Influence of soil parent materials and extent of weathering on plant available potassium and uptake in maize along a Kisii topo-sequence

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URI: http://erepository.uonbi.ac.ke:8080/xmlui/handle/123456789/34741
Date: 2005

Abstract:

A study was conducted on relationship letween chemical and mineralogical ~operties of basalts, trachytes and rhyolites and soils overlying them with regard to catIOns (Ca2+, Mg2+ and K+) and clay variation with depth, plant available K in !urface soils and maize K uptake in an exhaustively cropping greenhouse experiment. Mean Ca2+, Mg2+, and clay wntents were significantly different (P ~.O5), and decreased in the order of soils ~eveloped from basalts trachytes rhyolites. Mean K differences were not ~gnificant at P 0.05. Plant available K increased in the order of soils overlying lasalts trachytes rhyolites. Extracted K increased with the strength of reagents in ilie order water neutral NH40Ac hot HNOJ, and extracted more K as clay content in soils decreased. Water extracted 1.6,8.8 and 20.4 % exchangeable K in soils developed from basalts, trachytes and rhyolites, respectively. Calculated nonexchangeable K (NEK), and buffer power towards K increased with increase in clay morder of soils developed from rhyolites rachytes basalts. Dry matter yields, % K :ontent and K uptake by maize tops declined :ignificantly (P 0.00 1) in successive growth Icles. Maize plants grown on soils with high Ibile K yielded higher dry matter, had higher ;0 K in tissues and absorbed more K from Ichsoils significantly (P 0.001). Maize ant:;on soils with higher labile Kabsorbed preK, cumulatively, but amounts taken up per growth cycle dropped at a higher rate than in crops on a more clayey, well K buffered soils. Maize plants benefited from high labile K under greenhouse conditions, but the fast drop in K availability in less buffered soils, resulted in % K contents dropping close to the lowest attainable for the stage of growth at 0.3% K, irrespective of initial level ofK availability. As cropping continued, more K was sourced from the NEK pool in well-buffered soils than less cl~y soils. In the high K buffered soil developed on basalt, 57% of K taken up during the first growth cycle was sourced from NEK at a time where NEK for soils on rhyolite did not contribute to K uptake. In third growth cycle NEK contributed 100 % and 34.7 % ofK uptake in soils on basalts and rhyolites respectively. High K buffer in soils was considered a positive attribute in soils subjected to long- term and intensive cropping.