crop of the District. In rabiseason, rabi jawar, wheat and gram are predominant crops. Groundnut, bajara and sunflower are taken in summer season. In hilly area of the District, hill millets are predominant crops, productivity of which, is very negligible. Paddy is taken in both irrigated as well as rainfed condition. No other factor is as critical to paddy production as the moisture stress at the reproductive stage of the crop. Yield reduction from lack of water during reproductive stage can lead to serious losses in paddy productivity. Tur is mostly taken as inter crop in paddy, jawar, cotton and maize crop. Horticulture crops like mango, papaya,banana, chilly, cauliflower, cabbage, brinjal, onion and beans are important crops. The agricultural production and productivity of principal crops is low and fluctuating as compared with state as well regional level. District as a whole, only 20.50 % area is under cash crop/high valued crops and 5.21% area is under horticulture crops, which is in an undeveloped stage with few exceptions requires

additional inputs for reaching optimum level of productions. Aamchur is famous local value added product of mango prepared from local verities of mango, it fetches good market price. Chilly is also very remunerative crop. Chilly pockets have already been developed in the District.



Agro ecological situation of Nandurbar district

Farming system

The following major farming systems are observed in the District.

1. Agriculture – Horticulture

2. Agriculture – Dairy

Employment generation

Because of inadequate developmental activities in the District and greater scope for employment in the industrialized Surat town of bordering Gujarat state, a trend of migration of labours for work is of typical nature found in the District. However, they are not permanent migrants.

Market

Nandurbar itself is an old traditional market place for chilly, cotton and cereals. It is well connected by railway route Bhusawal – Surat to distance Cities like Ahmadabad, Baroda, Delhi etc. Surat and Khetiya are the bordering Districts in Gujarat and Madhya Pradesh respectively are the most nearest important big places like Mumbai and Pune in Maharashtra.

Value addition

Most of the tribal farmers take insitu mango plantation traditionally where survival rate is also more than the EGS plantation. From this plantation they got alternate year production. These traditional varieties are mainly grown for Amachur preparation. There is tremendous demand for this value added product.

Social and economic status

The total population of Nandurbar District is 16,48,295 of which nearly 69 percent population belongs to tribal community.The major occupation of tribal community is Agriculture. The land holding of this community is very small and fragmented. So the economic condition of most of the rural triable community is said to be poor. One of the peculiarities of this community is that they have strong social beliefs for their customs and traditions. Most of the population of Nandurbar District is illiterate and living in the remote areas. So the agricultural extension worker faces the problem in disseminating Agriculture technical knowhow.

Total Irrigated area of Navapur tehsil: (C-DAP Nandurbar: General description of the Nadurbardistrict , Chapter II,Page 26)

Sr. no	Taluka	Medium	Minor	Wells / Borewells	Total	% to total irrigated area dist.
1.	Navapur	3634	390.5	5066	9090.5	19.55

Sources of Irrigation water in Navapur tehsil: (C-DAP Nandurbar: General description of the Nandurbar District, Chapter II,Page27)

Sr. no	Taluka	Irrigation Source (No.)				
		Under Ground/ Storage Dam	Lift Irrigation Dam	Open wells	Agriculture Pump	
					Diesel pump	Electric Pump
1.	Navapur	93	0	166	653	7771

Available water spread area, Optimum fish production, present fish stocking in Navapur Tehasil (C-DAP Nandurbar: General description of the Nandurbar District, Chapter V Page 106)

Sr. No.	Taluka	Length of River	Tanks can be used for fisheries production		Total area brought under fish farming	Fish production (MT)	Prize (lakh)	Used fingerlings in lakh
			Nos.	Area				
1	Navapur	55	16	896	759	150	45	14

3. Conceptuliasation and implementation of improved technology Interventions / extension work

The hilly tracts of Nandurbar District receive heavy rainfall about 1500 mm while the eastern talukas receive barely 380-400 mm rainfall. Thus heavy rains in the mountain ranges Talukas, sometimes lead to seasonal flooding and there is drought in the eastern talukas. The District must therefore make efforts to practice contour farming and prevent soil erosion in the hilly tracts. Horticulture has great potential in the District and important fruit crops cultivated are mango, banana, papaya and strawberry. These crops have demand not only in urban markets but also export potential. Hence, all round efforts must be made to promote export of these crops so as to augment the incomes of farmers and give boost to the agricultural sector. Allied activities such as dairy, poultry, fisheries and aquaculture, sericulture play a very limited role in Nandurbar. It is necessary to encourage these activities so as to provide supplementary incomes to the farmers. The productivity from oilseeds is very low. Thus efforts must be made to increase productivity from oilseeds. Overall, water is a limiting factor because of which productivity of crops is low and cropping pattern is of low value cereals.

In order to capitalize on the potential of the agricultural sector in the state so as to improve the productivity in this sector and thus enhance the incomes of farmers, the following innovative works have been undertaken by the TSP Implementation committee of ICAR-National Institute of abiotic stress management.

Field crops

Rice

Issues / Problems identified:

- Improper Nursery management
- Lack of seed treatment
- Lack of improved high yielding varieties
- Application of balanced use of fertilizer & faulty method of fertilizer application.
- Very severe yield losses due to lack of plant protection measures for paddy.
- Low yield due to high infestation of weed during crop growing stage.
- Low rates to the grains due to cultivation of local varieties due to lack of vision for cultivating high yielding scented varieties of rice.
- Lack of preparatory tillage operations & lack of collection and destruction of stables which carries stem borer and other pest to next crop reducing yield.
- Improper of nursery management in paddy reducing the yield due to lack of healthy growth of seedlings in nursery.

- Lack of proper puddling operations to prepare land for transplantation.
- Lack of application of green manure at paddling i.e. Glyricidia and more leaching.
- Lack of proper spacing during transplantation and toping of seedlings to control stem borer.
- Low yield due to use local seed and lack of seed treatment, very low seed replacement continued use of same seed.
- Very low application of chemical fertilizers than recommended.
- Lack of proper pest / disease due to lack knowledge of diseases pests and micronutrient deficiency symptoms and no control measures applied.
- Severe yield loses due to lack of pest management.
- Low yield due to lack of nutrient management.
- Lack of protective irrigation and irrigation facilities in dry spell.
- Lack of inter culturing and mixing of used to paddy seed.
- Use of traditional or locally available interculturing implement not effective for inter culturing operations
- Improper stage of harvesting.
- Leading to empty searched padding.
- Reducing the quality of finished seeds & grains due to mixture of grains when the crop variety is threshed at on threshing yard.
- Use of local / traditional methods of rice hashing reducing the quality of whole grains due to more broken grains.

Implementation of improved technological interventions in field crops

Rice and sugarcane are the two major field crops grown by most of the tribal farmers in the selected villages of TSP project area of Navapur taluka in Nandurbar district of Maharashtra. However, productivity of both the crops is far below as compared to other parts of Maharashtra. Therefore, demonstration of technological interventions in rice and sugarcane were planned for the year 2015-16 and 2016-17.

Demonstration of improved technological intervention in rice

A large number of villages in Navapur Taluka of Nandurbar district were surveyed and farmers were contacted for demonstration of improved technological interventions in rice crop. Tribal farmers from various villages namely; Chitavi, Vadsatra, Devlipada, Neemdarda, Bandharpada, Gadad and Bokaljhar, were selected

for making on-farm demonstration of “Four point rice production technology” on farmers field. During meetings held with various group of farmers, detailed information related to pre-sowing seed treatment, raising of healthy and water efficient rice nurserywere given to the farmers. Certified seed of rice varieties Indrayani and Phule samruddhi were was distributed to each of all the selected farmers for raising nursery for transplanting in one acre area each. Participatory demonstration of “Four point rice production technology” have successfully been implemented. In addition, plantation of Gliricidia has been promoted among the farmers selected for rice crop intervention as live fences, which can also be used as green leaf manure for crop production and animal forage.

Distribution of rice seeds and farmers group meeting

Participatory demonstration of “Four point rice production technology

Gliricidia plants

Gliricidia plants in farmers field

Farmers training programmes:

Farmers training programmes were organized on 8th and 9th July 2015 at Visarvadi and Navapur, respectively for creating awareness about "Four point rice production technology" among the tribal farmers of the Navapur Taluka of Nandurbar district. A large number of farmers participated in the training programme at Visarvadi (182) and Navapur (139). During the training programme farmers were also sensitized for growing of *Gliricidia sepium*- a multipurpose forage grain legume tree. 600 saplings of Gliricidia were also distributed to 120 farmers. Farmers were advised to grow Gliricidia as hedgerow on field boundaries in place of Jatropha plants for protection of their crops from grazing/stray animals. Loppings of Gliricidia can be used as green leaf manure for crop production and fodder for animals.

Organization of farmer's field day on rice crop

Farmer's field day on rice crop was organized on 3rd & 4th November 2015 at Gadad and Chitvi villages, respectively where more than 250 farmers from nearby villages participated and exchanged their idea. Crop cutting from 1.0 meter x 1.0 meter was also done in presence of farmers for assessment of yield performance of rice variety Indrayani. Farmers were also taken to the rice fields grown with local varieties and hybrid rice and their performance were compared with given variety Indrayani.

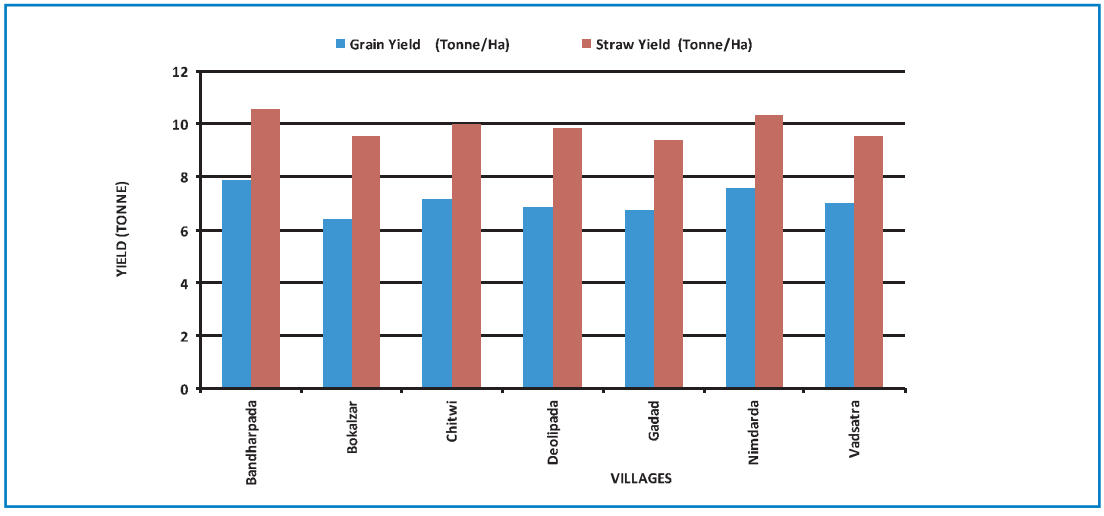
Farmer's field day on rice to showcase the participatory demonstration

The yield performance of var. Indrayani under demonstration was found more or at par with best hybrid rice variety grown in the area. Interaction and discussion was also held with farmers for assessment of overall impact of various technological interventions on performance of rice crop var. Indrayani over local practices compared to local and hybrid rice.

Regular visit and guidance to rice growing tribal farmers

Local variety under upland

Performance of Rice var. Indrayani



Village wise average grain yield and straw yield (2015-16)

Table : Rice yield (2016-17) (Villages Mughdhan, Bhardu, Nagzari, Chitvi, Devalipada, Vadsatra, Karanji bk)

Variety	Grain weight (kg/m^2)	Grain Yield (Tonne/Ha)	Straw weight (Kg/m^2)	Straw Yield (Tonne/Ha)
Phule Samrudhi	0.65 – 1.0	6.50 – 10.0	0.90 – 1.9	9.0 – 19.0
Indrayani	0.60 – 0.8	6.0 – 8.0	0.95 – 1.8	9.5 – 18.0

Sugarcane

Issues / Problems identified

- Lack of use of balance dose of fertilizers (INM), FYM, micronutrients, bio- fertilizer, use of excess water.
- Improper plant population affects on yield
- Low yield due to use of traditional planting methods
- Low yield due to soil salinity and lack of proper water management
- Low yield due to use of poor quality planting material
- Low yield due to heavy infestation of Convolvulus arvensis (field bindweed)
- Low yield due to lack of pest management
- Low yield due to lack of INP
- Low tonnage due to pest problems
- Low yield due to improper harvesting time

Demonstration of technological intervention in sugarcane crop

A large number of villages in project area of Navapur Taluka of Nandurbar district were surveyed and farmers were contacted for demonstration of technological interventions in sugarcane. Farmers were sensitized through personal contact and meetings about the importance of limited availability of water for irrigation, of which a large amount is being used for cultivation of rice and sugarcane following the flood method of irrigation. Farmers were convinced for adapting the water efficient cultivation technologies in sugarcane. Farmer's participatory demonstration on "water efficient crop production technology in sugarcane" was planned and discussed with the farmers. More than 100 beneficiaries were selected from 16 villages (Gadad, Bardipada, Bhardu, Canala, Tilasar, Mahalkadu, Savrat, Devlipada, Vadshatra, Chitvi, Kolda, Karanji BK, Bhavre, Pimpran, Mugdhan and Vaghlapada) of the project area at Navapur Taluka. Regular monitoring of progress in sowing and management of sugarcane crop was done through training, interaction with individual farmers and farmers group. Most of the selected farmers adopted improved method of planting along with drip system of irrigation. Average yield achieved in this area is about 40-75 tonne/acre and average price received by farmer is Rs. 2025 per tonne.

Participatory demonstration on "water efficient crop production technology in sugarcane

Organization of farmer's field day on sugarcane crop

To showcase the Farmers Participatory demonstrations on "Water efficient crop production technology in sugarcane" to the farmers of adjoining village/area, a "Farmers Field Day on Sugarcane" was organised at Karanji Bk village of Navapur Taluka where more than 150 farmers from various villages namely; Karanji Bk., Chitvi, Vadstra, Mahalkadu, Bhardu, Pimpla, Kolda, Pimpran and Bokaljhar participated in the programme and shared their views through discussions. This programme provided enough opportunity to a large number of farmers to visit the crop and exchange their ideas and at the same time also helped in making awareness about efficient use of water among farmers of the project area.

Farmer's field day on sugarcane crop

Horticultural Crops

Late kharif and rabi onion

Issues / Problems identified:

- Low yield due to use of locally produced
- Low quality onion seed and hence very low seed replacement with the certified seed of improved varieties.
- Late transplanting of onion seedling and no seedling treatment followed.
- Lack of micro nutrient application.
- Comparatively high 'N' Fertilizer application i.e. imbalance fertilizer leading to low keeping quality of onion bulbs.
- Lack of micro nutrient application.

Maharashtra is the largest producer of Onion producing about 33% of the total production of onion in the country, involving 4.91 m MT from an area of 0.42 M ha, having productivity of 11.8 MT/ha. It is mainly grown in Nasik, Ahmednagar, Pune, Satara, Sholapur, Dhule and Jalgaon districts. There is a huge demand of onion in the

export market. The state contributes to about 85% of the total onion export. With the setting up of processing industries, the demand for processable varieties, having high TSS has also increased. The Maharashtra State Agri Marketing Board along with Directorate for Onion & Garlic Research, Rajgurunagar and NHRDF has developed technology for onion storage, which is being promoted in the state. 31.31 lakh MT of onion have been traded in organized markets with average price of Rs. 8.89/kg.Improved technology intervention in Rabi onion (var. AFLR, N-2-4-1, Bhimakiran) late kharif onion (Bhimashakti) have successfully been demonstrated to 971 tribal farmers/ Beneficiaries in 21 villages of Navapur.

Rabi onion nursery and transplanting

Nursery raising

Proper nursery management are important operations in the onion crop. About 0.05 hectare nursery area is enough for getting seedlings to transplant in one hector. Seeds were sown in lines at 50mm to 75mm apart to facilitate the removal of seedlings for transplanting and quick weeding etc.

Onion nursery raising in tribal areas of Navapur

Transplanting

Proper care was taken by the farmers while selecting seedlings for transplanting. Over and under aged seedlings were avoided for better establishment. At the time of transplanting, one third of the seedling top was cut to get good establishment. The optimum spacing of 15 cm between the rows and 10 cm between plants were maintained. Late kharif var Bhima shakti and Rabi Onion var Bhima kiran have been distributed to 90 and 250 tribal farmers, respectively for implementation of improved technology intervention in onion during 2016-2017.

Transplanted onion seedlings

Table : Cultivation of onion

Onion variety	Cultivated area (ha)	No of farmers	Yield Kg/m²	Yield Tonne/ha	Average yield Tonne/ha
AFLR	66.6	333	3.8 – 6.6	38 - 66	63.68
N-2-4-1	30.8	154	2.5 - 6.5	25 - 65	55.14
Bhimakiran	29.6	148	2.5 – 6.8	25 - 68	36.11
Total	127	635	–	–	

Banana

Issues / Problems identified:

- Less availability of organic manures
- Less availability of good quality planting material
- less availability of water during summer season
- Lack of market infrastructure, Market fluctuation and low prices to produce
- High cost of production and residual effect of chemical pesticides and chemical fertilizers on farm produce
- Interculturing operation is not in application
- Due to high density plantation pest attack is more severe
- Lack of micro nutrient application
- Lack of use of balance fertilizer (INM), FYM, bio fertilizer, use of excess water

Improved technology interventions in banana

Maharashtra is the second largest producer of Banana after Tamil Nadu in the country and contributes to about 14.4% of the total production of banana in the country. The state produces about 4.3 m. MT of banana from an area of 0.08 m ha with a productivity of 52.5 t/ha. Main varieties grown in the state are Dwarf Cavendish, Basrai, Robusta, Lal Velchi, SafedVelchi. The cultivation is concentrated in the Jalgaon, Ahmednagar, Dhule, Nanded, Parbhani regions of the state. There is lack of post-harvest infrastructure for banana. Substantial quality of the produce is being marketed outside the state. 0.34 lakh MT of banana have been traded in organized markets with average price of Rs. 5-6/kg. DBT and ICAR-NRCB certified virus-free tissue culture banana plants var. Grand Nain were procured and distributed to identified farmers at Chitwi and Vadsatra villages. During meetings held with the farmers, detailed information related to the pit preparation, application of FYM, Neem cake, application

of water soluble fertilisers with drip irrigation and methods for preventing insects were disseminated to the farmers. The use of drip irrigation led to adoption of water and nutrient use efficient cultivation technologies in banana.


Virus free tissue culture banana plantation


Regular visit and guidance to banana growing tribal farmers

Advantages of Tissue culture seedling (Grand Nain) Plantation

1. Plants are same age and variety.
2. Plants are disease free and healthy.
3. Plants carry same character of mother plant.
4. As the suckers are selected from the mother plant with high yields the Tissue Culture Plants give High Yield.
5. Crop is ready for harvest in 11-12 months from plantation
6. Crop growth is uniform
7. Cost of irrigation, labour and cultivation are less because crop period is short
8. In 28-30 Months, one main crop and two crops can be harvested
9. More yield more profit

Banana cultivation using suckers

In 2016-17, suckers were used as propagation materials. There are 3 types of suckers: Maidenhead, a large non-fruiting pseudo-stem (with roots and some rhizome), Sword sucker, a sucker attached to the original (mother) rhizome with narrow sword-like leaves, and; Water sucker, a sucker next to but only superficially attached to the mother rhizome with broad leaves. Large sword suckers and maidenheads are the preferred planting material. Water suckers produce inferior fruit and are therefore not recommended. Sword suckers free from diseases and nematodes from the mother plant, with a well-developed rhizome, conical shape with lanceolate leaves, actively growing central bud, weighing 500 to 750 g were separated and selected. The roots and decayed portion of the corm were trimmed.

Kitchen gardening of dragon fruit

Activities related to implementation of improved technology interventions in horticulture crops have been expanded. Dragon fruit cuttings/saplings were procured from ICAR-NIASM and distributed to tribal farmers of Navapur taluka and Nandurbar District for kitchen gardening / backyard farming.

Distribution of dragon fruit cuttings/saplings for kitchen gardening

Livestock and Poultry

Vast stretches of grazing land and existing livestock based economy is in tune with the available agro-ecological situation. With this plus point of natural resources there is tremendous scope for Animal husbandry in upliftment of livelihood and economic condition of the tribal families.

Dairy

Issues / Problems identified:

- Low milk production due to non-descript poor quality animals, unavailability of optimum quantity of green fodder, concentrates mineral Mixtures, vitamins, etc.
- Low availability of good forage and fodder

- Non availability of nutritious forage varieties and more feeding of dry roughages.
- Lack of awareness about balanced feeding, breeding and health management in dairy animals leading to poor quality and low milk production per animal
- Reproduction problems like anoestrus and repeat breeding due to malnutrition, in-breeding, infections etc.
- Milk rates not paid on fat percentages basis.
- Presence of infectious and non-infectious diseases.

Technology interventions in dairy farming

Fodder production and Nutritional management

Farmers at Gadad and Jamtalav villages were identified for dairy farming, and fodder interventions. Root slips of Hybrid Napier "Phule Jayawant" variety were procured and fodder demonstration plots were established with the Hybrid Napier grass. Dairy demonstration units with buffaloes (Mehsana buffaloes) were distributed to 14 tribal farmers from Navapur tehsil. Training programmes on "Nutritional management in livestock for livelihood improvement of tribal farmers" were conducted on 17-18 Sept 2016, where 200 Tribal farmers from Navapur villages participated and benefitted.


Fodder development demonstration plot

Mehsana

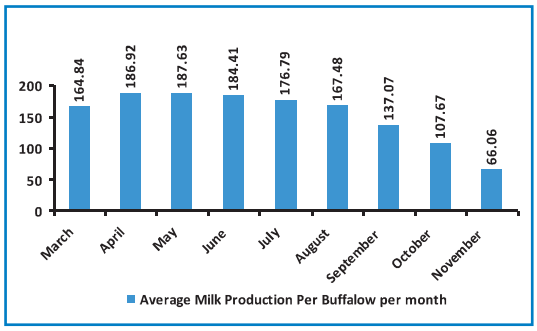
Characteristics are intermediate between Surti and Murrah. Jet black skin andhair are preferred. Horns are sickle-shaped but with more curve than the Surti. The udder is well developed and well set. Milk veins are prominent. Body weight of adult male is 570 kg. Body weight of adult female is 430 kg. Buffaloes are traditionally managed under domestic conditions together with the calf. They are hand-milked twice a day. They are fed different kinds of roughages: barley and wheat straw, cornstalks, sugarcane residuals. In addition, they are given concentrate mixtures.

Improved technology interventions in dairy farming

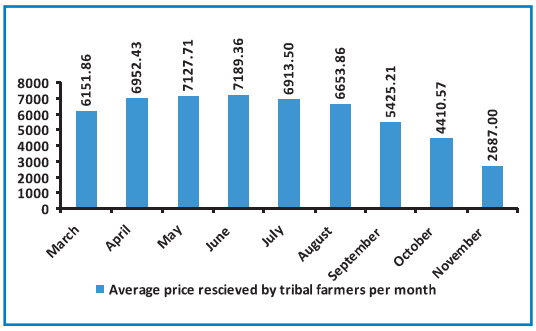
Deworming and mineral mixture supplementation

Training was conducted about parasitic disease of livestock and poultry and its management. More than 500 livestock farmers were provided with a broad spectrumpregnancy safe, single dose anthelminthic preparation for deworming.After deworming, the dairy animals were supplemented with specially formulated area specific mineral mixture.

Distribution of deworming medicines



Average milk production per buffalo per month



Average price received by tribal farmers per month

Goat Farming

Issues /problems identified

- Lack of knowledge about scientific goat rearing practices, particularly about feeding and economic management among the tribal farmers.
- Poor quality breeds and lack of availability of improved breeds within the reach of poor farmers.
- Poor growth rate, heath and reproductive problems and mortality among the goat population in the region.

Scope

- Availability of hilly terrain and stretches of grazing land is highly suitable for goat farming.
- Highly motivated and enthusiastic tribal youth and ladies for adapting goat farming as viable entrepreneurship.

Improved technology interventions in goatery has also been undertaken for livelihood improvement of tribal farmers. Four training programmes of three days duration each were conducted in collaboration with Krantisinh Nana Patil Veterinary College, Shirval for 177 tribal farmers from Navapur, Dhadgaon and Nandurbar District between 6th to 25th March 2017. Tribal Farmers were imparted with skill and knowledge of goat rearing techniques, management, feeding, breeding and disease management, insurance, bank loans etc. during training. Besides on hand training, field visits were also arranged for the farmers. All the trained farmers have expressed determination to take up goat farming in scientific way and on commercial scale. Out of these, 44 trained farmers have been supplied with goat units of four does and one buck of Osmanabadi breed. The goats were procured from Punyashlok Ahilyadevi Holkar sheep and goat development board, Dahiwadi Farm (Govt. of Maharashtra).

Poultry

Issues / Problems identified

- There is no hatchery for dual purpose poultry birds for backyard poultry in the district.
- Avian flu had taken a heavy toll of the industry all over the district
- Lack of knowledge about backyard poultry rearing, using improved stock.
- Annual egg production of birds was reported to be 40-50 eggs/ bird.

Technology interventions in poultry farming

Technology intervention in backyard poultry farming has successfully been demonstrated in the Navapur and Chitavi area. The cages for backyard poultry units to house 20 birds each were designed, fabricated and supplied to 300 tribal farmers.

3000 Vanraja birds (Dual Purpose) were supplied to these farmers after training and imparting skill for backyard poultry farming. The farmers were also provided with feeders, waterers and feed for initial month.Training programme and the group meetings with tribal farmers on "Backyard Poultry Farming" were organized on the 18th December 2015 and the 10th February 2016, where more than 300 tribal farmers participated and were benefitted.


Organisation of training programme on backyard poultry farming


Distribution of backyard poultry units and birds


Distribution of backyard poultry units and birds and training on backyard poultry farming


Distribution of goats to tribal farmers


Goat farming training campaign at College of Veterinary Sciences, Shirval.


Distribution of compost production unit


Distribution of waterer and feederers


Training programme on Poultry farming

Implementation of Improved technology interventions in fisheries

IMC aquaculture

The Indian major Carp (IMC) culture is to rear a healthy population of fish that are free of stress and diseases, and are feeding, growing and surviving at the optimum rate. The health of the fish and diseases are directly linked to environmental quality. Avoiding stress by maintain environmental quality through proper management is essential to maintain a healthy, diseases free population. Enhancing productivity by means of increasing the stocking density, feed, chemical and other inputs in semi-intensive and intensive farming systems has resulted in increasing stressed on IMC. In aquaculture systems, all the environmental components such as biological, chemical and physical may vary abnormally with the intensity of culture operation.

Six villages of Navapur Taluka namely Karanji, Bhomdipada, Borepada, Jamtalav, Chowky and Chitvi were selected for IMC aquaculture. Indian major carp (IMC) fingerlings (size 5-6 g) were stocked in farm/fisheries ponds (stocking density@ 10,000/ha). At villages namely Karanji, Bhomdipada, Borepada, Chowky and Chitvi, water quality parameters such pH, DO and ammonia were measured. Research on fish ponds led to the optimal water quality and plankton primary productivity. At Jamtalav pond, ammonia was found to be higher. In order to control ammonia level, zeolite (stilbite) trapped with silver nanoparticles was applied in the pond. This has helped in alleviation of multiple abiotic and biotic stresses in the pond with the result of higher fish production. Water analysis kit was also used for measurement of these parameters on the field.

Distribution and Stocking of IMC seeds

On farm demonstration of measurement of water quality parameters


Regular visit to tribal areas for technology intervention in fisheries


Application of zeolite based nano-composite in fisheries pond at Jamtalav Village

Farmers training programmes

Farmers training programmes were organized on 8th and 9th July 2015 at Visarvadi and Navapur, respectively for creating awareness about integrated agri-aquaculture, where more than 315 tribal farmers from Navapur villages participated and were benefitted. Training programmes on "Nutritional management in fisheries for livelihood improvement of tribal farmers" were conducted on 17-18 Sept 2016, where 200 Tribal farmers from Navapur villages participated and benefitted. Farmers were given training on farm pond preparation, water quality management, fertilisation of ponds, primary productivity, procurement of IMC seeds from nearby hatchery, feeding and nutrition, harvest and post-harvest technologies, fish marketing and integrated agri-aquaculture.


Farmers training programme on Integrated agri-aquaculture


Farmers training programme on Nutritional management in fisheries for livelihood improvement of tribal farmers

Organization of farmer's field day on fish culture

Farmers field days on Fish culture for higher productivity and income, were organized on 3-4 November 2015, where more than 180 tribal farmers from Navapur villages participated and were benefitted.Integrated agri-aquaculture has successfully been demonstrated. Farmers were taken to the aquaculture / farm ponds, stocked with IMC seeds and their primary productivity were compared.


Farmer's field day on fish culture


Demonstration of Farm pond preparation


Farmers group meetings

Exposure visit on fish and prawn farming and their management was organised for 38 tribal farmers of Navapur tehsil of Nandurbar District at Krishi Vigayan Kendra, Navasari on March 25, 2017. In addition, a training programme on method for Fish feed formulation and preparation was conducted at Navapur tehsil on March, 26, 2017 for livelihood improvement of tribal farmers of Nandurbar District, where about 100 tribal farmers participated and benefitted. Thereafter, farmers participated in the interactive session and expressed their happiness with the wide exposure received during the training programme and huge beneficial impact of ongoing TSP activities related to successful implementation of integrated agri-aquaculture at Nandurbar District.




4. Impact of work done in the Tribal area

It was observed that the cropping pattern in Nandurbar district is dominated by low value cereals. It was thus necessary to improve productivity in the agricultural sector by capitalizing on high value agriculture and generating income from allied activities.

Technology dissemination and adoption

The adoption of technologies for sustainable farming systems is a challenging and dynamic issue for farmers, extension services, agri-business and policy-makers. The agricultural sector needs to employ a wide range of evolving technologies and farm practices across many different farming systems and structures to meet a variety of changing and heterogeneous demands from consumers and the public for food, fiber and other goods and services provided by agriculture, often with uncertain outcomes in terms of their effects on sustainability.

ICAR-NIASM has successfully demonstrated improved technology interventions in field and horticulture crops, livestock and poultry, fisheries and aquaculture, which have been adopted by tribal farmers of Navapur villages:-

1. **Field crop:** Participatory demonstration of "Four point rice production technology" have successfully been implemented. Farmer's field days organized on 3-4 November 2015 helped farmers to adopt four point rice production technologyfor higher productivity and income. On the 2nd November, 2016, participatory demonstration of "Four point rice production technology was successfully done on farmers field. Participatory demonstration of improved technology intervention in water efficient crop production technology in sugarcane have successfully been demonstrated to tribal farmers at Navapur villages on 3rd November 2017.

2. **Horticulture:** Implementation of improved technology intervention in fruit and vegetable crops led to adoption of cultivation of virus free tissue culture banana, rabi and late kahrif onions in Navapur villages. Participatory demonstration of technology intervention in banana (var. Grand Nain), rabi onion (var. AFLR, N-2-4-1, Bhimakiran) and late kharif onion (Bhimashakti) have successfully been implemented to tribal farmers. On the 15th February 2017, exposure visit related to precision farming and micro-irrigation systems, agro-products and cultivation of tissue culture plants were organised at Jain Irrigation Jalgaon.

- **Livestock and poultry:** Implementation of improved technology intervention in dairy demonstration units, fodder crop, goatery and poultry led to adoption of dairy (Mehsana buffaloes) farming, cultivation of hybrid Napier grass, osmanabadi

goat farming and backyard poultry (Vanaraja) farming in Navapur villages. Training programme organized on the 18th December 2015 and the 10 February 2016, and the group meetings helped tribal farmers to initiate "Backyard Poultry Farming". The enthusiasm and participation of tribal ladies was more for this intervention as the egg production supported day to day requirement of the family in terms of extra proteins and earnings through sale of surplus eggs. The farmers reported improved weight gain and egg production from the birds.Training programme on "Nutritional management in livestock for livelihood improvement of tribal farmers" was conducted at Visarvadi and Navapur on 17-18 Sept 2016. On the 14th February, 2017, training programme related to backyard poultry farming was conducted, where back yard poultry cages and Vanaraja birds along with other poultry inputs were distributed to Tribal farmers. More than 300 tribal farmers participated in the programme. On the 6-8, 9-11, 20-22 and 23-25 March 2017, four exposure visits for three days each related to goat farming training campaign were conducted at KNP College of Veterinary Sciences, Shirval. 177 tribal farmers have been benefitted from this training programme.

3. **Indian Major Carps aquaculture:** Improved technology interventions in fisheries led to adoption of IMC aquaculture. Participatory demonstration of Integrated agri-aquaculture have successfully been implemented through improved technology intervention in IMC aquaculture, field and horticulture crops. Farmer's field days organized on 3-4 November 2015 helped farmers to adopt IMC aquaculture for higher productivity and income. Training programmes on "Nutritional management in fisheries for livelihood improvement of tribal farmers" were conducted on 17-18 September 2016 at Visarvadi. An exposure visit for aqua-farmers was organised at KVK-Navsari on 25 March 2017, where farmers got acquainted with IMC and prawn aquaculture. Training programme on fish feed preparation was conducted at Karanji village on 26 March 2017. Integrated agri-aquaculture have successfully been demonstrated through demonstration on improved technology intervention in IMC aquaculture, field and horticulture crops.

4. **Integrated farming:** Training programmes conducted on 8-9 July 2015, helped tribal farmers of Navapur villages to get acquainted with technology interventions in rice, banana, fodder crops, farm pond preparation,Integrated agri-aquaculture and integrated farming. Distribution of compost production units generated the concept of organic farming. Exposure visits conducted helped tribal farmers to gain knowledge on the "Improved technology interventions in field & horticulture crops, livestock & poultry, & IMC aquaculture for livelihood improvement of Tribal farmers" and "recent advances in integrated farming".

5. **Agricultural Soil Health and fertilizers recommendation:** During World Soil Day celebration on the 5th December 2015, at Navapur, importance of soil health

cards in ensuring balanced use of fertilizers, enhancing crop productivity along with reduction in cost of cultivation and the soil health card based farming soil health assessment, soil test based nutrient recommendations, edaphic stresses and their management through integrated farming and INM were popularized among more than 500 tribal farmers to improve the production and quality of the produce, which in turn uplift the socio-economic status of the farming community.

Marketing

- On the 7 & 8th February 2017, exposure visit related to Group base cultivation and marketing of baby corn was organised. 90 tribal farmers have been benefitted.

Productivity enhancement

Research efforts, farmer education and training, advice and information are shifting towards balancing economic efficiency with environmental and social sustainability. The focus of research and advice was to increase production, productivity and profits, whereas now the emphasis is on achieving those aims in a sustainable way, which often implies changing farm practices and using different technologies. As has often been the case, agriculture is drawing on and adapting technologies developed in or for other sectors of the economy. Although research is increasingly "problem based" rather than seen as exogenous, it is not always clear which technologies are profitable for farming to develop and which farm practices will contribute to sustainable farming systems in the long-term.

ICAR-NIASM has successfully implemented integrated farming, benefitting tribal farmers in terms of adoption of improved technologies interventions in field crops (rice and sugarcane), horticulture crops (banana and onion), dairy farming (Fodder and Mahsana), backyard poultry (Vanaraja) farming, fisheries and Integrated agri-IMC aquaculture. These interventions led to higher production of rice (Phule Samrudhi 6.50 – 10 tonnes/ha, Indrayani 6 –8 tonnes/ha), sugarcane (40-75 tonnes/acre), onion (Var. AFLR 38 – 66 tonnes/ha, Var. N-2-4-1, 25–65 tonnes/ha, Var Bhimakiran 25–68 tonnes/ha), banana (15,000-27,000 kg/acre), baby corn (4 tonnes/acre), milk (Av. 108 - 188 Litres/month), and fish (> 2000 kg/ha). The farmers reported improved weight gain and egg production from the poultry birds.

Crop	2006-07 to 2010-11			2012-13			2013-14			2014-15			2015-16			2016-17		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Paddy	185	273	1475	186	222	1191	226	394	1744	181	341	1884	253	515	2034	242	532	2197
S'cane (Y in MT/ha)	110	8250	75000	110	770	77000	114	320	80000	113	9763	86400	123	10701	87000	130	11700	90000

Gross value added from various crops at constant prices (last years) Rs. in ' 00 'Lakhs

Crops	Market Price Rs./Ton	2006-07 to 2010-11	2012-13	2013-14	2014-15	2015-16	2016-17
Paddy	14140	39	31	56	48	48	73
S'cane	1450	120	11	5	142	142	155

Present and Projected area, Production and Productivity of Horticulture Crops in Nandurbar District

Crop	2012-13			2013-14			2014-15			2015-16			2016-17		
	Ha	MT	MT/ Ha	Ha	MT	MT/ Ha	Ha	MT	MT/ Ha	Ha	MT	MT/ Ha	Ha	MT	MT/ Ha
Banana	2075.30	56733.00	27.34	2705.00	127257.00	47.05	2672.40	133619.85	50.00	2751.00	140300.84	51.00	2728.07	147315.88	54.00
Onion	1160.00	18330.00	15.80	1050.00	16590.00	15.80	1202.91	19246.50	16.00	1188.75	20208.83	17.00	1178.85	21219.27	18.00

Fish production in last five years from Nandurbar District

Year	Water spread Area (ha.)	Fish Production (Tones)	Price (Lakh)
2012-13	3545	870	156
2013-14	3722	914	163
2014-15	3908	959	172
2015-16	4104	1007	180

Income enhancement

Farmers like to adopt appropriate technologies, invest in and implement sustainable technologies and farm practices if they expect the investment will be profitable, if they have the right education, information and motivation. Agricultural policies can alter, however, the prices facing farmers for their inputs and outputs, which in turn will influence their decisions on investment and can lead to unsustainable farming practices. Implementation of improved technology interventions by ICAR-NIASM in field crops (rice and sugarcane), horticulture crops (banana and onion), dairy farming (Fodder and Mahsana), doat farming (Osmanabadi), backyard poultry (Vanaraja) farming, fisheries and Integrated agri-IMC aquaculture benefitted tribal farmers in terms of adoption of improved technologies interventions, enhancing income of the tribal farmers of Navapur taluka of Nandurbar District. Besides, tribal farmers have got acquainted with seed generation of rice and rabi onion and also used banana suckers for the next crop.

Baseline and projected productivity

Sr. No.	Sector	Base Line 2011-12 / Ha Productivity	Interventions	Projection (2016-17) / ha Productivity
Field crops				
1	Paddy – Increasing Productivity	11.91 Qt	1. Use of HYV, Drought Resistant Variety Seed 2. Integrated Nutrient Management & Integrated Pest Management. 3. Village Seed Production Programme	21.97 Qt
2	Sugarcane – Area Extension & Increasing Productivity	77.00 M.T	1. Use of HYV Variety. 2. Integrated Nutrient Management. 3. Integrated Pest Management	90.00 M.T
Horticulture				
3	Onion – Area Extension & Productivity	15.80 M.T	1. Integrated Nutrient Management. 2. Integrated Pest Management.	18.00 M.T
4	Banana– Area Extension & Productivity	27.34 M.T	1. Use of HYV Variety. 2. Integrated Nutrient Management. 3. Integrated Pest Management.	54.00 M.T
Animal Husbandry				
5	Dairy Poor per capita milk production in dairy	4 liters/animal	1. Improve conception rate of animals by training farmers, technical persons, improving AI infrastructure 2. Improve management practices by training and field visits. 3. Conducting facility improvements and health camps 4. Improve disease diagnosis by erecting disease diagnostic labs at each tahsil	10 liters /animal
6	Per capita mutton production (Sheep & Goat)	15 kg/animal	1. Improve breeding programme by supply of graded rams like Ramboulet and Bannur 2. Improvement in management practice by training and field visits. 3. Conducting dosing camps.	25 kg/animal
7	Farmers getting profit – only marginal in dairying	Low profit from dairying	1. Creating Dairy SHG (women) 2. To prepare Value added dairy products 3. Promote local sales and consumption	Improved profit in dairying
8	Poor maintenance of backyard poultry	Poor nutritional and health conditions of BPL families	1. Improving supply of Vanraja birds 2. Following strict vaccination schedule (with technical persons)	Increased consumption of eggs and chicken at village level

5. Economically viable integrated farming

The farmers concentrate mainly on crop production which is subjected to a high degree of uncertainty in income and employment to the farmers. In this contest, it is imperative to evolve suitable strategy for augmenting the income of a farm. Integration of various agricultural enterprises viz., cropping, animal husbandry, poultry, fishery, integrated agri-aquaculture, forestry etc. have great potentialities in the agricultural economy. These enterprises not only supplement the income of the farmers but also help in increasing the family labour employment.

- The integrated farming system approach introduces a change in the farming techniques for maximum production in the cropping pattern and takes care of optimal utilization of resources.
- The farm wastes are better recycled for productive purposes in the integrated system.
- A judicious mix of agricultural enterprises like dairy, poultry, piggery, fishery, sericulture etc. suited to the given agro-climatic conditions and socio-economic status of the farmers would bring prosperity in the farming.

The Nandurbar district is one of the tribal district of Maharashtra, which offers a very conducive climate for growing variety of horticultural and plantation crops. ICAR-National Institute of Abiotic Stress Management, Baramati has implemented improved technology interventions in field crop, horticulture, livestock, poultry, fisheries and integrated agri-aquaculture in various villages of Navapur Tehsil in Nandurbar District for improving the livelihood of resource poor farmers as part of Tribal Sub-Plan (TSP). Various training programmes, field days, exposure visits pertaining to technology interventions in rice, sugarcane, banana, rabi and late kharif onion, kitchen grandening of dragon fruit, fodder, dairy, goatry, back yard poultry, fish farming, and integrated agri-aquaculture were conducted. In the programmes, informative lectures related to “four point rice production technology”, “treatment of rice seeds and raising of healthy rice nursery”, “Plantation of Gliricidia as live fences and green leaf manure for crop production and animal forage”, “plantation of virus free tissue culture banana and application of FYM, neem cake and methods for preventing insects”, “Deworming, use of vitamin and mineral mixture”, “Farm pond preparation and IMC aquaculture, “the use of compost production units”, were delivered by the TSP team and interactive sessions were also held with the participants. Availability of fish seeds from nearby hatcheries was encouraging farmers to adopt agri-aquaculture. Farmers in interactive sessions expressed their happiness with the wide exposure related to integrated farming. Field and horticulture crops, livestock, poultry and fisheries activities not only provide additional income to the farmers, but also create employment opportunities in the rural areas for whole year.

During exposure visit at KVK Bhabhleshwar, tribal farmers got acquainted with onion seed production, midow-orchading in guva, livestock management, poultry management etc. While in MPKV Rahuri, farmers got abreast with Triveni breed of cow, Goat farm, Sugarcane field, Onion Field, Rice cultivation, Various types of nursery bed for rice, cultivation of onion for seed production, Poultry rearing, Plant Nursery, various verity of sugarcane, ATIC centre etc. Also at KVK-Baramati, farmers got exposure on sugarcane Field, Mandarin orange cultivation, Breeds of Poultry, Livestock Unit and HF breeds of cow, Goat Raring, Vermicomposting Unit, Silage preparation, Hatchery, Plant Nursery, Agro tourism Centre, Cultivation of bel paper in playhouse, Automated Irrigation System, Farm pond, Solar Water Pump etc. At ICAR-National Institute of Abiotic Stress Management, farmers visited research farm where various crops like Sugarcane, Green Gram, Wheat, Fish Pond, Cactus Plantation, Orchard of Pomegranate, Guava, Grape, Mango, Palm, Custard Apple, Orange and highly attracted towards the orchard of Dragon Fruit are planted.

Advantages of Integrated Farming System in Navapur area

- Higher production of rice, banana, onion, fish, milk and eggs
- Increased farm income of tribal farmers through proper residue recycling and allied components
- Sustainable soil fertility and productivity through organic waste recycling
- Integration of allied activities resulted in the availability of nutritious food enriched with protein, carbohydrate, fat, minerals and vitamins
- Integrated farming helped in environmental protection through effective recycling of waste from animal activities like poultry, and dairy rearing
- Reduced production cost of components through input recycling from the by-products of allied enterprises
- Regular stable income through the products like rice, banana, onion, egg, milk, fish from the linked activities in integrated farming
- Cultivation of fodder crops as intercropping and as border cropping resulted in the availability of adequate nutritious fodder for animal components like milch cow.
- Avoidance of soil loss through erosion by proper cultivation of each part of land by integrated farming
- Generation of regular employment for the farm family members of small and marginal farmers.
- Nutrient and water use efficiency

Exposure visit related to Integrated farming at KVK, Babhaleshwar


Exposure visit related to Integrated farming at MPKV




Exposure visit at NIASM Baramati


Exposure visit related to Integrated farming at KVK, Baramati


Exposure Visit of Tribal farmers to ICAR-NIASM


Nutritional management in livestock, fisheries and integrated agri-aquaculture
for livelihood improvement of tribal farmers


6. Agricultural Soil Health Assessment-Soil Health cards

"National Mission for Sustainable Agriculture (NMSA) is being implemented during 12th Plan with the objectives to make agriculture more productive, sustainable and climate resilient; to conserve natural resources; to adopt comprehensive soil health management practices; to optimize utilization of water resources; etc. "Soil Health Management (SHM) is one of the most important interventions under NMSA.SHM aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilisers including secondary and micro nutrients in conjunction with organic manures and bio-fertilisers for improving soil health and its productivity; strengthening of soil and fertiliser testing facilities to provide soil test based recommendations to farmers for improving soil fertility; ensuring quality control requirements of fertilisers, bio-fertilisers and organic fertilisers under Fertiliser Control Order, 1985; upgradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations; promoting organic farming practices etc.

Edaphic stresses have gradually increased, which are the major limitations to food production in crops, horticulture, livestock and fishes. Nutrient deficiency of soils can adversely affect crop yield and quality/nutritious value. Food grown on the soil with the poor nutrient value is not only less nutritious but also it increases the farmer's dependence on fertilisers. Indiscriminate and disproportionate/excessive use of fertilisers can rob of essential micronutrients and create soil alkalinity/sodicity, salinity and water logging, which in turns affect crop quality by making the end product food less nutritious. Soil characterization in relation to fertility status of a region is an important aspect in context of sustainable agricultural production. The information on macro and micro nutrients status in the study area is meagre. Therefore present study was undertaken to know physicochemical characteristics, the micro and macro-nutrient status of the soils. Composite soil samples were collected as per the geo position (GPS) based on the latitude and longitude. Physico-chemical characteristics such as pH, EC, organic carbon, macro-nutrients such as available N, P, K, S and micro nutrients such as Zn, Cu, Mn, Fe and B were determined in 263 soil samples collected as a part of the soil health cards programme. Based on the results of soil quality parameters, fertilizers recommendations for reference yields have been made.

The Taluka agricultural soil in general is deficient in nitrogen and sulfur. In 99.62% soil samples, level of nitrogen content was low. Data showed that while most of the agricultural soil samples (79.5%) had moderate/optimum phosphorous levels, its village wise content varied, other soil samples (20.53%) had low levels of P. Potassium, manganese, and copper contents in the soils of Navapur Taluka was found to be moderately in the high range.

On the 5th December 2015, World Soil Day was celebrated at Navapur, where more than 500 tribal farmers participated. Importance of soil health cards in ensuring balanced use of fertilizers, enhancing crop productivity along with reduction in cost of cultivation and the soil health card based farmingsoil health assessment, soil test based nutrient recommendations, edaphic stresses and their management through integrated farming and INM were popularised among all tribal farmers to improve the production and quality of the produce, which in turn uplift the socio-economic status of the farming community.

Distribution of soil health cards to tribal farmers

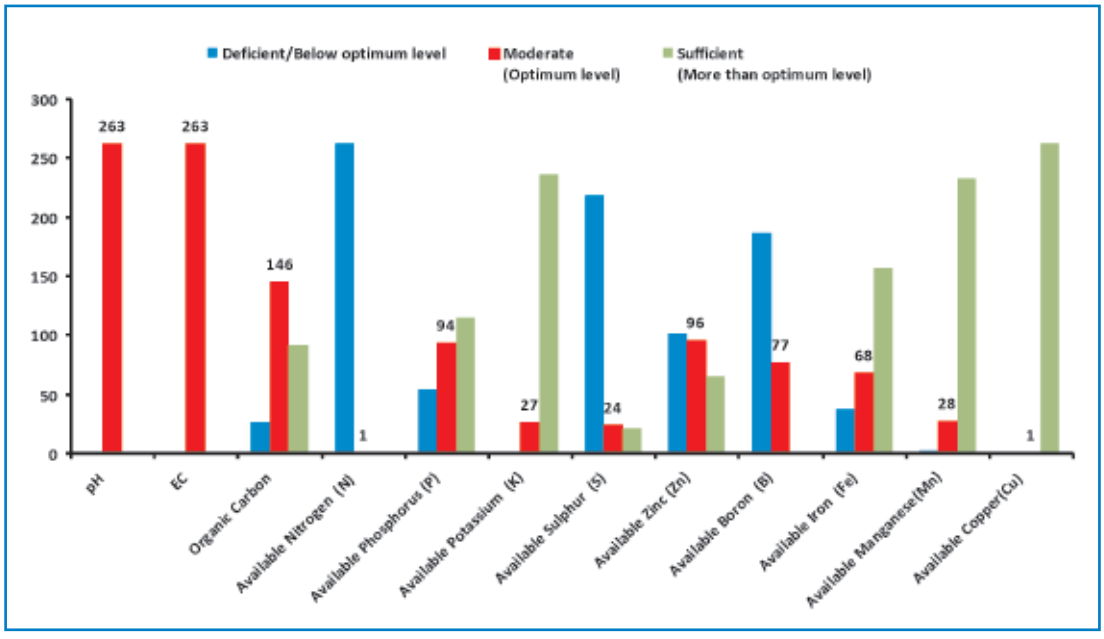
Celebration of World Soil Day on the 5th December 2015 at Navapur

Table : Agricultural Soil Characteristics

Soil characteristics	Range/Test value	Unit	Reference
pH	5.88-8.13		6.5 – 8.5
EC	0.08-0.61	dS/m	0-1
Organic Carbon (OC)	0.09-1.55	%	0.4-0.8
Available Nitrogen (N)	38-364	kg/ha	280-420
Available Phosphorus (P)	0.32- 101	kg/ha	15-28
Available Potassium (K)	131 - 1712	kg/ha	150 - 200
Available Sulphur (S)	0.50 - 71.00	mg/kg	0 – 1
Available Zinc (Zn)	0.09 - 4.96	mg/kg	0.6 - 1
Available Boron (B)	0.00 - 3.58	mg/kg	0.5
Available Iron (Fe)	1.63 - 54.00	mg/kg	4.5-10
Available Manganese (Mn)	1.80 - 45.45	mg/kg	2-5
Available Copper (Cu)	0.37 - 8.50	mg/kg	0.2-0.4

Table : Soil health based fertilizer recommendation

Soil characteristics	Number of soil samples (Out of 263)				
	Deficient/ Below optimum level	Moderate (Optimum level)	Sufficient (More than optimum level)	Percent samples within optimum and sufficient range	
				Total number	%
pH	Nil	263	Nil	263	100
EC	Nil	263	Nil	263	100
Organic Carbon	26	146	91	237	90.11
Available Nitrogen (N)	262	1	NIL	1	0.38
Available Phosphorus (P)	54	94	115	209	79.47
Available Potassium (K)	Nil	27	236	263	100
Available Sulphur (S)	218	24	21	45	17.11
Available Zinc (Zn)	102	96	65	161	61.22
Available Boron (B)	186	77	Nil	77	29.28
Available Iron (Fe)	38	68	157	225	85.55
Available Manganese (Mn)	2	28	233	261	99.24
Available Copper(Cu)	Nil	1	262	263	100



7. Human Resource Development

Improved technology interventions in integrated farming in terms of field, horticulture crops, livestock, poultry and fisheries were disseminated to tribal farmers through group meetings, field days, training programmes and exposure visits. In every event,therewas much more interaction between the TSP implementation committee members and the tribal farmers of every villageon various aspects of farming and allied activities like field and horticulture crops, livestock management, dairy and poultry farming, goat rearing, and fisheries and IMC aquaculture.

Year	Number of Technical Workshops/Training Programs / Field day / Exposure visit, group meetings organized	No. of Technologies demonstrated
2014-2015	10	5
2015-2016	12	6
2016-2017	15	10

i. Training programmes/Field days/Workshops/Exposure visits/Group meetings / Group Discussions:

Field crops

- Farmer's field day on Rice crop for higher productivity and income was organized on 3rd November 2015 at Gadad and Karanji, where more than 100 tribal farmers from several villages of Navapur Taluka participated and were benefitted.
- Farmer's field day on Rice crop for higher productivity and income was organized on 4th November 2015 at Vadsatra and Chitvi, where more than 120 tribal farmers from several villages of Navapur Taluka participated and were benefitted. Participatory demonstration of "Four point rice production technology was successfully done on farmers field.
- On the 2nd November, 2016, participatory demonstration of "Four point rice production technology was successfully done on farmers field (Beneficiaries>100 tribal farmers).
- On the 3rd November, 2017, participatory demonstration of "Water efficient crop production technology in sugarcane" was successfully done on farmers field. (Beneficiaries > 100 tribal farmers).

Horticulture

- **Group meetings:** Participatory demonstration of improved technology intervention, water efficient crop production technology in banana, has successfully been demonstrated to tribal farmers at Navapur villages.
- **Group meetings:** Improved technology interventions in Rabi onion (var. AFLR, N-2-4-1, Bhimakiran) and late kharif (var. Bhimashakti) have successfully been demonstrated (Beneficiaries 971tribal farmers).
- On the 15th February 2017, exposure visit related to precision farming and micro-irrigation systems, agro-products and cultivation of tissue culture plants were organised at Jain Irrigation Jalgaon. 100 Tribal farmers participated and were benefitted.

Livestock and poultry

- Training programme and the group meetings with farmers on "Backyard Poultry Farming" were organized on the 18th December 2015, where more than 250 tribal farmers participated and were benefitted.
- **Training programme/Group meeting on poultry farming:** on 10 February 2016. Technology intervention in backyard poultry farming has successfully been demonstrated to more than 250 tribal farmers.
- **Group meetings:** Group meeting was conducted to demonstrate establishment of fodder plots with hybrid Napier grass. Dairy demonstration units with animals (Mehsana buffaloes) were distributed to 14 farmers of two Navapur villages.
- Training programme on "Nutritional management in livestock for livelihood improvement of tribal farmers" was conducted at Visarvadi on 17th Sept 2016, where more 200 tribal farmers participated and benefited.
- Training programme on "Nutritional management in livestock for livelihood improvement of tribal farmers" was conducted on 18 Sept 2016 at Navapur, where, more than 150 tribal farmers from Navapur villages participated and benefitted.
- On the 14th February, 2017, training programme related to backyard poultry farming was conducted, where backyard poultry cages and Vanaraja birds along with other poultry inputs were distributed to Tribal farmers. More than 300 tribal farmers participated in the programme.
- On the 6-8, 9-11, 20-22 and 23-25 March 2017, four exposure visits for three days each related to goat farming training campaign were conducted at KNP College of Veterinary Sciences, Shirval. 177 tribal farmers have been benefitted from this training programme.

Fisheries and Integrated agri-aquaculture

- Farmers field days on "Fish culture and Integrated agri-aquaculture" for higher productivity and income, were organized on 3 November 2015 at Karanji, where more than100 tribal farmers from Navapur villages participated and were benefitted.
- Farmers field days on Fish culture and Integrated agri-aquaculture" for higher productivity and income, were organized on 4 November 2015 at Chitvi, where more than 120 tribal farmers from Navapur villages participated and were benefitted.
- Training programmes on "Nutritional management in fisheries for livelihood improvement of tribal farmers" were conducted on 17 Sept 2016 at Visarvadi. Integrated agri-aquaculture have successfully been demonstrated through demonstration on improved technology intervention in IMC aquaculture, field and horticulture crops.
- Training programmes on "Nutritional management in fisheries for livelihood improvement of tribal farmers" were conducted on 18 Sept 2016 at Navapur. Integrated agri-aquaculture has successfully been demonstrated through demonstration on improved technology intervention in IMC aquaculture, field and horticulture crops.
- An exposure visit on fish and prawn farming for tribal farmers was organised at KVK-Navsari on 25 March 2017 where 38 farmers participated and benefitted.
- Training programme on fish feed preparation was conducted on 26 March 2017, where 100 farmers participated and benefitted..

Integrated farming

- Training programmes pertaining to technology interventions in rice, banana, fodder crops, farm pond preparation and integrated agri-aquaculture were conducted on 8 July 2015 at Visarvadi, where more than 180 tribal farmers from Navapur villages participated and were benefitted.
- Training programmes pertaining to technology interventions in rice, banana, fodder crops, farm pond preparation and integrated agri-aquaculture were conducted on 9 July 2015 at Navapur, where more than 135 tribal farmers from Navapur villages participated and were benefitted.
- **Exposure Visits:** Three days Exposure visit related to "Improved technology interventions in field & horticulture crops, livestock & poultry, & IMC aquaculture for livelihood improvement of Tribal farmers" were conducted on 28-30 March 2016: (Beneficiaries 80 farmers).

- **Exposure Visits:** Three days Exposure visit related to "Recent advances in field & horticulture crops, poultry, dairy and aqua-farming and Integrated agri-aquaculture for livelihood improvement of Tribal farmers" were conducted on 2-4 March 2016 (Beneficiaries 90 farmers).

World Soil Day Celebration

- World Soil Day was celebrated at Navapur taluka of Nandurbar District on the 5th December 2015, where more than 500 farmers participated. Total 263 soil health cards were distributed to tribal farmers.

Marketing

- On the 7 & 8th February 2017, exposure visit related to Group base cultivation and marketing of baby corn was organised. (Beneficiaries 90 Tribal farmers).


Dairy, Poultry and Fish Farming


Exposure visit of Tribal farmers to ICAR-NIASM

8. Creation of capital assets and Distribution of General Inputs

Year	Amount earmarked for TSP	Expenditure (In lakhs)
2014-15	Rs. 43.00	Rs.42.99
2015-16	Rs. 61.37	Rs. 60.87
2016-17	Rs. 125.00	Rs. 120.00

Procurement of inputs for Distribution

Year	Inputs
2014-2015	• Seedlings: 1050 No. • Fertilizers: 829.254 qtl, • Shade net: 8.80 acres, • Implements: 03 No.
2015-2016	• 1396 kg rice seeds • 150 fabricated poultry cages along with 150 waterers and 150 feederers and 3000 Vanaraja chicks and 3750 kg feed and other miscellaneous items • 600 saplings of Gliricidia plants • Fodder root slips to 14 tribal farmers • Stocking of IMC seeds in 6 farm ponds of tribal farmers along with 2625 kg IMC feed. • 600 kg rabi onion seeds (var. AFLR, N-2-4-1, Bhimakiran) • 7000 tissue culture banana plants (var. Grand Nain along with miscellaneous items (pheromone funnel, yellow sticky traps, pesticides, neem cake etc) • 48 compost production units • 100 kg okra seeds • 1800 kg Vitamin mineral mixture for animal nutrition along with medicines (1500 doses) for deworming • 454 qtl fertilizers • 2400 kg micronutrients • 900sqm HDPE sheet for lining of farm pond • Soil Health Cards to 263 farmers
2016-2017	• 162.66 qtl Fertilizers • 425 kg Rice seeds (var Phule samridhi) • 90 kg late *kharif* onion seeds • 250 kg *rabi* onion seeds (var. Bhimakiran) • *Kharif* onion seeds (100 kg) • 150 fabricated poultry cages • Waterers (150) and feederers (150) • Giriraja chicks (3000) • Poultry feed (3750 kg) • IMC seeds • Fish feed (3150 kg) • Baby corn seeds (315 kg) • Dragon fruit saplings / Cuttings (20000)

Year	Inputs
2016-2017	• Chilli seeds (20 kg) • Vegetable seeds (400 kg) • Vitamin Mineral mixture (2750 kg) • Virus free tissue culture banana plants (7000) • Goatery (220 Goats) • Aerators (3) • Ice boxes (22) for aquaculture • Insect net (16000 m2) • Mulching paper for vegetable cultivation (150 role) • Fertilizers for banana (103 qtl) • Feed pelletizers and Grinding machines (2+5) • Compost production units (40) • Agricultural sprayers (80) • Feeding buckets (700) • Milk cans (700) • Multi-purpose containers (575) • Soil analysis kit (1) • Power tillers with accessories (12) **Miscellaneous** (Bags, polythene bags, neem cake, phorate, calendars depicting implementation of improved technology interventions)

Distribution of Inputs

9. Development and Vision Strategy for sustainability of technology dissemination

Field Crop

Rice: Tribal farmers are facing problems with paddy cultivation which yields in low productivity. Major area is under drill paddy, crop is cultivated on variety of soil viz. sloppy/light soils. Traditionally available see mostly used, Imbalance in use of fertilizers, Do not adopt 'Four step or SRI" method of cultivation these are the major area which should be focused while implementing the programme. To sustain these major problems the most emphasise should be given on cultivation of improved variety of paddy, use of improved technology intervention related with planting, fertilizer application, intercultural operations, Importance of Glyricidia Spp. Plantation, use of urea briquettes etc. which all should result in increased production for the Improved livelihood of tribal farmers.

Sugarcane: Problems of sugarcane cultivation are shortage of pure and disease free planting material, Improper Nutritional Management, Use of Bio-fertilizers, Green Manuring, compost, etc. is lacking, Intercultivation operations are not at proper time, indiscriminate use of water. Proposed extension activities include organization of training programmes on water management, micro irrigation and improving soil health by soil health assessment and soil test based fertilised recommendations, Green manuring, Crop rotation, Organic manure, improved production technology with special emphasis on selection of planting material, Organizing exposure visits to research stations and successful farmers, Organizing demonstrations on improved production technology.

Horticulture Crops

The major problems in horticulture is less availability of organic manures, good quality planting material, water during summer season, Lack of market infrastructure, Market fluctuation and low prices to produce etc. to overcome these problems committee proposed activities like promoting for vermi-compost, in-situ compost making, reparation of compost by NADEP methods, Promotion for preparation of nurseries, use of shedding nets for quality planting material production, Promoting farmers for use of drip irrigation, micro irrigation, Preparation of water storage tanks on group basis, Promoting farmer organizations groups for market study and market linkage development, Promoting farmers for biological pest control and organic farming, Organizing Training on nursery management for quality production of planting material.

Livestock & Poultry

The priority areas for livestock and poultry are Dairy farming, Goat farming, and Backyard Poultry farming. By keeping in view the availability of vast stretches of

grazing land, natural resources and existing livestock based economy, strategies for sustainability of livestock and poultry are planned.

In dairy sector low milk production is problem identified and prioritised. To address this problem training on balanced feeding, breeding and health management, deworming, mineral supplementation, clean milk production, fodder production are planned to update the tribal farmers with scientific knowledge and skills. After training, inputs like antihelminthic, Vitamin-Mineral Mixture, planting material for high yielding fodders are being supplied.

Thus TSP committee will be concentrating on efforts for promoting cultivation of improved varieties of forage crops and fodder varieties, promotion of combination of stall feeding and grazing, encouraging tribal farmers for balanced feeding, breeding, deworming and health management practices and clean milk production for improving milk production in the area.

The second area identified and prioritised is backyard/rural poultry farming. The tribal families are doingit in traditional way without any shelter and using local non-descript breeds of chickens which produce less number of eggs (40-50/annum) and low body weight gain (1100-1200g). Training the farmers for better poultry production by imparting knowledge and skills, introduction of dual purpose breeds like Vanaraja and Satpuda andproviding cages for housing of the birds are the strategies for sustainable technology dissemination for improvement of the livelihood of the tribal farmers which will improve availability of the quality proteins for the families and generate some additional income through sale of the surplus eggs.

Another major area which needs to be improved is goat farming. Most of the tribal farmers in the area are rearing local non-descript goats in traditional way. Strategy for improvement of goat production is to impart scientific knowledge through training and introduction of breeds like 'Osmanabadi' and 'Surati'. The area of Dhadgaon is very remote difficult to reach in the range of satpuda and tribals are very poor in this area. Special emphasis on small ruminant production is required for upliftment of tribal families in this area. Before taking up this intervention the basic socio-economic and agriculture related survey will be conducted.

Fisheries & Aquaculture

The aquaculture production and trade are capital intensive and constrained by environmental and health challenges, which are increasing worldwide. In view of these and considering the enormous resource size and untapped production potential, the reservoirs/water bodies have become the focus of future fisheries development plans in Nandurbar area.In addition, improved technologies interventions in Integrated agri-aquaculture in terms of abiotic and biotic stress management in crops, horticulture, livestock, poultry and fisheries are very much required for enhancing agricultural production in tribal areas. Environmental enhancement, stock

enhancement / replenishment, species enhancement / selection of right species, environmentally sound enclosure culture technologies, management enhancement, and integrated multi-trophic aquaculture may be explored as yet another bioremediation strategies for enhancing fish production.


Water Resources at Navapur




Vision Strategy for sustainability of technology dissemination

10. Publications and Innovation Introduced

Important Links
http://www.icar.org.in/en/node/12435
https://www.youtube.com/watch?v=aRlE1MhnKCg&feature=youtu.be
http://www.niam.res.in/TSP

NEWS in Local Newspaper


खा. डॉ.हिना गावीतांच्या हस्ते कुक्कुटपालनासाठी पक्षी वाटप


आदिवासी उपयोजनेंतर्गत शेतकऱ्यांचा अभ्यास दौरा

नवापूर : आदिवासी उपयोजनेंतर्गत तालुक्यातील दहा गावातील शेतकऱ्यांच्या अभ्यास दौऱ्याचे आयोजन जळगाव येथे करण्यात आले.

राष्ट्रीय अजैविक स्ट्रेस प्रबंधन संस्था बारामती यांच्याकडून शेतकऱ्यांच्या एक दिवसीय अभ्यास दौऱ्याचे आयोजन करण्यात आले. या वेळी तालुक्यातील दडमत्रा, चितवी, देवगोपाडा, कडाळ्या, गडद, मुणधर, डोकळझर, कुकराण, करंजी खुर्द व चेडापाडा येथील शंभरहून अधिक शेतकरी अभ्यास दौऱ्यात सहभागी झालेत. केळी, झाडोंड, उतिसंवर्धन रोपवाटीका, कांदा वासह फळे व शेतीमाल प्रक्रिया, सिंचनाच्या आधुनिक पद्धतींची प्रात्यक्षिके प्रत्यक्ष भेटीद्वारे शेतकऱ्यांना दाखविण्यात आली. (वार्ताहर)

पुढारी

शेतकऱ्यांची उपजिविका सुधारण्यासाठी
नवापुरातील सहा गावांना शास्त्रज्ञांची भेट

लोकमत

विसरवाडी व नवापूर येथे शेतीविषयक शिबिर

लोकमत

नवापुरात कृषितज्ज्ञांकडून पाहणी

लोकमत

भात शेतीसह मत्स्य पालणाबाबत शेतकऱ्यांना मार्गदर्शन
नवापूर तालुक्यातील गावांमध्ये भाताच्या नवीन वाणाबाबत जनजागृती

पुण्य नगरी

कृषितज्ज्ञांनी घेतल्या बैठका

बिलमांजरे : भारतीय कृषी अनुसंधान परिषदअंतर्गत येणाऱ्या राष्ट्रीय अजैविक स्ट्रेस प्रबंधन संस्थेतर्फे आदिवासी उपयोजना क्षेत्रात कृषितज्ज्ञांनी भेटी देऊन पाहणी केली.

नवापूर तालुक्यातील विविध गावांमध्ये शेती, फलोत्पादन, पशुधन, कुक्कुटपालन आणि मत्स्यशेती असे उपक्रम हाती घेण्यात आले आहेत. या उपक्रमांची संचालक डॉ. पी. एस. निनावे यांच्या मार्गदर्शनाखाली डॉ. के. के. कृष्णाणी, डॉ. एन. पी. कुवारे, डॉ. डी. पी. पाटील, डॉ. अंकुश कांबळे व डॉ. ए. व्ही. निर्मले या शास्त्रज्ञांच्या चमूने गावांना भेट देऊन पाहणी केली.

दाव्हान, या चमूने नवापूर तालुक्यातील मुणधर, करंजी खुर्द, चितवी, करंजी बुद्रुक, वाघबारपाडा, गडद या गावांच्यचे बैठका घेऊन मार्गदर्शन केले. येथे शेळ्यालाय निर्मिती आणि एकात्मिक शेतीच्या फायद्यांची माहिती सहभागी शेतकऱ्यांना देण्यात आली. भात व केळी लागवडीच्या दृष्टीने एकात्मिक शेतीचे प्रात्यक्षिक चितवी गावात या पथकाने केले. मत्स्य तलाव कार्याचे सूचित करण्यात आले. (वार्ताहर)

हॅलो नंदुरबार


नवापूरात २६३ शेतकऱ्यांना माती आरोग्य कार्ड वाटप


तज्ज्ञांकडून मार्गदर्शन : ४०० शेतकऱ्यांनी नोंदवला सहभाग
नवापूर तालुक्यातील शेतकऱ्यांना प्रशिक्षण


ऊस उत्पादक शेतकऱ्यांना मार्गदर्शन
नवापूर : शेती तंत्रज्ञानाची दिली माहिती

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(समतुल्य विश्वविद्यालय)

भारतीय कृषि अनुसंधान परिषद

मालेगांव, बारामती 413 115, पुणे, महाराष्ट्र, भारत

दूरध्वनी : 02112-254057, फैक्स : 02112-254056

ICAR-National Institute of Abiotic Stress Management

(Deemed to be University)

Indian Council of Agricultural Research

Malegaon, Baramati 413 115, Pune, Maharashtra, India

Phone : 02112-254057, Fax : 02112-254056

Web : www.niam.res.in