ORGANIC FARMING IN RESILENCE WITH CLIMATE CHANGE

Laraib Ahad , Rayees Afzal Mir

Glocal School of agricultural sciences Glocal University, Saharanpur (UP). India 247121
raies.afzal@gmail.com

Abstract: Organic farming offers a system that can reduce environmental impacts compared to conventional farming. Climate change mitigation is not (and should not be) the primary objective of organic farming, but increased conversion to organic agriculture can contribute to the reduction of greenhouse gas emissions, while also bringing important benefits, such as improved system resilience to the effects of climate change, maintaining or improving biodiversity on farmland, conserving soil fertility, reducing eutrophication and water pollution, and improving food security and farmers' sovereignty. To provide healthy food in a sustainable way, we need to transform the food & farming system and transition to agriculture and food production that can adapt to unavoidable climate change whilst preserving our natural heritage such as biodiversity, sustaining the quality of our soils, improving the livelihood of farmers, protecting the health and welfare of farmed animals and ensuring that the food produced promotes health and is of high quality.

Keywords: organic farming .eutrophication.biodiversity.conventional farming.climate change etc

INTRODUCTION: Organic farming, as an adaptation strategy to climate change and variability, is a concrete and sustainable option and has additional potential as a mitigation strategy. The careful management of nutrients and carbon sequestration in soils are significant contributors in adaptation and mitigation to climate change and variability in several climate zones and under a wide range of specific local conditions. Organic farming as a systematic approach for sustained biological diversity and climate change adaptation through production management, minimizing energy randomisation of non-renewable resources; and carbon sequestration is a viable alternative. The purpose of potential organic farming is therefore to attempt a gradual reversal of the effects of climate change for building resilience and overall sustainability by addressing the key issues. Research is needed on yields and institutional environment for organic farming, as a mitigation and sequestration potential.

Climate change is one of the biggest challenges of our time. Agriculture's role is twofold: it is a sector that contributes to climate change, yet it is also one of the first sectors to suffer from climate change, as do the people whose livelihoods depend on it. The impact of agricultural practices, food wastage, and diets must all be taken into account if we are to understand how food and farming can positively contribute to climate change mitigation and adaptation, while simultaneously ensuring food security. The issue about what is produced to meet human needs, what is produced for intermediate production purposes (e.g. livestock feed) and what is wasted between the field and the kitchen must all be part of the discussion.

Clear impacts from climate change are being witnessed in agriculture. Impacts are both positive as well as negative. They are, however dependent on latitude, altitude and type of crop. There have been noticeable impacts on plant production, insect, disease and weed dynamics, soil properties and microbial compositions in farming systems. According to IPCC 2007a, a temperature change in tropical areas has in general had a negative impact on food production and it is estimated that food production within South Asia will decrease by about 30% by 2050.

According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), greenhouse gas (GHG) emissions from the agricultural sector account for 10–12% or 5.1–6.1 Gt of the total anthropogenic annual emissions of CO2-equivalents1. However, this accounting includes only direct agricultural emissions; emissions due to the production of agricultural inputs such as nitrogen fertilizers, synthetic pesticides and fossil fuels used for agricultural machinery and irrigation are not calculated. Furthermore, land changes in carbon stocks caused by some agricultural practices are not taken into account, e.g., clearing of primary forests. Emissions by deforestation due to land conversion to agriculture, which account for an additional 12%2 of the global GHG emissions, can be additionally allocated to agriculture. Thus, agriculture production practices emit at least one-quarter of global anthropogenic GHG emissions and, if food handling and processing activities were to be accounted for, the total share of emissions from the agriculture and food sector would be at least one-third of total emissions. Considering the high contribution of agriculture to anthropogenic GHG emissions, the choice of food production practices can be a problem or a solution in addressing climate change.

Although causes and effect relations of climate change and agriculture are seen many forms and extent, assessment of those relations and effects of climate change on agriculture and the impact of (both conventional and organic) agriculture on climate change are not properly documented. Understanding of these nexus is vital not only to improve the agricultural sector productivity but it is also important to positively contribute to the environmental management regime at large.

Nitrous oxide emissions not only contribute to the greenhouse effect but also to the depletion of stratospheric ozone. Almost 90% of the global atmospheric N2O is formed during the microbial transformation of nitrate (NO2 -) and ammonia (NH4+) in soils and water. Globally, agriculturecontributes 65-80% of total N2O, mainly from nitrogenous fertilizers on cultivated soils, cattle and feedlots. N2O emissions from soils are due to the unproductive loss of mobile N. Any nitrogen input (mineral and organic fertilizers, biologically fixed N, crop residues) and the mineralization of nitrogen compounds in soils, contribute to the emission of N2O. Especially in agricultural soils, elevated N2O production depends on the nitrogen fertilization level.

Agriculture is believed to account for roughly two-thirds of the total man-made methane (CH4) emissions; mainly from paddy rice fields, burning of biomass and ruminants (enteric fermentation and animal waste treatment). Aerobic agricultural soils, however, are considered sinks for atmospheric CH4.

In this backdrop, global communities are in a quest of identifying more efficient farming practices which reduce GHGs emissions (mitigation) as well act as resilient systems that able to adapt impacts of climate change (adaptation). Organic agriculture is being considered as one of the appropriate farming systems that could serve the twin objectives of climate change mitigation and adaptation.

Benefits of Organic Farming

1. Recycling wastes of plant and animal origin in order to return nutrients to the land, thus minimizing the use of non-renewable resources.
2. Reduce global warming by lowering emission of greenhouse gases hence temperature rise.
3. Enhances biological diversity within the whole system and increase soil biological activity
4. Minimizes indiscriminate use of pesticides affects on human and animal health, biodiversity of wildlife etc. & cause of environmental pollution.
5. Maintains long-term soil fertility and overcome micronutrient deficiency.
6. Reduce energy loss for both animal and machine, and risk of crop failure.
7. Promote the healthy use of soil, water, and air, as well as minimize all forms of gaseous pollution that may result from agricultural practices.
8. Highly adaptive to climatic change due to application of traditional skills, farmers knowledge, soil fertility building techniques and a high degree of diversity.

The Fourth Assessment Report of the IPCC (Inter-governmental Panel on Climate Change states that “a wide array of adaptation options is available, but more extensive adaptation than is currently occurring is required to reduce vulnerability to future climate change. There are barriers, limits, and costs, but these are not fully understood" (IPCC 2007). The Bali Action Plan from the UN Climate Change conference in Bali in 2007 (UNFCCC 2007) clearly emphasizes the importance of enhanced action on adaptation. Organic farming has an inherent potential to both reduce GHG emissions and to enhance carbon sequestration in the soil. (Table 1). However, the adaptation aspects of organic agricultural practices must be the focus of public policies and research. One of the main effects of climate change is an increase of uncertainties, both for weather events and global food markets. Organic agriculture has a strong potential for building resilience in the face of climate variability. Organic farming addresses many of the key challenges identified for adaptation to climate change and variability and it fulfils many of the criteria, which are seen as important general UN Millennium Development Organic farming.

Major findings of IPCC 2007 Crop productivity is projected to increase slightly at mid to high latitudes for local mean temperature increases of up to 1-3°C depending on the crop, and then decrease beyond that in some regions. At lower latitudes, especially seasonally dry and tropical regions, crop productivity is projected to decrease for even small local temperature increases (1-2°C), which would increase risk of hunger. Globally, the potential for food production is projected to increase with increases in local average temperature over a range of 1-3°C, but above this it is projected to decrease. Increases in the frequency of droughts and floods are projected to affect local crop production negatively, especially in subsistence sectors at low latitudes. It is projected that crop yields could increase up to 20% in East and Southeast Asia while they could decrease up to 30% in Central and South Asia by the mid-21st century. Taken together and considering the influence of rapid population growth and urbanization, the risk of hunger is projected to remain very high in several developing countries.

CLIMATE CHANGE MITIGATION STRATEGIES FOR AGRICULTURE SECTOR

Intergovernmental panel on climate change (IPCC, 2007b) has suggested following mitigation technologies practices which currently commercially available and useful for the mitigation of climate change impacts on agriculture sector before 2030s (i.e. average of period 2021-2050). Restoration of cultivated peaty soils and degraded lands.

Improved crop and grazing land management to increase soil carbon storage. Improved rice cultivation techniques and livestock and manure management to reduce methane emission.

Improved nitrogen fertilizer application techniques to reduce nitrous oxide emissions.

Dedicated energy crops to replace fossil fuel use. Improved energy efficiency and improvement of crop yields.

In addition to above IPCC also suggested some of the adaptation strategies for agriculture sector like adjustment of planting dates and crop variety, crop relocation, improved land management e.g. erosion control and soil protection through tree planting, use of rainwater harvesting, water storage and conservation techniques, water-use and irrigation efficiency. Above all strategies are site and location specific and can be used as per applicability.

ORGANIC AGRICULTURE WHY?

Sustainable agriculture to meet the country's food production requires sustainability of the natural resources. Natural resources which play an important role in the crop production system include viz. arable land, water, soil and biodiversity. These natural resources are rapidly shrinking due to pressures of increasing population density, socio-economic pressures, impact of climatic variability on monsoon (temporal and spatial variation in rainfall), increase in surface temperature and increasing phenomenon likes floods and droughts (Chakraborty, 1998; Sharma, 2001). Other problem includes rapidly decline of groundwater levels in the several parts of the country (CGWB, 2009), deteriorating soil health due to over use, soil erosion and imbalanced use of fertilizers (Pandey and Singh, 2012). Depleting water resources and the land degradation are major threat to country's food production and environmental security. Therefore, proper management of natural resources is needed. Organic agriculture can serve the purpose to ensure sustainable agriculture due to its holistic approach of organic crop production system and have potential for meeting food demand, maintaining soil fertility and increasing soil carbon pool in context of climate change (Pandey and Singh, 2012). Basically an organic production system is designed to- Enhance biological diversity within the whole system Increase soil biological activity. Maintain long-term soil fertility. Recycle wastes of plant and animal origin in order to return nutrients to the land, thus minimizing the use of non-renewable resources. Rely on renewable resources in locally organized agricultural systems. Promote the healthy use of soil, water, and air, as well as minimize all forms of pollution thereto that may result from agricultural practices (Source: Muller, 2009).

Organic farming as a mitigation strategy may address both emissions avoidance and carbon sequestration. The first is achieved through:

- lower N_2O emissions (due to lower nitrogen input)—it is usually assumed that 1–2 percent of the nitrogen applied to farming systems is emitted as N_2O, irrespective of the form of the nitrogen input. The default value currently used by the IPCC is 1.25 percent, but newer research finds considerably lower values, such as for semi-arid areas (Barton et al., 2008).
- less CO_2 emissions through erosion (due to better soil structure and more plant cover)—there usually is less erosion in organic farming systems than in conventional ones.
- lower CO_2 emissions from farming system inputs (pesticides and fertilizers produced using fossil fuel).

The highest mitigation potential of organic farming lies in carbon sequestration in soils and in reduced clearing of primary ecosystems. Soil carbon sequestration is used to describe both natural and deliberate processes by which CO_2 is either removed from the atmosphere or diverted from emission sources and stored in the oceans, terrestrial environments (vegetation, soils and sediments). It is greatly enhanced through agricultural management practices (such as increased application of organic manures, conservation tillage, cover crops, nutrient management, irrigation, restoring degraded soils, pasture management, soil use of intercrops and green manures, higher shares of perennial grasslands and trees or hedges, etc.), which promote greater soil organic matter content and improve soil structure (Niggli et al., 2008). Increasing soil organic carbon in agricultural systems has also been pointed out as an important mitigation option by IPCC (2007b). The global carbon sequestration potential by improved pasture management practices was calculated to be 0.22 t C per ha per year. Assuming 0.2 t C per ha per year for organic farming practices, the total carbon sequestration potential of the world's grassland would be 1.4 Gt per year at the current state, which is equivalent to about 25% of the annual GHG emissions from agriculture (FAOSTAT, 2009)

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