



Briefing Note

Agriculture in the context of climate change – mitigation strategies

The background

The impacts of global warming are noticeable even today, as manifested by the increase in extreme weather events such as storms, droughts, floods and heat waves. In agriculture they are resulting in diminishing crop yields or even crop failures. The primary cause of the changes to the climate that have been observed for about the past 30 years, is attributed to greenhouse gases emitted by human activity. Agriculture accounts for almost one third of these, with roughly half being direct emissions, and the rest originating from changes in land use, for example the transformation of forests into agricultural cropland. The conversion of natural vegetation into arable and pasture land and the subsequent degradation of the soil release large quantities of CO₂ and nitrous oxide (N₂O). Carbon dioxide is produced in agriculture in various ways: slash-and-burn practices, the burning of harvest residues and the use of machinery. Nitrous oxide (N₂O) is released as a consequence of the mineralisation of organic matter in soils, the improper use of fertilisers and the storage of manure in the open air. Methane (CH₄) is produced in livestock farming, through ruminal fermentation, poor manure management techniques and when growing paddy rice. Agriculture is in fact the primary source of global N₂O and CH₄ emissions, accounting for a 60% share. Both of these gases have a significantly greater climate impact per unit of gas than carbon dioxide. More than half of the greenhouse gases emitted by agriculture worldwide are released in developing and emerging countries.

Up to now the measures that GIZ has supported in agriculture have mostly been focused on adapting to climate change. In future it will also assist its partner countries in reducing greenhouse gas emissions. It will help them to integrate appropriate action into their national development strategies. The aim is to use technologies and approaches that combine climate change mitigation measures with the reduction of other environmental impacts while simultaneously contributing to poverty alleviation. It is also important that the measures play an effective part in long-term reorientation towards a climate-friendly, low-carbon economy and harness cost-efficient potential for large-scale reductions in greenhouse gas emissions.

There are a range of opportunities for making such reductions in agriculture, which can be divided into two categories. One focuses on carbon sequestration in soil, for example through the build-up of organic matter, and the other on the reduction of emissions from agricultural activities. The latter category includes the dissemination of new methods of growing wet rice, for instance, or the improvement of fertiliser management.

Carbon sequestration in soil offers the greatest potential for reductions. It is estimated that of all the technical mitigation measures in agriculture, 89% come into the category of carbon sequestration in soil and only 11% are classed as emission reductions.

One approach that is currently the subject of international debate is climate-smart agriculture, a field in which the Food and Agriculture Organization of the United Nations (FAO) and the World Bank are taking a leading role. Climate-smart agriculture combines three elements. It increases the resilience of agricultural production systems to climate change, thereby ensuring better adaptation while also as a consequence improving food security. In addition it reduces greenhouse gas emissions, for example through targeted use of nitrogen fertilisers, and improves carbon storage by increasing the amount of organic matter in soil. That said, there are still certain reservations and questions surrounding methodology, financing and political enforceability. Climate-smart agriculture is seen by many as not being a strategy in its own right but rather as being part of sustainable agricultural practice.

Our position

In this context, GIZ takes the following positions:

1. Bioenergy is a two-edged sword

Biofuels are capable of replacing fossil fuels to a certain extent, thereby reducing the emission of greenhouse gases. However, the production of bioenergy crops also causes the release of climate-impacting gases such as nitrous oxide and CO₂. These severely restrict the positive effect that bioenergy might have on the climate. Furthermore, the production of bioenergy crops competes with food production. On the other hand, biofuels produced from cellulosic waste materials such as leaves, wood chips or green waste, do not constitute direct competition, nor do algae-derived biofuels. Development of these types of fuels is still in its infancy, however, and requires further targeted support, including through international cooperation.

2. Efficient energy use is a must

Efficient energy use in agriculture poses a major challenge, as does efficient energy production. Savings in energy use in developing countries, and above all in emerging economies, can primarily be made in irrigation and, at domestic level, in fossil fuels for transportation, heating and cooking. This will mean using solar pumps, for example, and energy-efficient stoves that consume less firewood. Disseminating such stoves in rural areas is an integral part of the drive to reduce greenhouse gases. International cooperation can support the partners in this work.

3. Emissions trading is of no interest to small-scale farmers

The sale of carbon credits is largely irrelevant to smallholders. For them, the proceeds from the sale of tradable permits from voluntary carbon reduction programmes, such as that backed by the World Bank in Kenya for example, are of minor significance. They contribute only little to improving their incomes. Boosting income by increasing production as a consequence of adaptation measures is considerably more important for these farmers.

Our recommended actions

In order to secure the supply of food to a growing global population, it is vital to utilise and develop synergies between adaptation measures and mitigation measures in agriculture. Such synergies are achievable in the production of inputs such as seed and fertiliser as well as in agricultural goods. Further mitigation potential is available in processing, trade, consumption and disposal.

GIZ considers the following the most important recommendations for action:

1. Make greater use of regional planning and land-use planning

Regional planning and land-use planning should be put to greater use. They lay the foundation for promoting appropriate greenhouse gas reducing land-use methods that combine sustainable forestry, agroforestry and agriculture. This is because a large proportion of the emissions caused by agriculture stem from inappropriate land use, such as the draining of moors, land degradation and deforestation.



2. Promote new soil management methods

Soil management methods that reduce emissions of greenhouse gases need to be encouraged. In developing countries such measures include increasing the carbon content of the soil, for example by green manuring, inter-and relay cropping or growing perennial crops and forage grasses. In emerging countries, technically more sophisticated measures tend to be used to reduce greenhouse gas emissions. These include cropping practices such as minimal tillage or new forms of paddy rice management. Improved fertiliser management matched to the soil and crops helps to limit emissions of nitrous oxide.

3. Adapt livestock rearing to environmental conditions

Adopting appropriate livestock farming systems can make a key contribution to reducing greenhouse gas emissions in partner countries. Better pasture management that prevents overgrazing and erosion improves the sward and thus increases the amount of organic matter in the soil. Improved fertiliser management in conjunction with the use of biogas reduces emissions of methane in particular. In future, international cooperation can build on this potential and integrate it into a climate-friendly strategy for sustainable agriculture.

4. Speed up and improve the implementation of research results

Agricultural research should be more closely focused on increasing mitigation potential in agriculture. In animal breeding, for example, it should concentrate on more efficient digestion and feed conversion, and in plant production on developing cropping systems that offer greater mitigation potential, including carbon storage in soils. In addition, researchers should develop methods for assessing the mitigation potential of various cropping systems in order to be able to quantify the possible reduction in greenhouse gases. The translation of research results into practice is crucial, and greater attention should be paid to this aspect in future.

5. Develop new means of financing mitigation measures in agriculture

The methods used to finance mitigation measures in agriculture need to be modified by introducing new mechanisms, for example ones that combine adaptation with mitigation measures. Both private-sector and government actors should participate. The options available include launching special-purpose funds or setting up market mechanisms. Once the mitigation potential of various cropping systems has been quantified, this could be used as the basis for introducing incentive mechanisms to promote improved systems in the long term. The possibilities include state subsidies or targeted concessions.

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