

Soil weathering degree controls silicon bioavailability by increased pH after biochar application

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Applying phytolith-rich biochar in agricultural soils increases soil pH, and the contents of plant nutrients and bioavailable silicon (Si). These increase induce positive impacts on plant growth, but hide the ones generated by Si uptake. Here we compare the effects of wollastonite (CaSiO₃) and two biochars on Si bioavailability and mineralomass of plants in a young Cambisol and a highly weathered Nitisol. The biochars were produced from rice straws respectively enriched and depleted in Si. They had identical pH and nutrient contents, but largely differed in Si content (respectively 51.3 g Si kg⁻¹ and 0.3 g Si kg⁻¹). The contents of soil bioavailable and phytolithic Si were assessed through CaCl₂ kinetic extraction and NaOH alkaline dissolution, respectively. Adding biochar markedly increased pH in the Nitisol, from 5 to 7. Phytoliths from phytolithic biochar provide bioavailable Si that increases plant Si uptake, biomass and Si mineralomass. At identical phytolith supply, the mobility of Si in the soil-plant system depends on soil pH and buffering capacity, hence soil weathering degree.

Key words: biochar, phytolith, Si bioavailability, pH, weathering degree