



## **The effect of wood ash and gypsum on carbon dioxide and nitrous oxide production rates in agricultural soils**

Marja Maljanen, Juho Nykänen, and Maarit Liimatainen

University of Eastern Finland, Environmental and Biological Sciences, Kuopio, Finland (marja.maljanen@uef.fi)

Drained and cultivated peat soils are significant sources of greenhouse gases (GHG) such as nitrous oxide (N<sub>2</sub>O) and carbon dioxide (CO<sub>2</sub>) and therefore there are needs to develop methods to mitigate GHG emissions from these peatlands. Peatlands have to be limed to increase soil pH to be more favorable for crops. The liming products may alter also other physical, chemical and biological properties of the soils and further affect the GHG emissions. In earlier studies we found that wood ash from bioenergy production could have potential to reduce N<sub>2</sub>O production rates in forested peatland soil (1) where it can be used as a fertilizer increasing simultaneously soil pH, but the effects on agricultural soils are not known. Gypsum (CaSO<sub>4</sub> · 2H<sub>2</sub>O) originating from phosphoric acid production has been used in a pilot project in Finland to reduce phosphorous leaching from agricultural soils (2), but the effects on nitrogen cycle and GHG emissions are not known. Both of these chemicals are industrial by-products, which could be utilized in cultivated peat soils to increase soil pH, improve soil properties and also to mitigate GHG emissions. We studied in a laboratory experiment how wood ash and gypsum (applied with a dose corresponding to 5000 kg ha<sup>-1</sup> ash and 4000 kg ha<sup>-1</sup> gypsum) change the CO<sub>2</sub> and N<sub>2</sub>O production rates when mixed with peat soil (organic matter content 86%) and two other soils having organic matter content of 5 and 11%. Wood ash slightly reduced CO<sub>2</sub> production rates after two weeks of incubation in all soils but gypsum had only minor effects. Nitrous oxide emissions were reduced in peat soil with both treatments but there were no effects on mineral soils. These results are showing that both wood ash and gypsum might be potential products to reduce GHG emissions from cultivated peat soils.

1) Liimatainen M, Martikainen PJ, Maljanen M 2014. Why granulated wood ash decreases N<sub>2</sub>O production in boreal acidic peat soil? *Soil Biology and Biochemistry* 79:140-148

2) Ekholm P, Valkama P, Jaakkola E, Kiirikki M, Lahti K, Pietola L 2012. Gypsum amendment of soils reduces phosphorus losses in an agricultural catchment. *Agricultural and Food Science* 21:279–291