EVALUATING OF INFLUENCE OF SOIL POLLUTION BY AGRICULTURE IN VILLAGE MOČENOK

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ABSTRACT

Aim of this article is to investigate the negative influence of agriculture in the form of pollution and possible exceeds of concentration of monitored elemnets or other limit values in soil in cadastrally area of village Močenok. In this article are presented results of measuring of concentration of monitored elemnets or other limit values in soil as an effect of agriculture. It compares the found concentrations with limits and norms according to the valid laws. In study area were according to the analyses measured following data: pH values, values of dangerous substances (heavy metals and other indicators) of soils and its evaluation and comparing with limit values.

Key words: limit values, soil, pollution, agriculture, heavy metals, monitoring of elements in soil

INTRODUCTION

Agriculture is based on basic natural sources from which is soil undoubdfully the most important. It offers the sources not only for agriculture but also for other branches of human efford without which the humanity could not exist. Because of this is appropriate a question of protecting of the soli not only from agriculture but also from other human activities. In the forefront the new methods, procedures and technologies of resource utilization arises which are not only economic but aslo are environmental. The significance of agriculture is basically many-sided and more complex than production of food. Agriculture has a potential to threat natural environment and life supporting systems, has big potential to influence to act positively on lowernig environmental, health and estetic burden of land, on highering biological diversity and prevent in its degradation (Demo a kol., 2005). Soil is the upper level of earth crust. It has origin in mutual influences of maternity rocks, relief, climatic conditions, living organismsm and also human. One of the most domimant function of soil is productional function, which is used mainly in agriculture and forestry (Chmielevská a kol., 2011). In nowadays is native agriculture land one of the archetyps of landscape (Hreško, Kanasová, Petrovič, 2010). In agriculture are chemical properties of soils the key parameter, which are defining the soil quality, possible pollution. Because of that it is important to monitor and analyse the soil properties and in first case to protect it. Chemical properties of soil are representing the complex of individual and simultaneously integrated chemical parameters of soil (Vanková, Baláž, 2008). Chemisation is in nowadays the most influential factor of intensification in agricultural production. Chemisation of agriculture as a major factor of intensifacation which consits from aplication of natural and artificial organic and anorganic substances which are increasing the effectiveness and quality of agriculture products. Increasing human population and increasing of personal consumption and its level and level of its technology are major factors of fast increasing of the amount of matter, which are burdening the all components of environment (Gábriš a kol., 1987). Legislation of Slovak Republic is focusing of soil protection mainly by the law č. 220/2004 Z. z. about protection and utilization of agriculture soil in which are clearly defined the protection together with care about agricultural soil. But in andvanced industrial society we see global influence on soil also from the side of non-agricultural activities, which are caosing the global changes of soil cover of the Earth. For all these facts is the higher protection of the soil and its aplication of a soil as those (Krnáčová, Hreško, Ďugová, 2008). Village Močenok is situated on south-west part of Slovakia. (Fig. 1). From the perspective of administrative separation it fit into Šaľa district and Nitra region. Area of Močenok is the most bigger is Šaľa district with 46,39 km^2. Village is situated in fertile area on south-west border of Nitranska hills between the rivers Váh and Nitra. A steam Dlhý kanál flows here. Village is situated in temperate zone with plenty of sunny days in year. The catastral area of village is have 4600 ha of soil. Catastral area of village Močenok is characterized by intensive agricultural activity.

The aim of tihs work is to monitor the influence of agriculture, its potentional pollution of soil in catartral area of village Močenok by the soil sampling and analysing of soil sampling from various localities in laboratory environment. The study evaluates actual concentration of individual elements in soil and its possible limits above threshold in connection with agriculture in study area. The results of the work also creates monitoring and chosen elements in soil in locality for monitored season.

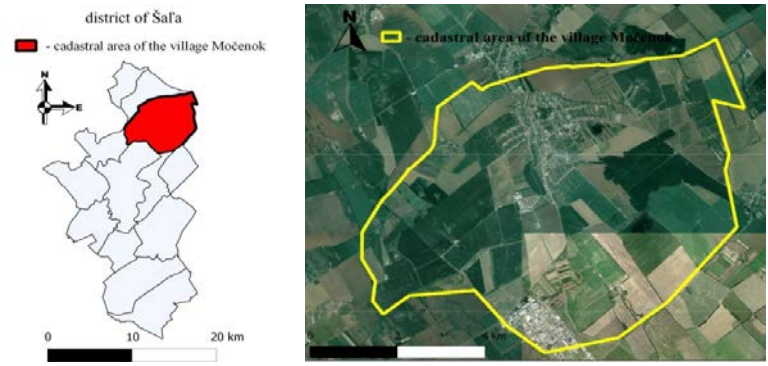


Fig. 1 Study area

MATERIAL AND METHODS

For detection of possible soil pollution was assesed the methods, which is taking into account the real possibilities of research, analyses and same collection with valid legislative and mandatory methods for sample collection of soil in such ways to to obtain data which are able to compare, evaluate, and apply into management with to compare with results acquired until now and with valid limit values. The steps were follows:

1, Obtaining basic infarmation about soil in study area and sampling of localities

For monitoring of individual factors which are influencing the quality of the soil and its properties it is necessary to have data for longer time-span and comparing the study areas with similar or the same function. From tihs reason was necessary to obtain the basic information about study area. For detailed monitoring of the soil in the area and for better to dividing of the functional using of soil was studied catastral area monitored in individual localities (P1 – P10) (Tab. 1.). Each locality is typed to represent main character and potential and soil utilization in study area (arable land used by agricultural subjects and private associations, wetlands, peasants, forest, ground cover, vineyards, orchards, and public vendure (Fig. 2.).

2, Collection of soil samples

Samples were taken one per month during one year with begining in february 2011 and ending in january 2012. These samples were analysed in water lye and one per year for lye in aqua regia (january 2012). Samples were taked according methods which are in agreement with valid directives always in the same lacalities (P1 – P10).

3, Analytical determination of soil samples in laroratory

Analytical determination were realized in laboratory from the argument of precision of data. Staps of analyses were follows:

- preparation of soil sample,
- pH measurement (pH of active soil reaction in H_2O, pH of exchanging soil reaction in KCl)
- filtration of soil sample (filtration through filtration paper, filtration by pressure),

- Definition of elements in water solution (tincture), preparation of point extraction in aqua regia,
- preparation of samples to measuring
- methods for measuring the samples of water and soil (Method OES-ICP, Method AAS - hydrid method, Method AAS – method of cold steams)

4, Evaluation of results and comparison with limit values

Results were noted into tables and graphs and subsequently compared with limit values according to valid legislative directives. Based of this comparison the conclusion were made about possible pollution caused by anthropogenic activities (agricultural or other human activities).

RESULT AND DISCUSSION

Evaluated were chemical elements, reaction of the soil in the samples from localities.

Chemical elements

- Macroelements: Ca, Mg, P, K, Na, Al, Mn, Fe
- Microelements: Cr, Zn, Cu, Pb, Cd, Co, Mo, As, Hg

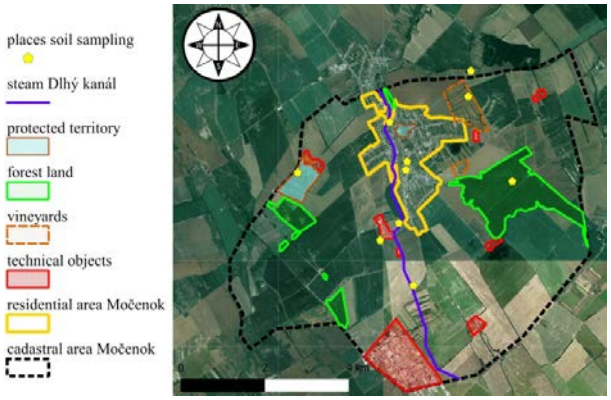
pH

- active soil reaction (pH/H_2O)
- exchanging soil reaction (pH/KCl)

SAMPLES OF SOIL		
locality	**symbol**	**sampling point**
locality 1	P1	most – orná pôda
locality 2	P2	Duslo – orná pôda
locality 3	P3	Dlhý kanál - mokraď
locality 4	P4	mäkký lužný les-mokraď
locality 5	P5	Obecný les
locality 6	P6	vinice
locality 7	P7	verejná zeleň
locality 8	P8	Šivavec – orná pôda
locality 9	P9	TTP
locality 10	P10	záhrada, sad

Tab. 1. - definition localities

Utilization of soil in the village Močenok (Fig. 2.)



Agricurtularly used soil
- individually working peasants - *lokalities P1, P6, P10*
- agricultural subjects - *lokalities P2, P8*

Non-agriculturaly used soil
- *wetlands - lokality P3, P4*
- *grassland - lokality P9*
- *cummunat vegetation - lokalita P7*
- *forestry - lokalita P5*

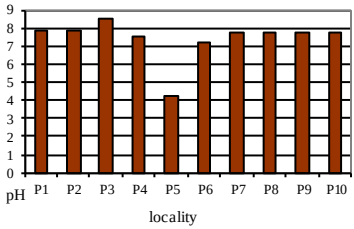
Fig. 2. – Places of soil samples and utilization of soil in study area

Whole evaluation of elements in water solution and soil reaction - pH/H_2O

The soil reaction (pH/H_2O) is balanced with minor deviations, what can be caused by climatic conditions, natural characteristic of the localities and by the influence of anthropogenic factors (fertilization, pesticides and waste). Only in locality P5 (woodland) were obtained values of pH which were lower. This was caused by forest ecosystem and its characteristic placement in landscape. Monitored chamical elemnts in study area have the values mostly around the mean. The highest value form macroelements were obtained in Ca, wich can be caused by soil composidtion in study area village Močenok. Measurements for P and K were higher only locally and possible from anthropogenic causes. Values for mikroelements as Al and Mn were not very stable, and reached high values, in many localities which was caused by variability among localities and climatic conditions. Elements in water lye*: Cr, Pb, Cd, Co, Ni, Mo, As, Hg, were not analysed, which means that the soil is not contamined by them.* They are heavy metal elements which is good to be monitored from the perspective of polluting the soil by agriculture. From this introduced knowledge it is clear, that agriculture has no polluting effect of soil. Differences in comparison between agriculturally used versus non-used localities were to diametrically significant.

Overall evaluation of elements in decomposition in solution of aqua regia and soil reaction pH/KCl

The water reaction pH/KCl (Tab. 2.) seems to be balanced in all localities for january month, except for P5 which was caused by similar reasons as in water reaction with pH/H_2O. The difference between siol reactions is in the evaluation of category, where with pH/KCl were soils predominanty strongly alcalical, and in pH/KCl ware mostly neutral and alcalical.



Tab. 2. - soil reaction by pH/KCl

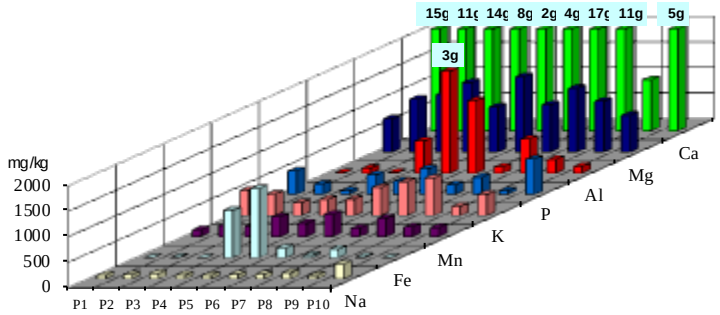
The desintegration of elements by aqua regia defines the values of elements form relatively stable occurence in soil for long time period. *Mo* element was not present in any locality. Elements which are heavy metals (in accordance with the law č. 220/2004 Z. z.) *As, Cd, Co, Cr, Cu, Hg, Ni, Pb obtained values were strongly under limit values* (with the exception in locality P6 – point pollution) (Tab. 3.). The main result is that agriculture has not significantly negavive impact of the quality of soil in studied area.

samples of soil (mg/kg) - **total decomposition (**january 2012**), pH** (KCl)										
	pH KCl	Cu	Cr	Pb	Cd	Co	Zn	Ni	As	Hg
P1	7,81	1,198	x	x	0,169	x	0,559	x	0,127	0,008
P2	7,80	1,998	x	x	x	x	6,393	2,646	0,025	0,001
P3	8,54	1,398	x	x	x	x	121,272	x	0,272	0,009
P4	7,56	4,995	0,480	0,121	x	1,341	21,371	2,006	0,014	0,015
P5	4,25	5,594	0,621	0,622	0,201	1,340	25,571	2,822	0,282	0,009
P6	7,17	112,487	1,680	0,623	0,019	1,814	30,96	3,401	0,216	0,088
P7	7,76	2,117	x	x	x	x	15,38	x	0,213	0,001
P8	7,75	3,096	x	x	x	x	21,971	x	0,186	0,027
P9	7,79	1,798	x	x	x	x	2,196	x	0,063	0,004
P10	7,71	8,991	x	x	x	x	25,573	x	0,537	0,002

x - value was not measured, below average value pH (locality - Obecný les), value exceeding the limit values (law č. 220/2004 Z. z.)

Tab. 3. – values of elements taken from chemical analysis

The results are telling that elements were impremented in bigger quantities into soils which were not high but relatively balanced (Mg, P, K). Also it is neccessary to consider that samples were taken in January 2012 when no agricultural activity is preformed. By desintegration of elemnts by aqua regia was proved that macroelements are basicly just like microelements, where ,in bigger



amounts like microelements, where by macroelements are reached higher values of Ca in water solution. From macroelements are hight only Al and Fe only locally. Here it is necessary to consider its movement in soil in the study area from whole desintegration of monitored elements from macroelements (Graph. 1.) were obtained the values form measuring Ca, except for locality P9, where multiple times exceeds the other monitored elements. The values of Al and Fe occured in higher levels in areas used from forestry (P4, P6). Into account we must take also an anthropogenic activity in agriculturally used localities and natural background of all sampled localities.

- value exceeding margin of graph

Graph 1. – values of measured elements - Macroelements

CONCLUSIONS

From the results it is obvious that in study area the measured values did not corss limits of heavy elements. Macroelements and pH of soil seems also balanced for whole area. From the knowledge of the work we can conclude that hygiene of the soil is well managed. The most positive finding is that measured values are multiple times lower that its limit values (mainly the concentration of heavy metals). From results of this work we cen also conclude that from the perspective of measured elements the agriculture practice did not have a negative influence on the soil in the study area and we did not found the contamination of the area. In spite of satisfactory results obtained, it is necessary to take care of the soil and to protect it, because soil is also in the future for people great potential.

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