International Federation of Organic Agriculture Movements

The Role of Organic Agriculture in Mitigating Climate Change

There is dramatic evidence that various Greenhouse Gases are responsible for Global Warming and climate change. It is also clear that the most important solution to Global Warming is the dramatic reduction of fossil fuel use, and that other strategies shall not be an excuse to continue with business as usual. A study commissioned by IFOAM discusses the potential of Organic Agriculture both to avoid and to sequester Greenhouse Gases (GHG), and makes comparisons with conventional agriculture.[1] The second part describes how Organic Agriculture can be considered within the implementation mechanisms of the Kyoto Protocol. The study shows that organic agriculture can play a role both for reducing GHG emissions and to sequester carbon.

The role of agriculture in climate change

Agriculture is a major contributor to emissions of methane (CH_4), nitrous oxide (N_2O), and carbon dioxide (CO_2). On a global scale, agricultural land use in the 1990s has been responsible for approximately 15% of all GHG emissions.

One third of all carbon dioxide emissions come from changes in land use (forest clearing, shifting cultivation and intensification of agriculture). Approximately two thirds of methane and most of nitrous oxide emissions originate from agriculture.

At the same time, agriculture offers options to reduce GHG significantly. One is to reduce emissions and, thereby, to minimise the production of atmospheric CO_2, CH_4 and N_2O. Agriculture shares this emission reduction potential with industry and other sectors. The second option consists in systematically sequestering carbon dioxide in soils and in plant biomass. It is unique for all types of land use.

However, the potential contribution of the land use sector for climate protection is limited. Although sinks in vegetation and soils have a high potential to mitigate increases of CO_2 in the atmosphere, they are not sufficient to compensate for heavy inputs from fossil fuel burning. The long-term solution lies in a reduction of the use of fossil fuel (developing alternatives to fossil fuel, reduce energy consumption etc.). Yet the contribution from the land use sector could buy time during which alternatives to fossil fuel can take affect. But mainstream agriculture is moving in an opposite direction; increasing releases of GHG from the green sector have made agriculture a producer of global warming rather than a mitigating factor.

[1] Kotschi J & Müller-Sämann K (2004): The Role of Organic Agriculture in Mitigating Climate Change. IFOAM. Bonn. 64 pp. downloadable from www.ifoam.org/Neil: PATH ??

The emission reduction potential of Organic Agriculture

Organic Agriculture can significantly reduce carbon dioxide emissions. As a viable alternative to shifting cultivation, it offers permanent cropping systems with sustained productivity. For intensive agricultural systems, it uses significantly less fossil fuel in comparison to conventional agriculture. This is mainly due to the following factors,

- Soil fertility is maintained mainly through farm internal inputs (organic manures, legume production, wide crop rotations etc.),
- Energy-demanding synthetic fertilizers and plant protection agents are rejected, and,
- External animal feeds - often with thousands of transportation miles - are limited to a low level.

As a consequence, the organic variants have in most cases a more favourable energy balance. Nevertheless there are reasons for organic farmers to do more to further reduce their dependency on fossil fuel and there are reasons to pay attention to the energy use on the food distribution system.

In avoiding methane, Organic Agriculture has an important though not always superior impact on reduction. Through the promotion of aerobic microorganisms and high biological activity in soils, the oxidation of methane can be increased. Secondly, changes in ruminant diet can reduce methane production considerably. However, technology research on methane reduction in paddy fields – an important source of methane production - is still in its infancy.

Nitrous oxides are mainly due to overdoses and losses on nitrogen. These are effectively minimized in Organic Agriculture because:

- No synthetic nitrogen fertilizer is used, which clearly limits the total nitrogen amount and reduces emissions caused during the energy demanding process of fertilizer synthesis.
- Agricultural production in tight nutrient cycles aims to minimize losses.
- Animal stocking rates are limited. These are linked to the available land area and thus excessive production and application of animal manure is avoided.
- Dairy diets are lower in protein and higher in fibre, resulting in lower emission values.

Using biomass as a substitute for fossil fuel represents another emission reduction option. Organic Agriculture is well positioned in this sector. It has the advantage that inorganic N-fertilizers are not applied, which cause significant emissions of N_2O and use a lot of energy.

The sequestration potential of Organic Agriculture

Organic Agriculture has a particular sequestration potential as it follows the key principle of tight nutrient and energy cycles through organic matter management in soils. This is achieved through improved practices in cropland management and in agroforestry.

Various long-term trials provide evidence that the regular addition of organic materials to the soil is the only way to maintain or even increase soil organic carbon (SOC). The systematic development and application of organic fertilization technologies has been the domain of Organic Agriculture for many decades and outstanding results have been achieved so far. Key issues of technology development have been:

- To optimise the quantity and application of organic manure. A close integration of crop production and animal husbandry and the systematic recycling of organic waste are basic elements.
- To improve organic waste processing techniques to obtain high quality manure. Through composting of animal and plant residues losses in the humification process are minimized and a higher proportion of the solid humus fraction is achieved.

Long and diversified crop rotations and legume cropping are further characteristics of Organic Agriculture that help to increase SOC.

In conventional agriculture, conservation tillage is largely promoted as a measure to sequester carbon dioxide. This technology combines minimum tillage with organic covers, herbicides and often herbicide resistant GMO crops. Both of the last two are prohibited in Organic Agriculture. Latest research results revealed that gains in soil organic carbon have been overestimated and are partly or completely offset by increased N_2O emissions. Thus it can be concluded that minimum tillage combined with mineral fertilizer application compares less well with Organic Agriculture if the focus is on GHGs in general rather than considering carbon sequestration alone. The task of Organic Agriculture will be to integrate conservation tillage in a way that negative effects are avoided.

Agroforesty – a management system that integrates trees in the agricultural landscape – is another technology that is systematically applied in Organic Agriculture. It is a feasible method to succeed shifting cultivation systems but also to improve and add value to low productive cropland. Agroforestry holds the biggest potential of agricultural carbon sequestration in tropical countries.

It is worth noting that the sequestration of carbon, i.e., an increase of soil organic matter is also leading to more fertile soils, better water retention capacity and reduced nutrient leakage.

Organic Agriculture - a strategy for climate protection

Several the measures mentioned above are often referred to as “recommended management practices”. Any type of agriculture could use them, but Organic Agriculture is unique in the sense that it offers a strategy that systematically integrates most of them in a farming system. This strategy comprises compulsory standards superior in their impact on climate protection. It also comprises a well functioning mechanism of inspection and certification that guarantees compliance of the organic principles and standards. The strictness of the system has made Organic Agriculture accountable and a generator for innovation.

As a conclusion, Organic Agriculture could contribute significantly to reduce GHG releases and to sequester carbon in soils and biomass. Secondly, there is sufficient evidence that Organic Agriculture is superior to mainstream agriculture. This is even more important as the capacity of Organic Agriculture to contribute to the mitigation of climate change can be considered as an ancillary benefit to its primary goal of sustainable land use. This primary goal is achieved by gains in soil productivity, consecutive food security, biodiversity conservation and many other benefits.

As opposed to the focus of conservation agriculture on a single technology, Organic Agriculture follows a site-specific and systematic approach that includes a comprehensive set of integrated technologies. Because of the inspection and certification systems required in Organic

Agriculture, monitoring and evaluation of carbon sequestration is simplified and cost-effective in comparison to conventional agricultural practices.

Policymakers should recognise the potential of organic farming for GHG reduction and develop appropriate programs for using this potential. Such programs may look into the emission reduction potential, in the sequestration potential, in the possibility for organically grown biomass, or in combinations of all the aspects. This is as relevant in developed countries as in developing countries.