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Mitigation and Adaptation Strategies – Organic Agriculture

The concept of organic farming in the context of climate change

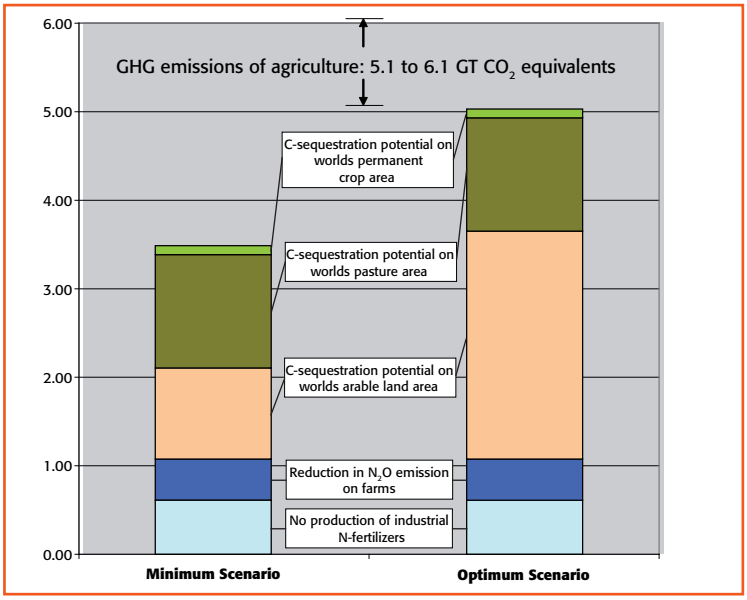
- Organic farming intensifies farm-internal processes like biological activities of soils, recycling of livestock and crop waste, enhanced biodiversity as well as nitrogen fixation and improved phosphorous availability by symbiosis.
  - Thus, reliance on high energy external inputs is reduced and less negative externalities occur.
- Organic farming diversifies farm organisation by more complex crop rotations, by more farm activities and by deploying more knowledge.
  - Thus, productivity gets higher, yields are more stable and farms become less vulnerable to climate change.
- Organic farming builds up soil fertility and increases or conserves soil organic matter.
  - Thus, synchronizing supply and demand of nutrients, conserving water and sequestering CO_2 into the soil.

Carbon sequestration on organic farms

Comparison of soil carbon gains and losses in different farming systems in long term field experiments

Field trial	Components compared	Carbon gains (+) or losses (–) kg ha^{-1} yr^{-1}	Relative yields of the respective crop rotations
DOK Experiment, CH (Mäder, et al., 2002; Fließbach, et al. 2007) Running since 1977	Organic, FYM composted	42	83 %
	Organic, FYM fresh	–123	84 %
	IP, FYM fresh, mineral fertilizer	–84	100 %
	IP, mineral fertilizer	–207	99 %
SADP, USA (Teasdale, et al., 2007) Running 1994 to 2002	Organic, reduced till	+ 819 to + 1738	83 %
	Conventional, no till	0	100 %
Rodale FST, USA, (Hepperly, et al., 2006; Pimentel, et al., 2005) Running since 1981	Organic, FYM	1 218	97 %
	Organic, legume based	857	92 %
	Conventional	217	100 %
Frick Reduced Tillage Experiment, CH (Berner, et al., 2008) Running since 2002	Organic, ploughing	0	100 %
	Organic, reduced tillage	879	112 %
Scheyern Experimental Farm, D (Rühling, et al. 2005), Running since 1990	Organic	180	57 %
	Conventional	–120	100 %

Is low GHG emission agriculture possible?



GHG reduction and mitigation potential in the agricultural sector (scenarios)

The GHG emissions of agriculture amount at 5.1 - 6.1 Gt CO_2-equivalents (top graph). With improved farm and crop management, most of these emissions could be reduced or compensated by sequestration. A conversion to organic agriculture would reduce industrial N-fertilizer use that emits 6.7 kg CO_2-eq per kg N on manufacture and another 1.6 percent of the applied N as soil N_2O emission. It could also enhance the sequestration of CO_2 into the soils in a considerable way. For the minimum scenario, we took a sequestration rate of 200 kg C ha-1 yr-1 for arable and permanent crops and 100 kg C ha-1 yr-1 for pastures. The maximum scenario combines organic farming with reduced tillage on arable land (sequestration rate 500 kg C ha-1 yr-1).

Consequences of an area-wide conversion to organic agriculture

Organic agriculture is less productive than input-intensive food production. Strengths of organic systems are:

- Organic agriculture halts erosion caused by wind and water as well as by overgrazing – a loss rate of 10 million hectare annually (Pimentel, 1995).
- Organic agriculture rehabilitates poor soils, restores organic matter content and bring such soils back into productivity.
- Organic farming productivity is higher than often criticised: Under best geo-climatic conditions, it is –30 to –40 %. In less favourable areas, its productivity tends to be equal to conventional farming. In regions with drought or subsistence agriculture, organic farming is superior (+112 %).
- Organic agriculture is based on lower livestock densities and can compensate for lower yields by a more effective vegetable production (land use ratio 1:7 for vegetable and animal production).
- The potential productivity of organic farms and organically managed landscape can be further improved by scientific agroecological research.
- Organic agriculture offers many added benefits: increased biodiversity, reduced environmental impacts, improved livelihoods due to high value food chains.

For references:

Niggli, U., Fließbach, A., Hepperly, P. and Scialabba, N. (2009) Low Greenhouse Gas Agriculture: Mitigation and Adaptation Potential of Sustainable Farming Systems. FAO, May 2009, Rev. 1 – 2009. 18 pages. (ftp://ftp.fao.org/docrep/fao/010/ai781e/ai781e00.pdf)