Biochar in soils cuts greenhouse gas emissions

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University of Tübingen microbiologists show soil microbe communities can be influenced to decrease nitrous oxide emissions.

Introducing biochar into agricultural soils changes the composition and activity of microorganisms in a way that emissions of nitrous oxide – also known as laughing gas (N2O) – are significantly reduced, according to researchers Johannes Harter and Hans-Martin Krause. Their study was supervised by environmental microbiologist Dr. Sebastian Behrens and geomicrobiologist Professor Andreas Kappler of the Center for Applied Geosciences at the University of Tübingen in cooperation with researchers from the University of Hohenheim. The results are important not only for a sustainable, more effective use of nitrogen fertilizers; they also present a new possibility for reducing greenhouse gas emissions worldwide.

Biochar is produced by high-temperature thermochemical decomposition of organic material, a process known as pyrolysis. Unlike charcoal, which is primarily used to produce heat, biochar is used as a soil supplement in agriculture. Nitrous oxide is produced by nitrogen-transforming microorganisms in the soil, and these emissions increase with the use of nitrogen fertilizers. Biochar's surface properties prevent nutrients from being washed out of poor soils. It also positively influences the abundance, composition, and activity of microorganisms in the soil, which form complex biological communities involving plants and animals. "Soil biochar amendment helps to raise water storage capacity and decrease soil nutrient leaching, which in turn increases soil

fertility and can help to reduce greenhouse gas emissions because it stores carbon in the soil," says Sebastian Behrens.

Indigenous peoples in tropical zones of South America and Africa were aware of biochar's positive effect on soil and plant growth thousands of years ago. The current study underlines the importance of biochar research – because biochar not only has the potential to open profitable new markets for agriculture and industry, it also provides data important to the protection of soils and the climate.

The results are also important in the light of the recently-released 5th Assessment Report, in which the United Nations Intergovernmental Panel on Climate Change (IPCC) revealed that concentrations of the greenhouse gases CO2, methane and nitrous oxide in the atmosphere have risen by 40%, 150% and 20%, respectively since 1750 because of human activity. The main source of nitrous oxide is agriculture (84%). It is therefore of great economic and environmental importance to find strategies to reduce nitrous oxide emission while making nitrogen fertilizer use sustainable – and maintaining crop yields.

More information: Harter, J. et al. (2013) Linking N2O emissions from biochar-amended soil to the structure and function of the N-cycling microbial community, *ISME Journal*. www.nature.com/ismej/journal/v … s/ismej2013160a.html

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