

Enhancing water and livelihood security and improving water productivity in tribal dominated paddy fallow agro-ecosystem of Odisha

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Location

A total of 535 farm families were selected in the villages Khuntapingu, Malarpada, Jamuda of block-Saharpada, district Keonjhar in Odisha.

OBJECTIVE

Improving agro-based livelihoods of the farmers and improving farmers' income.

INTERVENTIONS

The interventions under the Farmers FIRST project aimed at improving the agro-economic conditions of the people. The villages were predominantly poor and most of the population were Scheduled Tribes. The interventions specifically aimed at changing the rain-fed based monocrop agro-economic condition to double cropped scenario and improving farmer income and employment. The following six modules were implemented to address the low productivity and mono cropping practices.

Natural resource management based module

Rationale of the intervention: During 2017-18, water budgeting, monitoring of dug well and pond water level were done to assess water availability and crop water demand. Accordingly the farmers were advised to adopt a suitable cropping pattern as per availability of water and increasing

water use efficiency through adoption of micro irrigation in vegetable cultivation. SRI, replacing long duration local varieties with short and medium duration high yielding paddy variety, application of straw mulch in banana cultivation and utilization of residual moisture after paddy cultivation for a second crop were demonstrated in farmers' fields.

Vegetable cultivation in medium and low lands during post-*kharif* paddy period was introduced for enhancing farm income.

Three petrol start-kerosene run pumps of 3.2 hp capacities were distributed to farmer groups along with suction and delivery pipes for using water harvested in ponds/check dams during monsoon. Field bunding of uplands were also advised for *in situ* conservation of soil moisture. Three centrifugal pumps distributed in three villages provided assured irrigation to 11.72 ha of land during *kharif* 2020. Training on all aspects of scientific water management in agriculture was given to farmers. During 2018-19, farmers group was formed in Malarpada for group farming and scientific use of available water through crop planning and increasing water use efficiency. The group of farmers repaired a river-lift irrigation point, which was lying dysfunctional for six years. About 18 ha of land were brought under irrigation and SRI was demonstrated during *rabi*. A

total of 35,000 seedlings were distributed for vegetable cultivation covering 200 farmers and adoption scientific irrigation practices. During *kharif* 2019-20, rainwater conservation was done through ponds by providing inlets and piped outlets (ponds constructed under IWM by District Watershed Mission), groundwater was monitored for water availability for second crop, water use efficiency was increased through piped conveyance, sprinkler irrigation, line transplanting of paddy, SRI demonstrations, Polythene mulching in vegetable cultivation for moisture conservation, popularization of short duration high yield hybrid paddy varieties, scientific irrigation scheduling for drought proofing and improving water productivity were done.

Outcome: Mulching in vegetable cultivation reduced the evapo-transpiration and thus helped in better moisture conservation and weeds management. This reduced the irrigation water requirement. Interval between consecutive irrigations was observed to be increased by 1-3 days based on type of crop, land and plant growth stages. Optimum irrigation was provided to different crops through sprinkler irrigation system. Water saving by sprinkler irrigation system at different fields was observed to be 25-35% as compared to convention furrow method followed earlier (Table 1).

Horticulture based module

The horticulture based interventions were carried out to increase the income of farmers and diversifying upland paddy cultivation which required more water. The horticulture interventions included using uplands for *kharif* brinjal production, tuber crop plantations and banana cultivation under micro irrigation. Group farming was taken up by local youths with vegetable cultivation in river banks. The supplied centrifugal pumps were used by the youths in vegetable production. About 40 ha of lands were brought under vegetable production in three project villages.

Rationale of the intervention:

The land slope of the area varies from

1.5-6% and soil type is of sandy loam ustochrepts type in the order of inceptisols. The average annual rainfall in the area is 1405 mm and the climate is sub-humid monsoon dependent. The temperature varies from 4.5 degree in winter to 45 degree in summer. With such variation in temperature, agricultural operation is bit more challenging. However with availability of water in village ponds for at least four months crop diversification through horticultural interventions was thought to be profitable for the farmers.

Training was provided with involvement of KVK Keonjhar scientists on vegetable cultivation and use of micro irrigation. Exposure visit

to ICAR-CHES and CTCRI were taken up to develop knowledge about seedling preparation, horticultural and tuber crop cultivation. Vegetable seedlings of brinjal, tomato, chilli, cauliflower, cabbage, capsicum, okra, radish, Amaranthus were provided for cultivation in uplands with provision of irrigation. Timely advice was provided for plant protection and other operation. Mrs. Meena Mohanta, the leading woman farmer was also provided with power thresher cum winnower that she shared with other farm families of her locality for drudgery reduction in threshing and winnowing. Sprinkler irrigation system was provided for increasing water use efficiency and better water management. Meena

SUCCESS STORY

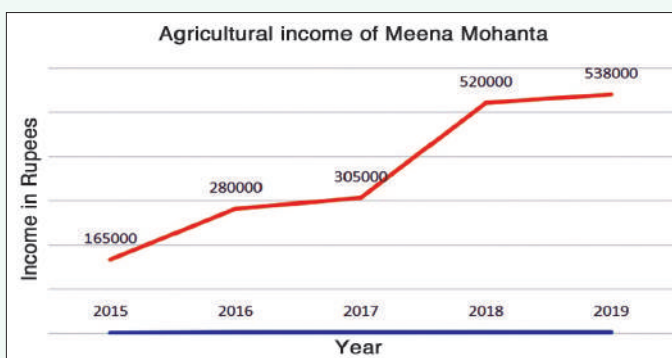
Mrs Meena Mohanta W/o of Jagadish Mohanta of Khuntapingu village under the Gram Panchayat of Mallarpada of Saharpada block; district-Keonjhar, Odisha is one of the leading lady farmer in the project village under Farmers FIRST Programme. She owns 1.5 ha of agricultural land out of which 1 ha is un-irrigated and 0.5 ha is irrigated through a Bore well. A dug well was the only source of irrigation for her land before start of the project. She takes pride in her agricultural work and improved agro-economic conditions due to Farmer FIRST project.

Mrs Meena Mohanta has been a big success among the Farmer FIRST project farmers with adoption of scientific vegetable cultivation, scientific water management and use of other inputs. After getting training from Farmer FIRST project, she took 2 acres of land on long term lease from neighbouring farmers for vegetable cultivation. She was the first women in the area to adopt sprinkler irrigation and train other farmers for its use. She

cultivates Brinjal, Bitter gourd, French bean, Peas, Cauliflower, Cabbage, Tomato, Chilli, Ginger and cowpea round the year, especially in off seasons. The cropping intensity in her field was computed to be 240%. Her net agricultural income increased from ₹ 1,65,0000 during 2015-16 to ₹ 2, 80,000 during 2016-17. It further increased to ₹ 3,05,000 during 2017-18, ₹ 5,20,000 during 2018-19 and ₹ 5,38,000 during the year 2019-20. She is a barefoot trainer on modern farming in the remote tribal area of Keonjhar. She also trained other farmers on methods of water conservation and its utilization. She was awarded as best farmer on the occasion of World Water Day at ICAR-IIWM on 22 March 2018. Honourable Secretary DARE and Director General ICAR Dr. Trilochan Mohapatra felicitated her for her accomplishments. She was again awarded as best farmer on 26th February 2019 by Honourable Union Minister of Agriculture and Farmer Welfare Sri Radha Mohan Singh at ICAR-IIWM. She has been the flag bearer successful farmer-entrepreneur under Farmer FIRST project and an ambassador of IIWM technologies dissemination for the fellow farmers and farm women in her village as well as in nearby villages. After getting high return from her crops she has dug one bore well to irrigate her land during 2016 and purchased rice huller during the year 2018, that gives her an additional off-farm income.



Mina Mohanta at her Bitter gourd, onion field



Increase in income of Meena Mohanta

Table 1. Economic and social impact

Impact	Before adoption	After adoption
Farmers' practice	Primarily rainfed paddy cultivation and <i>kharif</i> rain-fed vegetable cultivation with occasional flood irrigation from well.	Vegetable cultivation in <i>kharif</i> and <i>rabi</i> with sprinkler irrigation using bore well.
Fixed cost (₹)	5000 (Electric pump)	10,000 (annualised) cost (Bore well and Sprinkler set)
Recurring cost (₹/year)	1,88,700 (Family Labour, seed, fertilizer)	1,98,900 (1.0 ha) (including family labour, fertilizer, seedling cost, pesticide cost).
Gross income (₹/year)	3,58,700	5,38,000
Net profit (₹/year)	1,70,000	3,39,000
B:C ratio	1.90	2.70
Marketing	Sold in village market	Sold in village market, neighbouring villages markets, block market and district market Keonjhar.
Dissemination of knowledge in the locality	No	She has trained many women of her own village and nearby villages on vegetable cultivation and use of micro irrigation. She also produces seeds for own use and selling to other farmers.
Knowledge gain based on 1-5 scale*	1	5
Feeling of economic security based on 1-5 scale*	1	5
Ability to understand and solve problems based on 1-5 scale*	1	5
Self-image in community based on 1-5 scale*	1	5
Self-confidence based on 1-5 scale*	1	5

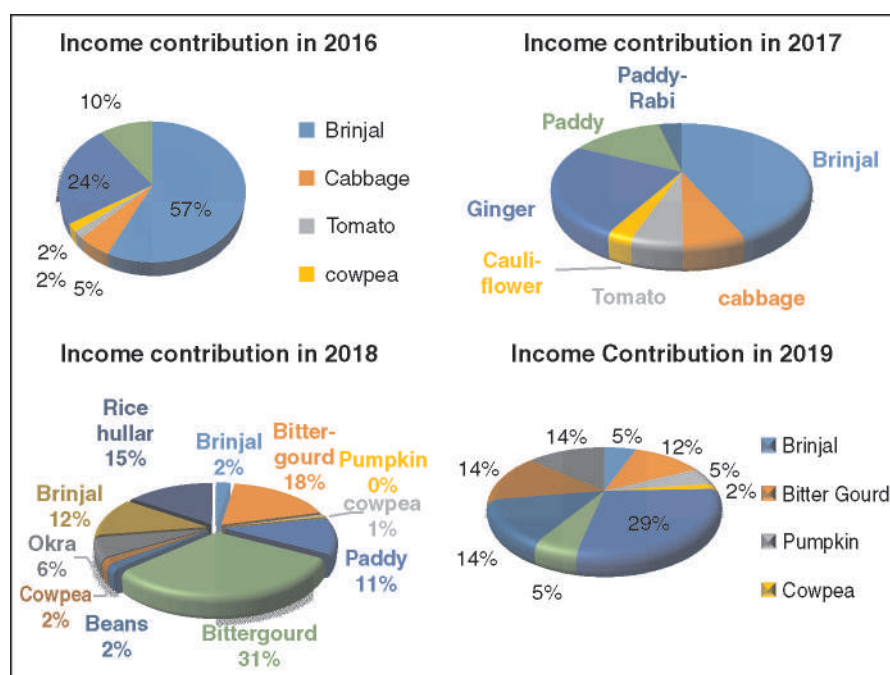
*1-5 scale where 1 = lowest and 5 = highest; higher B: C ratio is due to off-season vegetable cultivation.

Mohanta is now engaged in production of multiple vegetable crops throughout the year with the adoption of crop rotation in *rabi* and *kharif*.

Crop based module

Before the intervention of Farmer FIRST project, farmers were going for mono-cropping of paddy cultivation during *kharif* with broadcasting and conventional method and had negligible amount of vegetable cultivation in the backyard. After the introduction of Farmer FIRST project and with trainings, farmers are now practicing line transplantation, SRI, weed management by cono-weeder, balance fertilizer use and scientific irrigation practices. They have adopted intercropping, multi-cropping and latest technologies.

Interventions: *Kharif* paddy followed by fallow was the dominant cropping system in the project area before Farmer FIRST project. Use of high yielding seeds, even some farmers went for Hybrid seeds out of their own choice, line transplanting, use of cono-weeder and need based fertilizer application were introduced since 2017-18. Stakeholders were given field training on SRI and line transplanting and a group of 42 farmers were mobilized for demonstrating SRI during *Rabi* 2018-19.



Line transplantation of Paddy at Khuntapingu village

Rationale of the intervention: The paddy yield before the project intervention was about 1.5 t/ha and used to be drought prone in the event of scanty rainfall. As the area was subjected to recurrent droughts, water harvesting and adoption of scientific water management practices were aimed through Farmer FIRST project. The interventions resulted in adoption of line transplantation in 51 ha area during *kharif* 2020. High yielding varieties like swarna, and medium duration hybrid paddy seed like RIL 666 (110-120 days), pioneer 27P67 (130-137 days), Advanta (130-135 days) have also been practiced by farmers in project villages. The piped application of



Line transplantation of Paddy at Khuntapingu village

water, raising of field bunds, scientific irrigation scheduling reduced risk of crop failure due to climatic vagaries as compared to long duration varieties which are subjected to recurrent drought, but also made available of time and residual moisture for *Rabi* cultivation. Besides, due to higher productivity, it has also increased farmer's net income by 15-20% in comparison to pre-project scenario. Early maturity Sahabaghi dhaan (105 days) variety was also adopted in upland fields. The average yield under high yielding paddy has been recorded to be 12.84, 14.18 and 15.52 q/acre for Jamuda, Malarpada and Khuntapingu village respectively.

Outcome: Introduction of line transplantation has resulted in increase of production by 25-30% as compared to the conventional method. Three trainings were conducted in three project villages on "improving farm income and water use efficiency through integrated farming system, improved methods of paddy and vegetable cultivation, increasing cropping intensity through winter vegetables, improved livestock rearing etc. One field training on SRI during *rabi* 2018-19 was also conducted to in-depth understanding of the process. 1170 farmers were benefitted during 2017-20. The net on farm income increased by more than 25% in different cases due to enhanced yields and cost savings because of mechanization. The increase in net farm income induced farmers to invest in farming infrastructure like construction of bore wells, dug wells and purchase of agri-implements in some cases.

Fishery/IFS based module

The area is dominated by tribal population and most of them were predominantly poor. About 30% of the area was wasteland. Before the Farmer FIRST project, farm ponds were constructed under IWMP by Odisha Soil Conservation Department. But due to absence of knowledge on use of scientific water management practices the ponds were almost remained unused or being used for sanitation purposes. Under Farmers FIRST project, Farmers were motivated for fish farming in those ponds. Initially they were hesitant, but after getting trainings under the project, farmers were very enthusiast to try on fish farming. Three groups were developed comprising landless, SHG members and other farmers from each project villages of Khuntapingu,

Malarpada and Jamuda.

Intervention: Scientific pisciculture was introduced to the FFP villages during 2018-19.

Rationale of intervention: As the pond water was available for more than 4 months due to provision of inlets and controlled outlets, pisciculture was thought to be good intervention with formation of groups. Three farmer groups were formed consisting of 30 members and demonstrations were carried out in three community ponds. Fish fingerlings were released during 2018 and continuous monitoring was done. Fish feed was also supplied under the project to the groups. Farmers group took the ownership and devoted their time in fish rearing and management of ponds. The three villages harvested fish during 2019-20. The fish was sold in local markets with average price of ₹ 200/kg.

Outcome: Farmers received production of fish worth ₹ 4.976 Lakh rupees in three villages combined (Table 2). The farmer groups made corpus fund out of that and procured fingerlings for 2019-20 and 2020-21 themselves. Thus the intervention was huge success and the fish farming is running on self-sustainable mode.

TRAINING

Total 1170 farmers have been trained covering 5 courses and 30

Table 2. Community fish farming

Village	Pond area (sq.m)	IMC stocked/ pond	Yield (kg) of bigger size fish	Partial harvest	Gross income (₹)
Malarpada	22200	3600	1230		2,46,000.00
Khuntapingu	3900	1500	570		1,14,000.00
Jamuda	5100	1700	688		1,37,600.00
Total					4,97,600.00



demonstrations (13 ha area) in 2017-18; 3 courses and 51 demonstrations (35 ha area) in 2018-19 and 5 courses and 60 demonstrations (50 ha area) in 2019-20.

IMPACT

- Diversification of cropping pattern from mono-crop to double and triple cropping in some cases in three villages was possible through Farmer FIRST project. Earlier, farmers were practicing only paddy cultivation and only 1 to 2% farmers were involved in vegetable cultivation. Now the landless families are taking up land for lease and growing vegetables and paddy. The overall on net farm income has increased by more than 50% in the project villages after Farmers FIRST project.
- The on-farm employment has increased by more than 50% in project villages due to two to three crop cultivation after the project.
- Farmers are adopting line transplantation and SRI methods instead of earlier broadcasting and conventional methods of paddy transplantation.
- WhatsApp group expert consultation has been used for solving farmers' field problems timely.
- Farmers who have grown high yielding short or medium duration paddy varieties have been directly benefitted from the genetically tolerant Blast and BLB disease and received high yield, thus farmers income increase by around 30-37% from this single crop.
- Water saving up to 25-35% in the short to medium duration crops

Village	Percentage increase in Income				
	Whole Village	Marginal (<1 ha)	Small (1-2 ha)	Medium (2-10 ha)	Large (>10 ha)
Malarpada	45.07	44.67	51.34	50.24	54.55
Jamuda	39.28	30.83	36.21	41.19	46.67
Khuntapingu	50.45	45.76	47.89	47.85	65.89
Total	44.93	40.42	45.15	46.43	54.7

saves farmers from crop loss in changing climate. Water productivity increased about 20% in most of the cases due to application of scientific water management practices in cereal and vegetable crops

- Practice of growing crops in kitchen garden as part of their backyard cultivation has been popularised in FFP villages. Almost all farmers are now growing at least 4-5 crops in small area of 0.1-0.2 acres in the backyards. These ensure essential nutrient availability and maintain energy level of each household. The surplus vegetables was either sold to the market or given to their nearby relatives.
- Diversification of the cropping system from mono-crop to double crop and triple cropping system.
- The income of farmers increased between 25 and 300%.
- Adoption of water saving sprinkler irrigation technologies and use of machineries from puddling by power tiller to post-harvest power thrasher & winnowing and weed management by cono-weeder in agricultural fields has been widely adopted in these villages.
- Farmers have adopted *Aseel* and *Kadakhnath* variety in poultry rearing as alternate livelihood sources.

- Group of farmers adopted fish farming as they received high return.
- Poultry rearing farmers have been using poultry excreta and wastes as bio-fertilizers.

DRAWBACKS AND LESSONS LEARNT

- The power of community based agriculture is most adopted. As they take the ownership of the properties, this gives the sense of security. So the instrumentation provided will be sustainable in long run.
- High yielding hybrid varieties have given maximum production with the application of chemical fertilizer. Therefore to maintain the quality of soil and to make it live, the integrated approach of bio-fertilizer and tree based farming should be adopted.
- Technological intervention has increased the farmer's income manifolds. Sprinkler irrigation system was successful in providing assured irrigation and controlling the micro-weather of the particular crop fields and farmers found it handy. So, use of sprinkler and drip irrigation will be largely adopted.

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ICAR New Portals

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- ICAR-Enterprise resource planning (ERP) System to manage the human resource in information of the council including pay roll, finance and budgeting.
- KVK Knowledge Network Portal (<http://kvk.icar.gov.in>) to share basic information and facilities of KVKs with contingency plans, demonstration schedule, and advisories.
- Management System for Post-Graduate Education (MSPGE) enabling academic and e-learning modules while also being a repository of academic records
- E-Samvad, an online interface of the Council to answer citizens queries.
- KRISHI –A knowledge repository portal of digital information pertaining to research experiments, outputs, publications, etc.
- E-Krishi Manch, a dedicated portal for farmer-scientist interaction.