Advantages of organic farming for climate protection

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Organic farming uses less mineral nitrogen fertiliser. This results in fewer greenhouse gas emissions. In addition, organic farming practices promote the build-up of humus, which can bind CO_2 from the atmosphere in the soil. Together with a climate-friendly diet, organic farming therefore contributes to climate protection.

Agriculture must lower and bind greenhouse gas emissions

In order to achieve the goals of the Paris Climate Agreement[1], greenhouse gas emissions must be drastically and rapidly reduced in all sectors and all opportunities to offset the remaining emissions must be exploited. This also applies to agriculture, which both contributes to climate change and is severely affected by its consequences.

According to calculations by the Federal Environment Agency, German agriculture emitted a good 55 million tonnes of carbon dioxide equivalents (CO_2-eq.) in 2022[2]. This corresponds to around 7 % of total greenhouse gas emissions in Germany. Emissions in agriculture are caused in particular by digestive processes in livestock farming (methane) and by fertilising and tilling agricultural soils (nitrous oxide). Greenhouse gases are also produced in upstream processes of agricultural production, particularly in the energy-intensive production of nitrogen fertilisers and pesticides[3]. If these emissions are also taken into account, agriculture is responsible for around 13 % of German greenhouse gases[4].

Organic farming decreases greenhouse gas emissions

Organic farming contributes to climate protection in many ways. In particular, by reducing the use of nitrogen, dispensing with easily soluble mineral nitrogen fertilisers (the production of which causes high emissions of CO_2) and increasing carbon sequestration, the area-related greenhouse gas emissions in crop cultivation can be halved through organic farming. The reduction potential is estimated at around one tonne of CO_2 equivalents per hectare and year[5-7].

Reduced nitrogen surpluses lead to lower nitrous oxide emissions

Compared to conventional farming, soil-borne nitrous oxide emissions in organic farming are around 25 % lower per hectare in temperate climate zones[5]. One of the main reasons for this is the lower quantities of nitrogen that are applied to organically farmed areas. Scientific studies have shown that with organic fertilisation, as practised in organic farming, the proportion of nitrogen lost as nitrous oxide can be almost two thirds lower than with chemically synthesised mineral fertilisers[8].

Organic farming promotes the sequestration of carbon in the soil

Organic farming also promotes climate protection through various measures that help build up humus. These include, for example, diverse crop rotations, permanent soil cover, organic fertilisation and a well-adapted soil cultivation. Overall, this tends to lead to a higher content of organic carbon in the soil and a positive climate protection effect through the sequestration of carbon[9]. On average, around 250 kg C/ha/year (or around 900 kg CO_2-equivalents/ha/year) more CO_2 is bound in organic farming in temperate climate zones than in conventional farming[5]. The carbon content of organically farmed soils is therefore around 10 % higher than that of conventionally farmed soils[5]. In studies that also took into account analyses in other climate zones, the difference was around half a tonne of carbon per hectare and year[10,11].

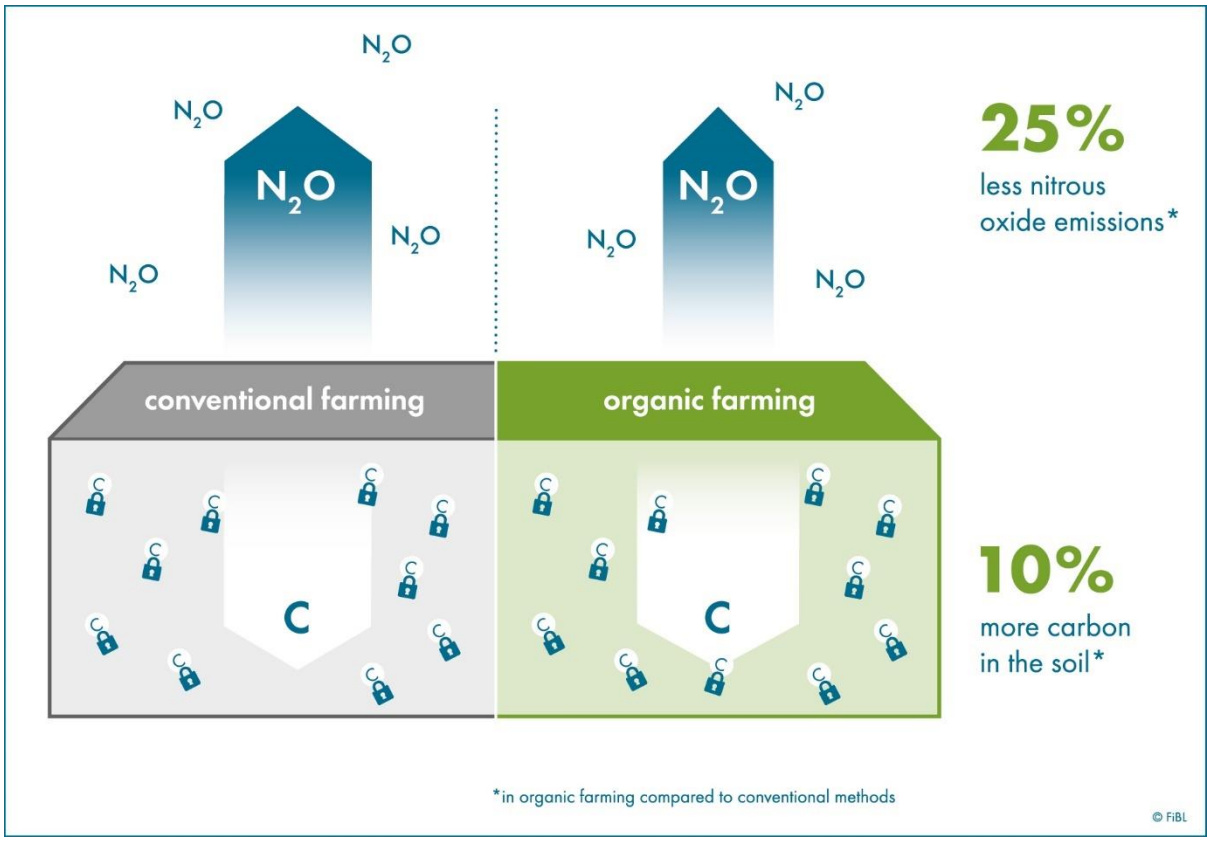
Less feed from the field, fewer feed imports - reducing the number of animals helps the climate

Comparative data on the climate impact of conventional and organic livestock farming is still limited. The sometimes contradictory results only allow a limited assessment[5,6,12]. In principle, many experts see the greatest potential for more climate protection in livestock farming in reducing the number of animals kept. Limiting the number of animals to around two livestock units per hectare, as prescribed in organic farming[13], is a measure that also helps the climate.

Less waste, fewer animal products - climate protection is only possible through a change in consumption patterns

The main options for reducing greenhouse gas emissions in agriculture are well known: less nitrogen mineral fertiliser, less (imported) arable feed (such as grain or soya), fewer livestock. Unavoidable emissions can be offset by building up humus in the soil. However, effective climate protection requires a change in consumption patterns. If a reduction in livestock numbers leads to more imports of animal products, nothing is gained. The same applies to shift effects due to lower yields in organic farming.

How organic farming helps the climate



Compared to conventional agriculture, nitrous oxide emissions in organic farming are on average around 25 % lower per hectare. In addition, organically farmed soils contain 10 % more carbon. In total, organic farming can save around one tonne of CO_2 equivalents per hectare per year.

Literature and notes

[1] In 2019, the Climate Protection Act set binding annual sector-specific emission targets, which were tightened again in 2021[1a,1b]. Accordingly, emissions in agriculture must be reduced by 10 % to 56 million tonnes of CO_2-eq. by 2030[1c,1d]. The aim is to achieve a balanced climate footprint across all sectors in Germany by 2045[1d]. In order to achieve this goal, it is necessary to reduce external nutrient inputs via mineral fertilisers and feed imports, the number of livestock kept and food waste. Further opportunities arise through the sequestration of carbon in the soil, i.e. through the build-up of humus, the preservation of permanent grassland and the climate-friendly management of peatlands.

[1a] Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (2019). Fact Sheet Klimaschutzgesetz. Available at: https://www.bmuv.de/fileadmin/Daten_BMU/ Download_PDF/ Klimaschutz/fact_sheet_klimaschutzgesetz_bf.pdf

[1b] Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (2021). Bundes-Klimaschutzgesetz (KSG). Available at: https://www.gesetze-im-internet.de/ksg/KSG.pdf

[1c] Umweltbundesamt (2023). Klimaschutz in der Landwirtschaft. Available at: https://www.umweltbundesamt.de/themen/landwirtschaft/landwirtschaft-umweltfreundlich-gestalten/klimaschutz-in-der-landwirtschaft#landwirtschaft-und-klimaschutz.

[1d] In June 2023, the Federal Cabinet agreed on a new version of the Climate Protection Act. The aim of the amendment is to make climate protection more forward-looking and effective. The government's draft stipulates that in the future, a multi-year and cross-sectoral overall calculation based on the year 2045 will be decisive for further measures[1e]. Sector-specific targets are therefore to be replaced in favour of an overall view.

[1e] Bundesministerium Bundesministeriums für Wirtschaft und Klimaschutz (2023). Referenten-entwurf des Bundesministeriums für Wirtschaft und Klimaschutz. Available at: https://www.bmwk.de/Redaktion/DE/Downloads/klimaschutz/entwurf-eines-zweiten-gesetzes-zur-aenderung-des-bundes-klimaschutzgesetzes.pdf?__blob=publicationFile&v=6

[2] Umweltbundesamt (2023). Treibhausgasemissionen aus der Landwirtschaft. Available at: https://www.umweltbundesamt.de/daten/land-forstwirtschaft/beitrag-der-landwirtschaft-zu-den-treibhausgas#treibhausgas-emissionen-aus-der-landwirtschaft

[3] Umweltbundesamt (Hr.). (2022). Berichterstattung unter der Klimarahmenkonvention der Vereinten Nationen und dem Kyoto-Protokoll 2022 Nationaler Inventarbericht zum Deutschen Treibhausgasinventar 1990 – 2020. Dessau: UBA. Available at: https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/2022-05-31_climate-change_24-2022_nir-2022_de.pdf.

[4] Lünenbürger, B. (2022). Klimaschutz und Emissionshandel in der Landwirtschaft. Dessau: UBA Available at: http://www.uba.de/uba-info-medien/4397.html

[5] Weckenbrock, P., Sanchez-Gellert H.L. und Gattinger, A. (2019) Klimaschutz. In: Sanders, J., & Heß, J. (Eds.). Leistungen des ökologischen Landbaus für Umwelt und Gesellschaft. 2. überarbeitete und ergänzte Auflage. Braunschweig: Johann Heinrich von Thünen-Institut. Thünen Report 65. DOI: 10.3220/REP1576488624000

[6] Hülsbergen K.-J., Schmid H., Chmelikova L., Rahmann G., Paulsen H. M., Köpke U. (2022) Umwelt- und Klimawirkungen des ökologischen Landbaus, Weihenstephaner Schriften Ökologischer Landbau und Pflanzenbausysteme, Band 16

[7] Chiriaco M V, Castaldi S, Valentin R (2022) Determining organic versus conventional food emissions to foster the transition to sustainable food systems and diets: Insights from a systematic review. *Journal of Cleaner Production* 380 (2022) 134937.

[8] IPCC 2022 (2019). *Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Volume 4 Agriculture, Forestry and Other Land Use, Chapter 11. Available at: https://www.ipcc-nggip.iges.or.jp/public/2019rf/vol4.html.

[9] The values for soil carbon also depend heavily on local conditions. In addition, carbon storage in the soil is subject to saturation dynamics. Depending on the initial situation, carbon storage stops increasing after 20 to 40 years following conversion to organic farming if no further management changes are implemented[12a]. Soil carbon can also be lost again if management changes are not sustainable, which is why the corresponding practices must be maintained in the long term. Finally, displacement effects must also be avoided, which can occur, for example, if high carbon sequestration is achieved by importing organic material from other areas where it is then lacking, which can lead to soil carbon losses there.

[9a] Leifeld J., Fuhrer J. (2010). Organic farming and soil carbon sequestration: what do we really know about the benefits? *Ambio* 39(8):585-599

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