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"Bridging the gap between increasing knowledge and decreasing resources"

Interactive Effects of Polyacrylamide and Dicyandiamide on Soil Organic Matter and Nutrient Dynamics

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Abstract

Soil conditioners are increasingly used in agriculture. For example anionic polyacrylamide (PAM) is used to improve the water holding capacity of the soil and to decrease soil erosion especially under arid and semi-arid conditions. Dicyandiamide (DCD) is used to optimise nitrogen (N) use efficiency in intensively managed systems by reducing the biological activity of nitrifiers. As a consequence, the question arises, if addition of PAM increases mineralisation and if nitrification can be effectively managed using DCD in combination with PAM. This study therefore investigates the short term effects of PAM and DCD on carbon (C) and N mineralisation and on soil microbial properties after addition of maize straw and ammonium-sulphate fertiliser (AS) in an incubation experiment. A sandy soil was incubated for 28 days at 22 °C and 50 % water holding capacity. PAM was added to the soil at a rate of 100 % and 200 % of the recommended application rate. In addition, also maize straw, ammonium sulphate and DCD were added. Throughout the experiment, soil respiration was monitored. Microbial biomass C and N mineralisation was determined at the end of the experiment. Addition of maize straw increased soil respiration and the soil microbial biomass, whereas NH_4^+ addition decreased both these measures. On the other hand, DCD addition resulted in a decreased basal respiration but did not decrease the microbial biomass. As a consequence, DCD application reduced the metabolic quotient (qCO_2) an indicator of substrate use efficiency. Moreover, DCD addition reduced nitrification as expected. The decrease in soil respiration and nitrification indicated a reduction of the nitrifier activity in the soil. However, the added PAM increased mineralisation and nitrification, especially when applied without additional fertiliser and increased the nitrate content in the absence of maize straw, which indicated that PAM may increase nitrification. Moreover, PAM increased the metabolic quotient, indicating either microbial use of PAM or an increased relative activity due to stress or less efficient substrate use in the presence of PAM. The present study showed, that DCD can be an effective tool to reduce nitrification under conditions, where mineralisation is increased by addition of PAM.

Keywords: Microbial biomass, mineralisation, nitrification, nitrogen management, soil conditioner

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