

Science for Environment Policy

How much sewage sludge should be applied to agricultural soils?

New research has investigated the long-term effects of applying sewage sludge to Spanish soils. The results indicate that sludge enhances soil properties, but recommends a maximum dose of 40 tons per hectare, applied biannually. Above this level, it appears the soil properties will not improve and may even worsen.

The EU-27 produces an estimated 10 million tons of sewage sludge (dry solids) a year and nearly 40% of this is spread on agricultural land. Sewage sludge can improve soil properties, such as organic matter, nutrient levels and water holding capacity. It is particularly beneficial for soils that are low in organic matter, such as those in the Mediterranean. However, there may be drawbacks as persistent organic pollutants (POPs) and potentially toxic elements (PTEs) are present in sludge. As such, it is important to find the optimal dose and frequency of application to avoid over-contamination and accompanying health and environmental risks.

The study assessed the repetitive application of sewage sludge for 16 years on wheat fields with calciferous soil in Pamplona in Northern Spain. There were eight different treatments, varying in the amount of sludge and frequency of application. It analysed a range of soil properties, as well as the potential toxicity for plants, effects on plant growth and the risk of water contamination.

The results revealed that the sewage sludge changed soil properties. There was an increase in soil acidity, soil organic matter, organic carbon levels, soil nitrogen levels and the activity of microscopic organisms in the soil. The changes were in proportion to either the quantity applied, or frequency, or both. The most influential factor for levels of organic carbon was the total amount of sewage sludge applied, whereas the level of nitrates was more related to the individual application dose of the sludge.

Although the levels of some metal elements were significantly higher in soils where sewage was applied, the concentrations were still well below the regulated threshold values established in Spain. There appeared to be no increase in plant toxicity from the sewage sludge, but the growth of one test plant (*A. cepa*) was significantly lower at high doses of sewage sludge (80 tons per hectare). This indicates that lower doses (40 tons per hectare) are more beneficial, which is supported by the findings that lower doses distributed over time achieve a sustained mineral nitrogen supply and minimise the nitrate losses.

The study recommends a biannual application of 40 tons per hectare. This is based on the finding that the number of applications (for the same total amount) is related to the concentration of potentially toxic elements and toxicity to plants, indicating that applying the sludge more frequently than biannually could be harmful. The recommendation may not be directly transferable to other countries and regions, but the study highlights the importance of performing a combined evaluation of both pollutant contents and the soil functioning to determine optimal application of sewage sludge.



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