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SHORT COMUNICATION

SOIL CONTAMINATION DESIGNED FOR CULTURE OF SOLANUM TUBEROSUM, L. AS AN RISK FOOD PHENOMENON

Július Árvay[*1], Ján Jobbágy[2], Ľuboš Harangozo[1], Radovan Stanovič[1]

Address: Ing. Július Árvay, PhD., Slovak University of Agricultural, Faculty of Biotechnology and Food Sciences, Department of Chemistry, in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, Slovakia

[1]Department of Chemistry, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture, Tr. A. Hlinku 2, 949 76 Nitra, Slovakia, +421 37 641 4378

[2]Department od Machines and Production Systems, Faculty af Engineering, Slovak University of Agriculture, Tr. A. Hlinku 2, 949 76 Nitra, Slovakia, +421 37 641 4796

*Corresponding author: julius.arvay@gmail.com

ABSTRACT

The aim of this work is to show the importance of monitoring and soil hygienic quality evaluation in the Slovak Republic area. In the past, when no emphasis was put on ecology, as it is nowadays, there was an uncontrolled emission of pollutants from different fields of anthropogenic activities. The consequences are manifested also nowadays, but immediate and expensive solutions are needed. In this work the results of the research of soil heavy metals contamination degree as well as their plant availability depended on soil reaction in the area of "Žitný ostrov" have been presented. The choice of this area is related to specific of mentioned the areas above are characteristic by anthropogenic, but also natural (geochemical) contamination and intensive agricultural activity, too. All the soil samples were analyzed to give changeable soil reaction. Analyses on heavy metal in the aqua regia extract (total content), humus content according Tjurin were conducted and bioavailable macronutrients in Mehlich II. leach.

Keywords: soil, crop plants, potatoes, heavy metals

INTRODUCTION

Quality of agricultural plants products, in close correlation with the level of environment contamination at all levels. It is well known that soil as one of the components of the environment is the greatest contributor to mop up the environment, with significant impact on the pollution, the persistence of risk elements, as well as other contaminants is very long (naturally hundreds to thousands of years) (**Tomáš *et al.* 2012**).

Soil as a conglomerate of mineral components, organic matter - humus, living organisms, air and water is vital for a healthy and viable population. In today's urban areas, the soil is shaken. Most affected are roads and adjacent surfaces, large industrial intensively used areas intended for the production of crops, which need maintenance. Hence the need for intensive fertilization, especially fertilizers (**Clemente *et al.* 2007**). Through which the soil and contaminants. Anthropogenic material (exhaust, oil residue, particles of tire components weathered surfaces of roads) together with the natural biogenic material (fallen leaves and other plant materials) can be adsorbed on its surface dust and thus represent a potential vector contamination larger area (**Omar *et al.* 2007**).

One of the most important groups of hazardous substances in the environment such as heavy metals (**Póti *et al.* 2012**). Heavy metals are among nondegradable contaminants, which are characterized by different source of origin, properties and action on living organisms (**Tóth *et al.* 2005**). The risk elements are biologically irreplaceable microelements (eg, Cu, Zn, Mn and others), as well as numerous non-essential chemical elements (Cd, Pb, Hg, etc.). (**Vollmannová *et al.* 2007**), the risks lie in ecotoxicity and accumulation in biotic and abiotic components of the environment.

MATERIAL AND METHODS

For the purposes of this paper we chose the land of small environmental loaded area of Slovakia. It is a land in the cadastral territory Imeľ in Komárno district under the administration of PD Agrocoop Imeľ. Interest land is used for intensive cultivation of potato plants.

Interest parcel is located south of the village Imeľ (bordering it). It is in the report Agrodružstvo Agrocoop Imeľ. Location coordinates are: 47° 47.083' N latitude (φ) and 18° 05.417' E (λ). Land area is 8.1 hectares. Parcel identification number is 9501/1. Valuated

soil-ecological unit of land is 0040001, soil type ČMm - typical chernozem and soil type - sand (ssh) – light. Altitude of land was ranged from 104.5 to 106.3 above sea level.

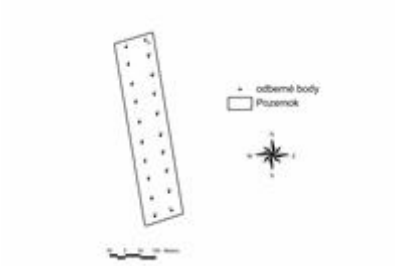

Figure 1 Border of interest land, orientation and localization of sampling points

In the study plot, we collected soil samples from a depth of 0.0 to 0.1 meters, and sampling was performed using a handheld navigation device, a way of determining grid connection points. In all soil samples analysis was performed to determine the exchange soil reaction pH_{KCl}, total content and mobile forms of studied heavy metals (Cd, Pb, Zn and Cu) in aqua regia extract and extract of NH_4NO_3 (1 $mol.dm^{-3}$). Limit values and critical risk elements monitored by which we determine the level of contamination of the law defines. 220/2004 (**Criteria for the identification of areas at risk of contamination of agricultural products and methodology of assessment, 2007**). For the purpose of finding cropping potential of soil analysis was performed to determine the content of humus by Ťjurina and available nutrients (K, Ca, Mg) by Mehlich II method. Terminal for detecting heavy metals in the extracts obtained by atomic absorption spectrometry on a Varian AA 240 FS. The figures obtained were processed into isolinear content maps that accurately identify places in the area with a potential negative impact on the quality and quantity of the crop.

RESULTS AND DISCUSSION

In the present work we aimed to evaluate the basic agrochemical soil characteristics, intended for planting potatoes. One of the most important parameters that significantly affects all chemical processes in the soil is the soil exchange reaction. Studied site is located in an area where a significant pedological process of sedimentation of dispersed particles in the river Žitava. This process of shaping the character of Acidification of soil solution. Exchangeable soil reaction to the reported plot ranged 5.37 ± 1.10 $mg.kg^{-1}$. Mean pH was acidic level (the whole plot from strongly acidic to alkaline. Founded values indicate the

optimum pH for growing potato (exception sampling points 4 and 5). Another important factor is the content of organic matter, which is represented humus content in%. Its mean value was in the range 7.84 ± 0.30 mg.kg^{-1}. These, relatively extreme levels of humus, define land as a high supplied with organic matter such as crop grown comfortable with. Referred indicators are graphically shown in Figure 2.

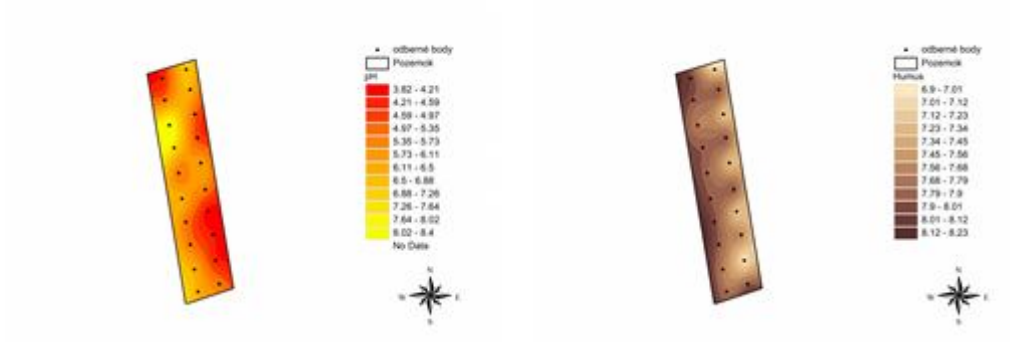

Figure 2 Content maps showing the range of the exchange of soil reaction (left figure) and humus content in % (right figure) at the monitored site

Other factors include content macro-elements (P, Mg, Ca and K), which greatly affect the quality and quantity. Particularly important for potato is sufficient supply mainly P, K and Mg, these essential nutrients should be in the form of soil organic and nonorganic intake. The contents of the macro-elements in the study plot ranged in the following intervals: P - 51.70 ± 23.37 mg.kg^{-1}, K - 265.50 ± 28.99 mg.kg^{-1}, Mg - 341.50 ± 123.29 mg.kg^{-1} and Ca - 9918 ± 4145 mg.kg^{-1}. Us the data on the content of macro-elements are suitable. Surface levels monitored variables are shown in Figure 3.

Quality but also the quantity harvested of potato production can significantly affect the level of soil contamination risk elements (**Castilo-Michel *et al.* 2009**). Among the most hazardous elements that negatively affect the growth and production of potatoes is cadmium. While its amounts in soil moving at substantially lower levels than is the case with other heavy metals, its chemical characteristics which enable it to bind to a variety of other molecules (amino acids and regulatory proteins), and the bypass natural barriers, which the plant equipped. It is also often used interchangeably with other trace elements, which receives nightshade potato in large quantities for their proper growth (**Dong *et al.* 2006**). A similar issue is also addressed by **Gonçalves *et al.*** (**2009**), who found that to overcome the barriers to entry of cadmium into the bed of potato plants largely influenced by the varietal membership. The content of Cd in the reference site ranged 0.48 ± 0.10 mg.kg-1. The standard deviation

indicates a low variability during cadmium and low median defines land as uncontaminated (LH - 0.70 mg.kg^{-1}). The contents of other risk elements were in the following intervals: Pb - 12.0 ± 1.03 mg.kg^{-1}, Zn - 26.7 ± 1.76 mg.kg^{-1}, Cu - 10.05 ± 0.83 mg.kg^{-1}. Even when other risk elements we did not exceed the limit values defined by the act no. 220/2004.

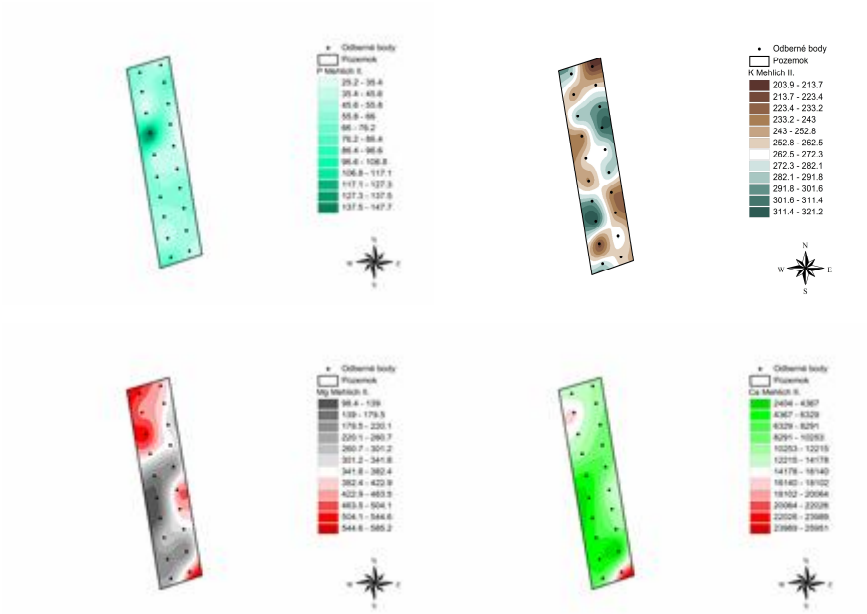

Figure 3 The macroelements content maps of monitored site

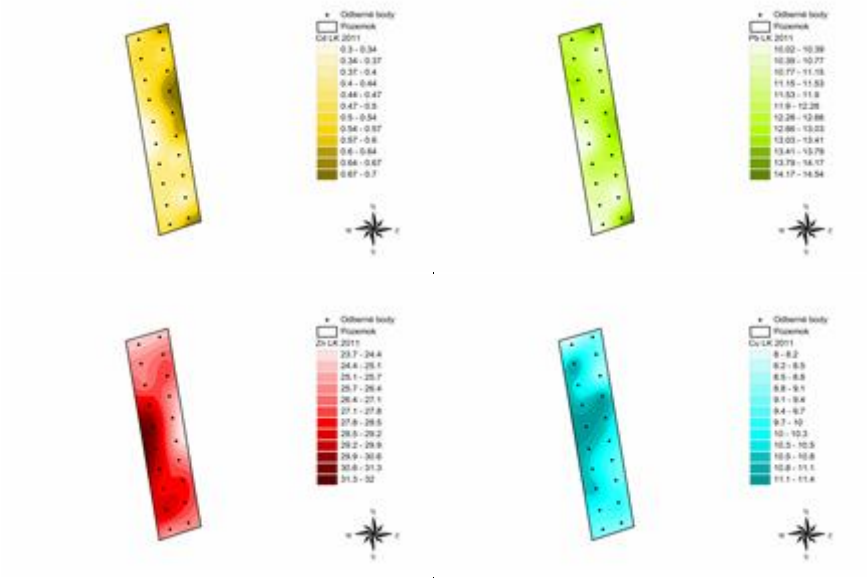

Figure 4 The heavy metals content maps of monitored site

CONCLUSION

In the present work, we focused on the evaluation of agrochemical soil characteristics, intended for planting bed of potato (S. *tuberosum*, L.). Basic physical characteristics that define BPEJ point to the ground with a high production potential, which was also confirmed by the analysis of basic agrochemical soil exchange reactions, and determining the content of humus. The content of macronutrients defines land as well stocked, but the soil structure does not prejudice the long-term retention of monitored elements in the soil, which in turn increases the cost of fertilization during vegetation. If the contents of risk elements we did not in any case exceed the statutory limit values implying that land interest is greatly suitable for growing potato.

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