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Labile carbon regulates protease activity and nitrogen acquisition in boreal forest topsoil.

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In boreal zone, soil organic matter (SOM) contains a substantial amount of recalcitrant material and forms a large nitrogen pool. However, this pool is to a great extent inaccessible to plants, due to its low decomposability. Although, the nitrogen supply is the most limiting factor of net ecosystem production (NEP) in boreal forests, it has been speculated that as a result of the accelerated decomposition of SOM induced by climate warming, part of this nitrogen pool could be released. It has also been shown that a substantial proportion of gross primary production (GPP) is allocated below ground and acts as an energy source for decomposing rhizomicrobial organisms, and that changes in the GPP rate could therefore increase the belowground turn over rate of otherwise recalcitrant nitrogen-rich SOM. We were studying the effects of increasing labile carbon input on the symbiotic microbial N acquisition and protease activities in a controlled microcosm experiment. We compared the natural abundance of isotope ratios of ^{13}C and 14C in soil CO_2efflux, protease enzyme activity, natural abundance of ^{15}N in the needles, and microbial biomass in microcosms containing bare soil and tree seedlings. In addition, we had treatments were additional energy was given to the bare soil and seedling microcosms in the form of glucose. The age of the CO_2 originating from the decomposition process of SOM was older in all treatments where easily decomposable carbon (energy) was available for soil microorganisms. The increased natural abundance of ^{15}N in the needles of the seedlings treated with glucose, suggests a shift in nitrogen acquisition to different SOM pool, which was reflected strongly to the total N content of the SOM and evolving ^{13}C signature in soil CO_2 efflux. The protease activity was highest in treatments with artificial glucose addition. Our results suggest that the increased input of easily available carbon from aboveground enables the decomposition of recalcitrant nitrogen rich compounds in SOM and could therefore increase the nitrogen supply to plants.