

## A STUDY OF THE CONTENT OF MACRO-NUTRIENTS OF SOILS WITH DILUTED COMPLEX FORMING SOLUTIONS

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### Introduction

In soil science of Hungary, for the characterisation of phosphorus and potassium supply, the AL method is used. The technique using the traditional extractants, however, overestimates the phosphorus supply of the soils containing carbonates (Sarkadi-Thamm-Pusztai, 1988 Hegymegi-Simon-Micheli 2006, Osztóics et al. 2006, Lazányi-Loch 2006), therefore, a suitable extractant has been searched, which may characterise the available phosphorus and potassium content of soils both either with carbonates (alkaline) or of acidic nature.

According to Mart (1990), extracting methods based on the chelating technique suitable for several elements simultaneously could be applied for that purpose.

Kocsis-Kunos-Pásztor (2006) proposed the EDTA diluted to its 1/15<sup>th</sup> concentration (without changing the rate of its constituents). For the diluted EDTA, a convenient volume of EDTE was added with NH<sub>4</sub>Cl as exchangeable cation for the recovery of nutritive elements. Results obtained have been compared with those results obtained with EUF as well as with 0.01 M CaCl<sub>2</sub> as solvent. It was stated that the results coincided largely obtained with all the three methods (e.g. in phosphorus), whereas for some others, there were considerable deviations (e.g. Mg). In the case of more elements, the results could be calculated from each other (e.g. potassium).

In order to interpret the results obtained with extraction using EDTE+NH<sub>4</sub>Cl, experiments have been planned to assess the absorbency of the respective elements. The correlation between the data received with the different extracting procedures and the absorbency would qualify the utility of the extraction method.

### Material and method

The procedures applied for the analysis

The standard method MSZ-20135: 1999: AL – P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O

0.01 M kalcium-klorid (CaCl<sub>2</sub>) – According to Houba and associates (1986)

ammonium-chloride with ethylene-diamine-tetra-acetic-acid solution (EDTE+NH<sub>4</sub>Cl)

The extractant is 0.0033 M ethylene-diamine-tetra-acetic-acid, 0.0067 M ammonia solution and 0.0067 M ammonium-chloride in 1 dm<sup>3</sup>.

*Preparation:* in a test-tube of 1000 cm<sup>3</sup>, 0.96 g ethylene-diamine-tetra-acetic acid and 40 cm<sup>3</sup> distilled water is filled. Then 0.9 cm<sup>3</sup> 25 m/m % ammonia solution is added and agitated until EDTE was dissolved (3-4 minutes). Next, 0.33 g ammonium-chloride after being dissolved, the solution will be completed to circ. 950 cm<sup>3</sup>. The pH of the solution has to be checked and adjusted with 0.01 M hydrochloric acid or ammonia solution to pH 7.00 ± 0.05. Finally, the test-tube is completed with water to the caesura. Instrumental measurements were performed with spectrometers of Thermo-Jarrel Ash made, type ICAP 61E.

## Soils examined in the experiment

Two series of analyses were executed. In the first series, 124 soil samples taken from the upper 20 cm layer of different soil types of the Great Plain were used and processed with the extraction with  $\text{CaCl}_2$  and  $\text{EDTE}+\text{NH}_4\text{Cl}$ .

The 2<sup>nd</sup> series contained 22 samples derived from 5 soil profiles (Table 1). In those samples, the analyses were combined with nutrient absorption tests.

Table 1. Results of the 2nd series of analyses representing 5 sampling spots with different layers of the soil

Soil type	Depth of the layer cm	pH-KCl	pH-H <sub>2</sub> O	Humus content %	K <sub>A</sub>	Salt %	CaCO <sub>3</sub> %	AL (mg/kg)	
								P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Chernozem	1 (0-36)	7.27	7.94	3.06	43	0.08	3.2	203.6	418
	2 (36-61)	7.31	8.04	1.83	47	0.02	15.0	46.5	100
	3 (61-86)	7.55	8.21	0.81	44	0.02	26.0	33.0	70
	4 (86-110)	7.54	8.23	0.48	41	0.05	22.0	21.4	59
	5 (110-150)	7.84	8.40	0.23	37	0.18	12.0	13.6	43
Loam with carbonates	1 (5-25)	7.05	7.81	3.73	55	0.11	1.1	281.7	424
	2 (35-55)	7.20	8.19	2.48	55	0.08	6.2	51.1	209
	3 (80-100)	7.32	8.45	1.67	54	0.03	13.0	28.9	158
	4 (110-130)	7.30	8.55	0.00	52	0.04	12.0	18.8	133
Loam without carbonates	1 (0-11)	4.92	5.95	3.76	57	0.02	0.0	66.0	221
	2 (11-43)	5.03	6.25	2.84	58	0.02	0.0	28.2	192
	3 (43-81)	5.59	7.06	1.50	61	0.03	0.0	15.8	178
	4 (81-118)	6.38	7.81	0.50	61	0.05	0.1	28.4	114
	5 (118-150)	6.91	8.31	0.31	64	0.05	4.9	24.0	95
Sandy soil with carbonates	1 (10-20)	7.17	7.99	1.83	34	0.05	3.8	281.7	360
	2 (75-85)	8.10	8.60	0.22	26	0.02	18.0	33.9	43
	3 (140-150)	8.39	8.73	0.00	28	0.02	12.0	8.1	43
	4 (170-180)	8.37	8.97	0.70	26	0.02	10.1	15.8	43
Sandy soil without carbonates	1 (2-25)	6.94	7.17	0.77	27	0.02	0.0	290.8	117
	2 (40-50)	7.11	7.44	0.40	26	0.02	0.0	92.1	77
	3 (70-90)	7.07	7.53	0.36	26	0.02	0.0	101.9	77
	4 (110-130)	7.49	8.24	0.22	25	0.02	0.0	60.2	89

## Experiment to study absorption of nutritive elements by the soil

For the purpose to examine the absorption of nutritive elements, phosphorus and potassium, two experiments have been designed. The solution applied to the soil samples contained 20 mg P<sub>2</sub>O<sub>5</sub>/l and 14 mg K<sub>2</sub>O/l (as in the combination KH<sub>2</sub>PO<sub>4</sub>). Thus 100 ml was given to 10 g soil. The dose referred to 1 g soil was 0.2 mg P<sub>2</sub>O<sub>5</sub> and 0.14 mg K<sub>2</sub>O, which means about 900 kg/ha P<sub>2</sub>O<sub>5</sub> and 590 kg/ha K<sub>2</sub>O given to the upper 30 cm layer in the field. The soil sample was suspended with the respective extractant solution and shaken over one hour, then left alone for 24 hours, subsequently filtered for the analysis. Phosphorus and potassium retained by the soil has been expressed as a per cent of the quantity administered.

**Results and discussion**

The results achieved with extraction using  $\text{EDTE}+\text{NH}_4\text{Cl}$  has been compared with that using  $\text{CaCl}_2$  as extractant, and they are presented in values calculated as coefficients of correlation in Table 2.