

Science for Environment Policy

How to improve agricultural soil quality: add compost, don't till, and rotate crops

Adding compost, manure, and other forms of organic matter to farmland soil can boost earthworm numbers, crop yield, and the stability of soil, finds a recent analysis of long-term case studies. No-tillage and crop-rotation practices also have positive effects on soil, although no-tillage's benefits for earthworms are often absent on farms that use herbicides and other pesticides. The study also confirms that organic farming typically produces lower crop yields than conventional farming, but provides recommendations on how to reduce this 'yield gap', while highlighting positive aspects of organic agriculture.

Good soil health is vital for crop and livestock farming, as well as for providing ecosystem services to society, such as water purification and climate-change mitigation. As it is a very slow process to rejuvenate soil once it has been damaged, soil is increasingly seen as a non-renewable resource in terms of human timescales.

This new study helps to address the growing risk of soil depletion by identifying measures that keep soil in good condition. The researchers analysed results from 30 long-term field experiments at 13 case-study sites in Europe and China, conducted under the EU [iSQAPER](#) project¹, to assess how four agricultural management practices affected four indicators of soil quality. These results were complemented by data from 42 long-term experiments across China, and 402 observations taken from an extensive review of agricultural studies from around the world.

The four practices were: **adding organic matter** (such as compost, manure, and slurry) to soil, **no-tillage**, **crop rotation**, and — at a broader system level — **organic agriculture**. The four soil-quality indicators were: soil organic matter content, pH, aggregate stability, and the number of earthworms. The study also considered the effects of these practices on crop yield.

The researchers calculated a 'score' to indicate the response of the four soil-quality indicators and yield to each of the management practices, compared with the response to the 'opposing' management practice, for instance, the effects of no-tillage versus tillage. A score below one indicates a negative change (e.g. a reduction in yield compared with the opposite practice), whilst a score above one suggests a positive change — an increase. The further the score from one, the greater the response.

The analysis showed that adding organic matter has a positive effect on all four indicators and on yield (compared with no organic matter input). The effects were particularly strong for earthworm numbers, which had a mean average response score of 2.45 across the sites considered. This is the highest of all scores in the study, although the result should be interpreted with care as data on this impact only came from six sites.

Organic matter input also had very positive effects on yield, when compared with no organic matter input (mean average score: 1.67). No tillage had notable positive impacts on earthworm numbers (1.53), soil organic matter (1.46), and aggregate stability (1.45). No-tillage did not always enhance earthworm populations where herbicides or other pesticides were used, however.

Continued on next page.



10 January 2019
Issue 519

**Subscribe to free
weekly News Alert**

Source: Bai, Z., Caspari, T., Gonzalez, M.R. *et al.* (2018). Effects of agricultural management practices on soil quality: A review of long-term experiments for Europe and China. *Agriculture, Ecosystems & Environment*. 265: 1–7. DOI:10.1016/j.agee.2018.05.028. This study is free to view at: <https://www.sciencedirect.com/science/article/pii/S016788091830224X>

Contact:
zhanguo.bai@wur.nl

Read more about:
[Agriculture](#), [Soil](#)

The contents and views included in *Science for Environment Policy* are based on independent, peer-reviewed research and do not necessarily reflect the position of the European Commission. Please note that this article is a summary of only one study. Other studies may come to other conclusions.

To cite this article/service: "Science for Environment Policy": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.

1. iSQAPER (Interactive Soil Quality Assessment in Europe and China for Agricultural Productivity and Environmental Resilience) is supported by the European Commission under the Horizon 2020 Programme for Research and Innovation www.isqaper-project.eu

Science for Environment Policy

How to improve agricultural soil quality: add compost, don't till, and rotate crops (continued)

10 January 2019
Issue 519

**Subscribe to free
weekly News Alert**

Source: Bai, Z., Caspari, T., Gonzalez, M.R. *et al.* (2018). Effects of agricultural management practices on soil quality: A review of long-term experiments for Europe and China. *Agriculture, Ecosystems & Environment*. 265 pp. 1–7. DOI:10.1016/j.agee.2018.05.028. This study is free to view at:

<https://www.sciencedirect.com/science/article/pii/S016788091830224X>

Contact:

zhanguo.bai@wur.nl

Read more about:

[Agriculture](#), [Soil](#)

The contents and views included in *Science for Environment Policy* are based on independent, peer-reviewed research and do not necessarily reflect the position of the European Commission. Please note that this article is a summary of only one study. Other studies may come to other conclusions.

To cite this

article/service: "[Science for Environment Policy](#)":

European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.

2. Spiegel, *et al.*, 2015. Compatibility of Agricultural Management Practices and Mitigation and Soil Health: Impacts of Soil Management Practices on Crop Productivity, on Indicators for Climate Change Mitigation, and on the Chemical, Physical and Biological Quality of Soil. Deliverable reference number: D3.371, CATCH-C Project (www.catch-c.eu).

The extent of organic matter input's effect on soil organic matter depended on the material applied. Compost, farmyard manure, and slurry have been shown in separate research to increase soil organic matter content by 3%, 23%, and 21%, respectively, in the top 10 centimetres of soil². Crop rotation was also found to be beneficial for soil organic matter (1.41).

A notable negative score in the study was for the effects of organic farming on yield (mean average score: 0.94). This score indicates that average yield under organic systems is 4% lower than for conventional farming. Although such yield gaps are widely known, the researchers suggest that they can be minimised by careful management — for instance, by using multi-cropping and crop rotation practices to significantly reduce the gap. Conversely, the researchers add that organic farming has positive aspects, such as reduced environmental damage and a higher marketing price.

