EVALUATION OF THE MIXED ION EXCHANGE RESIN METHOD FOR THE SIMULTANEOUS EXTRACTION OF AVAILABLE POTASSIUM MAGNESIUM AND OTHER CATIONIC PLANT NUTRIENTS

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ABSTRACT

Precise, accurate and rapid determination of available nutrients of agricultural advisory soil samples is very important for fertilizer recommendation to perennial and semi-perennial crops cultivated in upland soils of Sri Lanka. Among the chemical methods used for determination of available nutrients, ion exchange resin method is a non-destructive multi element extraction method. Therefore by the present study, ion exchange resin method was evaluated for determination of exchangeable bases, zinc, manganese, iron and copper in upland soils of low and mid country region of Sri Lanka. There are twenty two soil series have been sampled from six agro-ecological regions, viz., IL_1, IL_3, IM_3, WL_3, DL_1 and DL_3 for the present study. The potassium status and magnesium status of each soil were determined by two different and independent methods, viz. bioassay and laboratory analysis. For bioassay, pot experiments were carried out with *Peuraria phaseoloides* as an indicator plant for Mg and *Panicum maximum* for K. the treatments were +K and +Mg and -K and -Mg as fertilizers. Total dry matter production, K and Mg concentration of vegetative parts and relative uptake of K and Mg by the crop were determined. Relative bio mass production (RBP) was calculated soil by the percentage ratio of dry matter weight of - K or - Mg treatment to + K or + Mg treatment.

Mixed ion exchange resin (MIER); cation exchange resin (CER) by employing 3 different extraction periods (4h, 8h and 16h), 2.5% acetic acid (HAc) method and 1M ammonium acetate extraction (1M NH_4Ac) were used. Exchangeable bases determined by MIER and CER at the three different extraction times (4h, 8h, 16h) highly

significantly correlated ($r^2 > 0.81$) with all exchangeable bases except Na determined by 1M NH_4Ac, 2.5% HAc. The correlation data showed that, 4h extraction time of CER and MIER methods could be used for determination of exchangeable bases instead of 16h extraction.

The goodness of fit of RBP of indicator plants and corresponding soil K or Mg determined by each method to Cate and Nelson model (Cate and Nelson, 1971). Relative biomass data of *Panicum maximum* and soil K values by CER ($r^2 = 0.60$), MIER ($r^2 = 0.43$), 1M NH_4Ac ($r^2 = 0.56$) and 2.5% HAc ($r^2 = 0.55$) showed high correlations and significantly fitted to Cate and Nelson model. The linear regressions between the concentration of K in *Panicum maximum* and log (soil K) determined by CER (16h), MIER (16h), 1M NH_4Ac and 2.5% HAc were highly significant with correlation coefficients 0.83, 0.82, 0.82, and 0.81 respectively. The foregoing results showed that all four methods were suitable for determination of plant-available K in soils.

Soil Mg determined by all four methods did not show significant correlations with RBP or relative Mg uptake of *Pueraria phaseoloides*. The linear correlations between log (soil Mg) and Mg concentration of *Pueraria phaseoloides* were also poor ($r^2 < 0.51$) for all four methods. Therefore none of the methods were found suitable for determining plant available soil Mg in soils.

The quantity of four micronutrients, viz., Fe, Mn, Zn and Cu exchanged from solution phase to the resin with NH_4^+ was very high (> 96%), for both MIER and CER. But

percentage recovery of those nutrients from resins by the effluent solution of 1M NH_4Cl was very low (58%). The quantities of Fe and Cu of soils exchanged with NH_4^+ of CER or MIER were very low. The quantities of Zn and Mn on soils extracted by the resins were sufficient for determination by effluent analysis. But quantities of extractable Zn by CER and MIER did not significantly correlate with those at by 0.005M DTPA extraction, but they significantly correlated with extractable Zn by EDTA/ NH_4HCO_3 (r^2; 0.55, $p < 0.01$) and 0.01M HCl (r^2, 0.75, $p < 0.001$) methods. The resin extractable soil Mn did not significantly correlate with the 0.05M DTPA extractable Mn. The results showed that further modifications should be made to MIER and CER methods if they were to be used for determination of micronutrients in soils.