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Can soil microbial communities be coaxed into the sequestration of atmospheric CO_2?

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Abstract

Sulphur is essential in healthy plant and crop yields. Rapidly, largely due to emission controls, soils are becoming depleted in sulphur. Soils also act as a significant carbon sink but suggest that soil carbon is largely released back into the atmosphere. Here we examine the potential of soil microorganisms in the sequestration of atmospheric CO_2 whilst examining the role sulphur has to play on the fixation of CO_2.

Agricultural soils were incubated in a carbon dioxide incubation chamber (ECIC) for 12 weeks where $^{12}CO_2$ or $^{13}CO_2$ was added at 400 ppm. One sample-soil A-had elemental sulphur added as a supplement. Total microbial DNA obtained from $^{12}CO_2$ and $^{13}CO_2$ experiments were subjected to Isopycnic centrifugation. Labelled DNA fractions and total microbial DNA extracts- following incubation- were subjected to Pyrosequencing. RubisCO genes were quantified by qPCR over the course of the experiment.

Phospholipid fatty acid analysis and DGGE was used to monitor the microbial community structure over the duration of the experiment. To track the fate of labelled carbon into the soil throughout the incubation NMR analysis was performed on soil samples at defined time points. We established that the addition of sulphur to soil, as a fertilizer, has a significant impact on the microbial community structure. The sequestration of atmospheric CO_2 by soil microorganisms was stimulated through the addition of sulphur whilst Rubis CO gene copy numbers increased significantly following its addition to soil.