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RESEARCH ARTICLE

PROMOTION OF ORGANIC FARMING IN TRIBAL FARMERS OF AKOLE WITH RELATION TO CLIMATE CHANGE

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ABSTRACT

The changing climate has become worldwide concern. Climate is directly affected the crop production and its effects on poor farmer community in tribal's. It is need to build up healthier crop to resist adverse climatic condition. It was prove that the organic practices get the crop healthier, high yield potential and sustainable production. This study helps those farmers' lives in tribal area depend up on rainfed paddy crop and also guide farmers how to cultivate paddy with low cost inputs to withstands climate change.

INTRODUCTION

WOTR has specific competencies in Watershed Development and Natural Resource Management, Integrated Water Resources Management, Adaptive Sustainable Agriculture, Rural Development, Community Mobilization, Gender and Women's Empowerment, Systems Development and Capacity Building. In all, WOTR has carried out developmental work in over 2,500 villages in five states of Maharashtra, Andhra Pradesh, Madhya Pradesh, Rajasthan, Jharkhand and Odisha (Orissa). In its 20 years since inception, it has organized over 1,100 watershed developmental and climate change adaptation projects, covering over 6,80,000 hectares and impacting over 9,70,000 people. Its involvement in over 8,300 women's SHGs, micro-finance, training and other initiative have benefitted over 1,00,000 women. Similarly, over 3,00,000 people from 27 states in India and 35 countries have participated in WOTRs Training and Capacity Building programs. WOTR work in Akole since 2010-11 under the climate change adaptation project which is being implemented in 12 villages of Akole covering an area 5,870 ha. directly benefiting 10,419 people from 1,783 households. WOTR usually, work in Akole, with Schedule Tribes (ST) such as Mahadev Koli, Thakar Koli and OBC having poor economical condition and small land holding. The WOTR team has been decided to conduct sustainable organic practices with paddy crop along SRI system of cultivation since 2010-11. Based on the outcome of experimentations in various villages of Akole, WOTR has shift chemical use to sustainable organic practices.

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Organic farming

Is a system which primarily aimed at cultivating the land and raising crops in such a way, as to keep the soil alive and in good health by use of organic wastes (crop, animal and farm wastes, aquatic wastes) and other biological materials along with beneficial microbes (biofertilizers) to release nutrients to crops for increased sustainable production in an eco friendly pollution free environment. FAO suggested that "Organic agriculture is a unique production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity, and this is accomplished by using on-farm agronomic, biological and mechanical methods in exclusion of all synthetic off-farm inputs".

INM

Integrated Nutrient Management refers to the maintenance of soil fertility and of plant nutrient supply at an optimum level for sustaining the desired productivity through optimization of the benefits from all possible sources of organic, inorganic and biological components in an integrated manner

Climate Change

The entire income of tribal farmer is often dependent on a single season – the unpredictable Indian monsoon. A failed crop affects not just these farmers but also has direct implications for the farmers. Being dependent on farmers and their ability to provide earning opportunities, an uncooperative climate means migration and disrupted families for them. But

in India's monsoon-driven weather system, local agro-meteorological conditions, especially rainfall, vary even within a kilometer; and distantly located weather stations at taluka places are not able to provide accurate data, that can generate local-specific knowledge. Also, most indigenous knowledge about weather predictions based on observing surrounding flora and fauna, is now lost.

Agromet stations

The aim of Agro-meteorology component of WOTR's climate Change Adaptation (CCA) project is to improve agriculture productivity despite variations in local weather conditions. 12 weather stations have been installed in the project villages and simultaneously, interested youth in the villages have been trained to read the met-data and display them on daily weather information boards installed at prominent places in the villages. This helps people be informed about local weather conditions like rainfall, temperature, humidity, wind speed etc.

Agro-advisories

There is also an automated online platform that uniquely combines locale-specific Met-advisories and Agro-advisories that provide timely information to farmers so that they can plan their agricultural activities accordingly. WOTR has also tied up with the Indian Meteorological Department (IMD) for regular 3 days weather update, received online, which are relayed to the field through SMS and word of mouth too. This is indeed an instance of application of advanced technology to solve issues in remote villages. WOTR's Agro met stations empower through knowledge generation at the local level to regeneration Tribal capacities and build resilience to climate change.

Components of integrated organic farming

The major components have been introduced on farmers field viz.

A. 1. Organic manures -FYM, compost, green manures.
2. Biofertilizers - Azotobacter, Rhizobium, PSB,
3. Vermicompost
B. Biopesticides and fungicides - tricoderma
C.Trap crops- Rajgira, Merigold, coriander, sorghum, castor and maize
D.Biological pest control i.e. amrutpani, vermiwash, dashparniark, neem ark.
E.Soil health- jeevamrit
F.Urea-DAP briquets for paddy cultivation

Agronomical practices adopted by WOTR team in Akole

The WOTR team has initiated a fourfold practices in agriculture in the tribal area of Akole, SRI in paddy cultivation, organic soil management, use bio-extract for pest and disease control and efficient water management practices.

1. SRI : Seed treatment, low seed rate, line to line sowing, use of cycle hoe for weeding etc. all cultivation practices.
2. Organic soil management: In organic practice, the soil is treated as living entity with microbial formulations for e.g. Azotobacter, PSB. Deep ploughing and the application of FYM, Vermicompost, and Compost are encouraged. Intervention such as jeevamrit and amritpani are taken up with the farmers. Vermicompost and compost is a improved source of organic manure.

- Improved composting method 6 ft by 3 ft by 2 ft structure is made. All forms of biomass such as dung, leaves, grass etc. are used to fill it. Then add culture inoculants such as Azotobacter, PSB and tricoderma are added to it. Then top is plastered using mud and the ingredient remain buried for three months after which they are completely decomposed and serve as an excellent organic manure.
- "vermicomposting" means the use of earthworms for composting organic residues. Earthworms can consume practically all kinds of organic matter and they can eat as much as their own body weight per day. The excreta or "casting" of earthworms are rich in nutrients (N, P, K and Mg) and also in bacterial and actinomycetes population.
- Jeevamrit

Table 1. The process of making jeevamrit

S.No	Particulars	Quantity	Purpose of component
1	Fresh cow dung	10 kg	Micronutrients
2	Cow urine	10 lit.	Pesticide value
3	Besan	2 kg	Fermenting agent
4	Jaggery (gur)	1 kg	Fermenting agent
5	Water	200 lit.	base
	Total Jeevamrit	223 lit	

Method of preparation

Take 200 lit. capacity plastic barrel, then mix all above material into the barrel, add 200 litre water in it. Then stir with wooden stick clockwise and anti clock wise in the morning and evening for 5 to 10 min for 6 days. It should be kept under the shed. After 6 days jeevamrit is ready for application to the soil. Apply it 200 lit per acre on soil surface at the time of irrigation.

- Amritpani

Table 2. Material required for preparation of amritpani

S.No	Particulars	Quantity	Purpose of component
1	Fresh cow dung	1 kg	Micronutrients
2	Cow urine	1 lit.	Pesticidal value
3	Green neem leaves	1 kg	Pesticidal value
4	Besan	1 kg	Fermenting agent
5	Jaggery (gur)	100 gm	Fermenting agent
6	Water	10 lit.	base
	Total Amrit pani	14.1 lit.	

Method of preparation

Take 15 lit. capacity plastic bucket, then mix all above material into the bucket then it well mix using wooden stick and cover with lid, keep for 10 days below the shade. The mixture should be stir with wooden stick clockwise and anticlockwise for 5 to10 min every day in the morning and evening. After 10 days the mixture should be filter with cotton cloth then it is ready for spraying.

Dose of application

100 ml. amritpani mixed with 10 lit. of water and spray it on all crops at vegetative stage with spray pump. Use 2 lit. of amritpani + 200 lit. of water for one acre area.

Pest and Disease control

- Use of pheromone traps for control of pest
- Seed treatment with tricoderma for disease control
- Neem ark as preventive pest control
- Dashparni ark for pest control

Neem ark :

Table 3. Material required preparation of neem ark

S.No	Particulars	Quantity	Purpose of component
1	Dried neem seeds	5 kg	Pesticidal value
2	Soap powder	200 gm	Sticking agent
3	Water	10 lit.	Base
4	Plastic bucket	One	
	Total neem ark (5 %)	15.2 lit	

Method of neem ark preparation : take 5 kg dried neem kernel powder in 10 litres of water mix with 200 gms soap powder for 24 hrs. Then separate out neem ark by filtrate through cotton cloth and neem ark will be ready for spraying. Recommended spraying rate is 150 ml per 10 lit of water for one pump spray.

Dashparni ark:

Table 4. Material required Preparation of dashparni ark

S. No	Particulars	Quantity	Purpose of component
1	Leaves of neem	5 kg	Pesticidal value
2	Leaves of ghaneri (Lantana camera)	2 kg	Pesticidal value
3	Leaves of karanj	2 kg	Pesticidal value
4	Leaves of kanheri	2 kg	Pesticidal value
5	Leaves of jatropha or castor	2 kg	Pesticidal value
6	Leaves of gulvel	2 kg	Pesticidal value
7	Leaves of custard apple	2 kg	Pesticidal value
8	Leaves of rui	2 kg	Pesticidal value
9	Leaves of papaya	2 kg	Pesticidal value
10	Leaves of nirgudi	2 kg	Pesticidal value
11	Gomutra (Cow urine)	5 liter	Pesticidal value
12	Cow dung	2 kg	Pesticidal value
13	Water	170 lit.	Base
	Total Dashparni ark	200 lit.	

Method of preparation

Mix all above content in a 200 lit. plastic container or barrel. Keep it as for 5 days. Add 5-7 lit of water in it and mix again all the content. Keep the barrel as it for one month. Place it in shade. After one month separate the ark through sieve. You can use it for spraying as bio pesticide. Dose of application – Recommended spraying rate is 125 ml per 10 lit. water for one pump spray. Use 2.5 lit. dashparni ark along with 200 lit. of water per acre.

Promoting seed material of paddy against effect of climate change in Akole

Changing agro-climatic patterns would have direct impacts on food production in tribal of Akole. The projections pertaining to temperature increase, indicate major declines in agriculture food production, especially in rice and wheat (MOEF, 2012; Kelkar and Bhadwal, 2007), as also in cash crops. Adverse temperature and moisture conditions would result in yield losses and also would affect quality of food grains. Sudden variations in temperature, e.g. frost, can destroy crops overnight. India is among 27 countries that are most vulnerable to increase in the frequency and intensity of extreme events such as heat waves, storm surges, droughts, floods, etc. that can hamper or wash away crops (National Mission for Sustainable Agriculture, 2010). On this background WOTR team decided to promote farmers to cultivate varieties of paddy which stand adverse condition of climate in Akole. Following table 1 shows varieties for adverse climatic condition.

Table 5. Varietal resistance of paddy to adverse climatic condition

S.No	Name of variety	Duration (days)	Specific character	Av. Grain yield (Kg/ha)
1	Warangal	120-125	Resistance to rust disease	5140
2	Tamkud	110-115	Resistance to cold waves	3230
3	Kalbhat	120-130	Drought resistance	2755
4	Suhasini	130-135	Drought tolerant	5671
5	Laxmi	130-135	Drought tolerant	4860
6	Daftari-9	125-130	Rust resistance	6386
7	Rupali	110-115	Resistance to frost	6515
8	Punam	115-120	Resistance to frost	6950
9	Indrayani	135-140	Resistance to rust	7411
10	Vaishnavi	120-125	Resistance to cold waves	5428

(Source: Mehrtre, S. *et al* 2006)

Integrated organic paddy cultivation

Farmers traditionally grow paddy through both the chemical and the organic methods. Even traditionally, the dependence on external input was low. But in the last decade or so, the use of chemical fertilizer had gone up. Urea and DAP was applied in large quantities. The average production was around 8 quintals per acre in traditional method, 12 quintal per acre in traditional along with chemical fertilizer and 22 quintals per acre in SRI along with Organic formulations and use of urea-DAP briquets. In the years 2012 and 2013 kharif season, WOTR initiated the System of Rice Intensification (SRI) with 356 farmers with integrated nutrient management. Of these, nearly 300 farmers were started to adopt the organic formulations jeevamrit, amritpani and dashparni ark practices in paddy. Following table shows the comparative results of paddy cultivation.

Table 6. Average yield of paddy in different practices

No.	Type of Practice	Average yield in Quintal per acre
1	Traditional farming no use fertilizer	8
2	Traditional farming with chemical fertilizer	12
3	SRI method + INM + Organic formulations	22

During the subsequent seasons, the quantity of the chemical input in paddy cultivation was reduced gradually whereas that of organic input was increased. By taking Farmers Field School WOTR build up confidence and awareness to improve organic agriculture in tribal's in year 2011-12, while in 2012-13, the practice of combining chemical pest control, organic fertilizers for paddy cultivation along with SRI system of planting was promoted on 96 farmers field. Then after, next kharif 2013-14 WOTR team managed to shift from chemical insecticide to bio-extracts such as Amritpani, Dashparni and Nimboli ark for pest control in paddy. In the kharif season of 2013, pest control was completely through organic bio-extract with chemical pesticides being rarely used. The following table shows that pattern.

Table 7. Method conducted by WOTR for paddy cultivation

Year	Application of fertilizer	Rationale	Pest management
2011-12	Chemical fertilizer 40:20:20 kg NPK per acer.	Awareness of farmers to motivate organic agriculture	Chemical use
2012-13 kharif	INM - Use Urea DAP briquets 70 kg per acre, vermicompost 1 tons per acre	This was the second year wanted to know the effect and to build confidence in jeevamrit	Reduced Chemical fungicide and pesticide use
2013-14 kharif	INM - Use Urea DAP briquets 70 kg per acre, vermicompost 1 tons per acre	Started applying jeevamrit, use of bio fertilizer for seed treatment.	Use of bio-extracts.

Table 8. Grain yield, monetary returns and B:C ratio of paddy during *kharif* season 2012-13

S. No.	Name of the cluster	Name of the village	No. of demo plots	Av.Grain yield in demo plots (kg ha^{-1})	Av.Grain yield in control plots (kg ha^{-1})	% grain yield increased over control plot	Gross monetary returns (Rs. ha^{-1})	Cost of cultivation (Rs. ha^{-1})	Net monetary returns (Rs. ha^{-1})	Benefit : Cost ratio (B:C ratio)
1	Akole	Pimpri	8	5058	4475	13.02	69813	46354	23459	1.5
2		Ghoti	9	5167	4630	11.59	69970	39346	30623	1.8
3		Kohane	9	5142	4585	12.15	77349	46819	30530	1.7
4		Khadki kh	17	5927	5235	13.23	91900	43711	48189	2.1
5		Shiswad	7	4929	4260	15.69	70500	42084	28416	1.7
6		Khadki bk	7	4907	4135	18.66	65285	43700	21585	1.5
7		Purushwadi	6	5170	4520	14.38	72427	44306	28121	1.6
8		Wanjulshet	4	4983	4170	19.50	69249	43500	25749	1.6
9		Satewadi	5	6457	5460	18.26	99098	47540	51558	2.1
10		Umbarewadi	5	6107	5242	16.49	91599	47195	44404	1.9
11		Palsunde	19	7180	5725	25.42	107538	46864	60673	2.3
		Total	96							
		Average		5548	4767	16	80430	44674	35755	1.8

Though the WOTR would have ideally liked to shift to organic paddy as early as possible, the process has been gradual due to several factors. All the farmers were not ready for complete shift. Even from the technical point of view, the chemical practices followed have led to a depletion of microbial activity of soil. This will require some years to be restored. Farmers also do not have sufficient organic matter for a large-scale transition.

Results of Experiments

In 2011-12, the WOTR promoted awareness for SRI system of paddy cultivation, conduct farmers field school and build up confidence of farmers in tribal area. Next year 2012-13 implementations of SRI demo plots with use of organic formulations with INM, conducted 96 demos on 96 farmers field and compared with control plots. In year 2013-14 WOTR team started applying Urea- DAP briquets along with compost, vermicompost as well as bio-extract for pest and disease control, total 260 farmers benefited for cultivating SRI paddy. Almost 150 farmers have used vermi-compost in paddy and other crops. Following Table 2 shows that the detail study conducted in Akole villages of paddy crop in year 2012-13.

DISCUSSION

Total 96 crop demonstration were conducted in villages of Akole cluster on paddy crop, results indicated that, average grain yield of paddy (5548 kg ha^{-1}) was obtained in demo plot over the control plot (4767 kg ha^{-1}) and there was increases in grain yield by 16 % in demo plot. While the average NMR 35755 Rs.ha^{-1} with higher B:C ratio 1.8 in demo plots during kharif season of 2012-13. After seen the results of SRI paddy demonstrations conducted by WOTR team, farmers motivated to cultivation of SRI paddy in tribal area of Akole tahsil. Then, next year, farmers sown paddy by SRI method in his field, it is large achievement by WOTR team. In year 2013-14 kharif nearly 260 plots were cultivated by SRI method of paddy with use of organic compost, bio- pesticides and Urea- DAP briquets.

Conclusion

Bio-extract are used as spraying and soil application. Jeevamrit helps in increasing crop growth, improving soil health and increasing microbial activity in soil. Amritpani is a good tonic for crop it increases growth of crop. Neem ark and Dashparni ark is an excellent organic bio-pesticide. Use of Urea DAP briquets release slow nitrogen in soil it is beneficial to meet need of nitrogen for paddy crop. Farmers in tribal tract of Akole normally poor in economic condition, therefore, they have attracted toward the organic bio-pesticides because it has a low production cost and homemade formulations. More than 200 farmers are trained, in preparation organic formulations in Akole.

The way forward

An integrated approach will be followed for paddy, and it will take a few years for complete shift to organic paddy to take place. The WOTR team will also promote the traditional high yield variety of paddy, bring it back to mainstream and make the farmers conscious of the importance of having the control of seeds in their hands. The WOTR team believes that the organic approach to farming is holistic and caters to the need of farmers in tribal's and has high level of acceptance among villagers. This goal will be pursued with greater opportunity in coming period. The awareness & Knowledge regarding organic farming must be disseminate among the farmers for sustainable agriculture practices which controls hazardous effect on crop, soil, livestock and human being. Organic farming has a wide scope to maintain biodiversity in rural area and also scope improves social motivation to recover destruction of environment. It is need to promote organic farming in tribal area of Akole region with respect to climate change.

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