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Do land management affect atmospheric methane oxidation in soils?

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Soil plays a very important role in methane turnover. Depending on the water/air conditions, it can be a source of this greenhouse gas (methanogenesis) or a sink (methanotrophy). Methanogenesis occurs in anaerobic conditions, i.e. when the soil is flooded. Methanotrophy takes place when the concentration of oxygen is higher and some soil pores are filled with air.

It is well known that the methanotrophy process, which can be defined as biological oxidation of methane in soils, is inhibited by ammonium ions. Hence, soils under agricultural use oxidize methane to a lesser extent that forest soils. However, agricultural soils are also able to sustain the process of methanotrophy, as the ammonium ion concentration is not the only influencing factor.

The aim of this work was to compare the influence of field management on potential methanotrophy. Two agricultural systems were investigated: fields cultivated traditionally (i.e. with ploughing) and fields cultivated without ploughing. The experimental fields were located in the south-eastern part of Poland on the Haplic Luvisol soil. Variants with and without mineral fertilization were investigated. Winter wheat was cultivated in both cases. The samples were collected in late April on the same day from both plots; hence, the air/water conditions were practically the same.
Summarizing, much more intensive methanotrophy was noted in the ploughed field. Methane oxidation in the traditionally cultivated soil (ploughed and fertilized) was even higher than in the non-ploughed one without nitrogen treatment. This can be explained by the fact that the water retention in the non-ploughed soil was higher, which consequently provided no optimal water/air conditions in terms of methanotrophy.

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