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The effects of H2SO4 and (NH4)2SO4 treatments on the chemistry of soil drainage water and pine seedlings in forest soil microcosms

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Abstract. An experiment comparing effects of sulphuric acid and reduced N deposition on soil water quality and on chemical and physical growth indicators for forest ecosystems is described. Six H_2SO_4 and $(NH_4)_2SO_4$ treatment loads, from 0 – 44 and 0 – 25 $kmol_c\ ha^{-1}\ yr^{-1}$, respectively, were applied to outdoor microcosms of *Pinus sylvestris* seedlings in 3 acid to intermediate upland soils (calc-silicate, quartzite and granite) for 2 years. Different soil types responded similarly to H_2SO_4 loads, resulting in decreased leachate pH, but differently to reduced N inputs. In microcosms of calc-silicate soil, nitrification of NH_4 resulted in lower pH and higher cation leaching than in acid treatments. By contrast, in quartzite and granite soils, $(NH_4)_2SO_4$ promoted direct cation leaching, although leachate pH increased. The results highlighted the importance of soil composition on the nature of the cations leached, the SO_4 adsorption capacities and microbial N transformations. Greater seedling growth on calc-silicate soils under both treatment types was related to sustained nutrient availability. Reductions in foliar P and Mg with higher N treatments were observed for seedlings in the calc-silicate soil. There were few treatment effects on quartzite and granite microcosm tree seedlings since P limitation precluded seedling growth responses to treatments. Hence, any benefits of N deposition to seedlings on quartzite and granite soils appeared limited by availability of co-nutrients, exacerbated by rapid depletion of soil exchangeable base cations.

Keywords: acidification, manipulation, nitrogen, ammonium, deposition, soil, drainage, pine, microcosms, forest

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