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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 CO₂ into the soil.

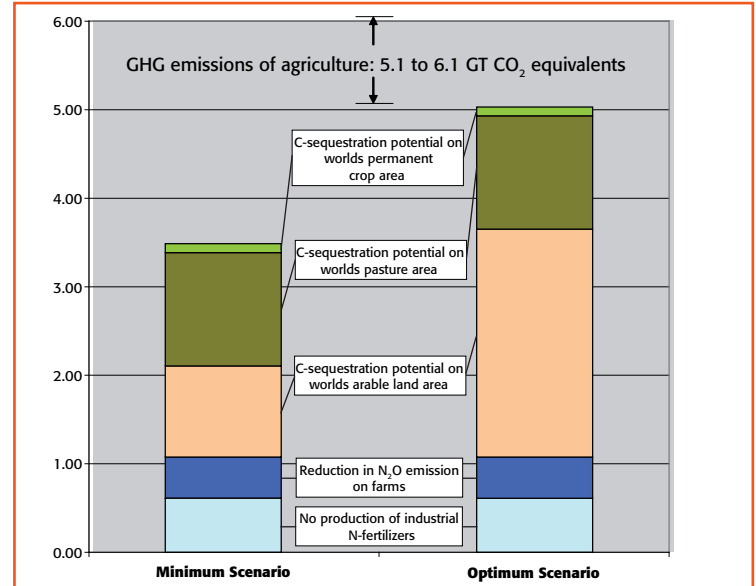
Carbon sequestration on organic farms

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 (Bernier, 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 CO₂-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 CO₂-eq per kg N on manufacture and another 1.6 percent of the applied N as soil N₂O emission. It could also enhance the sequestration of CO₂ 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>)