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SOIL QUALITY MONITORING IN ALBA COUNTY

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Abstract

The land an agriculture monitoring system in Alba County includes 17 sites. The first determination was in 1994 and the second was realised in 2005. Every site was characterised from a morphological, physical and chemical *point of view. Also, the content of heavy metals and total DDT and total HCH were determined. Research showed that the most af the sites belong to the slightly acid class on the 0-20 cm depth and neutral class on the 0-50 cm depth. The average content of organic matter, total nitrogen, and mobile potassium is moderate. The mobile phosphorus average content is low. The average contents of Cu, Zn, Ni and total HCH are higher than normal contents accepted by legislation. The other heavy metals belong to the normal class.*

INTRODUCTION

Soil is one of the most important parts of the natural environment and it is largely non-renewable. Worldwide, all economies depend on the goods and services provided by the natural environment. Soil, as a natural resource, performs a number of key environmental, social and economic functions [1].

Soil monitoring is esential for the early detection of change in soil quality. Such early detection enables the design and implementation of policy measures to protect and maintain the sustainable use of soil so that it continues to deliver ecosystem goods and services [6]. This paper presents the research results of soil monitoring from Alba County - second determination.

MATERIAL AND METHODS

Methodology. The achievement and maintenance of soil-land monitoring systems at level I (16x16 km) was done under the order no 223/2002 for enforcement 444/2002 law and methodology of soil survey elaboration. In Alba County there are 17 agricultural monitoring sites. The second determination of agricultural land monitoring in Alba County was in 2005. The physical analyses comprised six parameters (particle analysis with ten fraction, density, total porosity, penetration resistance, hydraulic conductivity, structural instability index). Chemical analysis

comprised nine parametres (pH_{H2O}, $V_{pH8,3}$, total nitrogen, organic matter, mobile forms of phosphorus and potassium). Also heavy metals - total forms - (Cu, Pb, Cd, Zn, Ni, Co, Mn), total DDT, total HCH and sulphur were analysed.

RESULTS AND DISCUSSION

Soil cover in Alba County. The interaction of the pedological factors led to the existence of a large number of soil types. In Alba County there were identified a total of 12 classes of soil with 23 types and 91 subtypes of soils. Regosols (10.43%), Aluviosols (10.88%), Preluvosols (19.4%), Luvosols (10.98%), Erodated soil phases (11.66 %), Cernozems (6.43 %), Eutric Cambisols (4.96%) and Dystric Cambisols (6.52%) [3].

The processes affecting the quality status of agricultural land in Alba County are:

- *pollution from excavation to date with waste and inorganic waste* is excessive (76-100% crop loss) on 3,946 ha;

- *pollution drift substances* (Zlatna area, Alba Iulia, Ocna Mures), affecting 5500 ha, of which 3,500 ha are very strong, due to ferrous metallurgy Zlatna area;

- *pollution and waste organic residues, agricultural and slurry*, totaling 11.5 ha;

- *pollution by erosion and landslides* in different degrees affect 166,080 ha of agricultural land in the county, reducing yields and causing considerable damage to the sealing and destruction of buildings and facilities;

- *acidic soils* affects strongly 35,937 ha;

- *scarcity of nutrients* and *organic matter* affected from moderate to strong 151,300 ha;

- *soil compaction* on 40,000 ha.

Land quality in Alba County, after the evaluation note, is dominated by the high percentage of land from III and V classes for arable, vineyards and orchards. The prevailing quality of pasture and meadow belongs to IV and V classes [3].

Representativeness of system monitoring. Classes of soil most common are well represented, but not proportionately. Depending on the type of use, there are relatively well represented arable land, pasture and hay fields, and are not represented at all the vineyards and orchards, which occupies 1.53% of total land.

Taxonomic characteristics. Soil types and subtypes of I level monitoring network are: Regosols - 17.4%, Fluvisols - 5.9%, Haplic and Vertic chernozems -17.7, Vertic luvisols - 5.9%, Eutric cambisols and Dystric Cambisols - 41.2%, Pellic vertisols 5.9%, Anthrosols - 5.9%.

Physical characteristics. Table 1 shows the main physical characteristics of agricultural soils in the I level monitoring gride in Alba County. In the A horizon, the prevailing texture is fine (58.8%), followed by medium (35.3%) and in one case (5.9%) the texture is light.

Saturated hydraulic conductivity (K sat, mm.h^{-1}), in the first layers (0-25 cm and 25 cm), varies from moderate to very high and the average is very high. On the 35-50 cm layer, K sat varies from extremly low to very high.

Resistance to penetration (RP, kg.f.cm^{-2}) varies from very low to moderate and the average is low in all layers.

The degree of compaction (GT). The minimum and average values belong to non-compacted classes. The maximum value varies from slightly compacted in the first layer to strongly compacted on the 35-50 cm layer. Average values are in non-compacted class.

Structural instability index (IIS), in all layers, varies from very low to very high. The average is low in the 0-25 cm and 25-35 cm layers and moderate in the 35-50 layer.

Edaphic volume (VE) presents a large range of values, from small to very large, and the average is high.

Table 1

Statistical parameters of physical characteristics

Statistical parameters	Ksat, mm.h-1			RP, kgf.cm-^{2}			IIS			VE
	0-25	25-35	35-50	0-25	25-35	35-50	0-25	25-35	35-50	
n	17	17	16	17	17	16	17	17	16	17
X_{min}	4.12	2.32	0.2	3.0	2.0	3.0	0.04	0.03	0.05	0.03
X_{max}	167.1	113.3	111.8	32	34	42	1.40	1.23	1.63	1.40
X_{med}	77.1	56.2	47	14.2	16.2	20.0	0.34	0.39	0.45	0.77
±σ	46.32	36.1	38.3	9.0	10.4	12.4	0.31	0.28	0.38	0.40
cv,%	60.1	64.1	81.5	63.5	64.5	62.2	91.2	71.8	84.4	51.9

n-total number of samples; X_{min}-minimum value; X_{max}-maximum value; Xmed-mean value; σ-standard deviation; cv,%-coeficient of variation

Chemical characteristics. Table 2 shows the main chemical characteristics of soils in I Level monitoring gride in Alba County.

Soil reaction (pH_{H2O}) in agrochemical layer (0-20 cm) varies from very strong acid to weak alkaline, and the maximum value, in the layer 0-50 cm, range from moderately strong acid to alkaline. Most of the sites belong to the slightly acid class in the 0-20 cm and neutral on the 0-50 cm thickness.

The degree of saturation in the base ($_{pH8.3}$) ranges in oligobazic-saturated in bases field and the average is eubasic in the both layers.

Organic matter content (Ht, %) varies from very low to high in the both layers and the average is moderate.

The content of total nitrogen (Nt, %) is in close correlation with the organic matter ranging in the low-high field in topsoil and in very low-high in 0-50 cm layer, and average is moderate in the both layers.

The content of mobile phosphorus (Pm) is extremly low-very high in both layers and average is low.

The content of mobile potassium (Km) ranges from very low to very high in both layers and the average is moderate in the both layers.

Compare with the first determination, there were found some changes of chemical properties. The soil reaction was slightly decreased and also the average of total nitrogen content, the mobile phosphorus and potassium content were lower at the second measurement.

Table 2

Statistical parameters of physical characteristics

Statistical parameters	**pH**		**Ht, %**		**Nt, %**		**Pm, mg/kg**		**Km, mg/kg**		**$V_{pH8.3}$ %**	
	20 cm	50 cm	20 cm	50 cm	20 cm	50 cm	20 cm	50 cm	20 cm	50 cm	20 cm	50 cm
n	17	17	17	17	17	17	17	17	17	17	17	17
Xmin	4.3	4.7	0.67	0.56	0.105	0.053	3.9	3.6	41	44	30	31
Xmax	8.1	8.5	9.50	9.68	0.423	0.314	120	99	508	361	99	100
Xmed	6.2	6.9	4.74	3.55	0.240	0.190	18	14	188	154	80	81
±σ	1.3	1.3	2.36	2.04	0.078	0.067	29	23	124	100	24	25
cv, %	20.9	19.3	50	57.5	32.5	35.3	163	170	66	65	30	31

Table 3 shows the statistical parameters of potentially polluting substances contents.

The content of total Cu varies from 8.4 to 138 mg/kg and average is 35 mg/kg. The average is higher than the average content (23.3 mg/kg) of copper from I level monitoring greed [4] and typical values (20-30 mg/kg) for our country [2].

The content of total Pb varies from 2.6 to 22.7 and the average content is 12 mg/kg. This average is under the average content (29.3 mg/kg) typical of agricultural I level monitoring greed [4].

The content of total Zn varies from 33 to 255 mg/kg and average is around 109 mg/kg. This average is higher than specific values of our country [2, 4].

The total Cd content is very low (0.1-0.3 mg/kg). The average content is lower than average content (0.9 mg/kg) of agricultural I level monitoring greed (Dumitru, 2000) and average value (1.11 mg/kg) reported by Lăcătuşu, 1997 [5].

Table 3

Statistical parameters of potentially polluting substances (mg/kg)

Statistical parameters	Cu	Pb	Zn	Cd	Ni	Mn	$S\text{-}SO_4^{2-}$	DDT	HCH
n	17	17	17	17	17	17	17	17	17
Xmin	8.4	2,6	33	0.14	7.1	92	78.8	0.004	0.009
Xmax	138	22.7	255	0.32	54.7	1015	222.3	0.114	0.033
Xmed	35	11.8	109	0.23	36.5	460	134.7	0.020	0.020
±σ	10.6	5.7	50	0.07	12.6	193	44.4	0.030	0.010
cv, %	38.4	48.5	46	30.4	34.5	42	33.0	150	50

Content of total Mn varies from 92 to 1015 mg/kg and the average is around 460 mg/kg. These values are closed to the reported values by Bajescu&Chiriac, 1984 [2].

The content of soluble sulfur ($S\text{-}SO_4$, $mg.kg^{-1}$) varies in the field 79-222 mg/kg. The maximum values are located in field of low load without reaching the alert threshold of sensitive use [7].

Although DDT and HCH had been banned over 20 years, they were found in soil. The values of total DDT content are in the normal field and the values of total HCH content are over normal values according to Order no 756/1997 [7], but below the alert threshold of sensitive use.

Compared with the first determination, the contents of potentially polluting substances were lower.

CONCLUSIONS

1. Research has shown that the most af the sites belong to the slightly acid class on the 0-20 cm depth and neutral class on the 0-50 cm depth.
2. The average contents of organic matter, total nitrogen, and mobile potassium are moderate. The mobile phosphorus average content belongs to low class.
3. The average of total nitrogen content, the mobile phosphorus and potassium content were lower at the second measurement.
4. The average contents of Cu, Zn, Ni and total HCH are higher than the normal contents accepted by legislation. The other heavy metals belong to the normal class.

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