Cation exchange capacity of sandy salt-affected paddy soils by ammonium acetate, cobalt-hexamine and compulsive method

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Abstract

Sandy soils of Northeast Thailand have for long been identified as problematic soils. Acidity, salinity, low organic matter contents and low cation exchangeable capacity (CEC) have been established as the main soil constraints to rice production on these sandy soils. CEC values are dependent on clay content, soil organic matter content and soil pH. In the context of sandy salt-affected soils, precise and accurate determinations of low CEC values are often considered problematic and a large number of methods are available to measure this attribute. The objective of the study was to compare the values obtained on a set of 6 samples using different methods of CEC determination in the context of salt-affected sandy paddy soils. Ammonium acetate method at pH 7 and cobalt-hexamine at soil pH methods with or without alcohol pretreatment were compared with compulsive method, with $CaCl_2$ at the same pH. In sandy soil paddy profiles with a low clay content and CEC values measured with compulsive methods, less to 2.67 $cmol_c\ kg^{-1}$ determinations with ammonium acetate and cobalti-hexamine methods presented linear relationships with the compulsive method results in $cmol_c\ kg^{-1}{}_{(of\ soil)}$ ($CEC_{cobalt} = CEC_{compulsive} * 0.45 + 1.84$, $R^2 = 0.93$) and ($CEC_{ammonium} = CEC_{compulsive} * 0.37 + 1.91$, $R^2 = 0.87$). The same type of relationships were established performing previous alcohol treatment in order to remove salts although with lower significance (respectively $R^2 = 0.56$ and $R^2 = 0.80$). These results indicate that using ammonium acetate or cobalt-hexamine methods, in salt-affected sandy soils with a CEC lower 2.67 $cmol_c\ kg^{-1}$ will lead to overestimation of CEC when compared to compulsive method. This overestimation was found to be independent of pH values and salt-effect.

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