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谷頭部斜面におけるリンの空間分布および挙動について
Spatial distribution and transport of phosphorus in a hillslop profile in Ichikawa City, Chiba Prefecture, Japan

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Transport of phosphorus (P) in subsoil is presumed to be minor in comparison to transport in topsoil. Three Soil columns that located at upland (agriculture land), hillslope and forest (background) were sampled in Ichikawa City (35.76^{o}N, 139.97^{o}E), Chiba Prefecture, Japan. Contents of the total P (STP), organic P (OP) and inorganic P (IP) were determined to assess the spatial distribution, origin and transport pathways of P in the soil of unsaturated zone. In unsaturated zone soil texture is in a sequence surface layer (SF), Kanto loam layer (LO), Joso clay layer (CY) and Narita sand layer (SA) of the upper part of slope profile and SF, the secondary deposited loam layer (SE), clayey sand layer (MI) and SA of the down part of slope profile. Soil samples were obtained from the slope profile at four sites (A, B, C, D). LO, CY and SA is covered the forest soil profile.

In forest soil, the contents of STP, OP and IP were 30-163 mg/kg, 5-63 mg/kg and 19-103 mg/kg, respectively. There averages in different layers were in the order: LO >CY >SA, respectively. In hillslop, the contents of STP, OP and IP were 42-1723 mg/kg, 20-1229 mg/kg and 18-839 mg/kg, respectively. The average in different layers were in the order: SF (1564 mg/kg) >SE (1349 mg/kg) >LO (494 mg/kg) >MI (492 mg/kg) >SA (91 mg/kg) >CY (69 mg/kg). There were similar changing trends between OP, IP and STP with the average in different layers. And the contents of OP were not higher than IP content in most layers, however, more than twice in SF and SE. Ratios of OP/STP in SF and SE were 63% and 64% which were similar with the ratios in topsoil of upland profile. Therefore, it is supposed that P in topsoil of hillslope was transported from upland by runoff and soil erosion. In addition, the average ratios of OP in LO, CY, MI and SA were 30-52%, lower than the average in SF and SEin hillslope profile.

STP contents of subsoil in hillslope were much higher than forest. It is assumed that there was external phosphorus loading on the subsoil in slop profile. The results indicated that P transported form the surface soil to subsoil. Moreover, there was an accumulation on the soil above CY which the depth is 2.8-3.4m than upper LO of A site. The CY is supposed to block the P transport along the profile. In SE, there was no obvious change of site B and C, showing that the soil of SE may be in saturation status of the P adsorption. And STP contents of MI and SA were lower than SE. It means there was no a great phosphorus accumulation on MI and SA. So P could transport toward to deeper stratum with soil water flow. Finally, P would be likely to enter the groundwater.

The results indicated that the contents of STP, OP and IP varied greatly in different stratum. And this study inferred that two P transport pathways. One was P transports as particulate form by surface runoff, soil erosion in the topsoil. The other one was P transports with the infiltration of soil water as soluble phosphate in the unsaturated zone. And P is likely to enter the groundwater, and would be moved towards wetland with groundwater flow, affect the ecological environment finally.

Keywords: phosphorus, spatial distribution, transport, hillslop profile