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DEVELOPING WATER EFFICIENT SUSTAINABLE ORGANIC FARMING IN RAINFED AGRICULTURE OF INDIA

J. S. Pachpute[1], S. T. Pachpute[2] and Sane G. G.[3]

[1]*Associate Professor, Agricultural Engineering Section*

[2]*Professor, Animal Science Dairy Science Section and*

[3]*Junior Research Fellow, RKVY Project on RRWHSFS, College of Agriculture, Pune*

Mahatma Phule Krishi Vidyapeeth, Rahuri

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Abstract: *Rainwater harvesting can reduce vulnerability to drought and improve sustainable smallholder viability in rainfed areas. Organic farming increases soil water and nutrient holding capacity and provides a low external input strategy for sustainable production, while also capitalizing on the comparative advantages of small-scale Indian farmers, who have used little chemical fertilizer on their farms. Socially, at local, sub-catchment level, soil management represents what could become a social networking movement, bringing together those rural people working towards sustainable land management. Rainwater harvesting, soil management and organic farming in combination represent a sensible strategy for rural development, which is socially, environmentally and economically sound. To eliminate rural poverty in semiarid rainfed areas of India, household food security should be aimed at, broad-based, economically sound, family farming on modest land units (mostly of the order of 2 ha). Based on the research conducted in RKVY project on Rain Runoff Harvesting for Smallholder Farming Systems, a three phase program is outlined to assist in the development of organic horticultural gardens and certified small commercial organic farms in rainfed areas of Maharashtra.*

Key words: *Rainwater harvesting, organic farming, soil management.*

Introduction

In India, rainfed agro ecosystem covers arid, semi arid and sub humid zones which represents more than 70% of the geographical area. Rainfed farming systems are more diverse and mixed as compared to irrigated areas where mono-crop, high intensive cropping systems are commonly established. Historically, rainfed farmers followed a low intensive sustainable farming system with excellent integration of crops-trees-pastures and livestock. The vast majority of rainfed farmers in remote areas still practice low external input or no external input farming which is well integrated with livestock, particularly small ruminants. Based on several surveys and reports, it is estimated that upto 30% of the rainfed farmers in many remote areas of the country do not use chemical fertilizers and pesticides (Katyal and Reddy, 1997). Thus, many resource poor farmers are practicing organic farming by default. The Government of India task force on organic farming and several other reviewers have identified rainfed areas as more suitable for organic farming in view of the low input use (GOI, 2001; Dwivedi 2005; Ramesh et al 2005).

There are about 1.32 billion people living today in India and more than half of them are or used to be actively involved in farming. Water for food production and nutrient conservation are key factors in their survival. There is necessity to develop Water System Innovations for sustainable crop production. The RKVY (Rashtriya Krishi Vikas Yojana) project on Rain Runoff Water Harvesting for smallholder farming systems (RRWHSFS) implemented in semi-arid areas of Maharashtra State, in *Gadakwadi* and *Thakarwadi* villages has developed an innovative system using storm water runoff to stabilize food production. Storm water runoff is slowed down, infiltration is encouraged, evaporation

is reduced, soil's water and nutrient holding capacity is increased and the overland flow is stored. By following this strategy the soil moisture availability in crop root zone is increased during the crop season and when required, supplementary irrigation is provided for saving the crop. This strategy reduced risk for small-scale farmers and simultaneously dealt with the soil erosion hazards generated at steep slopes where the flow of water is concentrated.

However, such technical solutions for rural development problems are not adequate for dealing confidently with the crises. Rural livelihoods in India depend on confident rural people feeling secure enough to invest their time and resources reasonably in wealth-creating activities. Looking towards the year 2050, this paper addresses current needs, reviews research into meeting both technical and leadership needs and presents a vision for breaking rural poverty.

Needs analysis of India's rural areas

The per capita water availability in the country is reducing progressively due to increase in population. The average annual per capita availability of water in the country, as per the 2001 census, was 1816 cubic meters which reduced to 1545 cubic meters as per the 2011 census. As far as agricultural land is concerned, the per capita availability of land is only 0.48 ha. Land degradation has deteriorated the quality of land and it is now estimated that about 175 million ha (53%) of the total cultivable area suffers from degradation in some form such as water erosion, wind erosion, ravines, salinization, water logging, shifting cultivation, degraded forests and special problems.

The National Water (Prevention and Control of Pollution) Act, 1974 and the national water policies of year 1987, 2002 and 2012 attempted to provide guidelines for community participation in Integrated Water Management, but thus far they have failed to connect adequately with issues of land use and community participation (Cullet, 2015). From independence till year 2012 the Ministry of Agriculture and Ministry of Rural Development have implemented several watershed development programme however, implementation on the ground has not progressed very far as only 571.07 lakh ha was treated out of the target area of 175 million ha. In Australia, Land Care is a farmer-driven national movement, strategically supported by a few government inputs. (Ewing, 1999). In year 2015, the World Bank-assisted 'National Watershed Management Project' or 'Neeranchal' received the approval for implementation by the Union Cabinet. The project aims to fulfill the watershed component of the Pradhan Mantri Krishi Sinchai Yojana (PMSKY) to reduce surface runoff of rainwater, increase groundwater levels and better water availability in rain-fed areas through several water user groups throughout the country. The challenge now is to identify and support strategies which will bring about food security at household level and also allow small-scale commercial farmers to enter the market place.

Leadership and livelihoods

Strengthened rural leadership is a prerequisite for sustainable rural development, as are participatory approaches, which help people to become actively involved in local development processes. Diversification of the rural economy is also essential to food processing, craft industries, agro-ecotourism, forestry, rural short term service industries and medicinal plant products. Household food security also has an important part to play in combining its obvious contribution to nutrition with community building, leadership, stimulation of self-confidence and training in basic land management. In addressing rural development, the role of horticultural gardens in promoting rural well-being and helping farmers to enter commercial markets needs to be addressed. Within the context of agricultural production, six priorities were concluded:

- Reduce drought vulnerability
- Improve water use efficiency
- Improve water quality
- Increase agricultural productivity
- Add value to agricultural products
- Reduce natural resource degradation.

In reviewing these six priorities, some research-based solutions are presented.

Reducing drought vulnerability

In year 2016, 330 million people were affected by drought in India. Both inter- and intra-seasonal droughts are common in most parts of India. The UNESCO conference on Integrated Drought Management made a number of recommendations Wilhite (1999). These included the establishment of early warning systems for drought and food insecurity and studies on drought forecasting and climatic instability. Strategies were proposed for reducing the health impacts of drought on vulnerable communities.

The rainwater harvesting with human efforts was started in India from 3000 B.C. Different parts of India used different structures for harvesting rain water. In Gujarat the *Jhalaras* and *Baoris* were used , *Tankas* and *Kundis* were popular in Rajasthan, in Bihar *Ahars* were used while Andhra Pradesh, Karnataka and Tamil Nadu show evidences of using *Ery* system which is a chain of tanks. Today the water conservation structures such as farm ponds are subsidized by GOI.

Improving water use efficiency

Improving water use efficiency requires that the available water should be optimally used. In semi-arid areas of Indian villages such as *Gadakwadi* and *Thakarwadi*, three factors contribute dramatically to crop failure namely high levels of evaporation; poor water infiltration; and low soil water holding capacity. The farms potentially lose more water in evaporation than the total annual precipitation. Most farming practices occur in areas where the mean annual potential evaporation, MAPE, (e.g. 1540 mm at *Gadakwadi*) exceeds the mean annual precipitation, MAP, (e.g. 650 mm at *Gaddakwadi*). Evaporation can be effectively reduced while protecting the soil against degradation, by the use of mulches. This simultaneously improves soil texture, reduces the oxidation of organic matter by the hot sun, reduces raindrop impact and thus soil erosion and with good conservation engineering (e.g. the uses of contour farming, dead-level contour banks, micro-catchment basins, tied ridges) can dramatically increase water infiltration.

Organic farming methods, based on the use of compost, crop rotation and the development of balanced farm organisms, help increase in soil water holding capacity. At *Gadakwadi* and *Thakarwadi* villages, the increase in infiltration due to the contour farming is approximately equal to ten rainfall recharges of 0.2 m, while mulches seem to reduce evaporation by about 40% and application of compost increased water holding capacity of the soils by 30 %.

The farm pond system catches and stores 1100 cu.m. water to supplement one hectare of crop with two irrigations using efficient water distribution method such as micro-irrigation system. In addition, the groundwater recharge is about 26% of the available water. Water was harvested from the upper collection area, stored in farm ponds and brought to a lower concentration area such as farms, where topography is steep and rainfall intensity high, At lower elevations the infield approach was established. Ploughing was done along the contour and a collection area of about 2 metres was left above the concentration area of about 1 metre, where two rows of crops are planted, one above and one just below a small basin, or micro-catchment formed by a dead level bund.

Improving water quality

Agriculture is a major polluter of streams, rivers and the atmosphere. Organic farming methods do not only increase water use efficiency by improving the water holding capacity of soils but uses the compost, which in supplying nutrients in the form of colloidal humus, ensures that these nutrients are stable, while remaining available to plants (Vereijken, 1998).

In the *wasserschutzgebiete* of Bavaria (Germany), farmers are fined for exceeding stipulated levels of pollution. If, on the other hand, pollution levels are below a lower threshold level, they receive a paycheque for their achievement. Many farmers have converted to organic farming to bring this transformation about (Vereijken, 1998).

India needs similar policies to control the agricultural pollution and maintain water quality.

Increasing agricultural productivity

The agricultural productivity in Indian farms is low. Improving rural livelihoods and increasing agricultural production requires confident and secure rural people. Effective local leadership is essential. However, given the low levels of rural incomes and low levels of management expertise, systems which are to contribute to raising agricultural production will need to incorporate strategies for building managerial skill, while working pragmatically with the small amounts of capital available. While fertilisers, pesticides and genetically engineered seeds can increase production dramatically, they require high levels of cash inputs, as well as high levels of managerial skill. Even where the inputs can be purchased and where the skills are present to manage them well, the failure rate will be high unless erratic water supply has been addressed. Technology can certainly raise production levels if these constraints are addressed, but raising productivity is more difficult (Kumar *et.al*, 2013).

Sustainable agricultural development must be built on local knowledge, culture and values (Chambers, 1983). Until local people understand and embrace new ideas in a way which is integrated with their norms, values and beliefs, outside innovations will always remain only as the *project* (Argyris *et al.*, 1985).

Adding value to agricultural products

Small-scale farmers generally find great difficulty in entering the world of commercial agriculture beyond local market sales. As soon as the local market has been exhausted, problems of transport, economies of scale, bank accounts, telephones, packaging, continuity of supply, consistency of quality and poor prices, make it difficult for small-scale farmers to make money out of agriculture. The rainfed farmers have used very few chemical fertilisers or pesticides and so their comparative advantage is that they can easily convert to organic production. Given the current rapid development of organic markets, both in India and in the more developed economies, there is a real opportunity for small-scale farmers to move into this market niche, first here in India and later into the export market as soon as quality and quantity have progressed sufficiently. Further opportunities for manufacturing of jams, preserves and processed and packaged agricultural products could capitalise on the Fair Trade markets, with their premiums for produce from developing economies, as well as the organic premium currently commanded by organic produce worldwide. This double premium, together with the value added through processing, will give small-scale farmers entry to markets which would otherwise be closed to them. The one requirement is that production is sufficiently organised to benefit from these opportunities.

Reducing natural resource degradation

The soil erosion, urbanisation and chemical farming have taken their toll on natural resource integrity. Rainwater harvesting, community leadership and organic farming can play a major part in addressing these problems. Since it is at local level that land is abused or cared for, it is more practical to work at local level through Participatory Land Care Groups (PLCGs). Using PLCGs as the vehicle for addressing natural resource degradation is a practical way of building a network of local activities and support structures. The work in the *Ralegaon Siddhi* or *Hivare Bazzar* villages in Maharashtra (Tiwari *et. al* , 2007, Sakhuja, 2008, Sangameswaran, 2006), as well as a number of other catchment projects show how local participation can contribute to integrated catchment management. These three practices organic farming, rainwater harvesting and the formation of local PLCGs are mutually reinforcing and together constitute a workable rural development strategy. Having analysed some of the major needs in our rural areas and identified some of the opportunities in the market place and some issues which need to be addressed, let us look at what Indian rural areas could look like in 2050.

A vision for the year 2050

In the first few years i.e. the pilot phase training courses should developed which can be run

effectively in Agricultural Colleges/institutes by the time that the next consolidation phase begins. During consolidation phase pilot projects may begin with appropriate monitoring and evaluation mechanism, Once the consolidation phase has shown that it is possible to scale up the effort effectively, the Institutionalization Phase can begin, with government taking the lead role in establishing the network of organic farmers. Establishing such a network of organic farmers and organic fruit gardeners should go hand-in-hand with the setting up of farmer networks and cooperative marketing operations.

Conclusions: Water and nutrient conservation technology have an important role to play in the evolution of sustainable rural development strategies for India. In order to be effective, technology must be combined with vocational education and assisting farmers to organise and develop Participatory Land Care Groups and Farmer Networks. These networks will be able to secure niche markets for farmers if they find ways of adding value effectively, such as helping their members to become certified organic producer groups. A strategy for rainwater harvesting, organic farming and land care requires a long term planning horizon if it is to contribute towards banishing rural and peri-urban poverty.

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