Contrasting of nitrogen leaching from Moso bamboo forest and Japanese cedar forest: Role of vegetation in retaining nitrogen

*Dongchuan Fu[1], Masaaki Chiwa[1]

1. Kyushu University

[Introduction]

This study aimed to compare nitrogen (N) dynamics of soil water between Moso bamboo forest and Japanese cedar forest. High level of nitrate leaching from Japanese cedar plantation has been observed in response to elevated atmospheric N deposition. However, N loss from Moso bamboo plantations has been rarely studied. It is postulated that increased N deposition could stimulate invasion of bamboo into adjacent forests due to the fast-growing characteristic of bamboo under high nutrient conditions. Therefore, monitoring N dynamics in a Moso bamboo forest and adjacent woody forest is meaningful to evaluate the effects of elevated N deposition on the invation of Moso bamboo.

Reduced plant N uptake is a primary mechanism for increased nitrate leaching. In situ depletion method was used in this study to assess the N uptake by fine roots of trees. The objective of this study is 1) to measure NO_3^- and NH_4^+ concentration in water of surface and deep soils from a Moso bamboo forest and adjacent Japanese cedar forest. 2) to measure root N uptake rates of these two plants by the depletion method.

[Methods and materials]

1) Water sample collection

This study was conducted in a Moso bamboo forest and a adjacent Japanese cedar forest in the Kasuya Research Forest of Kyushu University, Fukuoka, western Japan. Five 10m×10m plots were established in these two forests. Water samples at surface (0-5 cm) and at a depth of 50cm soil below rooting zone were collected from each plot once a month from April, 2021 and concentrations (μmol/L) of NO_3^- and NH_4^+ were measured by ion chromatography.

2) Root N uptake by depletion method

Measurement of fine root uptake of NO_3^- and NH_4^+ by these two species were made from October 2021. Fine roots were excavated and then inserted into solution for 4 hours containing 20 mL 200 μmol/L NH_4Cl and $NaNO_3$. Single fine root N uptake rate was measured by this method and plant-scale N uptake was calculated by multiplying root uptake rate by root biomass.

[Result and Discussion]

1) Concentrations of NO_3^- and NH_4^+ in soil water

In Japanese cedar forest, NO_3^- concentration of soil water at depth of 50cm was significantly higher than in Moso bamboo forest. NO_3^- concentration in deep water was comparable with that of surface water in cedar forest, while it was significantly lower than that of surface water in bamboo forest. Higher NO_3^- concentration in deep water of cedar forest indicates severe N leaching. Moreover, lower NH_4^+ concentration was found from cedar forest than from bamboo forest. This result indicates that Moso bamboo might retain N as a form of NH_4^+, resulting in decrease in N leaching from Moso bamboo forest.

2) Fine root NO_3^- uptake rates

NO_3^- uptake rates of Moso bamboo were higher compared to that of Japanese cedar. In addition, the biomass of fine roots in bamboo forest was particularly larger than in cedar forest, which resulted in higher NO_3^- uptake in bamboo forest. Previous study has shown that there is no significant difference of soil nitrification between bamboo forest and cedar forest (Shimono et al., 2021). Thus, the higher uptake

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of NO_3^- could decrease N leaching in bamboo forest.

Keywords: Nitrogen leaching, Moso bamboo, Japanese cedar, Root uptake rate

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