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LIMING INCREASES EUF EXTRACTABLE, LABILE, AND PLANT AVAILABLE P ON LOESS SOILS

Augmentation par chaulage de la teneur en phosphore labile, assimilable par les végétaux et soluble par électro-ultrafiltration (EUF) / Kalkdüngung steigert EUF-extrahierbares, labiles, und pflanzenverfügbares P auf Lössböden

ABSTRACT

In Europe, sugar beet is frequently grown on loess soils of pH$CaCl_2$ 6.5-7, that are low in Ca content, irrespective of their neutral pH. Liming such soils can increase the soil pH above the range of maximum P availability (pH 6-7), due to shifts between soil P pools. Thus it was hypothesized that plant available P decreases after lime application, which can be predicted by the EUF method. Burnt lime (CaO) and calcium sulfate were added in three doses to two loess derived topsoils (pH$CaCl_2$ 6.7-7.1, low Ca content). Another treatment consisted of sodium hydroxide (NaOH) application given in low dose only. The soils were incubated for four and eight weeks (12 °C; 40% water-holding capacity). Subsequently they were analyzed by EUF and sequentially extracted according to Hedley, and used to grow sugar beet in pot experiments. The plant material was harvested after eight weeks, and the P uptake was calculated from dry matter yield and P content. The increase in soil pH due to the application of CaO in low and medium dose and NaOH significantly increased water soluble inorganic P (H_2O-Pi) and EUF-P. In addition, liming considerably increased bicarbonate extractable P ($NaHCO_3$-Pi). The enhancement in labile P (H_2O-Pi+$NaHCO_3$-Pi) corresponded to a decrease in NaOH-Pi. Neither the increase in pH, nor the addition of Ca, nor the combination of both affected sparingly soluble Ca-P as extracted by HCl. There was a very close relation between the first EUF-P fraction and H_2O-Pi. Moreover, the P uptake by sugar beet was closely related to labile inorganic P, but less closely to total EUF-P.

Liming of low-Ca, near neutral loess soils likely results to Fe/Al-P mobilization and thus, an increase in labile P. The EUF method requires improvement regarding its performance in extracting plant available P bound to Ca.