

Nitrogen mineralization rates in forest soils in the Japanese archipelago measured by field incubation

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1. Introduction

To predict the effect of climate change on nitrogen dynamics in the forest ecosystem, it is necessary to investigate nitrogen mineralization and nitrification at various locations allowing for modeling of nitrogen dynamics in soils. In this study, we selected 20 sites from the Japanese archipelago and conducted field incubation for measuring net nitrogen mineralization and nitrification. We also considered whether parameters obtained from laboratory incubation were applicable in the field by comparing the ratios between field and laboratory incubations (Urakawa et al., 2013).

2. Method

We conducted buried bag method to investigate field net nitrogen mineralization and nitrification rate. In autumn 2012, we established an experimental plot (20 *20 m) at each site, and at each plot, five soil sampling locations were established. At each sampling location, mineral soil samples were collected from 0-10, 10-30, 30-50 cm depths. Soil samples were sieved (4 mm mesh) to remove roots and gravel, and composited soils from five plots into one sample at each depth. After collecting soils for the initial extraction, buried bags were made and buried in the plots again. We collected them in spring, summer, and autumn 2013, and measured net nitrogen mineralization and nitrification for three seasons (autumn 2012 - spring 2013, spring - summer, summer - autumn). Soil samples were extracted with 2M-KCl solution (1:10) and concentrations of ammonium nitrogen and nitrate nitrogen were measured by colorimetric method. Net nitrogen mineralization and nitrification amount of each season were summed to evaluate the annual amount.

Simultaneously with the field incubation, inorganic nitrogen leaching was investigated by resin column method. Resin columns containing ion exchange resin was installed at depths of 0 and 50 cm. Inorganic nitrogen absorbed by ion exchange resin was extracted with 1M-KCl and concentration of inorganic nitrogen was analyzed by colorimetric method.

3. Results and Discussion

Annual net nitrification in 0-50 cm layer ranged widely from 40 to 140 kgN ha⁻¹ y⁻¹. Nitrification amount in 10-50 cm layer was comparable to that in surface soil layer (0-10 cm) due to large bulk density and thickness, while nitrification in 0-10 cm layer accounted for about a half of that of all soil layers.

There was a significant positive correlation between nitrification measured by field and laboratory incubation. This suggests that estimation of field nitrification using parameters obtained from laboratory incubation is possible.

4. Reference

Urakawa et al. (2013) Characteristics of nitrogen mineralization rates and controlling factors in forest soils in Japanese archipelago, 2013 AGU Fall Meeting, San Francisco, 9-13 December 2013

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