How can organic agriculture contribute to long-term climate goals?

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Implications

The EU countries aim to reduce their emissions of greenhouse gases (GHG) by 80-95% by 2050 (European Commission, 2011). The food sector accounts today for 25% of Swedish greenhouse gas emissions, most of which arise in agricultural production, so there is a need for radical reduction of GHG emissions in this sector. For organic farming in Sweden, this implies that it is time to move beyond the discussion on whether organic products have a lower or higher life-cycle climate impact than conventional products (Cederberg et al 2011). Instead, the interesting question is: What can and should be done to drastically reduce the climate impact of organic agriculture? The science-based response to that question is relevant for Swedish agriculture as a whole.

Development towards lower climate impact from organic agriculture requires further monitoring and technology development to reduce emissions of nitrous oxide, methane and carbon dioxide. But it also involves developing production systems that are more efficient in the use of nutrients, energy and land, as well as shifting focus from producing animal food towards more legume, grain, vegetable and fruit products.

Background and objectives

EPOK's aim is to disseminate knowledge and coordinate and initiate research on organic agriculture in Sweden. As the climate impact of organic agriculture is high on the agenda, a knowledge synthesis was initiated (Röös and Sundberg 2013). The aim was to describe the state of knowledge and identify knowledge gaps regarding greenhouse gas emissions from organic agriculture in Sweden and its potential to contribute to reduced climate impact from the food sector. This required an explanation of the principles of systems analysis needed for comparison of climate impact from different agricultural production systems.

Key results and discussion

Improved nitrogen efficiency: Nitrous oxide emissions from soil are the largest, but also the most uncertain source of greenhouse gas emissions from agriculture. It is important to monitor emissions from current and alternative production systems. It is known that nitrous oxide emissions are linked to availability of surplus nitrogen, so improved nitrogen use efficiency is important for reducing the nitrous oxide emissions from organic agriculture.

Higher yields: Increasing the yields and decreasing losses in organic production is important for decreased climate impact per kg of product. High yields caused by increased nitrogen use efficiency gives double climate benefit, but other measures aiming at higher yields may be in conflict with animal welfare or biodiversity.

Increased soil C stocks: Grass and clover forage, common crops in organic farming, contributes to reduced climate impact through increased soil carbon stocks (Leifeld and Fuhrer 2010). However, very high increases in soil carbon are required if this is to compensate for methane emissions from ruminants. The climate benefit can be large if grass and clover is used for bioenergy production.

Resource efficient systems: Energy use is a minor part of greenhouse gas emissions from agriculture, but the energy used is largely of fossil origin. This can be replaced by renewable fuels, and bioenergy production for on-farm use requires only a small proportion of the agricultural land (Ahlgren, 2009). There is a need for research and development for design of production systems that produce valuable products with reduced requirements on land and other limited resources. Optimal use of local resources such as pasture land, local feed crops, by-products and waste heat is necessary, in order to reduce the pressure on global land and energy resources.

More vegetarian food: Swedish organic farming is dominated by milk production, but animal products have much higher climate impact than crop produce. There is a need for development of organic production of new and old crops for human consumption in a variety of production systems (with or without livestock, and in mixed systems that produce animal and vegetal foods). In these systems, nutrient supply is a key issue. Anaerobic digestion of manure, grass and residues can contribute to nutrient supply as well as reduced climate impact through supply of renewable energy.

How work was carried out

The synthesis was based on a review of scientific literature and interviews with about 30 researchers in scientific and technical subjects. In a report from the project, mechanisms for emissions of nitrous oxide, methane and carbon dioxide are described, as well as climate aspects in a systems perspective, including life cycle assessment, food production, bioenergy production, land use change, and climate aspects of nutrient cycles (Röös and Sundberg 2013). Biogas production and the potential to sequester carbon in soils are addressed specifically.

References

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