Tribal Sub-Plan Programme

ANNUAL REPORT

2017-2018

DOUBING TRIBAL FARMER'S INCOME THROUGH INTEGRATED FARMING

ICAR-National Institute of Abiotic Stress Management

Malegaon, Baramati, Pune, Maharashtra, India 413 115

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Foreword

Maharashtra Government has recently identified 10 districts as vulnerable to climate change, out of which Nandurbar is the most vulnerable district to be affected by climate change in the coming decades. Climate change with untimely rain, heavy rain, gaps in monsoon, and scarcity of water during summer are the major constraints for crop production in this District. The impact of climate change on the agricultural production system is expected to affect the tribal community severely. 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 characterized by low input resources and lower technological interventions, therefore, the nature of the agricultural productivity of various crops in the tribal areas is often very low. For overcoming these lacunas, Tribal Sub Plan (TSP) on behalf of ICAR - 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. The Committee has worked with a moto to assist the sustainable development of livelihood of tribal farmers by improved technology interventions in integrated farming. The entire TSP implementation committee has worked very hard and they really deserve appreciation for their sincere efforts. I thank the TSP Implementation Committee led by Dr. KK Krishnani, who made tremendous efforts for highlighting information on livelihood improvement of tribal farmers and success stories in this annual report. I also place on record my thanks to editorial members for contributing to this annual report.

(Narendra Pratap Singh)

Preface

Based on the resource assessment, characterization and baseline survey carried out in the tribal areas of different Tehsils of Nandurbar District, concerted efforts were taken up by the TSP Implementation Committee to enhance income of the small and marginal farmers and landless labourers. Subsidiary occupations/other allied activities such as dairy, goatery, poultry, and fisheries were promoted besides cultivation of field and horticulture crops. Tribal farmers from three different Tehsils were adopted after consultation with the tribal council and village captains to improve the farming system through integrated farming system approach.

I express my deep sense of gratitude to all those individuals and institutions for extending their help and cooperation in implementing the TSP programme successfully. I am extremely thankful to the scientists and experts of the ICAR and Non-ICAR Institutions, and other Institutions, who provided timely assistance and cooperation, for execution of TSP activities. I am also thankful to our TSP team who worked tirelessly in the field for the conduct of various field demonstrations and organization of several HRD programmes.

Chairman
TSP Implementation Committee

Executive Summary

Efforts to actualize honorable Prime Minister's vision on 'doubling farmers income' requires adoption of suitable integrated farming options. Integrated farming system is a sustainable farming technique, which aims to maximize the production in the cropping pattern and takes care of optimal utilization of resources as well as proper reuse and recycling of farm wastes. The approaches need to encompass technologies to increase production, avoid losses, optimum utilization of available resources and minimizing production cost. It requires an approach of integrating agriculture with other allied interdependent activities such as animal husbandry and fish farming. The tribal farmers from Nandurbar district 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 strategies for augmenting the income of a farmer. Integration of various agricultural enterprises viz., cropping, animal husbandry, poultry, fishery and integrated agri-aquaculture have great potentialities in the enhancing farmers income. In this direction, ICAR-NIASM has implemented improved technology interventions in field crop, horticulture, livestock, poultry, fisheries and integrated agri-aquaculture in various villages of Navapur, Nandurbar, and Dhadgaon Tehsils of Nandurbar District for improving the livelihood of resource poor farmers as part of Tribal Sub-Plan (TSP) programme. These technological interventions are envisaged to not only provide additional income to the farmers, but also create employment opportunities in the rural areas throughout the year. During the year 2017-18, various training programmes, field days and exposure visits pertaining to technology interventions in rice, sugarcane, banana, onion (rabi and late kharif), kitchen gardening of dragon fruit, dairy, goatery, backyard poultry, fish farming, and integrated agri-aquaculture were conducted. The assured availability of fish seeds from a nearby hatchery encouraged farmers to adopt agri-aquaculture. The integration of fish culture with livestock and/or cash crops, holds a considerable potential for augmenting production of animal protein, generation of employment opportunities in the rural areas and improvement of socio-economic condition of the farmers. Monitoring of various activities was carried out during the period 2017-18. It was found that improved technology interventions led to higher production and marketable yield of rice (4.5-5 tonnes/ha), wheat (2.4-2.8 tonnes/ha), sugarcane (100-185 tonnes/ha),

onion (35-79 tonnes/ha), banana (15,000-18000 kg/acre), eggs 4-5 /day from a unit of 20 birds, milk (108 - 188 litres/month), and fish (3000-4000 kg/ha). Mechanization with power tillers in field crops such as rice, sugarcane and cotton also helped to increase the yield of field crops due to timely farm operation besides reducing labour involvement.

About The Tribal Plan

Nandurbar district has now been declared as one of the backward and undeveloped districts of Maharashtra. A detailed survey was carried out in the targeted areas of Nandurbar district. The following major farming systems were observed in the district at the begining of the TSP work.

1. Field crops – Horticulture, 2. Field crops – Dairy

A majority of the tribals (50.47%) in Nandurbar district was stricken with poverty and the farming was not diversified due to lack of knowledge and suboptimal resource use. 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 *rabi* jawar, 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 an overall farming system of the District. It is seen that farmers are in need not only of 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 at completion stage. Increasing the cropping intensity as well as judicious use of irrigation is the basic need to increase water productivity. The agricultural production and productivity of principal crops is low and fluctuating as compared with the state as well as regional levels. For the 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. Amongst other allied activities, animal husbandry, poultry and fishery may be the major subsidiary occupations for small and marginal farmers and landless labourers of the District. Therefore, concerted efforts are required for the additional income generation by the farmers from these subsidiary occupations. Accordingly TSP implementation committee ICAR - National Institute of Abiotic Stress Management, Malegaon Khurd, Baramati has purposefully selected 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 was constituted, that was the pillar of the bridge between the tribal farmers and improved livelihood through sustainable agricultural development.

Multidisciplinary team/TSP implementation committee analyzed the existing farming systems, identified the constraints and potentialities of target areas, then planned and implemented improved technology interventions in field crops, horticulture crops, dairy, goatery, poultry and fisheries, integrated crop-livestock-fisheries through the proper coordination among scientific team, targeted tribal society and other stakeholders

Scientist	**Designation**	**Specific contribution**
Dr. KK Krishnani	Principal Scientist (Agricultural chemicals) I/c-Head-School of Edaphic Stress Management I/c-Head- School of Atmospheric Stress Management	Implementation of Improved technology interventions in integrated farming in terms of field crops, horticulture crops, livestock, poultry, IMC aquaculture and reservoir fisheries; Organisation of training programmes cum Field Day, and group meetings; Soil health assessment/card based fertilizer recommendations; Impact assessment of technologies disseminated to tribal farmers
Dr. NP Kurade	Principal Scientist (Veterinary pathology)	Implementation of Improved technology interventions in livestock and poultry: Organization of training programmes related to dairy farming and goat rearing techniques, breeding and disease management and impact assessment of technologies disseminated to tribal farmers
Dr. Neeraj Kumar	Scientist (Fish Nutrition)	Implementation of improved technology interventions in fisheries
Dr. MP Brahmane	Principal Scientist (Animal Biotechnology)	Stock enhancement in small reservoirs for culture based fisheries
Dr. BB Gaikwad	Scientist (Farm Machinery and Power) Member Secretary	Identification, sensitization and distribution of suitable hand tools for small farm mechanization.

Project Details

Project Title: Doubling Tribal Farmers Income through Integrated Farming

Sub-project	Objectives	Activities
Improved technology interventions in field crops	Improved technology interventions in rice	• On-farm demonstration of "Four point rice production technology" • Yield performance of rice variety Indrayani • Farmers participatory demonstration on Four point rice production technology
	Improved technology interventions in sugarcane	• Demonstrations on "Water efficient crop production technology in sugarcane" • Organization of farmer's field day on Sugarcane crop
Improved technology interventions in horticultural crops	Improved technology interventions in banana	• Cultivation of Virus free tissue culture banana
	Improved technology interventions in onion	• Onion nursery raising in tribal areas • Transplanting of onion seedlings • High yielding and long storage varieties of *Rabi* and *late kharif* onion
	Improved technology interventions in dragon fruit	• Distribution of dragon fruit cuttings/saplings for kitchen gardening / Backyard farming
Improved technology interventions in livestock	Improved technology interventions in dairy	• Monitoring the activities and impact assessment of dairy intervention. • Nutritional management in livestock for livelihood improvement of tribal farmers • Deworming, bypass fat and mineral mixture supplementation. • Creating awareness about parasitic disease of livestock and poultry and its

		management through training.
	Improved technology interventions in goatery	• Monitoring of Goat units and training programmes for imparting knowledge and skills through goat rearing techniques, management, feeding etc.
	Improved technology interventions in backyard poultry	• Monitoring the activities of backyard poultry farming. • Group meetings with tribal farmers on "Backyard Poultry Farming"
Improved technology interventions in fisheries and aquaculture	Improved technology interventions in IMC aquaculture	• Distribution and stocking of IMC seeds • Nutritional management in fisheries for livelihood improvement of tribal farmers • Fish farming and their management • Stock enhancement in small reservoir for culture based fisheries
Improved technology interventions in Integrated farming	Improved technology interventions in field & horticulture crops, livestock, poultry and fisheries	• Integrated Crop-Livestock-Fisheries • Integrated Livestock cum Fish farming • Integrated Goat cum Fish farming • Integrated agri-aquaculture

Improved technology interventions

Use of power tillers in field crops

Rice

A power tiller drawn Cultivator was used to break up/till the soil prior to transplanting. A rotary assembly with lugged wheels was used for puddling the soil to obtain a fine churned tilth - free from lumps. This process has assisted transplantation of rice seedling, minimizing water usage through reduced percolation losses and effective weed control.

Sugarcane

A cultivator drawn by a power tiller was used to break up/till the soil prior to sowing.

Cotton

A Cultivator drawn by a power tiller was used to break up/till the soil prior to sowing of cotton seeds. The ridger was used for making ridges for row crops and for opening furrows for water flow. This has led to higher cotton yield. The use of power tillers has led to higher yield of field crops.

Improved technology interventions in Rice

Productivity of rice and sugarcane is far below in Nandurbar district as compared to other parts of Maharashtra. Therefore, four point rice production technology and water efficient crop production technology in sugarcane were demonstrated to tribal farmers. Several villages in Navapur and Nadurbar Tehsils of Nandurbar district were surveyed and farmers were contacted for demonstration of the improved technological interventions in rice crop. Tribal farmers from various villages of Navapur Tehsil (Kadwan, Tarapur, Kanhal, Devakipada, Chitvi, Vadsatra, Pimpran, Pimpla, Chedapada) and Nandurbar Tehsil (Devpur, Pawla, Natavad, Tokartalab, Konda) were selected for On-farm demonstration of "Four point rice production technology". Certified seed of high yielding rice variety (Indrayani) were distributed to 416 selected farmers from these villages. Rice nurseries were raised by all the farmers and seedlings 25-30 days of age were transplanted in one acre area each. During meetings held with various group of farmers, detailed information related to pre-sowing seed treatment, raising of healthy and water efficient rice nursery, application of Urea-DAP briquettes were given to the farmers. Participatory demonstration of "Four point rice production technology" have been successfully implemented.

During farmers' field day, 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 the given variety Indrayani.

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 the overall impact of various technological interventions on performance of rice crop var. Indrayani over local practices compared to local and hybrid rice. Average yield achieved in this area is about 4.5-5 tonne/ha and average price received by farmers is Rs. 1500 per quintal with return of 1.21 lakhs/ha and total gross return of Rs. 124.8 lakhs to 416 selected farmers.

Improved technology intervention in wheat

7600 kg wheat seeds of var. Lokwan was procured from Mahabeej and distributed to 238 tribal farmers of Pawla, Umaj, Natavad, Arditara, Devpur villages of Nandurbar District. The seeds performance was reported to be better as compared to previously used seeds. Average yield achieved in this area is about 2.4-2.8 tonne/ha and average price received by farmers is Rs. 1100-1200 per quintal with total gross return of Rs. 20.6 lakhs to 238 selected farmers.

Demonstration of technological intervention in sugarcane crop

A large number of villages in the project area of Navapur Tehsil 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 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. 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. 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 as compared to > 30 tonnes/acre previous yield records. The average price received by farmers is Rs. 2000-2200/tonne, with the return of Rs. 3.15 Lakhs/ha and the total gross return of Rs. 220 lakhs.

Improved technology interventions in horticulture crops

Improved technology interventions in onion

Rabi Onion var. Bhima kiran has been distributed to more than 200 tribal farmers of various villages of Nandurbar District (Pawla, Tokaratalab, Natavad, Arditara, Devpur, Toranmal) for implementation of improved technology intervention in onion during 2017-18.

Nursery raising

Proper nursery management is crucial for onion crop production. About 0.05 hectare nursery area is enough for raising seedlings needed to transplant in one hectare area. Seeds were sown in lines spaced 50 - 75 mm apart to facilitate easy removal of seedlings for transplanting and quick weeding etc.

Transplanting

Proper care was taken by the farmers while selecting seedlings for transplanting. At the time of transplanting, one third of the seedling top was cut to get good establishment. The optimum row spacing of 15 cm and plant spacing of 10 cm were maintained. Average yield achieved in this area ranged from 35-79 tonne/ha, with the gross return of Rs. 148 lakhs.

Improved technology interventions in banana

DBT and ICAR-NRCB certified virus-free tissue culture banana plants var. Grand Nain were used by identified farmers at Karanji. In Chitvi and Vadastra villages, banana suckers were used as propagation materials. 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, and weighing 500 to 750 g were separated and selected. The use of drip irrigation led to adoption of water and nutrient use efficient cultivation technologies in banana. The bananas were partially harvested. The average price received by farmers is Rs. 5-8 per kg, with the gross return of Rs. 1-1.5 lakhs/acre/season with the total gross return of Rs. 4.15 lakhs.

Kitchen gardening of dragon fruit

The pitaya is one of nature's most unique plants. Dragon fruit contains a surprising number of phytonutrients including captin, besides antioxidants, carotene, protein, vitamin C,

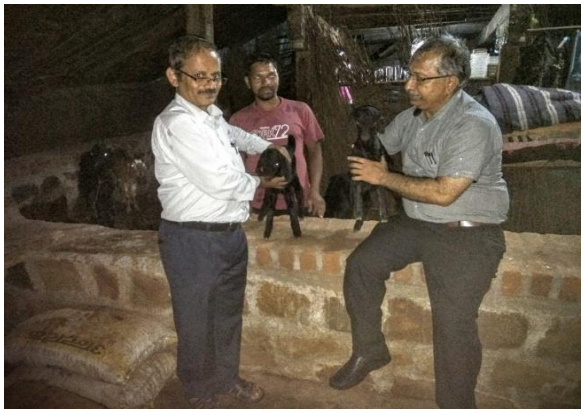
polyunsaturated fatty acids and vitamins B that may be needed for carbohydrate metabolism. The dragon fruit is also a source of other nutrients like calcium, iron and phosphorus. Activities related to implementation of improved technology interventions in horticulture crops have been expanded. Dragon fruit cuttings were distributed to tribal farmers of Navapur, Dhadgaon and Nandurbar Tehsils for kitchen gardening / backyard farming. Cuttings were used by tribal farmers for planting near their houses.

Improved technology intervention in dairy, goatery and backyard poultry

Improved technology interventions in Dairy animals, goat farming as backyard enterprise and backyard poultry farming have been undertaken for livelihood improvement of tribal farmers since 2015 onwards. 14 tribal farmers from Navapur tehsil (Gadad, Jamtalav Nagzari and Chitvi villages) were trained for dairy intervention by providing one Mehsana buffalo during 2015-16. During 2017-18, 300 kg bypass fat was distributed to 30 tribal farmers of Umaj, Pawala, Natawad, Devpur, Tokartalav villages of Nandurbar District.




Impact assessment of dairy intervention revealed milk production in range of of 108-188 litres/month/buffalo with the total gross return of Rs. 7 lakhs to 14 tribal farmers/lactation. All the 14 tribal dairy farmers have got 1 or 2 calves from each buffalo.




An improved technology intervention in goatery has also been undertaken for livelihood improvement of tribal farmers during 2016-17. A total of 184 tribal farmers were imparted with skill and knowledge of goat rearing techniques, management, feeding, breeding and disease management. 44 farmers were provided with a unit of 4 female and one male Osmanabadi goats. Farmers are rearing Osmanabadi breed goats using available resources with them and the number of goats is increasing with the arrival of new kids. Within one year most of the farmers were having units of 8-10 goats. Farmers are using goat milk for their day to day requirement.

Technology intervention in backyard poultry farming has successfully been demonstrated. One specially designed cage along with 20 birds of improved variety (Vanraja and Giriraja) were distributed to 150 tribal farmers each during 2015-16 and 2016-17.



This intervention proved to be a huge success as the birds grew faster and were giving at least 4-5 eggs daily. The male birds grew up to 4-5 kg body weight and were utilized for breeding and meat purpose. This has helped the farmers for getting some additional income as well as providing protein requirement of the family. The poultry cages provided to farmers have become a long term asset for most of the farmers continued for rearing backyard poultry.

Improved technology interventions in farm pond based IMC aquaculture

Eight villages of Navapur Tehsil namely Chitvi, Karanji, Chowky, Jamtalav, Bhomdipada, Borepada, Raigaon, Wagdi, and Pawla village of Nandurbar District 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). Water quality parameters such pH, DO and ammonia were measured. Research on fish ponds led to the optimal water quality and plankton primary productivity. 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 in the field. Fishes were partially harvested. The average fish production was 3000-4000 kg/ha. Price received by farmer is Rs. 90-120 per kg, with the total gross return of Rs. 9.5 lakhs.

Culture based fisheries in small reservoirs / water bodies

Reservoirs and wetlands provide vast potential for fish production enhancement to meet nutritional requirement. Improved technologies interventions in terms of environmental enhancement, selection of right species, environmentally sound enclosure culture technologies, and harvest and post-harvest management are mandatory for optimizing fish yield, which in turns would help in achieving estimated production potential of reservoirs and wetlands. Stock enhancement was done in small reservoirs of Pawla and Wagdi villages of Nandurbar District for culture based fisheries. 20,000 to 50,000 IMC fingerlings have been stocked in small reservoirs.

Trainings/Programmes organized

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. Interaction between the TSP implementation committee members and the tribal farmers of every village on various aspects of farming and allied activities like field and horticultural crops, livestock management, dairy and poultry farming, goat rearing, and fisheries and IMC aquaculture was carried out during:

- A Field Day cum Training Programme on “Improved technology intervention in Field crops and Reservoir Fisheries for enhancing the livelihood of tribal farmers” at Pawla Village of Nandurbar on 11 Oct 2017 for more than 60 tribal farmers.
- A Field Day cum Training Programme on “Integrated Agri-aquaculture for enhancing the livelihood of tribal farmers was organized in the Karanji village of Navapur on 11 Oct. 2017 for more than 250 Tribal farmers”
- Interaction meeting cum training programme on “Integrated Field-Horticulture-Livestock-Fisheries for enhancing the livelihood of tribal farmers” on 23 Oct 2017 for more than 85 tribal farmers.

Distribution of inputs







Programme on 14 May 2017 at Navapur






- A programme related to "Integrated farming for livelihood improvement of tribal farmers" was conceptualised and organised on 14 May 2017 at Navapur for more than 675 tribal farmers. The programme was chaired by Dr. Heena Gavit, Hon'ble Member of parliament-Nandurbar District, Dr. Vijay Kumar Gavit, Hon'ble MLA, Nandurbar and Dr. NP Singh, Director, ICAR-NIASM.
- A programme on "Improving livelihood of tribal farmers through inputs utilisation" was organised on the 13th May 2017 at Pawla Village for more than 120 tribal farmers, in the presence of the Hon'ble Member of Parliament from the Nandurbar constituency, Hon'ble MLA, Nandurbar and the Director, ICAR-NIASM.
- Demonstration of Soil Test Kit and Soil Health Assessment based fertilisers recommendation at Chitvi village of Navapur on 13 Oct 2017 for about 40 tribal farmers.

Summary of the training programmes / Field Day organized

Sl. No	Programme	Duration and place	Beneficiaries	Total Amount
1	Training Programme on "Integrated farming for livelihood improvement of tribal farmers". Training Programme on "Improving livelihood of tribal farmers through inputs utilization"	14 May 2017 Navapur 13th May 2017 Pawla Village	675 Tribal farmers 120 tribal farmers.	Rs. 60,000
2	A Field Day cum Training Programme on "Improved technology intervention in Field crops and Reservoir Fisheries for enhancing the livelihood of tribal farmers". A Field Day cum Training Programme on "Integrated Agri-aquaculture for enhancing livelihood of tribal farmers. • Demonstration of Soil Test Kit and Soil Health Assessment based fertilizers recommendation	Pawla Village of Nandurbar on 11 Oct 2017 Karanji village of Navapur on 11 Oct 2017 Chitvi village of Navapur on 13 Oct 2017	More than 60 tribal farmers. More than 250 Tribal farmers" More than 40 tribal farmers.	Rs. 20,000
3	Interaction meeting cum training programme on "Integrated Field-Horticulture-Livestock-Fisheries for enhancing livelihood of tribal farmers"	23 Oct 2017 Pawla	More than 85 tribal farmers.	

Details of technology disseminated

Sl. No	Name of the input distributed	Quantity	Beneficiaries * I/F	Tehsil / Tehsil	Villages	Technology disseminated
1	Rice seeds	-	416 (I)	Navapur Nandurbar	Kadwan, Tarapur, Kanhal, Devakipada, Chitvi, Vadsatra, Pimpran, Pimpla, Chedapada, Devpur, Pawla, Natavad, Tokartalab, Konda	Four point rice production technology
2	Urea Briquette	28000 kg	416 (I)	Navapur Dhadgaon Nandurbar	Kukran, Kanhala, Mughdhan, Kadwan, Bhardu, Karanji Bhud, Pimpran, Gadad, Savart, Chitvi, Devakipada, Kamode, Vadastra, Chetapada, Tarapur, Pimpla, Raigaon, Navapada, Nagjhari, Chowky, Khoksa, Karanji, Bhavre, Kolda, Kotkhan, Umran, Kukran Bujgaon, Dhanaje Bud, Sheshmal, Pawla, Tokaratalab, Natavad, Arditara, Devpur	
3	Onion seeds (var. Bhima kiran)	200 kg	200 (I)	Nandurbar Dhadgaon	Pawla, Tokaratalab, Natavad, Arditara, Devpur, Toranmal	Improved technology interventions in *rabi* onion
4	Wheat	7600	238 (I)	Nandurbar	Pawla, Umaj, Natavad,	Improved

	seeds	kg			Arditara, Devpur	technology intervention in wheat
5	Bypass fat	300 kg	30 (F)	Navapur and Nandurbar	Umaj, Pawala, Natawad, Devpur, Tokartalav	Improved technology intervention in high yielding dairy
6	IMC seeds	1.2 lakh	15 (F)	Navapur Nandurbar	Chitvi, Karanji, Chowky, Jamtalav, Bhomdipada, Borepada, Raigaon Wagdi Pawla	Improved technology interventions in farm pond based IMC aquaculture and culture based fisheries in small reservoirs / water bodies

*I : Individual, F: Families

Quaterly progress Overview

Quarter: April, 2017 - June, 2017						
Sl. No	Major Schemes	Output*	Unit	Target	Actual	% Target achieved
1	2	3	4	5	6	7
1	ICAR-National Institute of Abiotic	Inputs distributed to tribal farmers *Field crop* Rice seeds *Horticulture*	 qtl nos nos	 56 20,000 500	 56 20,000 400	100%

	Stress Managem ent- Baramati	Dragon fruit cuttings Vegetable seeds Agricultural sprayers Multi-purpose containers Soil analysis kit (Mridaparishak) Power tillers with accessories Fisheries Fish Feed pelletizers Grinders for fish feed Aerators Ice boxes for aquaculture	nos nos nos nos nos nos nos nos	80 575 1 12 2 5 3 22	80 575 1 12 2 5 3 22	
2		Trainings organized / Capacity building Event/ programme organized Training programmes / Farmers participatory on-farm demonstration on “Four point rice production technology” for higher productivity and income	 nos nos	 1 3	4 1 3	100%
3		Individual Farmers / Farm Families benefitted Improved technology interventions in field crop (rice) Programme/Event on Improved technology interventions in integrated farming in terms of field & horticulture crops, livestock & poultry & fisheries	Nos nos nos	1100 400 700	1100 400 700	100%

Quarter: April, 2017- June, 2017		
S.No.	SCSP/TSP Allocation	Exp.upto I Quarter
1	2	3

1	General Rs. 15 lakhs	(Rs. 1.92 Lakhs) + Payment of Rs. 5.32 lakhs is in progress towards procurement of briquettes

Quarter: July, 2017- Sept, 2017

Sl. No	Major Schemes	Output*	Unit	Target	Actual	% age Target achieved
1	2	3	4	5	6	7
1	ICAR-National Institute of Abiotic Stress Management-Baramati	Inputs purchased for distribution to tribal farmers *Field & Horticulture crops* Briquette (Fertilizers) Pack of reagents for soil test kit *Livestock* Bypass fat *Fisheries* IMC seeds	 Tonnes No Kg	 28 1 300	 28 1 300	100%
2		Group meetings with farmers for implementation of improved technology interventions in integrated farming	No.	4	4	100%
3		Individual Farmers / Farm Families benefitted Improved technology interventions in field crop (Rice and sugarcane) Improved technology interventions in horticulture crops (*Kharif / Late kharif* onion, Green chili, Radish, and Coriander) Group meetings with farmers for implementation of improved technology interventions in integrated farming	No No No	500 600 50	> 500 >600 >50	100%

Quarter: July, 2017- Sept, 2017		
S.No.	SCSP/TSP Allocation	Exp. pp to II Quarter
1	2	3
1	General Rs. 15 lakhs	(Rs. 8.09 Lakhs)

Quarter: October, 2017 - December, 2017						
Sl. No	Major Schemes	Output*	Unit	Target	Actual	% Target achieved
1	2	3	4	5	6	7
1	ICAR-National Institute of Abiotic Stress Management-Baramati	Inputs purchased / distributed to tribal farmers *Field and Horticulture crops* Wheat seeds *Rabi* onion seeds (var. Bhimakiran) *Fisheries* Indian major carp (IMC) seeds	 Qtl Kg Lakhs	 76 200 1	 76 200 1.2	100%
2		Group meetings with farmers/training programmes for implementation of improved technology interventions in field and horticultural crops, livestock, fisheries and stock enhancement	No.	4	4	100%
3		*Individual Farmers / Farm Families benefitted* Improved technology interventions in field crop (wheat) Improved technology interventions in horticulture crops (*Rabi* onion) Group meetings with farmers	 No No No No No	 238 200 50 300 150	 238 200 >50 >320 150	100%

		for demonstration of Mridaparishak kit for soil analysis Field day cum Training programme related to Agri-aquaculture for livelihood improvement of tribal farmers Interaction meeting cum training programme				

Oct-Dec 2017		
S.No.	SCSP/TSP Allocation	Exp.upto III Quarter
1	2	3
1	General (Rs. 15 Lakhs)	(Rs. 14.87 Lakhs)

January – March 2017				
S.No.	Description	Unit	Target	Achievements
1	2	3	4	5
1.	By-pass fat	Kg	300	300

Physical Outcome Targets / Achievements: 4th Quarter (Jan.-March 2018)

S.No.	Description	Unit	Target	Achievements
1	Improved technology intervention in *rabi* onion	No	200	200
2	Improved technology intervention in wheat	No	200	238
3	Improved technology intervention in high yielding dairy/ Farmers meet	No	30	30
4	Improved technology interventions in farm pond based IMC aquaculture and culture based fisheries in small reservoirs / water bodies	No	12	15
	TOTAL	No	442	483

Location & Beneficiary Details

S.No.	State	District	Sub – District	Village	Individual Section Amount	ST Population Benefited
1	Maharashtra	Nandurbar	Nandurbar Navapur Dhadgaon	15 villages in three Tehsils	Fund utilised during 2017-2018 Rs. 14.97 lakhs	483

Financial achievement/Total Budget received and utilized during 2017-18:

Sl. No.	Budget received (Rs. in lakh)			Budget utilized (Rs. in lakh)		
1	Capital	Revenue	Total	Capital	Revenue	Total
	--	15	15	--	14.97	14.97

Post Technological Intervention Assessment

Change in Socio-economic profile of tribals

The technological interventions have certainly increased the income level of farmers, which has resulted in certain changes in his social profile as well as expenditure pattern. It was observed that the Integrated crop-livestock-poultry-fish model introduced in the tribal areas increased the diversity and productivity of agricultural produces in which some of them are grown for the first time. After TSP intervention, the following major farming systems are observed in the villages/Tehsils of Nandurbar District:-

1. Field crops – Fruit crop
2. Field crops – Vegetable crops
3. Field crops – Fruit crop-Vegetable crop
4. Field crops-Dairy
5. Field crops – Horticulture – Dairy
6. Field crops – Fisheries
7. Field crops – Horticulture –Dairy – Fisheries
8. Field crops – Fisheries – Poultry

Productivity enhancement

Research efforts, farmer education and training, advice and information are helpful for shifting towards balancing economic efficiency with environmental and social sustainability. The focus of research and interventions was to increase production, productivity and profits, whereas now the emphasis is on achieving those aims in a sustainable way, which often implies changing farming 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 seeing 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. When the work was initiated in Nandurbar district the production and farm productivity was very low owing to rare exposure of tribal farmers to the improved technologies and practices.

The interventions in the form of improved rice varieties have immensely benefited the farming community. ICAR-NIASM has successfully implemented integrated farming,

benefitting tribal farmers in terms of adoption of improved technology interventions in field crops (rice and sugarcane), horticulture crops (banana and onion), dairy farming (Fodder and Mahsana buffalo), backyard poultry (Vanaraja/Giriraja) farming, fisheries and Integrated agri-IMC aquaculture. These interventions led to higher production of rice (Indrayani 4.5–5 tonnes/ha), wheat (2.4-2.8 tonnes/ha), sugarcane (100-185 tonnes/ha), onion (Var. Bhimakiran 35–79 tonnes/ha), banana (partial harvest 15000- 18000 kg/acre), milk (108-188 litres/month), and fish (> 3000-4000 kg/ha). The farmers reported higher weighing poultry and egg production than the traditional ones. The field crop and fruit and vegetable production increased due to proper soil and nutrient management, micro-irrigation, adoption of integrated nutrient and pest and disease management measures in the selected areas. By integration of crop, fish and animal components, net farm income of tribal farmers increased by 44-75% even in climate change prone selected areas.

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 and also have the right education, information and motivation to do so. Agricultural policies can be formulated accordingly, however, the price fluctuations faced by farmers for their inputs and output produce, influence their decisions on investment and can lead to unsustainable farming practices. Implementation of improved technology interventions by ICAR-NIASM in field crops (rice, sugarcane, wheat), horticulture (onion, banana, dragon fruit), livestock (dairy and goat farming), fodder, poultry (backyard poultry), fisheries (IMC aquaculture) and Integrated agri-IMC aquaculture benefitted tribal farmers in terms of adoption of improved technologies interventions, enhancing income of the tribal farmers of different Tehsils of Nandurbar District by 44-75%. Furthermore, net farm income of innovators/progressive tribal farmers increased by 2 times mainly due to adoption of integrated farming in terms of field and horticulture crops, dairy, goatery, poultry and fisheries. Many of the tribal farmers have standardized seed generation of rice, rabi onion and also used banana suckers for the next crop. Farmers from Nandurbar district have been benefited from the technological intervention carried out by the participating scientists. Though it is not possible to quantify each and every benefit emanated from the project activity, some of the quantifiable activities are presented below:

Year	Budget utilized	Beneficiaries (Number)	Number of farmers whose income was doubled due to implementation of improved technology interventions under TSP
2014-15	42.99	2845	1428
2015-16	60.37	1659	665
2016-17	120	3631	1218
2017-18	14.97	2049	518
Total	238.33	10184	3829 (37.6%)

Rice yield

Variety	Cultivated area, ha	Number of Beneficiaries	Straw yield , Tonne/ha	Paddy Yield, Tonne/ha	Gross Returns, Rs. in lakhs/ha	Total Gross Returns, Rs. in lakhs
Indrayani	160	416	9.0 – 19.0	4.5-5	1.21	218

Sugarcane yield

Variety	Cultivated area, ha	Number of Beneficiaries	Yield, Tonne/ha	Gross Returns, Rs. in lakhs/ha	Total Gross Returns, Rs. in lakhs
Co 86032 Co 265	70	175	100 – 185	3.15	220

Onion yield

Onion variety	Cultivated area, ha	Number of Beneficiaries	Yield Tonne / ha	Avg. yield Tonne / ha	Rate/Tonne, Rs.	Gross returns, Rs. in lakhs/ha	Total Gross Return, Rs. in lakhs
Rabi (Bhima Kiran	31	241	35 – 79	59.71	8000	4.78	148

Banana cultivation

Variety	Cultivated Area (ha)	Number of Beneficiaries	Yield (kg/acre)	Rate/kg (Rs.)	Gross Return	Total Gross Returns, Rs. in lakhs
Grand Nain	2	5	16000-18000	5-8	1-1.5 / season / acre	4.1
Grand Nain (Suckers)	2	4				

Dairy farming

Breed	Number of beneficiaries (distributed during 2015-16)	Average Milk production, Litres / month	Rate, Rs/Litre	Gross income / annum, Rs. in lakhs
Mehsana buffaloes	14	108-188	35	7*

*There are at least one or two calves with each farmer

IMC aquaculture

Fish species	Cultivated Area, m^2	Number of Beneficiaries	Partial harvest, kg/ha	Rate/kg, Rs.	Gross Returns, Rs. in lakhs
Indian major carps	900-2000	18	3000-4000	90-120	9.5

Sustainable Technology Dissemination

Improved technology interventions in Integrated Farming in terms of field and horticultural crops, livestock, poultry and fisheries have improved livelihood of tribal farmers. Based on constraints identified during resource assessment and impact of climate change, abiotic and biotic stresses on agriculture, technological interventions and sustainability of these techniques were devised and integrated during the planning phase. Research on fish ponds led to the optimal water quality and plankton primary productivity. Availability of fish seeds from nearby hatcheries and training on Farm pond preparation has encouraged farmers to adopt agri-aquaculture.

The main focus was on skill upgradation, motivation, social networking, economic stability, market access and linkages. "Four point rice production technology', Water efficient

production technology in sugarcane, Virus free tissue culture banana cultivation using suckers, High yielding and long storage *late kharif* and *rabi* onion cultivation and seed generation, kitchen gardening of dragon fruit, backyard poultry farming, fodder and high yielding dairy and goat farming, Integrated Crop-Livestock-Fisheries, Integrated Livestock cum Fish farming, Integrated Goat cum Fish farming, Integrated agri-aquaculture, Integrated dairy cum Fish farming, Integrated poultry cum Fish farming have been adopted by the farmers.

Nutritional improvement

The interventions carried out in the tribal areas significantly increased the production of cereals, sugarcane, vegetables, fruits, meat, egg and fish. It was also seen that the banana, onion, milk, eggs and fish has exceeded the requirements which created a marketable surplus. Thus, the production model resulted not only in achieving nutritional improvement, but also produced a marketable surplus in certain food items.

Innovations introduced

1. Four point rice production technology
2. Promotion of *Gliricidia* plantation for rice cultivators as live fences, and green leaf manure for crop production and animal forage.
3. Water efficient crop production technology in sugarcane
4. Creation of twelve interest groups/SHGs, to whom capital inputs were distributed.
5. Improved technology intervention in cultivation of late *kharif* and *rabi* onion with high yielding, long storage varieties and seed generation.
6. Cultivation of virus free tissue culture banana and suckers of the same cultivar
7. Economically viable compost production for organic farming
8. Improved technology intervention in kitchen gardening of dragon fruit
9. Improved technology intervention in high yielding dairy and goat farming with deworming and disease management.
10. Improved technology intervention in backyard poultry farming
11. Use of mineral mixture and bypass fat for livestock.
12. Economically and environmentally viable farm pond preparation
13. Intensive aquaculture of Indian Major Carps
14. Method development for fish feed preparation
15. Development and application of zeolite based nano-composite for alleviation of abiotic and biotic stresses in farm pond aquaculture
16. Optimization of water quality in fisheries/farm ponds through best management practices
17. Stock enhancement of water bodies/small reservoirs for culture based fisheries
18. Implementation of other off-farm activities and value addition for improving livelihood of tribal farmers.
19. Integrated farming in terms of field and horticultural crops, dairy and poultry farming, Fish farming and Integrated agri-aquaculture
20. Improved technology intervention in Integrated Crop-Livestock-Fisheries, Integrated Livestock cum Fish farming, Integrated Goat cum Fish farming, Integrated agri-aquaculture, Integrated dairy cum Fish farming, Integrated poultry cum Fish farming

Advantages of adoption of Integrated Farming System in tribal areas

- 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 viz. 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

Success stories documented

Integrated Crop-Livestock-Fisheries, Integrated Livestock cum Fish farming, Integrated agri-aquaculture, Integrated field-cum horticulture, Integrated field cum dairy farming, Integrated field cum goat farming, Integrated field cum poultry farming have been adopted by thousands of tribal farmers of Nandurbar district. Due to the efforts of the team over the years, many farmers could achieve increase in production and productivity of farming enterprises acting as a motivation and role model for other farmers in their area. As evident from the publications in local News Papers, the achievements of such farmers are documented and few of them are presented below:

Sl. No.	Farmer's Name	Tehsil/Village	Technology intervention adopted by the farmer	Documentation
1	Suresh Gavit	Navapur, Karanji	Integrated field-horticulture-dairy, goat-fish farming	Local News papers
2	Ratilal Gavit	Navapur, Chitvi	Integrated field- horticulture-dairy-goat-poultry-fish farming	
3	Arvind Gavit	Navapur, Chitvi	Integrated field- horticulture-poultry-fish farming	
4	Somu Gavit	Navapur, Chitvi	Integrated field-horticulture-poultry	
5	Gempunoora Gavit	Navapur, Karanji Kurd	Integrated Rice and sugar cane – Banana-Fish-Onion,	
6	Kotia Khatria Watsave	Navapur, Wadsatra	Integrated sugarcane- Rice-dairy- goatery, onion-poultry	
7	Jay Singh Rewa	Navapur, Karanji	Integrated Sugarcane – Fish-Rice-Onion	
8	Rupali Magan Gavit	Navapur, Karanji	Integrated Rice- Sugarcane Banana-Onion-Fish	
9	Bilkiya Sega Gavit	Navapur, Devlipada	Integrated Sugarcane- Rice-Onion- Chilli –Poultry	
10	Jyotipal Basant	Navapur, Pawala	Integrated –Rice, onion, Goat, fish	
11	Vishal Dashu Gavit	Nandurbar, Tokartalab	Integrated – Sugarcane, wheat Rice-Onion	
12	Durga Raju	Navapur, Sarwat	Integrated Sugarcane- Rice-Poultry	
13	Suresh Gavit	Navapur, Jamtalav	Integrated field- horticulture-dairy-poultry-fish farming	
14	Girish Rao	Navapur, Gadad	Integrated field - horticulture-poultry farming	
15	Vilas Gavit	Navapur, Chowky	Integrated field- horticulture-poultry-fish farming	
16	Suresh Gavit	Navapur, Vadsatra	Integrated field- horticulture-dairy-goat-poultry	
17	Self help Group	Pawla, Nandurbar	Stock enhancement in small reservoir for culture based fisheries	
18	Self-help group	Wagdi, Navapur	Culture based fisheries in small water body	

Award bestowed to tribal farmers

Eight tribal farmers under TSP got an award/certificate from ICAR-National Institute of abiotic Stress Management during ICAR-NIASM Foundation Day on Feb 22, 2018.

Publications/Local News Papers showing success stories

1. ICAR-NIASM technical Bulletin No. 10. A step towards improving livelihood of tribal farmers through Integrated farming, Pp.50.
2. ICAR-NIASM Technical Bulletin No.11 (Samnvit matsya palan), pp.12.
3. ICAR-NIASM Technical Bulletin No. 12 (Ekatmik Matsya Palan/Integrated Agri-aquaculture), pp.12.
4. ICAR-NIASM Technical Bulletin No.13 (Matsya palan/Fish Farming), pp12.
5. ICAR-NIASM Technical Bulletin No. 14(Carp Sanvardhan), pp.12.
6. TSP Brochure: Fish feed preparation. Technical folder No. 20. 2017.
7. Improving livelihood of tribal farmers through implementation of improved technology intervention in integrated agri-aquaculture. SEPO13, pp 469. 11th Indian Fisheries and Aquaculture Forum, Kochi, 2017.

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