POTASSIUM CONTENT IN SOME REPRESENTATIVE ALBANIAN SOILS ESTIMATED BY EUF METHOD

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Introduction

The electroultrafiltration (EUF)-method is one tool in determining of nutrient quantity and the nutrient intensity of different soils. The EUF technique was proved to be a useful method to measure the nutrient quantity and intensity in soils (Nemeth, 1979; Nemeth, 1985). Mengel and Uhlenbecker (1993) investigated the kinetics of nonexchangeable K released by EUF. The EUF kinetic parameters that describe the release of nonexchangeable K were well correlated with the K uptake of the ryegrass.

In order to characterize better the K dynamics some soil samples were analyzed by EUF and routine methods with objectives: to determine potassium availability by their desorption kinetics and release into soil solution using the EUF technique

This study was carry out with soil samples from nine sites located at different locations of Albania.

Methods

Soils from nine different sites in Albania are used. The soil samples were sieves to pass a 4 mm sieve, were air-dried and were used for analyzing of soil texture and the mineralogy of clay fraction. For further physico-chemical analyzes the air-dried soils was ground to pass a 1mm sieve. Exchangeable K was determined by the Ca acetate-Ca lactate-acetic acid method (CAL) (Schüler, 1969) and pH was measured in a soil:0.01 M CaCl2 ratio of 1:2.5. Organic matter content was determined with potassium dichromate method and the total N was measured with the Kjeldahl method.

On the other side content of K in soil samples was extracted by EUF method. The EUF technique as a routine analysis method normally extracts two fractions: the first fraction is extracted from 0 to 30min at 20^0 C and 200V and the second fraction is extracted from 30 to 35min at 80^0 C and 400V (Nemeth, 1985). For analyzing the kinetics of K release , after EUF routine-program, five other fractions were extracted every five minutes at 80^0 C and 400V. So, seven fractions were employed to analyze the kinetics of K release. The EUF extracts from anode and cathode were mixed together.

Results.

The average dates about Extractable K content extracted with CAL and EUF and clay mineralogy are given in Table 1 and 2.

The clay fraction of the topsoils from Shkodra contains more illite than the other soils. The other topsoils contain a mixture of illite and smectite in their clay fraction. The topsoils from Shkodra have more labile 2:1 clay minerals (> 2nm) and their amount was found to be significant different from that of the other soils. Tributh et al. (1987) reported that smectite is formed from transformed illitic clay minerals when low K concentration and pH below 6 are present in the soil solution. It seems that the higher percentage of labile 2:1 clay minerals in the topsoils from Shkodra is supported by the CAL and EUF results which indicate a low K concentration.CAL and EUF extractable K concentration was found to be lower in the Shkodra topsoil than in the other soils.

Usually, the concentration of the nonexchangeable K in soils is affected by the clay concentration, the types of clay minerals present, and the changes over time of the K balances in soils (Sparks and Huang, 1985). It seems that Albanian soils contain relatively high amounts of nonexchangeable K since these soils are rich in illite and smectite and have considerable amounts of clay.

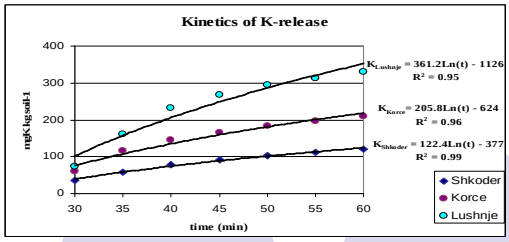
Table 1. K extracted by CAL and EUF

	mg K kg^{-1} soil extracted by:			
	CAL	**$EUF_{0\text{-}30\ min}$**	**$EUF_{30\text{-}60\ min}$**	**$EUF_{60\ min}$**
Shkoder	41.5	35.5	85.7	121.2
Korçe	95.3	59.9	150.4	210.4
Durres	138.8	81.7	266.5	348.2
Lushnje	141.1	74.4	255.4	329.8

Table 2. Clay Mineralogy

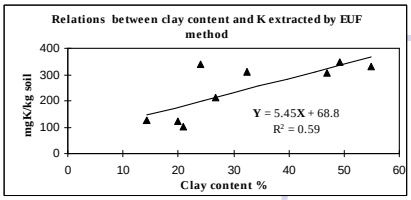
Samples	Kaolinite	Illite	Smectite	Labile minerals	Others
Shkodra	14	60	1	12	13
Korca	11	47	28	2	12
Durres	5	42	36	8	9
Lushnja	4	40	41	11	4

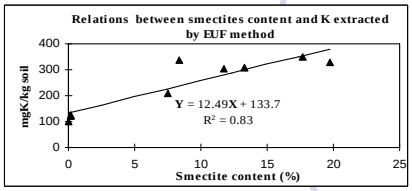
The kinetics of cumulative EUF extractable K, were well described by Elovich function [$y = a + b \ln(t)$] and the determination coefficient, and term a and the b values for this regression are calculate and will presented.



In all the cases the data matched the curve very well, r^2 being highly significant. The calculated b values represent the slope of each line and indicate EUF-K release rates (mg K kg^{-1} and time $unit^{-1}$). Mengel and Uhlenbecker (1993) found a good correlation between the slope of EUF-K release curve and K-uptake of *Lolium perenne.* They proposed to use the slope of this curve to approximate the rate of nonexchangeable K release. The slopes of the cumulative EUF-K release curves from Albanian soils indicate that these soils have a higher potential of plant available nonexchangeable K

The important factors that influence in variability of K desorption from selected soils are the clay, smectite and illite content in soil. The dates indicate strong relationship between clay and smectite content in one side and EUF- K, and steepness of slope b on the other side.





Conclusions

The here presented data of the K availability determined by the CAL- and the EUF method and the mineralogy of the clay fraction of representative Albanian soils show a relatively high potential for available nonexchangeable K. It has to be considered that the nonexchangeable K is only then in high quantities released if the soil is moist and plant species can mobilize the nonexchangeable K. However, in Albania most of the summers are of light precipitation and plants can have water stress and it might that a latent K deficiency occurs in plants during summer time. For this reasons we recommend a K application although the soils are rich in EUF extractable nonexchangeable K.

References

Nemeth, K. 1979. Adv. Agron. 31: 155-188.;
Nemeth.K, 1985. Plant and soil 83, 1-19.
Mengel.K, Uhlenbecker.K, 1993. Soil Science 57, 761-766.
Schüller, H. 1969. Z. Pflanzenernähr. Bodenk. 123: 48-63.
Tributh et al. 1987. Soil Sci. 143: 403-409.
Sparks, D.L. and P. M. Huang. 1985. *In:*R.E. Munson (ed.) Potassium in Agriculture. ASA-CSSA-SSSA, Madison, WI, USA. p. 201-276.
Steffens.D, 1994. Soil Sci.Soc.Am.J., 58

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