

Phosphorus addition and plant presence effects on N₂O emission and nitrogen leaching

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Availability of phosphorus (P) can affect gaseous and leaching loss of nitrogen (N) by influencing microbial and plant root activities in soil. Although P addition can reduce nitrous oxide (N₂O) emission (from nitrification and denitrification) and nitrate (NO₃⁻) leaching by increasing plant and microbial N uptake, alleviation of P limitation on N₂O producing microorganisms as well as increased labile organic carbon supplied from increased plant production after P enrichment can increase N₂O production. We hypothesized that increased availability of P in a P-poor soil would increase N₂O emission, induce greater plant N uptake, and thereby reduce N loss through leaching. We conducted a pot experiment under controlled environmental conditions, including and excluding plants (*Phalaris aquatica*) in pots with soil low in P availability. Three different levels of P (0, 10 and 20 mg P kg⁻¹) were applied to the pots splitting the amounts equally over 3 different times (11, 32 and 53 days after sowing). Gas samples were collected before and after each time of P application for N₂O and carbon dioxide (CO₂) analysis. Leaching was induced twice directly after last two P applications. We also added 15N-labelled KNO₃ (1 mg 15N kg⁻¹) to all pots along with non-labelled N (192 mg N kg⁻¹) to assess P addition effect on 15N recovery in plants, microbes, leachates and soils. We found significant increase in plant biomass and plant P content with increased P availability in soil. Although P addition significantly increased NH₄⁺ concentration in soil, it did not affect microbial N immobilization or leaching loss of N. Pots with plants showed significant decrease in soil and leachate inorganic N concentration suggesting increased plant and/or microbial N assimilation, and/or microbial N₂O emission. However, N₂O concentrations of gas samples and plant N contents are still to be analysed along with all 15N data.