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A comparison of nitrogen and carbon reserves in acid sulphate and non acid sulphate soils in western Finland

Keywords carbon, nitrogen, nitrification, mineralization, soil organic matter, acid sulphate soils, subsoil, drainage, humus,

Abstract

Previous studies suggest that nitrogen (N) loads from acid sulphate soil (AS soil) catchments in Finland are higher than those from other agricultural catchments. This study seeks to explain this difference by measuring carbon (C) and N profiles in both an AS soil and a neighbouring non AS soil. In Lapua, western Finland, two adjacent fields (Dystric Cambisols), subjected to similar agricultural practices, were analysed to the depth of 240 cm for pH, total C (Ctot), total N (Ntot), NH4 +-N, NO3 --N, sulphur and bulk density. Field A, an AS soil, contained sulfidic materials and 0.9% Ctot below 170 cm, while Field B, not an AS soil, had 0.3% Ctot in the subsoil and no sulfides. In these soils, the groundwater level declined below 200 cm in summer, subjecting the subsoil to oxidation. This study revealed large stocks of Ctot, Ntot, and mineral N in the subsoil, particularly in the AS soil. At 20–240 cm, Field A contained 292 tons of Ctot ha-1 and 25 tons of Ntot ha-1, while Field B had 152 tons of Ctot ha-1 and 11 tons of Ntot ha-1. Field A contained up to 435 kg of mineral N ha-1 in autumn, while in Field B there was only up to 137 kg of mineral N ha-1. In Field A, NH4 +-N dominated strongly, while NO3 --N dominated in Field B. It is suggested that the greater concentration of mineral N in the AS soil is due to 1) a greater stock of total (mineralizable) N and 2) the slower rate of nitrification resulting in substantial NH4 +-N retention on cation exchange sites.

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[Full text] (PDF 160 kt)

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