

Organic farming stands for sustainable yields

Jörn Sanders, Robert Hermanowski

Organic farmers forego maximum yields in favour of the environment. Nevertheless, a sufficient global food supply would be possible if humanity ate less meat and less food was lost. Organic farming also strives for higher yields – but in a sustainable way.

Yields in organic farming are lower than in conventional farming. One of the main reasons for this is the absence of chemically synthesised pesticides and easily soluble mineral fertilisers^[1,2]. On average, the yield level of arable crops in Central and Western Europe is between 10 and 40 % lower than that of conventional agriculture^[3-5]. The differences in yield vary considerably and depend heavily on the intensity and management of organic and conventional farming, the location and the crop. In principle, it can be assumed that the more intensively conventional farming is practised, the greater the difference in yield^[3]. It should also be taken into consideration that organic farms use part of their land for the cultivation of nitrogen-fixing legumes such as clover grasses. These areas are then only available for food production to a very limited extent^[6,7].

Maximum yields burden the environment due to high use of inputs

In the discussion about yield differences, too little consideration has been given to the fact that the high yields in agriculture sometimes have a considerable impact on the environment^[8,9]. This is where organic production has an advantage. As organic farming uses fewer external inputs and production intensity is overall lower, the environment is less impacted compared to conventional production^[10-13]. Specifically: fewer greenhouse gas emissions and pollutants are emitted as a result of the system-approach, fewer nutrient surpluses are produced and biodiversity is promoted (see also chapters 3-9). In view of the fact that the planetary boundaries are currently being exceeded, organic farming can therefore help protect natural resources and the environment, which is a prerequisite for sustainable and resilient food production^[14,15].

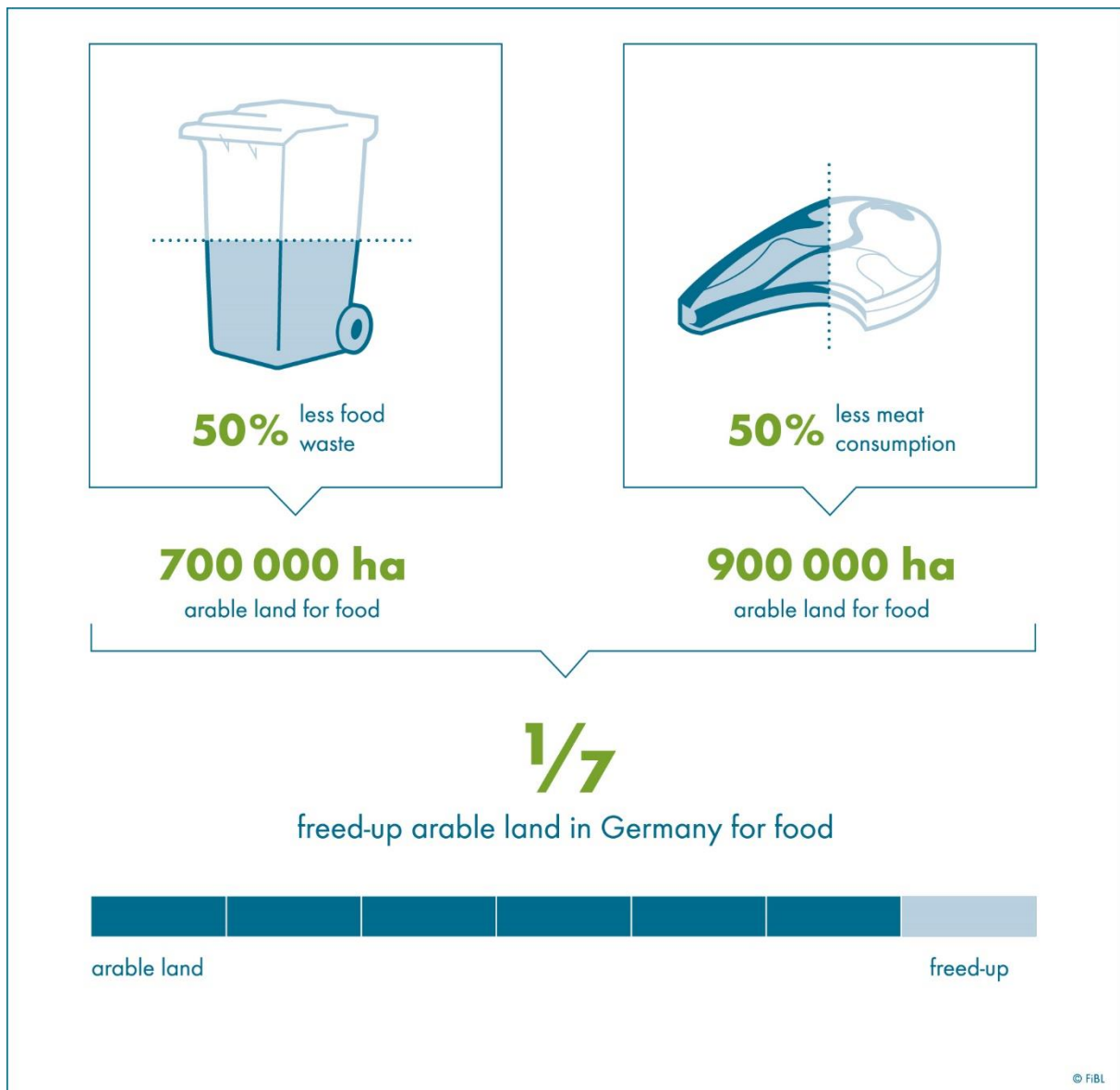
Securing the world's food supply requires a change in food consumption

In order to ensure global food security parallel to a growing world population, it is estimated that global food demand will increase by 35 to 55 % by 2050 compared to 2010 if consumption habits are not adjusted^[16]. From this perspective, the lower yields in organic farming would need to be critically assessed. However, a continuation of the existing consumption patterns of industrialised countries is undesirable. For health reasons, it would make more sense to consume less animal-based food^[17]. In addition, around a third of food produced globally is currently thrown away or lost due to poor infrastructure in storage, transport or cooling chains^[18]. Halving meat consumption in line with the nutritional recommendations of the German Nutrition Society^[19] would free up 900,000 hectares of arable land in Germany alone, which is currently used to grow animal feed^[20]. In addition, the amount of arable land required in Germany could be reduced by a further 700,000 hectares if 50 % less food was thrown away^[20]. If there was a corresponding change in eating and consumer habits at a global level, it would be possible to meet the global food demand using organic production methods^[21].

Organic farming also wants higher yields, but sustainably

Organic farming also strives to increase yields through the development and implementation of innovative methods. In this regard, various production technology approaches are being discussed: further advances in breeding, better nutrient management, mixed cultivation of crops or the development of new machinery and organic fertilisers^[22]. In addition, IT applications to improve systemic management^[22] and sector-specific information and training programmes on organic farming provide opportunities for increasing yields. It is important to note that yield increases in organic farming should not be at the expense of the environment, but should take planetary boundaries into consideration.

Area potentials through changes in consumer habits



Halving meat consumption and food waste would free up 1/7th of the arable land in Germany that is currently being used for growing animal feed.

Calculation based on data from BMEL and Wirz (2017).

Literature and notes

- [1] Organic farming stands for a holistic concept of land management with the aim of taking the limits of nature into special consideration^[2]. The use of interrelationships in ecological systems, nutrient cycles that are as closed as possible in terms of minimising losses and recycling nutrients, and the primary use of internal and regional production resources are important cornerstones of the production system. As a consequence, system-oriented strategic approaches are used instead of the resource and energy-intensive use of external factors, such as chemically synthesised pesticides and easily soluble mineral fertilisers. These include the integration of legumes and the cultivation of varieties that are less susceptible to disease and pests in adapted crop rotations, the promotion of beneficial insects and mechanical weed control. Fungicides and insecticides are only authorised on a natural basis. Herbicides are not used in organic farming.
- [2] Europäisches Parlament & Rat der Europäischen Union. (2018). Verordnung (EU) 2018/848 des Europäischen Parlaments und des Rates vom 30. Mai 2018 über die ökologische/biologische Produktion und die Kennzeichnung von ökologischen/biologischen Erzeugnissen sowie zur Aufhebung der Verordnung (EG) Nr. 834/2007 des Rates.
- [3] de Ponti, T., Rijk, B., & van Ittersum, M. K. (2012). The crop yield gap between organic and conventional agriculture. *Agricultural Systems*, 108, 1-9.
- [4] Seufert, V., Ramankutty, N., & Foley, J. A. (2012). Comparing the yields of organic and conventional agriculture. *Nature*, 485, 229-232.
- [5] Ponsio, L. C. (2014). Diversification practices reduce organic to conventional yield gap. *Proceedings B*, 282(2), 2014396.
- [6] Kirchman, H. (2019). Organic farming is not the way forward. *Outlook on agriculture*, 48(1) 22-27.
- [7] Leifeld J. 2016 Current approaches neglect possible agricultural cutback under large-scale organic farming. A comment to Ponsio et al. *Proc. R. Soc. B*, 283: 20151623. <http://dx.doi.org/10.1098/rspb.2015.1623>
- [8] Heißenhuber, A., Haber, W., & Krämer, C. (2015). *30 Jahre SRU-Sondergutachten "Umweltprobleme der Landwirtschaft" - eine Bilanz*. Publisher: Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit. *TEXTE 28/2015: Umweltforschungsplan des Bundesministeriums für Umwelt, Naturschutz, Bau und Reaktorsicherheit, Forschungskennzahl 3712 88 288, UBA-FB 002092.9*.
- [9] Ritchie, H., Rosado, P., & Roser, M. (2022). Environmental Impacts of Food Production. Published online at OurWorldInData.org. <https://ourworldindata.org/environmental-impacts-of-food> [Online Resource]
- [10] Sanders, J., & Heß, J. (Eds.). (2019). Leistungen des ökologischen Landbaus für Umwelt und Gesellschaft. 2. überarbeitete und ergänzte Auflage. Braunschweig: Johann Heinrich von Thünen-Institut, 398 Seiten. Thünen Rep 65. DOI: 10.3220/REPI576488624000
- [11] Stolze, M., Piorr, A., Häring, A., & Dabbert, S. (2000). *The Environmental Impacts of Organic Farming in Europe*. Stuttgart-Hohenheim. (Organic Farming in Europe: Economics and Policy; 6). ISBN 3-933403-05-7

- [12] Gomiero, T., Pimentel, D., & Paoletti, M. G. (2011). Environmental Impact of Different Agricultural Management Practices: Conventional vs. Organic Agriculture. *Critical Reviews in Plant Sciences*, 30(1-2), 95-124. <https://doi.org/10.1080/07352689.2011.554355>
- [13] Reganold, J. P., & Wachter, J. M. (2016). Organic agriculture in the twenty-first century. *Nature Plants*, 2, 15221. <https://doi.org/10.1038/nplants.2015.221>
- [14] Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F. S., Lambin, E., & Foley, J. (2009). A safe operating space for humanity. *Nature*, 461, 472-475.
- [15] Eyhorn, F., Muller, A., Reganold, J. P., Frison, E., Herren, H. R., Luttikholt, L., Mueller, A., Sanders, J., Scialabba, N., Seufert, V., & Smith, P. (2019). Sustainability in global agriculture driven by organic farming. *Nature Sustainability*, 2, 253-255. <https://doi.org/10.1038/s41893-019-0266-6>
- [16] van Dijk, M., Morley, T., Rau, M. L., & Saghai, Y. (2021). A meta-analysis of projected global food demand and population at risk of hunger for the period 2010–2050. *Nature Food*, 2, 494-501.
- [17] Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., De Vries, W., Sibanda, L. M., Afshin, A., Chaudhary, A., Herrero, M., Agustina, R., Branca, F., Lartey, A., Fan, S., Crona, B., Fox, E., Bignet, V., Troell, M., Lindahl, T., Singh, S., Cornell, S. E., Reddy, K. S., Narain, S., Nishtar, S., & Murray, C. J. L. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, 393(10170), 447.
- [18] Schmidt, T., Schneider, F., Leverenz, D., & Hafner, G. (2019). *Lebensmittelabfälle in Deutschland - Baseline 2015*. Braunschweig: Johann Heinrich von Thünen-Institut, Thünen Rep 71. DOI: 10.3220/REPI563519883000
- [19] Deutschen Gesellschaft für Ernährung (2023). *DGE-Ernährungsempfehlungen*. Verfügbar unter: <https://www.dge.de/gesunde-ernaehrung/dge-ernaehrungsempfehlungen>.
- [20] Wirz, A., Kasperczyk, N., & Thomas, F. (2017). *Ökologisierte Landwirtschaft in Deutschland - 2050*.
- [21] Muller, A., Schader, C., El-Hage Scialabba, N., Brüggemann, J., Isensee, A., Erb, K. H., Smith, P., Klocke, P., Leiber, F., Stolze, M., & Niggli, U. (2017). Strategies for feeding the world more sustainably with organic agriculture. *Nature Communications*, 8, 1290. DOI: 10.1038/s41467-017-01410-w
- [22] EIP-AGRI Focus Group on Organic Farming - Optimising Arable Yields: Final Report https://ec.europa.eu/eip/agriculture/sites/default/files/fgl_organic_farming_final_report_2013_en.pdf