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Biochar reduces efficiency of nitrification inhibitor 3,4-dymethylpyrazole phospate (DMPP) mitigating N2O emissions.

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Nitrous oxide (N2O) is the strongest greenhouse gas associated with agricultural soils. Current agricultural practices, based on the use of N fertilizers, can lead to environmental N losses, with some losses occurring as N2O emissions. Among the strategies suggested by the Intergovernmental Panel on Climate Change to decrease N losses through agriculture is the utilization of nitrification inhibitors, such as DMPP (3,4-dimethylpyrazole phosphate). This compound inhibits nitrification, thus reducing N2O emissions. However, the efficiency of DMPP might be affected by soil amendments. One soil amendment is biochar, which typically increases soil C, can reduce N2O emissions, affect the retention of water, and alter the C and N cycle. Nevertheless, these effects are not uniformly observed across varying soil types, N fertilization schemes and biochar properties. Assuming that both DMPP and biochars with C/N > 30 ratios are presumably able to reduce soil N2O emissions, the aim of this study was to evaluate the synergic effect of a woody biochar applied in combination with DMPP on N2O emissions. For this purpose, a laboratory incubation study was conducted with a silt loam grassland soil and a biochar obtained from Pinus taeda at 500ºC. The experimental design consisted of an arrangement including two biochar levels (0 and 2% (w/w)), three fertilization levels (unfertilized, fertilized and fertilized+DMPP) and two soil water content levels (40% and 80% of water filled pore space, WFPS), giving rise to 12 different individual treatments with four replications of each treatment. Soil N2O emissions were monitored over the incubation period (163 days). Results showed that DMPP reduced N2O emissions to levels comparable to the unfertilized controls. Biochar showed ability to mitigate N2O emissions only at the low soil water content (40% WFPS). However, when DMPP was applied to the biochar amended soil, a counteracting effect was observed, since the reduction in N2O emissions induced by DMPP was less than without biochar. This study demonstrates that the biochar amendment diminishes the efficiency of the nitrification inhibitor DMPP both at low and high soil water contents.
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