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モウソウチク林におけるケイ素の循環
Silicon cycle in moso bamboo forests in central Japan

梅村 光俊[1*], 竹中 千里[1]
Mitsutoshi Umemura[1*], Chisato Takenaka[1]

[1] 名古屋大学大学院生命農学研究科
[1]Graduate School of Bioagricultural Sciences, Nagoya University

Silicon (Si) plays an important role in processes of soil formation in terrestrial and aquatic ecosystems. Among various plants, the gramineous plants are classified as silicon-accumulators [1, 2]. Therefore, graminoid dominated vegetation such as bamboo forests is considered to have a large pool of biogenic amorphous silica ($SiO_2 * nH_2O$) named as phytolith. Through the death of the plant, the phytolith contributes to an amorphous Si pool in the upper soil layers and constitute an important component in soil systems [3]. However, the researches on Si biogeochemical cycles in bamboo stands are a few. The purpose of this study is to evaluate Si dynamics in moso bamboo (*Phyllostachys pubescens*) forests spreading around eastern Asia, and to understand a role of them in Si biogeochemical cycle in forest ecosystem.

A study on the organic pool and biological cycle of Si was conducted at 15 * 15 m quadrats in three moso bamboo stands in central Japan. To evaluate Si accumulation and supply, we sampled each organ of living bamboo and litter fall. Biomasses of culms, branches, leaves were calculated from all bamboos' DBH in each quadrat using moso bamboo-specific allometry equations [4]. The biomasses of rhizomes and roots, which were taken on Dec 2009, were calculated for five 50 * 50 cm subplots with 30 cm of soil depth, and for five soil core samples (0-30 cm depth), respectively. Si concentrations of each organ were determined by combination method of gravimetry and ICP-AES after wet digestion with nitric acid [5]. Litter falls were collected using five litter-traps with 50 * 50 cm once a month from Aug 2008 to Jul 2009. Si accumulations and annual Si supply per area in each bamboo organ were determined by multiplying the Si concentrations in each organ by corresponding mass in each site. Turnover time (year) of Si was calculated by dividing total Si accumulation (above- and under-ground) by annual Si supply to forest floor through litter fall.

Si accumulations in three sites were 200-360 kg/ha above ground and 180-460 kg/ha in underground. The Si underground accumulations corresponded to 46-59% of the whole. Bamboo roots in the surface horizon (0-10 cm depth) existed 54-60% of the whole root biomass. Si supply was 77-324 kg/ha/yr, and their 72-88% were leaf litters. The amount of supply as phytolith (SiO_2) by bamboo litter fall was estimated about 140-700 kg/ha/yr, and it was comparable to phytolith supply in grass vegetation and much more than those in coniferous or broadleaved vegetation [6]. The turnover time of Si showed a range of 1.3-12 years from the results of this research.

From our research, we indicated that the huge biogenic Si source comparable or more than those in aboveground parts exists in the underground parts in moso bamboo stands. In addition, moso bamboo stands circulate much quantity of Si as amorphous silicic acid comparing with other forest vegetation, and should play an important role in Si biogeochemical cycles.

Refferences

[1] Takahashi E, Miyake Y (1976) Journal of The Science of Soil and Manure 47:296-300
[2] Bakker DNVJ, Hemminga MA, Soelen VJ (1999) Plant and Soil 215(1):19-27
[3] Struyf E, Smis A, Damme S, Meire P, Conley DJ (2009) Silicon 1(4):207-213
[4] Okuda S, Torii A, Ito T, Uemura T, Sasaki T, Ito T, Kimura M, Toyota N, Sado Y, Yamada T, Yamada M, Ito T, Takeuchi I (2007) Kenkyu Seika Sensyu, Forestry and Forest Products Research Institute 64:42-43
[5] Umemura M, Takenaka C (2010) Chubu Forest Research 58:165-166
[6] Kondo R (2010) Hokkaido University Press pp 387

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