



Organic Farming in Northeast Region of India: Boon for Environmental Sustainability

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(Received 18 August 2022, Accepted 01 October, 2022)

(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The changes observed in the environment are occurring slowly over time. Organic farming has the nature friendly approach and it acts as a natural tool for the environmental protection and sustainable development while considering the agricultural production system. Environmental health is the prime importance for organic farming. In the crop production technique of organic farming mineral fertilizers and other chemical pesticides are not encourage, so the nutrient and energy cycling is increased and the retentive abilities of the soil for nutrients and water are also enhanced. Such management techniques plays an important role in boosts the stable biodiversity, promotes water conservation and water management, reduce climate change and helps in soil erosion control. The paper presents a framework for selection of indicators based on the principles of organic agriculture which may be used to monitor and improve the performance of organic agriculture with respect to environmental sustainability. On the basis of review of scientific literature the impact of organic agriculture on environmental sustainability is studied in North Eastern region of India.

Keywords: Sustainable Agriculture, Organic Farming, Environmental Sustainability, NE India.

INTRODUCTION

Organic farming is the boon for environmental sustainability besides providing the healthy food along with money and ethics. It preserves the soil, ecosystem and people. The impact of organic agriculture on natural resources is essential for both agricultural production system and conservation of nature. Organic farming favours the endeavour for sustainability and it provides the produces which are free from harmful residues and maintain harmony with nature by sustainable methods (Bordoloi 2021 a; Darnhofer *et al.*, 2010). It is a holistic approach of integrated farming which provides the scope for produces food without using conventional fertilisers, synthetic pesticides, growth hormones, chemicals or genetically modified organisms. The aim of organic farming is to produce food by establishing an ecological balance to prevent soil fertility or pest problem. It is based on ecological processes, biodiversity and always imparts importance to local conditions instead of use of inputs with adverse effects to the nature. It combines the traditional, innovation and scientific ideas to benefit the environment and promote a fair relationships and good quality of life for all involved (Anonymous, 2009; Bordoloi *et al.*, 2020). Organic farming is prevailing in India from ancient time. The history of organic farming of India is available from long back from 4000 years ago in the Vedic period, as in *Arthashastra* it is

mentioned that the farmers of that period had the fair knowledge about the sustainability of soil, seed selection, plant protection, sowing seasons and soil fertility management in different lands organically by following the natural laws (Chandra *et al.*, 2004; Sofia *et al.*, 2006).

India rank 9th on the basis of organically managed agricultural land and produces 10 percent of organic product in the entire world. In India 5.21 M ha land is under organic certification out of which 69.45 thousand hectare is from Northeast India (Anonymous, 2020). Northeast India has vast scope to become a major supplier of organic product. Environmental concern as well as economic concern is the driver of increasing the demands of organic products. The cautiousness to health and increasing the purchasing power of the consumers the demands for organic vegetables and other products are increasing in Domestic market as well as in International markets (Bordoloi 2021 b; Das *et al.*, 2018).

Environmental health is the prime importance for organic farming. It has the nature friendly approach and it act as a natural tool for the environmental protection and sustainable development. This paper aims to assess the ways of environmental sustainability through organic agriculture based on scientific evidence in Northeast India.

Effect of organic farming on soil health and its productivity. Organic farming is the blessings for the

environment more particularly for the soil which otherwise managed by harmful chemicals and pesticides. Healthy soil is the base for grow healthy crop. One of the objectives of organic farming is to management of soil organic matter for maintaining the soil physical, chemical, and biological properties (Ramesh *et al.*, 2005; Bordoloi, 2021 c).

In general conventional agricultural production system is based on short term soil fertility management, otherwise the organic agricultural production system is meant for long term soil fertility management as well as for sustainable soil health management practices. Organic management of soil can improve the soil structure, organic matter content and porosity of soil (Papadopoulos *et al.*, 2014; Bordoloi and Islam 2020). It also lowers the nitrate leaching capacity of soil. In organic farming nature friendly techniques are used to creates a more stable and environmental friendly system which sustains the soil fauna and flora. For soil nourishment in organic farming organic manures, green manures, beneficial micro-organisms along with crop rotations, inter-cropping, cover crops etc. are use successfully for getting holistic production and maintain a sustainable environment. The green manuring crop like dhaincha (*Sesbania aculeata* L.) significantly improves the grain yield of rice and chickpea (Singh *et al.*, 2001). Application of organic fertilizer not only provides nutrient to the standing crop but also it provides the nutrients for the succeeding crop (Jannoura, 2014). Minimum tillage is also an objective of organic farming, which also helpful for protects the soil from degradation. The application of organic matters to soil helped to increase the grain and straw yield of rice (Sharma and Mitra 1990). The FYM improves the crop yield in to a satisfactory level compared to unfertilized plot. The microbial biomass is vital to maintain the productivity of soil. For release of nutrients from organic matter to the plants it is required to have balanced amount of microbial biomass in the soil (Pandey and Singh 2012; Sanjay-Swami and Singh 2020). According to Bhardwaj *et al.* (2014) soil treated with organic fertilizers hosts billions of useful micro-organisms which break down chemicals, plant residues and livestock wastes into useful soil nutrient that is very much essential for binding and structural characteristics. More overuse of organic sources of nutrients increase the growth and activity of mycorrhizae and other beneficial organisms in the soil that increase the secondary nutrients and micronutrients and beneficial for soil health management and crop productivity (Nambiar *et al.*, 1992).

Apart from other organic matter, vermicompost is a good source of organic fertilizer. It helps for soil building up along with supplies the major and micro nutrients to the soil. Several reports are there which implies the positive results of crop production and soil health management by application of vermicompost. Bordoloi (2021 d) had also stated that the application of vermicompost and bio-fertilizer along with reduced rate of chemical fertilizers had given significantly higher yield of tomato as well as has the capacity to improve the soil health with increased amount of soil nutrients in

Meghalaya. Higher numbers of fruits in brinjal by application of vermicompost is recorded by Tomar *et al.* (1998). Likewise Jat and Ahlawat (2006) were recorded the increased yield of chickpea and improved dry matter accumulation, grain yield and grain protein content in chickpea by application of 3 t/ha vermicompost to the crop field.

Effect of organic farming on conservation of biodiversity. Organic farming is the milestone for encouragement of natural biodiversity. It substantiates the environmental protection, biodiversity enhancement, sustainable resource use, reduced energy use and CO₂ emissions. It is also associated with ecological services like soil formation and conditioning, soil stabilization, waste recycling, carbon sequestration, nutrients cycling, predation, pollination, habitats etc. Organic farming provides the higher crop yield without overwhelming the costly inputs. Northeast India is characterized by biodiversity hotspot of India with diverse agro-climatic situations and geographical locations. The introduction of traditional species of plant and animal is encouraged in organic farming (Anonymous, 2011). Meghalaya is a mega biodiversity region receiving very high rainfall. It is also rich in biomass production. In North East India a potential of 46 million tonnes of manures comprising of crop residues and livestock excreta is there which is almost equivalent to the requirement for organic production in identified areas of the North eastern part of India (Bujarbaruah, 2004). The valleys of Northeast India are rich in organic matter but on steep slope organic matter status is poor to medium because of continuous removal of topsoil (Das *et al.*, 2018).

Organic Farming encourages healthy and stable biodiversity. There is an ample potential for higher productivity due to the presence of abundant natural elements in the organic farm as because more diversity is an ecosystem gives result for more stable system. Several studies reveal that organic farming system reflex higher biodiversity compared to the conventional farming. Bengtsson *et al.* (2005) stated that the average species richness was 30% higher in organic farms compared with conventional farms especially for birds, plants and predatory insects. The diverse biodiversity components of the organic farms may be interlinked with each other and increase the abundance of other components like insects similar to bees are dependent on the flowering plants including weeds in the organic fields or may be to the adjacent field (Hald, 1999). Organic farming reduces the erosion of agricultural biodiversity and enhances species richness and abundance by almost 30% as compared to inorganic farming methods. Norton *et al.* (2008) stated that even though organic farms were associated with heterogeneous landscapes which in itself had given higher biodiversity, they also actively increased the field and farm complexity compared with conventional farms in the same landscape resulting benefits for biodiversity. In conventional farming traditional or conventional seeds, breeds and farming methods are used which provides resistance to infectious diseases. Moreover intensive agricultural system disturbs natural

habitats and their heterogeneity results for the less biodiversity (Yadav, 2013; Bordoloi, 2021 e). The use of genetically modified organism is also not permitted in any stage of organic food production, processing or handling. Although there is profuse numbers of widely documented positive effect on biodiversity and abundance of wild species in the organic fields and field margins, the effect of organic agriculture differs with type of farms and the type of landscape, especially the degree of heterogeneity and percentage of cultivated area.

Effect of organic farming in water conservation and water management. Organic farming plays an important role in water conservation and water management and it has the capacity to provide quality food without hampering the environment. In organic farming soils are loaded with organic manures which increased the nutrient retention abilities of the soil and as a result the water infiltration and retention capacity also improved due to the improvement of soil structure. The soils loaded with organic matter acts like a sponge that keeps soil and plants moisture. According to Dumanski *et al.* (2006) organic farming has the capacity of recharge underground water up to twenty percent. Organic farming checks the ground water pollution. In conventional farming polluted runoff water contaminates the basin water as well as the ground water. The toxins, antibiotics to the livestock's, chemicals to the crop for nutrient and pest management are not allowed in organic farming, so it prevents the water contamination. In organic farming water conservation can also be done by mulching and moreover heavy dose of organic matter increase the water retention capacity of the soil, so less irrigation water is required in organic farming as compared with conventional farming.

Effect of organic farming on climate change. Organic farming system addresses the issues of green house gas emission and global warming by sequestering carbon in the soil system. The organic agriculture has been found to emit lower levels of green house gas compared with conventional farming system in per hectare of crop cultivation (Lynch *et al.*, 2011). Organic agriculture means for reducing the non-renewable energy use by decreasing the need for agrochemicals. The energy use per hectare is low in production of organic crops compared to conventional crop production. Some studies stated that healthy organic agriculture system can slow down the climate change as it reduces the emission of carbon dioxide. Some organic agriculture practices like reduced tillage, use of crop rotation, nitrogen fixing legumes etc. can maximise the carbon concentration in the soil. So, the soil organic carbon contents under organic farming are considerably higher than the conventional farming system. Moreover the use of legumes and catch crops in organic rotations the nitrous oxide emissions per hectare in organic crop rotations is less as compare to the level of emissions in conventional rotations (Bordoloi, 2021 f; Chirinda *et al.*, 2010). Organic agriculture helps to mitigate the greenhouse effect and global warming through its ability to sequester carbon in the soil. More overdue to

the application of organic manures in organic production system the soil organic matter content is increased and leads to net carbon sequestration in organic crop rotations (Azeez, 2009). It is possible to reduce the relative magnitude of green house gas emission per kilogram of product produce by adopting organic farming when it is compared with conventional farming systems. More the ability of soil to retain the organic carbon, higher the mitigation potential of agriculture against the climate changes (Kassow *et al.*, 2010). The countries where intensive agriculture is follows a significant part of total emissions of green house gas is occupied by agriculture system. The total amount of green house gas emission per kilogram harvested crop depends on the relative yields of the system. Knudsen (2011) found in his 14 out of 17 life cycles assessment studies on organic crops that approximately 10 to 30 percent less green house gas emissions per kilogram of crop yield is occurs compared with conventional agriculture production system.

Effect of organic farming on combating erosion. Organic agriculture not only improves the yield of crops but also improves the soil physical, chemical and biological quality for maintaining the sustainable soil environment. It reduces runoff loss by improving soil binding. According to Lotter *et al.* (2003) the organic farming is good for those areas where rainfall is very high as it helps for better absorption and less runoff water in the field. In organic agriculture the soils are becomes nutrient rich and becomes suitable for sheltering of earthworms, nematodes and encourage the bacterial growth like Rhizobium. It makes the soil less sandy and improves the physical and biochemical properties of soil and as a result the runoff loss of nutrients is reduced and helps for combating erosion.

Organic farming on supporting animal health. Organic farming mostly linked to natural farming where animals can live happily on the farmland. Birds, fishes, insects and other animals were allowed to feed naturally and encourage natural predation for pest control in organic farming by preserving their natural habitat. The domestic animals were allowed to feed naturally by grazing as well as by providing chemical free feedings with clean and healthy environment which encourage them to be naturally healthy and resistant to illness. In organic farming chemicals are not encourage which results a rich organic area for flora and fauna such as pollinators and pest predators (Hole *et al.*, 2005). More diverse farm may be capable of flexibility with weather conditions, diseases and pests attack and simultaneously less biodiversity, where less natural biological components are available is associated with increase the prevalence with infectious diseases, pests and bed weather condition.

CONCLUSION

Organic farming helps for environmental sustainability by promoting a less polluting agricultural system. It offers a viable system of crop production which assures the sustainability of environment as in organic agriculture biodiversity in soil is increases, reduces the

runoff loss as well as nutrient loss, enhances the soil productivity and encourages the predation for pest control. Organic farming system is a highly complex and integrated biological system to maintain good soil health and other component of agriculture production system and environment. The negative impacts on environment from agriculture are creating the issues of unsustainability of the environment. Organic agriculture ensures the reduction of natural resources degradation, soil enrichment and conditioning, soil stabilization, eco friendly waste decomposition, carbon sequestration, balancing the pest and predation and encourages the pollinators. It has both direct and indirect effect to soil properties as it affects more than one component of the system simultaneously. Organic agriculture can balance the resource use efficiency and environmental performance which are important for resource sufficiency perspective of sustainability. But it may not be enough to solve the challenges of global food demand and agriculture. The productivity of organic farming is somewhat less compared to conventional farming. So, there is a need to identify suitable crops and other products on regional basis for organic production that has more demands nationally and internationally for income generations. For getting the full benefit from Organic agriculture all the aspects like economical, social and institutional aspects need to be considered. Further research are needed for commercialization of Organic farming in North Eastern Region of India by implementation of modern and improved technology for income generation and for environmental sustainability.

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How to cite this article: Popiha Bordoloi & A. Arunachalam (2022). Organic Farming in Northeast Region of India: Boon for Environmental Sustainability. *Biological Forum – An International Journal*, 14(4): 302-306.