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土壌微生物バイオマス窒素同位体比の窒素可給性指標としての可能性について
Nitrogen availability and natural abundance of 15N of soil microbial biomass

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Nitrogen (N) availability in forest is a strong driver controlling net primary production of plant. Soil microbes regulate the N availability since they are responsible for the production of available N (inorganic and some organic N) for plants and soil microbes. Thus, balance of N and carbon (C) availability to soil microbes is quite important for the understanding of N cycle in terrestrial ecosystems and soil C/N ratio has been used as a parameter for that. However, C/N ratio of bacteria and fungi differs greatly and relative importance of them to the total soil microbes can differ among different soils, simple C/N ratio cannot determine the actual balance of C and N availability.

Recently, natural abundance of ^{15}N ($d^{15}N$) of the soil microbe has been proposed as a new parameter that can provide the information on relative C and N availability to the soil microbes (Dijkstra et al. 2006, 2008). Enrichment in $d^{15}N$ ($Dd^{15}N_{MB-Soil}$) of the soil microbes from the substrate (bulk soil N or extractable soil N) should be high when N availability is high because the soil microbes would extrete the excess N with low $d^{15}N$ due to the isotopic discrimination during the N metabolism. Even this new parameter r of $Dd^{15}N_{MB-Soil}$is expected to provide new insights into the actual C and N availability of the soil to the soil microbes, the measurement of $Dd^{15}N_{MB-Soil}$ is tedious due to the low concentration of soil microbial N. We explored the potential of $Dd^{15}N_{MB-Soil}$ in a temperate forest in Japan with denitrifier method that can allow us to measure $d^{15}N$ with small sample size (20-50nmol-N).

We collected the soil samples (Ao, 0-10 and 10-20cm depth) from Kamigamo Experimental Forest, Kyoto Univ, Japan from two plots located in upper part and lower part of a mountain slope. We measured $d^{15}N$ the extractable N (NH_4^+, NO_3^-, TDN and DON) in 0.5M K_2SO_4 soil extract. We also used the fumigation-extraction method to measure C and N content, and the $d^{15}N$ of soil microbial biomass. DOC concentration in the 0.5M K_2SO_4 soil extract and $d^{15}N$ of bulk soil N were also measured for the reference.

$d^{15}N$ of soil microbial biomass was significantly correlated with that of bulk N ($P<0.001$) but always higher than that of bulk N. Actually, $d^{15}N$ of soil microbial biomass was quite similar with $d^{15}N$ of DON, suggesting that the soil microbial biomass N is the source of soil DON as previously suggested (Koba et al. 2010). $Dd^{15}N_{MB-Soil}$ significantly correlated with soil C/N ($P<0.01$), which suggested that $Dd^{15}N_{MB-Soil}$ should reflect the C and N balance for soil microbes. However, the intercept of the regression lines obtained from two sites differed greatly. This difference in the relationship between $Dd^{15}N_{MB-Soil}$ and soil C/N strongly suggested that the same soil C/N does not indicate the same balance of C and N availability to the soil microbes. We discuss the usefulness of the new parameter of $Dd^{15}N_{MB-Soil}$ in the presentation together with other parameters such as DOC/DON and $d^{15}N$ of inorganic N.