Clays concentrate nutrient reserves in a toposequence of sandy soils in Northeast Thailand

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Abstract

Poorly fertile sandy soils are widespread in Northeast Thailand. This represents a serious threat to local farmers and constrains economic development in the region. Here, we evaluate the fertility of these soils. We studied the physico-chemical and mineralogical properties of five pedons along a transect located at 25 km Southwest of Khon Kaen, respectively under forest (F), sugarcane (SC) and in paddy fields (PF1, PF2, PF3). All soils have a very low organic matter content (<1%). They differ in weathering stage and mineral reserve. The well drained soils under the F and SC are more weathered than the poorly drained PF profiles. Kaolinite is the major phyllosilicate in F and SC, whereas smectite is the dominant clay mineral in PFs. In the toposequence, the total content of major alkaline and alkaline-earth cations (TRB), i.e. mineral reserve, is confined to the clay fraction (<2 μm). From PFs to SC and F, it decreases with decreasing CEC and total Mg content, as well as with the disappearance of smectite and the appearance of 1:1-2:1 mixed layered clay minerals. In addition, KCl-extractable Al becomes the major cation on the effective CEC in the well drained soil profiles. We propose that clay minerals act here as key proton-consumers. As such, smectite dissolution is supported by a high content of exchangeable Mg relatively to Ca, and by the XRD detection of 1:1-2:1 interstratified clays. Such clay minerals represent, indeed, an intermediate stage in the processes of smectite dissolution and kaolinite formation in low silica and freely drained soil environments. The conservation of the clay exchanger must be a key objective in the management and use of these poor sandy soils. In addition, ***in situ*** *soil monitoring is required to further assess the dissolution of 2:1 clay minerals and the proposed corresponding Mg-depletion.*

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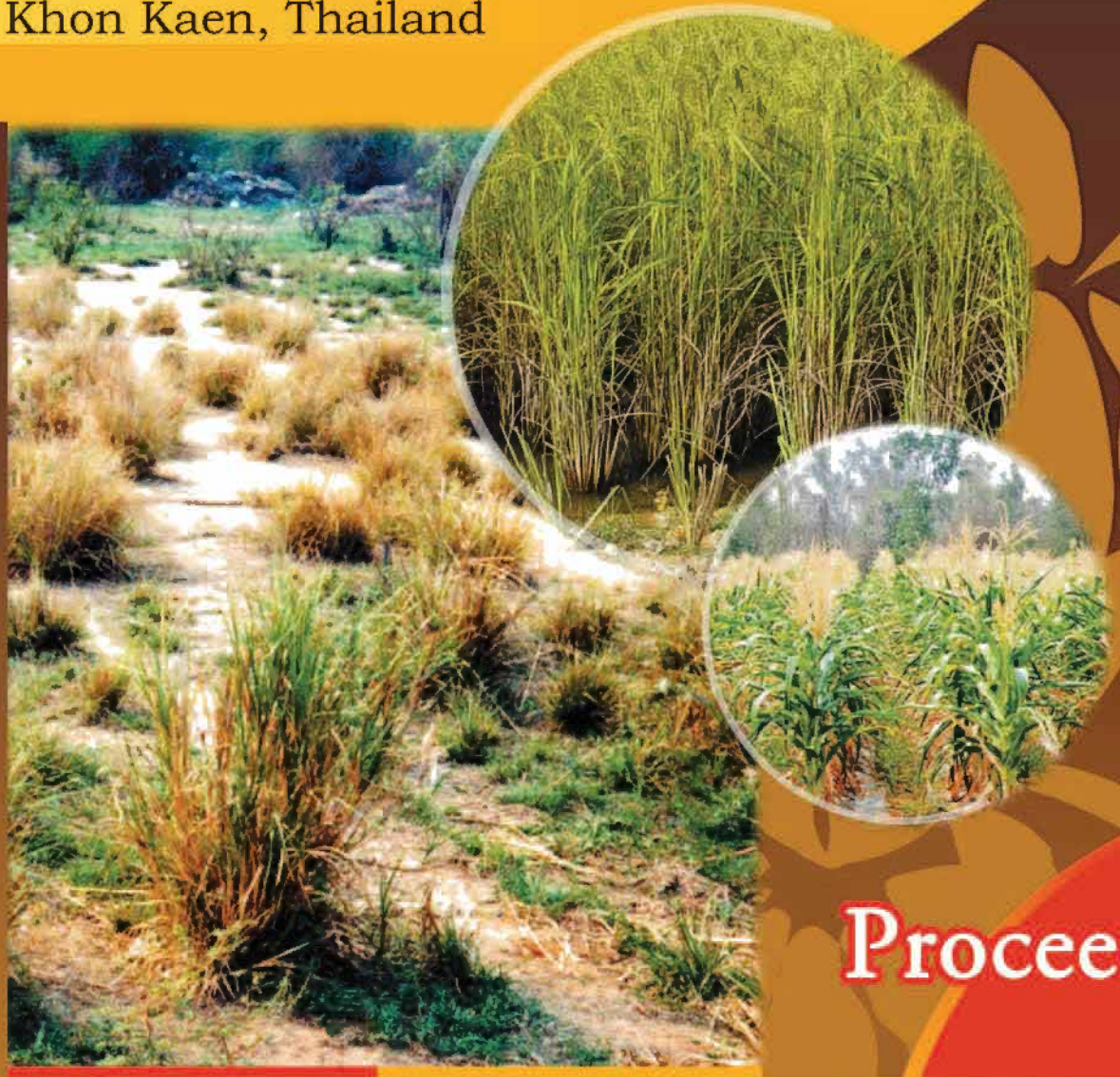

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