



## Non-lateritic red soils of the Brazilian drylands: taxonomy, pedogenic processes and potential for sustainable agriculture

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Non-lateritic red soils cover vast areas of the semiarid region of Northeast Brazil, or “Sertão”, whereas laterites remain currently scarce and are confined to ancient summit surfaces and/or to more humid areas along the coast. The land cover of the Brazilian drylands is dominated by dry deciduous woodland, or “caatinga”, in areas with mean annual rainfall and temperatures of 400-800 mm/y and 24-26 °C, respectively. According to morphological descriptions and analytical data, the red soils of semiarid Brazil mainly classify as Luvisols (chromic) in the WRB soil correlation system, and Alfisols in the USDA Soil Taxonomy. In all cases, their formation is strongly controlled by clay illuviation, allowing the diagnosis of a Bt (argic) horizon often rich in clay coatings. Contrary to lateritic soils extending over large tracts of tropical South America, the red soils of NE Brazil are high-activity-clay soils with high cation exchange capacity ( $> 24 \text{ cmol}(+)/\text{kg}$  of clay) and moderate to high base saturation levels ( $> 0.5$ ). The pedogenic interpretation for their development is that of a fersiallitic pedogenesis, which involves high contents of free iron (DCB extractable Fe / total Fe ratio  $> 0.5$ ) and the prevalence of 2:1 clays (e.g., illite, smectite and mixed-layer illite-smectite) in the soil mineral assemblage. In the regional setting, the red fersiallitic soils typically formed above shallow, grus-type weathering mantles developed from crystalline parent rocks, under pedoclimatic conditions driven by low, but irregular, deep drainage. In many ways, they are very similar to the red, decalcified fersiallitic soils developed on the crystalline shield of dryland peninsular India, but are very different from tropical ferruginous soils of semiarid West Africa. As in the Indian setting, the red soils of NE Brazil exhibit good agronomic characteristics in terms of chemical fertility, physical properties and water holding capacity in the upper horizons. All these characteristics make the red soil regions of dryland Brazil relatively convenient to development strategies based on a model of sustainable agriculture, in a regional context of recent spread of agroecological practices.