Mineralogical characterization and chemical properties of soils as a consideration for estabilishing sustainable soil management strategies

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Abstrak

Problems of soil limiting factors affecting crop growth were not fully understood owing to little attention has been given to soil mineralogy and its association to soil chemical properties. The objective of the study was to assess soil mineralogical and chemical properties of seven soils derived from different parent materials as an integrated strategic consideration to establish soil management. Field study was carried out in 2009. Soils were sampled from each horizon of profiles. Results showed that primary and secondary minerals had a strong effect on soil chemical properties. The sand fraction of soils derived from basalt, gabbro, mica schist and serpentinite was dominated by resistant minerals (quartz or opaques), leading to very limited, if any, nutrients released from parent materials. The clay fraction was dominated by kaolinite for soils derived from
basalt, mica schist and gabbaro, and by amorphous materials for the soil derived from serpentinite resulting in low soil cation exchange capacity (CEC). For other three soils derived from volcanic tuff, volcanic basaltic andesite and volcanic ash, the easily weatherable minerals (feldspar and ferromagnesian) were dominant, suggesting the high reserved nutrients. The presence of halloysite and smectite minerals in the soil derived from volcanic tuff resulted in high soil CEC, while the dominance of amorphous materials in soils derived from volcanic basaltic andesite and volcanic ash was responsible for the low CEC. For soils derived from basalt, serpentinite, mica schist and gabbro, therefore, the strategic management should be directed to restore soil CEC, pH, exchangeable cations and P content. For soils derived from volcanic tuff, volcanic basaltic andesite and volcanic ash, the presence of easily weatherable minerals indicated many reserved nutrients; hence the soil management is directed for replenishment of nutrients removed by crops.