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# Decoupling of soil C and N mineralization by labile C inputs explain high C sequestration rates in response to N fertilization

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During the last decade there have been an ongoing controversy regarding the extent to which N fertilization can increase C sequestration in forest ecosystems by stimulating primary production. There is also evidence that N fertilization commonly results in reduced soil respiration rates that cannot be fully explained by lower root respiration. Several hypotheses aimed at explaining the phenomenon have been proposed, but the mechanism remains elusive. The aim of this study was to examine if decreased decomposition and respiration of soil organic matter (SOM) in response to N fertilization can be explained by diminishing priming effects, and to determine to which extent priming of SOM decomposition is manifested as C or N mineralization under different loadings of labile C and N. We also aimed at determining if any changes that occur in response to N fertilization are long-term effects dependent on a shift in e.g. microbial community composition, or an immediate effect caused by increased N availability and decreased N mining. To achieve these aims we designed an experiment where the potential priming of microbial C and N mineralization was studied in a Norway spruce forest. SOM derived respiration, gross N mineralization and 13C-incorporation into microbial biomarker lipids (PLFA's) were measured 4 and 24 hours after addition of 13C-enriched glucose. Field treatments included control, N fertilization, and two levels of tree density. We also included a treatment where the control soil received inorganic N, at the same level as in the field N fertilization treatment, in addition to glucose.

Glucose additions in most cases caused a significant reduction in microbial respiration of SOM, resulting in what is commonly referred to as "negative priming". In contrast, gross N mineralization rates generally increased in response to the glucose additions. Glucose additions, therefore, appeared to result in a decoupling of microbial respiration of SOM and gross N mineralization, possibly because of preferential glucose use by the microbial community. The decoupling was most pronounced in the N-fertilized plot with high tree density, where an up to 30 percent decrease in microbial respiration of SOM coincided with a more than 7-fold increase in gross N mineralization. A PLSR-analysis of 13C incorporation into microbial biomarker lipids (PLFA's) suggest that fungi was mediating this response, since the proportion of glucose derived 13C that was recovered in the fungal biomarker PLFA 18:2$\omega$6,9 was negatively correlated to respiration of SOM and C priming, and positively to gross N mineralization and N priming. The results suggest that labile C inputs can contribute to C sequestration above as well as below ground, since microbial immobilization of the labile C may result in decreased microbial respiration of SOM that coincides with a strong increase in the production of plant available N. Tree density and N fertilization appear to be important mediators of the response, which could potentially explain the strong effect of N fertilization on net ecosystem exchange that have previously been reported.