European Commission

Science for Environment Policy

Compost and climate change: a novel mitigation strategy?

23 July 2015
Issue 422

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Source: Ho, A., Reim, A., Kim, S., Meima-Franke, M., Termorshuizen, A., de Boer, W., van der Putten, W. & Bodelier, P. (2015). Unexpected stimulation of soil methane uptake as emergent property of agricultural soils following bio-based residue application. *Global Change Biology*. DOI: 10.1111/gcb.12974

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Native soils are thought to take up more of the greenhouse gas methane than land used for farming. This study shows that, while agriculture can exert an adverse impact on soil methane uptake, the application of soil conditioners like compost may compensate for loss of the methane sink function. The researchers propose new land management strategies based on this finding.

Agriculture has become the most dominant land use in Europe. Traditional landscapes have been transformed into modern, intensive agricultural land, notably owing to the EU's Common Agricultural Policy. This entails the increased use of soil conditioners, bio-based residues added to soil to improve its quality and fertility.

While the addition of these residues may make the land better for growing, it can also decrease the methane consumed by agroecosystems. This is of concern from a climate change perspective as methane is a potent greenhouse gas with a global warming potential more than 30 times that of carbon dioxide[1].

However, agricultural land does have the potential to take up methane, as well as emit it. Methanotrophic bacteria, which use methane as a source of carbon and energy, are found in wetland agricultural soils like rice paddies as well as dry (aerated) soils. While methanotrophs within rice paddies have been studied extensively, those in well-aerated soils have received little attention, as they are assumed to have a low capacity for methane uptake.

This study is the first to properly test this assumption. The researchers measured methane uptake in two aerated soil types — sandy loam and clay — taken from two typical agricultural fields in the Netherlands. The researchers applied organic conditioners to the soil, then measured the effect on methane uptake.

The conditioners tested were sewage sludge, aquatic plant material, compost, wood material and compressed beet leaves, added at amounts typical of intensive agricultural practice. After being added to soil samples, the mixtures were incubated in a chamber for approximately two months. The researchers measured methane and carbon dioxide flows, as well as the rate at which methane was oxidised.

Their analysis revealed a surprising finding: the addition of the soil conditioners contributed to increased methane uptake. The researchers suggest the conditioners had this effect by increasing the nutrients available in the soil by introducing new methanotrophs, both of which can stimulate methane oxidation (although the latter by a lesser extent).

The researchers determined methane uptake rates at a range of methane concentrations using the untreated agricultural soils. The agricultural soils showed the ability to oxidise methane over a wide range of concentrations, from atmospheric levels to very high concentrations, but after treatment, methane consumption increased up to threefold higher than in the untreated soil.

Consistent in both soils, amendment with compost had the greatest effect, and was able to offset approximately 16% of net emitted carbon dioxide. Applying compost to agricultural soils could thus reduce the impact of carbon dioxide and methane emission — both of which are greenhouse gases.

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1. IPCC Fifth Assessment Report. See: http://www.climatechange2013.org/images/uploads/WGIAR5_WGI-12Doc2b_FinalDraft_Chapter08.pdf

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The transformation of land for intensive agriculture is known to reduce methane uptake relative to natural landscapes. This study makes recommendations for management strategies to compensate for this. The authors suggest simple changes, such as the repeated application of compost, could reduce the impact of greenhouse gas emissions.

It is important to note that this research was conducted in the laboratory. The researchers therefore recommend field-based studies, as well as investigations of the impact of the intevention on nitrous oxide emission, another major greenhouse gas.

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