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Soil-atmosphere fluxes of the greenhouse gases N2O, CO_2 and CH4 from a long term compost experiment in Austria.

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The application of composts as fertilizers is becoming increasingly important to achieve a closed-loop economy. However, greenhouse gas (GHG) emissions, especially N2O, from agricultural fields may increase as well. In this study different compost types and N amounts were investigated, especially in terms of their GHG fluxes.
We used the closed chamber method to estimate GHG flux rates over one vegetation period from an agricultural soil fertilized with different compost types. The study was conducted on a long term compost experiment site near Linz (Austria) with a crop rotation. The soil is a loamy silt and in 2015 maize was planted. Six different compost treatments were investigated. Organic waste compost (OWC) and farmyard manure compost (FMC) was applied with nitrogen concentrations of 175 (OWC1, FYC1) and 525 kg N ha-1 (OWC3, FYC3). Two compost treatments were fertilized additionally with 80 kg N ha.1 mineral fertilizer (OWC2, FYC2). One treatment (TN) was fertilized only with mineral fertilizer (120 kg N ha-1) and one treatment was not fertilized at all (C). Additionally to the GHG flux rates, ammonium and nitrate content, microbial biomass C and N and different enzyme activities were analysed in the top soil.
Nitrous oxide (N2O) was emitted over the entire vegetation period with highest fluxes from April until June, until the plants have been established sufficiently. Overall, at the FMC treatments (FYC2, FYC3) highest fluxes were measured. Compared to FMC, lower N2O emissions were measured from the OWC treatments. The combination of compost and mineral N fertilization resulted in the highest N2O emissions, especially after precipitation events. The treatments OWC1 and FYC1 were not different from the control.
Methane (CH4) was mainly taken up at all treatments, but uptake rates were lower at the high N input sites (OWC3, FYC3) with no differences between the compost types. No significant differences were found in the soil respiration rates.