Biochar’s effect on soil nitrous oxide emissions from a maize field with lime adjusted pH treatment

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Biochar is a carbon-rich, porous product from pyrolysis of organic residues. Especially tropical soils have shown positive response in yield to biochar addition. Its high stability in soil makes biochar a potent carbon sequestration option at the same time. A number of laboratory incubations have shown significantly reduced nitrous oxide (N2O) emissions from soil when mixed with biochar. Emission measurements from the field show the same trend but are much more scarce. One of the hypothesized mechanisms for reduced N2O emissions from soil is owing to the increase in soil pH from the application of alkaline biochar. To test the effect of biochar on N2O emissions from a temperate maize system, we set up a field trial with a 20 t/ha biochar treatment, a limestone treatment adjusted to the same pH as with biochar and a control without addition. An automated static chamber greenhouse gas measurement system measured N2O emissions for each replicated (n=3) every 3.6 hours. The field was conventionally fertilised at a rate of 160 kg-N/ha in 3 doses of 40, 80 and 40 kg-N/ha.

Cumulative emissions show a significant reduction for N2O in the biochar treatment by about 55 % relative to the control. The limed treatment shows similar emissions than control but with higher variability. This suggests that the N2O reduction effect of biochar is not mainly due to its liming effect. In conclusion, we confirm that biochar is a promising material to reduce N2O emissions from intensively managed agricultural soils.