POTENTIAL OF USING AB-DTPA MULTI-IONIC EXTRACTANT TO DETERMINE AVAILABLE NUTRIENT STATUS OF HIGHLAND AND LOWLAND SOILS OF SRI LANKA

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ABSTRACT

Use of multi-element extractants is advantageous in routine soil analysis because of low cost and less time taken for analysis. Even though AB-DTPA extractant has been proved to be successful for alkaline soils, its potential as a multi-element extractant for tropical acidic soils and for lowland soils has hardly been reported. This study examined the suitability of AB-DTPA extractant to determine available P, K, Na, Ca, Mg, Zn, Cu, Fe, and Mn in highland and lowland soils of Sri Lanka.

Soil samples were collected from different locations, which included 31 highland soils and 31 lowland soils. The available nutrient status of all soils was analyzed by conventional methods as well as by AB-DTPA method. In the experiment with lowland soils, the standard AB-DTPA (using a soil:extractant ratio of 1:2) as well as a modified AB-DTPA procedure (using a soil:extractant ratio of 1:4) was tested. The conventional methods tested were Olsen, Bray-1 and Pi-P (Pi-P was tested only for lowland soils) for available P, neutral ammonium acetate method for exchangeable Ca, Na, K and Mg, and DTPA extraction method for available Fe, Mn, Cu and Zn, Contents of nutrients in plants and plant uptake were obtained by conducting two pot experiments using Guinea grass (*Panicum maximum*) for highland soils and paddy (*Oryza sativa*) for lowland soils, as indicator plants. Relationship between nutrients extracted by AB-DTPA methods with that of conventional methods and with plant nutrient concentration and uptake were analyzed using simple linear regression.

In highland soils, P, K, Na, Mg, Fe, Mn, Cu and Zn extracted with AB-DTPA method showed highly significant correlation ($p<0.001$) with those extracted by conventional methods. However, the amount of Ca extracted by AB-DTPA showed a poor correlation with ammonium acetate extractable Ca. The correlations between AB-DTPA extractable levels of elements and plant uptake were highly significant for P (r=0.85***), K (r=0.83***), Na (beneficial nutrient) (r=0.86***) Mn (r=0.75***), Zn (r=0.74) and Cu (r=0.75***). Comparatively weak, but a significant correlation was observed between AB-DTPA extractable Fe with plant uptake of Fe (r=0.48*). However, Ca and Mg extracted by both AB-DTPA and ammonium acetate methods did not show a significant correlation with plant uptake, probably due to the relatively high level of ca and Mg in the tested soils.

In lowland soils, P, K, Na, Mg, Fe, Mn, Zn and Cu, extracted by standard AB-DTPA (1:2) as well as by modified AB-DTPA (1:4) methods correlated well ($p<0.01$) with those extracted by conventional methods tested. For, Ca, a significant correlation was observed between Ca extracted by 1:4 AB-DTPA and ammonium acetate methods ($p<0.01$), but the correlation between Ca extracted by 1:2 AB-DTPA and ammonium acetate methods was poor. Highly significant correlations were observed between plant uptake and extractable nutrients by 1:2 AB-DTPA and 1:4 AB-DTPA methods for P (r=0.70***and 0.73***, respectively), K (r=0.79*** and 0.66***, respectively, Na (r=0.86*** and 0.78***, respectively) Fe (r=0.60** and 0.68**respectively), Mn (r=0.72*** and 0.78*** respectively) and Zn (r=0.66** and 0.74***, respectively). As in highland soils, extractable Ca and Mg showed a poor relationship with plant uptake of respective ions. The

relationship between Cu and plant uptake of Cu could not be tested as Cu level in plants was undetectable.

Under both highland and lowland conditions, AB-DTPA method was as good as, or even better than the conventional methods in evaluating available nutrient status, indicating the possibility of replacing all the conventional extractants tested by the single AB-DTPA multi-element extractant, which will reduce the time and cost of analysis. AB-DTPA extraction at both 1:2 soil:extractant ration and 1:4 soil :extractant ratio was effective under lowland conditions, but 1:2 method was superior to the 1:4 method.