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Exchangeable Cations in the Soils of Quercus Dominated Forests in Northeastern Austria

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In northeastern Austria there is a growing interest in increased utilisation of forest biomass for energy. This study focuses on soil properties and nutrient pool characteristics in deciduous forests in order to provide advice for forest management. We (i) quantified selected exchangeable cations in the soils of our study area and (ii) identified the effects of stand age, soil type, soil depth and soil pH on exchangeable cations and cation exchange capacity (CEC). Nine permanent Quercus petraea dominated plots on sandy, clayey cambisols and calcic chernozem were selected for our study. From each plot 18 soil samples were collected in a systematic grid by means of a soil corer with 70 mm diameter to a maximum depth of 60 cm. Soil pH, exchangeable mineral elements K, Ca, Mg, Na, Mn, Al, and Fe were determined in five geometric soil horizons. Statistical analysis showed that (i) forest age did not influence the exchangeable K content of the sandy soils; (ii) the exchangeable K content decreased with increasing stand age in clayey cambisols; (iii) exchangeable K, Na and Mg were higher in calcic chernozems and clayey cambisols (iv) exchangeable Fe was significantly higher in sandy forest soils except in the 60-80 years old stand; (v) exchangeable Fe was below detection limit in calcic chernozem soils. A comparison of exchangeable cations revealed that (i) Ca is the key element of base cations (ii) the content of base cations is strongly significantly higher in calcic chernozem soils (iii) calcic chernozem soils have the highest CEC. CEC ranged from 38 to 190 μmol/g in the entire research area. Base cations, acid cations and CEC differ with soil depth as followed (i) in sandy and clayey cambisols, CEC had a minimum in 20 cm depth and then increased with soil depth to 50 cm; (ii) CEC decreased steadily with soil depth in calcic chernozems. As expected, CEC is significantly positively correlated (Pearson correlation coefficient 0.661, $P<0.01$) with the pH of the soil. The contents of plants and above ground biomass nutrients, the rate of mineral nutrients accumulation or loss from soil and the correlation of mineral nutrients with nitrogen and carbon pools will be analyzed from samples collected in this study if funded. Our results show that the spatial distribution of mineral element pools is heterogeneous in this study area. On the whole the study suggests that soil fertilization is currently not necessary in deciduous forest in northeastern Austria. Stand age has no large influence on mineral nutrients, indication that no nutritional bottleneck results from incorporation of nutrients into the biomass. Soil type, soil depth and soil pH are the most important factors to influence the mineral nutrients and CEC of deciduous forests in northeastern Austria.

Key words: Oak stands; Austria; soil properties; exchangeable cations; CEC; base saturation