Journal of Rural Development and Agriculture (2016) 1(1): 20-29

REVIEW PAPER

Organic farming: Hope for the sustainable livelihoods of future generations in Pakistan

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ABSTRACT Organic farming is centuries old human and natural intervention which has been eco-friendly and economically viable. It comprises eco-friendly agricultural techniques leading towards the maximum production without using chemical inputs. Nature friendly farming approach helps in reducing the negative effects of environmental pollution by recycling crop rotation, using crop debris, farm yard manure, pest control with biological methods, appropriate tillage, cultivating legumes to add organic matter in the soil and to mitigate the climate hazards. A majority of rural population in Pakistan is willing to adapt the organic farming practices to save their input costs for better livelihoods. The present component of Pakistan economy is agriculture which contributes 21% to GDP and adds more than 45% labor in agricultural activities. The Pakistani farm-home women are playing a great role in agricultural development and livestock management. Organic farming is efficient for eco-system providing a balance in the life of human, crops and animals; hence leading to the sustainability of the system.

Keywords: Agricultural development, Food security, Future prospects, Livelihoods, Organic farming

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To cite this article as: Anjum, A. S., Zada, R., & Tareen, W. H. (2016). Organic farming: Hope for the sustainable livelihoods of future generations in Pakistan. *Journal of Rural Development and Agriculture*, *1*(1), 20-29.

INTRODCUTION

Organic farming movement started in many countries in response to the dangers to the livelihoods of the farming community and their surroundings (Rundgren, 2006). Now-a-days, 85% of the world produce is contributed by smallholders that supply food to the needy population. A majority of the smallholders face poverty and cannot afford costly inputs (International Federation of Organic Agriculture Movements [IFOAM], 2015).

Due to increase of contaminants in food items contributed by chemical pesticides and fertilizers; health risks are increasing at a high level. These chemicals also have bad effect on wildlife as well as other beneficial organisms like earth worms which help in improving the soil health (Maass Wolfenson, 2013). Organic farming is the solution to recover the soil made of salt intake by local natural organic matter as a ground cover with compost and organic fertilizer (Yousafzai et al., 2016). The source of the production of compost and organic fertilizer which contributes much to the economy of Pakistan is livestock. It plays a crucial role to support family income and jobs for the landless, smallholders and women in rural communities. It has been estimated that 30-35 million rural populations of Pakistan is getting 30-40% of their income through livestock directly or indirectly (Government of Pakistan [GOP], 2007a). Organic food fulfills the human nutritional vitamins, minerals, enzymes and micronutrients. Pakistan has to produce extra food grains to meet the dietary needs of the increasing population which is currently over 191.71 million (Pakistan Economic Survey, 2014-15). Overall dietary needs of the population have reached to twenty million tons wheat (Alam, 2003). It has been reported that harmful pesticides spray applied by the farming community contaminated nearly 10-15 percent of stored food during storage (Ali et al., 2011). Moreover, the researchers face the challenges of post-harvest losses. During sixties, Green Revolution was introduced in developing

countries through the use of chemical inputs and high yielding crop seeds. This increased food production but caused health and environmental risks (Ahmed et al., 2002).The similar scenario was witnessed in the entire world where gains were achieved putting life into risks, so an urgent response was needed to combat the alarming situation (Food and Agriculture Organization [FAO], 2012).

Conventional agriculture produces about one third of global greenhouse gases by the use of chemical inputs, machinery and livestock (FAO, 2011a). It results in wind and water erosion from soil surface, loss of soil fertility, water holding capacity and desertification due to overgrazing especially in Africa and northern meadows in Pakistan (FAO, 2011b). Moreover, pesticides and herbicides are accumulated in groundwater below the agricultural lands. Other pest and disease problems include more than four hundred pests and seventy dangerous pathogens have become resistant to one or more pesticides (Labelling Ecology Approved Fabrics [LEAF], 2010). Salinity and sodicity affected nearly 6.28 million hectares land in Pakistan and caused potential yield reduction. Soil degradation through natural hazards has also damaged the soil. The maximum erosion rate estimated was 150-165 tones/hectare/year (Bhutta, 2010).

Organic farming is the solution to recover the soil made of salt intake by local natural organic matter as a ground cover with compost and organic fertilizer (Baldwin, 2006). The source of the production of compost and organic fertilizer which contributes much to the economy of Pakistan is livestock (Chaudhry et al., 1999). It is estimated that 30-35 million rural populations of Pakistan is getting 30-40 percent of their income through livestock directly or indirectly (GOP, 2006). The fertilizer gap can be filled by organic farming with the addition of bio-fertilizers, vermin-composting, composting as well as crop rotation of cover and leguminous crops (Ali et al., 2015).

During the last few years, the horrific events such as climate change, natural disasters, land degradation, pollution of the environment and decline of biodiversity posed a threat to food security and nutrition in the world and created a state of development challenges related to the environment, socio-economic and security (United Nations International Strategy for Disaster Reduction [UNISDR], 2012). The safe food production threatens the most vulnerable people of the world, and high food prices have reversed the achievements in decreasing hunger as well as poverty. A serious and united response is needed among different people of the world to combat the problem of safe food production (FAO, 2008). Narayanan (2005) reported that conventional agriculture is unsustainable due to reduction of crop production, damage of environment and contamination caused by chemicals. An alternative method of crop production has emerged in the form of organic farming that produces good quality foods by using ecological phenomenon. Willer and Kilcher (2011) were in argument that organic farming can be performed by composting, cover cropping, intercropping, green manuring, farm yard manuring, effective microorganisms technology, mulching, and use of humic acids. Organic farming helps the communities to take interest in community development and safe environment (Wyatt, 2010).

Organic farming is a method which deals with the growing of plants and rearing of livestock in a natural way. This method involves the use of local biological material by avoiding chemical substances to maintain and enhance soil fertility and environmental balance by minimizing the pollution and wastage of resources. It involves the nature friendly agricultural principles like green manure, organic waste, integrated pest management (IPM) and crop rotation. In organic farming, little use of pesticides as well as fertilizers becomes possible only if these are natural and do not give any harm to the environment (Kesavan & Swaminathan, 2008).

When organic wastes (plant debris, farm yard manure, grass clipping, decomposed leaves etc) is compiled, the decomposition process starts. The microorganisms begin to decompose the organic materials and the temperature inside the pile rises up to 54-65 ˚C within three to four weeks of decomposing. It is very important to maintain the adequate aeration and moisture during the microbial activity that produces the compost in the shortest period of time. When the organic matter is completely decomposed and the temperature decreases to about 37 °C, then the compost is ready for use. On-farm compositing method includes piles, pit compositing and vessel compositing (Morgera et al., 2012).

Prospects of eco-friendly agriculture in Pakistan

1. Pakistan and organic agriculture

The current agriculture system is an essential component of Pakistan's economy and it accounts 21% share to gross domestic product. It acts as a source of employment as human labor for more than 45% people of Pakistan, while 60% of rural population is directly involved in this sector for its livelihoods (GOP, 2007b). Pakistan has a great potential for organic farming as the most of the farming community is interested in adapting organic farming technologies for their sustainable livelihoods and biodiversity in addition to reducing their farm expenses (Husnain & Khan, 2015). There is a need of awareness among the people of Pakistan about the benefits of organic farming. Eco-farming is being practiced in Pakistan at about six million hectares of the cultivable land is arid and rainfed regions (Baig et al., 2013). The soils in Baluchistan, Azad Jammu and Kashmir (AJK), Gilgit-Baltistan, Khyber Pakhtunkhwa (KPK) and northern areas of Punjab are available for organic farming where organic fertilizers and natural pest control with favorable climatic conditions are only tools for the farming community (Rasul & Hussain, 2015). During 2008, National Institute of Organic Agriculture (NIOA) was established at National Agricultural Research Centre, Islamabad. This institute is involved in working on organic farming techniques and disseminating new knowledge to the smallholders across the country (Musa et al., 2015).

Unfortunately, there is lack of inspection and certification system of organic products due to which their export is limiting to a great extent. The agriculture income is decreasing due to poor price policies of the government related to markets of agriculture products. Therefore, it is crucial to transfer the latest technologies of organic agriculture to the farming communities and to allow the rural women to participate in organic production. Easy loans and regular trainings should be arranged for these women to improve the organic production. The sustainable agriculture develops the farmer capacity especially stallholder and farm-home women to achieve the goal of their own resources like water, soil, meadows and forests. It also creates the farmers capacity to use their own local natural resources for the growth of their living standards which ultimately contribute in economic growth of the country (FAO, 2014).

The smallholder eco-friendly agriculture is the key to open the window towards sustainable future by saving the millions of souls from hunger and malnutrition (Serageldin & Steeds, 1997). There is an alternate option in the shape of home gardening trainings, bio-control of harmful insects/pests, Farmer Field Schools (FFS), nursery raising, seed bank, strategies of rain harvesting, conservation of land and water, and provision of poultry and livestock to the needy peasants. The Pakistani farm-home women play a great role in agricultural development and livestock management. The women farmers produce 80% of food and have a close relationship with land and food production of Pakistan (FAO, 2011d).

2. Plant protection and low yield

Although the gap between extension and research is very broad but it can be filled with mass education. In Pakistani rural society, the small medium farmers comprise 93% of the whole farming community, of which 81% cultivate less than 12.5 acres of land (World Bank, 2007). This majority of smallholders always face problems in seeking the field solutions from agricultural extension workers. Research and extension are the two basic elements of agricultural development. At present, the linkage between these two components is very weak. This gap can be filled with adequate funds, proper capacity building trainings, coordination between research, extension and the farming community. Research organizations should establish outreach components to design and evaluate appropriate extension methodologies by using information and communication technology (Rwelamira, 2015). The average of major crops production in Pakistan is around 50-83% which is less than that of the developed countries (Iqbal & Ahmed, 2005). The realization of this potential could offer unfinished tremendous opportunity for the future growth of agriculture. The introduction of valuable crops such as saffron, herbs, mushrooms and dried fruits in specific areas can bring a revolution in the lives of people. This revolution can occur only in a few years after the establishment of local cooperative system as well as the export facility supported by the organic certification system.

Organic farming can play a vital role in the betterment of rural and urban communities. Two thematic evaluations regarding organic agriculture and poverty reduction were done by International Fund for

Agricultural Development (IFAD) during 2001-2004 in Latin America, Caribbean and Asia (China and India). The evaluations examined the practices of organic methods associated with poverty reduction, food security and trade. The results were very promising for adapting nature friendly agriculture techniques along with better marketing (International Fund for Agricultural Development [IFAD], 2013).

As far as the use of chemical fertilizers is concerned; its use can be minimized by the preparation of organic fertilizers on the farm which is quite simple. Different organic substrates are easy to find in rural areas such as plant debris, leaves, grasses and weeds, farmyard manure, phosphate rock, press mud, gypsum, sulphar mud and green algae etc. (Kadir et al., 2016). The material is decomposed after mixing the ingredients and covered with plastic sheet which usually takes 45 days. This simple activity can save a huge number of the farming community. Organic fertilizers give the excellent results when used in crop rotations and green manure. The soil health can be restored every 4-5 years with the cultivation of leguminous crops to add organic matter and maintain the health of the soil (National Institute of Organic Agriculture [NIOA], 2012).

Local poisonous plants like neem (*Azadharacta indica*), Aak (*Calotropis procera*), Arosa (*Adhatoda vasica*), chili (*Capsicum annuum*), garlic (*Allium sativum*) with insecticidal properties contribute well in the management of harmful pests. The bio-pesticides have remarkable effect against the leaf cutters along with repelling the sucking insects (Directorate of Organic Farming [DOF], 2010).

3. Conservation agriculture

Conservation agriculture reduces the requirement of water up to 70%. The countries of Latin American are predominantly adapting the soil conservation techniques at 10% of the total world area (FAO, 2010). Only 1% increase in farm area has been recorded in the last 52 years in Pakistan, which was originally 48.6% at that time. The 18% area of Pakistan is rainy, while nearly 82% of the farm land is irrigated. With the help of water harvesting techniques nearly 0.9 million hectares can be brought under irrigation for better production. Organic agriculture and better drainage facilities can save more than 21.5 billion rupees per year. If the rainy water collecting tanks may be developed to drive the irrigation water, then a large area of cultivable wasteland (about nine million hectares) can provide good agricultural production. Moreover, a huge amount of money (about 21.5 billion rupees) can be protected per year if the soils are improved by developing drainage system as well as the use of organic material (South Asian Association for Regional Cooperation [SAARC], 2011).

4. Condition of marketing system

There are four climates in Pakistan. Dry hot areas of Pakistan produce fruits like dates, citrus, mangoes, while other three cold climatic zones produce apricots, apples and plums etc in Gilgat-Baltistan, Quetta and Swat valley. The most of the fruit grown in Gilgit-Baltistan ripen at the end of summer and the start of rainy season (Gilgit Baltistan Bulletin, 2011). Evidently, this is not the ideal climate for sun drying of fruits. Even when the day is sunny, the night temperature falls rapidly resulting in dew and frost. Any fruit left out in the open area is thus damaged. Moreover, a huge loss of fruit occurs due to lack of enough roads from farmer field to the market, improper post-harvesting techniques, non-availability of skilled labor, lack of easy loans as well as serious diseases of fruit. Due to these problems, 30-50 percent of the fruit production is destroyed (Khan, 2012). The valleys of Baltistan, Gilgit and Hunza are producing apricot, mulberry, almond, apricot, cherry and apple. In these areas, each village is producing dry apricot (8-10 tons), dry mulberry (1-1.5 tons), almond (1 ton), dry apricot (5 tons), fresh cherry (2 tons) and fresh apple (25 tons) ("Hunza Apricots: Reaching Great Heights," 2006). Large quantities of fresh and dry fruit are being produced from northern regions of Pakistan but due to lack of necessary management practices, more than half of the quantity is being wasted (Alam & Mujtaba, 2002).

The local producers in northern areas are facing many challenges in fruit harvesting, processing, grading, marketing and trading with foreign states to earn sufficient income for enhancing the living standards of the local people. Moreover, the scope of sea buckthorn and wild mushroom has potential in these regions to earn billions of rupees every year. Sea buckthorn is abundantly available in northern areas where a heavy capital can be earned and employment can be offered to the local people (Niaz, 2009).

The northern and southern areas of Kashmir having blessed lands produce cherries, pear, apples, walnut, citrus, mangoes and guava ("Economic Survey 2014-15: A General Review," 2015). Billions of dollars can be earned annually by providing marketing facilities in association with local agriculture related organizations having organic certification facility. The same areas in Baluchistan, Sindh and desert regions must be given priority in training facilities, storages, small equipments like solar driers, bio-gas units, post-harvest technology, packing, labeling and transportation.

Private trading agencies can contribute by cooperating with the public bodies to establish a strong marketing system to fulfill the local and foreign needs. A plan to support small scale agro-based industries in rural areas would check the migration of youth towards cities and thus the burden on cities will be reduced in terms of shortage of resources.

5. Development of small farms

The most of the rural society in Pakistanis lacking agricultural skills and the resources are destroyed such as burning of wheat straw after harvest, injudicious use of field grasses and plant debris, the post-harvest losses and huge grain losses due to inadequate storage facilities (Siddiqui & Sarwar, 2002). In many parts of Pakistan, warm climate is too favorable for the cultivation of flowers and herbs with a huge export potential in other countries. Value addition is another activity to earn huge capital, and the circumstances are still favorable if only a small support is made possible by the government to the smallholders. Farm-house women can bring a revolution in the community by providing organic food on the cost of small and simple loans in Pakistan.

6. Plant breeding techniques and issues of certified seeds

Agricultural research and development (R&D) mentions the most fruitful investment on agriculture sector in developing countries. R&D also refers to the investment on education, infrastructure and input credits. During 1965-2000, almost 50% of global crop production was achieved due to better crop management and improved plant varieties (Martino & Baethgen, 2014). The plant breeding division of agriculture has been severely affected due to the reason that various plant genetic organizations of Pakistan have not invested to boost up this division. The high yielding varieties can be developed by the conservation and sustainable use of plant genetic resources of plant breeding. These varieties would be efficient in utilizing nutrients and water as well as adaptable under biotic and abiotic stress conditions (Haggag et al., 2015). In Pakistan, during the past, the activity of private seed companies has increased due to the liberal government. Priorities should be given to private farms near agricultural research stations for seed production. In addition, seed certification services must strengthen their role to ensure food standards. A struggle is being done by Monsanto and other multinational organizations of seeds to seize and control over the global seed market and to make the farmers slaves. This is indeed an alarming situation for the developing world and its solution is only to save our own indigenous seeds that would be adaptable in our environment.

7. Water harvesting techniques

The benefits of irrigation are very important however judicious use of water plays a very important role in crop production and sustainable agro eco-system. It is estimated that irrigated agriculture in poor countries with 20% of all cultivable land is used for 47% of all crop production (FAO, 2016). The use of the best irrigation techniques contributes in feeding 9 billion people with expansion of irrigated areas (Foley, 2014). Pender (2008) reported that water harvesting and soil moisture conservation techniques are crucial to improve the fertility of soil and to reduce costs of chemical fertilizers and pesticides. The water courses can be channelized on water reservoirs and in deserts during the rainy season to save from the drought-hits, in addition to check dams that are built to save water for future requirements. Many beneficial traditional management techniques can help to expand the cropping area even in deserts or in changing climates. Today, the storage capacity of water has been limited to 30 days of supply, while the recommended storage capacity is 1000 days for countries having similar climate (Khan, 2014). Increase in temperature affects the snowmelt and flow of the Indus River, the main power source.

8. Urban agriculture

The population in the cities of Pakistan is increasing due to migration from rural villages putting enormous economic pressure and creating environmental pollution and health hazards (Azam & Khan, 2015). Roof top gardens have become popular among residents of large cities by creating greenhouses on the rooftops. Organically produced food in this method is safe, economical and less resources are needed (Germain et al., 2008). Moreover, the empty places on the edges of roads, canals and parks can be taken to grow for legumes, leafy vegetables and fruit trees. Herbal, vegetable and flower gardens can produce organic food as well as employment opportunities for the poor masses of the cities. At the same time, environmental pollution can be reduced and the fresh air is available for good health. The city waste can be turned in to compost and huge capital can be earned by this activity with the cooperation of private-public partnership (Modak et al., 2010).

9. Ecologically-based organic model in Brazil

The progress in eco-friendly agriculture in Brazil was initiated by rural elite agriculturists and agriculture-based professionals (Brandenburg, 2002). Ecologically-centered farming system was promoted by strong political system that is involved with the progress of a new model of society, associated with equality and justice. More than 55% of the Brazilian population is a part of the middle class. It has been noticed that in Brazil 70% of all the food consumed comes from the small holders. The great success of Brazil is multiplying the food quantity without expanding the use of lands and damaging the environment. This is also a tool against climate change and ecological imbalance. The main tools of agricultural production in Brazil are elimination of subsidies, enough funding and resources allocated for R&D and agro-based industry in rural areas (Madre & Devuyst, 2016). Moreover, strengthening of contact farming, promotion of family entrepreneurs, creation of domestic markets and cooperatives are playing a vital role. Small holding farmers were promoted in the area of direct sale-system and market safety. The modernization of agriculture in Brazil started in the southern states during 1970s with a movement against monoculture with the loss of genetic bio-diversity especially agro-biodiversity, along with soil erosion, water contamination and loss of capital in rural sector (Pereira, 2012).

10. Prevention of post-harvest losses

The fruit and vegetables (12-14%) are destroyed during the post-harvest activities due to improper handling, extreme temperature, high humidity, improper packaging and poor transportation and marketing (Asian Productivity Organization [APO], 2006). Recycled organic matter is simply used for packaging instead of plastic and paper bags in which large quantities of perishable fruits and vegetables can be stored. The main objectives of postharvest technology applications include quality maintenance (appearance, flavor and nutritive value), food safety and reduction of losses between harvest and consumption (Kitinoja & Kader, 1995). Simple, low cost, eco-friendly technologies can be more appropriate for limited resources stallholders to supply food items to the poor countries. Moreover, the growing demand for organically produced fruits and vegetables offer new skills for smallholder growers and traders (Kelly & Metelerkamp, 2015)

11. Organic farming and climate change mitigation

Organic agriculture has the capacity to mitigate greenhouse gases through nature friendly farming methods that enhance fertility of land and promote the use of natural substrates. The organic farming technologies consider organic management as relevant mitigation and adaption practices such as introduction of leguminous crop in to crop rotation, soil cover techniques, mixed and combined farming methods and sustainable agronomic practices (FAO, 2011c). A report published by environmental think-tank German watch stated that Pakistan was among the three states most affected by severe climate hazards during 2012 (Naeem, 2013).

CONCLUSION

Although, there is enough food available, everyone has the food, yet there are nearly 1 billion people worldwide who are facing hunger and another 1 billion are suffering from malnutrition owing to lack of

micronutrients they need to lead a healthy life. A majority of poor people cannot approach the food or access it. This is the situation of extreme poverty, natural disasters, conflict and war, poor infrastructure and overexploitation of the environmental resources. Organic farming is simple, cheap and effective in helping the poor communities around the world to have healthy food and better living conditions adapting the methods of good natural cures for the community. It is very important to know that all the farmers can improve their production with best appropriate agricultural techniques that are environment friendly. In addition, it is very important to advance emergency documentation and training under good biological technologies to ensure that smallholder farmers can have the best sustainable food production for the future human generations. Pakistan can learn from the Brazilian experience and flexible model combining the resources of all the provinces of Pakistan under the strong socio-political system.

Author Contribution Statement Abdul Sattar Anjum drafted the manuscript. Roshan Zada and Waqarul Hassan Tareeen conceived the review and helped to draft the manuscript.

Conflict of Interest The authors declare that they have no conflict of interest.

Acknowledgements The authors thank Faisal Sohail Fateh, Senior Scientific Officer, National Integrated Pest Management Program, National Agricultural Research Centre (NARC), Islamabad, Pakistan for editorial suggestions.

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