Size distribution of soil particles containing phosphorus in forest and agricultural soils in a watershed draining to Lake Biwa

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Eutrophication of lakes and marshes is one of the important environmental issues for its influences on water quality and biological diversity. Phosphorus (P) is an essential nutrient for organisms and is often enriched in water systems due to human activities. Farmlands are potential sources of excess phosphorus in water systems because of receiving a lot of P as fertilizer for plant productivity. Phosphorus is typically observed in agricultural soils as phosphoric acid, which is easily adsorbed to soil minerals.
Therefore, agricultural soils generally contain a large amount of P. Such soils can be transported to aquatic area including lakes and marshes directly through rain and soil erosion. It has been suggested that P export from farmlands is greater than from forests and is mainly through particulate forms rather than dissolved forms. Thus, we hypothesized that size distribution of soil particles is associated with the difference in the amount of P export between agricultural and forest soils.
In this study, we collected soils from farmlands (paddy fields and crop fields) and a forest in a watershed draining to Lake Biwa, fractionated the soils in size, and compared size distribution of soil particles and their P concentrations among the land types. The size fractionation was carried out into five? particle sizes, 300 μm-2 mm(F1), 75 μm-300 μm(F2), 10 μm-75 μm(F3), and smaller than 10 μm(F4). These fractionated soils were processed to measure total P, organic P, and inorganic P.
The results showed that the agricultural soils showed higher percentage of small soil particles (F4), which are to be easily exported to streams, than those from forest soil. The total P concentrations in small particle fractions in agricultural soils were not significantly higher than those in forest soils. Consequently, the total amount of P in small soil particle fractions in agricultural soils was estimated to surpass that of forest soil. These observations suggest that farmlands in the watershed have greater potential of particulate P export than forests, which would partly explain why farmlands supply greater amount of P to water systems than forests.

Keywords: Lake Biwa, particle size, phosphorus, agricultural soil, forest soil

