

Environmental controls on patterns of plant nitrogen uptake in Canadian permafrost soils

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Plants develop different strategies of nitrogen (N) uptake in response to N limitation. This may explain N supply to plants from N-limited soils and niche differentiation due to soil N levels. To analyze the relationships between N availability and patterns of plant N uptake, plant uptake rates of different N sources (¹³C, ¹⁵N-glutamic acid, ¹⁵N-urea, ¹⁵N-ammonium, ¹⁵N-nitrate) were measured in the field condition. To assess N availability, the concentrations of amino acids, ammonium, and nitrate in soil solution and the mineralization rates of glutamic acid, arginine, ornithine, and urea were studied. We compared four sites in Northwest Territories, Canada; white spruce forest (WSF) at upper slope and black spruce forest (BSS) at lower slope on foothill of glaciofluvial sands, black spruce forest (BSF) and shrub birch tundra (TND) on fluvial sediments. In soil solution, DON was abundant at all sites, but inorganic N was abundant only in TND and BSS. Urea mineralization potentials were consistently high at all sites, except for BSF. This suggests microbial N mineralization is highly limited in N-limited BSF soil. Birch and grass preferentially absorbed inorganic N, while white spruce and black spruce can utilize amino acid-N under N-limited soil to bypass N flow between soil and plants.

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