Soil Conditions in Szombathely

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Abstract: In our further investigation in Szombathely we collected samples of the soil on 88 points of the town and analysed their physical and chemical parameters. Relying upon these findings the pH of soils is usually neutral and alkaline. The lime content was provable in the samples which is the result mainly of the centre of the town, where we found that the pH of solution was above 7. The physical kind of soil was clayey loam in 41 % and the content of humus and nitrogen was significant. The AL-solvent potassium content was medium and the values of phosphorus transcended the 19 mg/100 g soil value in half of the samples. In case of the KCl-solvent calcium and magnesium content we found higher values only near the traffic zones or agricultural areas, but all in the distribution was exact. Values of zinc were between 3.5 and 10 mg/kg in the soil in the downtown. On the basis of the research of the coppers we found steadily high values in marked places in the centre of the town. We detected higher values of iron by the side of Gyöngyös stream. From the values of manganese we realized salient manganese content in both layer in the surroundings of the Monument.

Keywords: Szombathely / urban, suburban, agricultural and forested area / soil /chemical and physical parameters / upper and lower layers

1. INTRODUCTION

The urban soil sciences are very young discipline compared to the classical soil sciences which originally deal with the agricultural and forestal environment. Fundamentally the municipal soils have only been a topic since the middle of the 1970s, particularly in the USA, Germany and Russia. The first considerable book is of BULLOCK and GREGORY (ed.,1991), which discussed urban disturbed soils in the United Kingdom. The other important handbook originated from CRAUL (1992), and concentrated on soils of cities in the USA anthropogenically. From the 1990s numerous books (e.g. HILLER –MEUSER 1998; KOLLENDER-SCYCH et al. 2008; MEUSER 2010; HAZELTON – MURPHY 2011) and well-founded articles (e.g. BURGHARDT 1994; SCHARENBROCH et al. 2005) have been published internationally. Nowadays this branch has become extraordinarily ramifying, and in accordance with the theme it increased significantly in trade journals. In the Hungarian special literature there are few works which are suitable for the area of science. From among our towns the heavy metal content of soil has only been measured in Budapest (KOVÁCS – NYÁRI 1984) and in Debrecen (SZEGEDI 1999). PUSKÁS and colleagues performed the measuring and classification of urban soils in Szeged (PUSKÁS – FARSANG 2007; PUSKÁS et al. 2008). Thus our examinations can give a useful basis for the future urban soil development and for the traceability of transformation, for correction of the urban soils and for their protection.

1.1 Study area

Szombathely, which has got nearly 85.000 residents and is 420 square kilometers big, is located in Vas county, on the Gyöngyös plain. It has a slight downward gradient toward South-East, the low surface's elevation is 207 meters in average and is covered by glacial

loam, argillic loamy loessal sediment and loess; the dominant soil types are the woodland soils. In the low carbonaceous and non-calcareous valleys of the Gyöngyös and Perint water races are raw alluvial (meadow) soils. Their climate is temperately cold and dry, the average annual temperature is 9.0–9.5°C. The average amount of the annual fall is 630-650 mm, the direction of the wind has been featured under the drift-modify of the Alps, thus the most frequent direction of the wind is the North and the other typical is the South. The most important water-courses of Szombathely are the Gyöngyös and the Perint, its only lake is of 11.2 h area. On the basis of their vegetation it is a temporary characteristic area, their flora has become poor, but the elements of the Alpokalja can still be found and are important (DÖVÉNYI 2010).

2. MATERIALS AND METHODS

About the sampling and the baggier description of our examination method read more in our other article: BIDLÓ et al. (2012): Soil scientific investigation of Székesfehérvár.

3. RESULTS

By measurements of the basis of watery pH it is demonstrable that the mean is 6.9, thus the majority of the samples belong to the neutral category of acidity (*Figure 1*). In the suburb the pH values of the soils are lower, in which the fertilizers, which have been used on the fields and on the lawns to create good fertility soil, may play a great roll. All in all, the majority of samples were between 5.5 and 8.2.

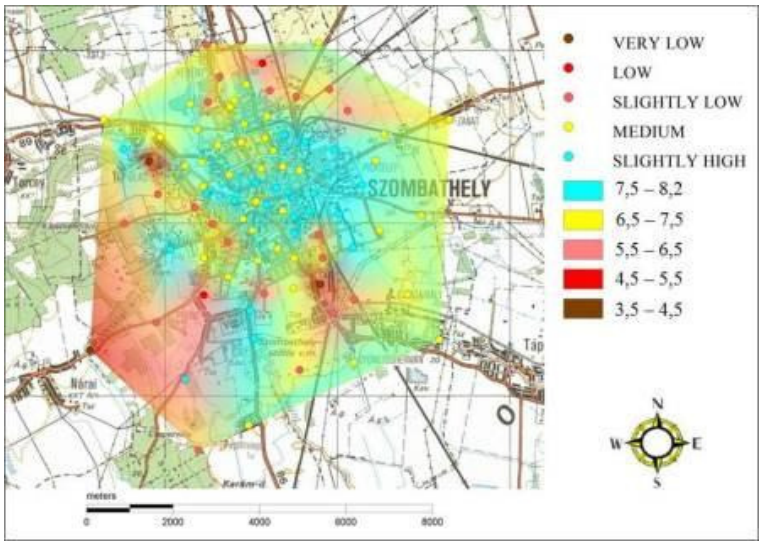

Figure 1. The soil pH values (pH_{H2O}) in upper part (0-10 cm)

Half of the examined specimens didn't contain any calcium-carbonate. The percentile value of calcium-carbonate in the upper part is 42%, in the lower part is 43%. We measured over 3% lime content in 54% of the upper layer and in 54% of the lower part. Going outward from downtown we detected continually less calcium-carbonate content in soil samples. The lime content showed a strong connection with the acidity. Where we did not find calcium-carbonate of the samples, all the acidity values were between 4.2 and 6.9. The values of the lime samples were 2-12 %. The higher lime content values suit with the ones described in the literature, the effect of the activity of earlier constructions may lift the lime content of the soil on the inner-city area.

On the strength of the particle size distribution and the Arany-type compactness analysis the greater part of samples is clayey loam physical assortment, which is 41-41% of soil samples in the upper and lower layer *(Figure 2)*. The physical peculiarities of the soils define their water management, their nutrient fixation and their service ability (SZODFRIDT 1993).

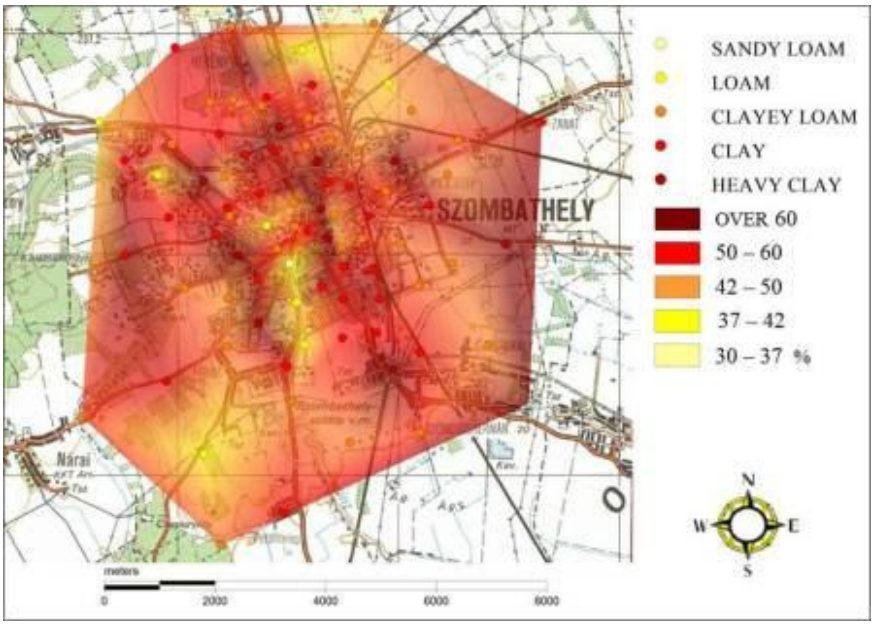

Figure 2. The physical assortment in the upper layer (0-10 cm)

From the soils of Szombathely it can be said that they are humus-rich. In our examinations many samples showed humus values between 2-10% in both layers, which belong to the humic (2-4%) and to the strongly humic (4-10%) category (STEFANOVITS et al. 1999). We discovered over 10% humus content boggy soils in only one place in the town. Small humic content upper soils are situated in the NW and SE region of the town.

On the basis of total nitrogen content investigation the upper soil layer is well supplied with nitrogen (0.25 N% above) in 69%, medium supplied (0.1-0.25 N%) in 30% (STEFANOVITS 1992). In the lower layer the values of nitrogen are similar to the upper part. The results were between 0.04-7.3 N% in both soil levels. We measured the maximum nitrogen value (7.3 N%) in the upper layer in the soil of Jókai park and in the lower layer (6.58 N%) near Gyöngyös creek in the soil of Kámoni Arborétum.

According to the analysis of the ammonium-lactat-acetous acid (AL) solvent potassium content the samples of the upper soil horizon fall into the low and the moderately medium category predominantly, now the lower level's samples fall into the very low and low category (JUHÁSZ ed., 2006). In case of 10 samples in all we have given very high values (31 mg/100g soil above), along the busiest roads mainly. Values of potassium fall among 2.2 and 43,7 mg/100g soil.

According to the analysis of the AL solvent phosphorus content in most samples the values of soils are above 19 mg/100g in both levels *(Figure 3)*. Thus, in soils of Szombathely the phosphorus content is significant. There was a salient value (120.4 mg/100g soil) at the busy crossing of Petőfi street and Paragvári street, in both levels we measured here the maximum values, but their higher values can correlate to the busiest traffic roads.

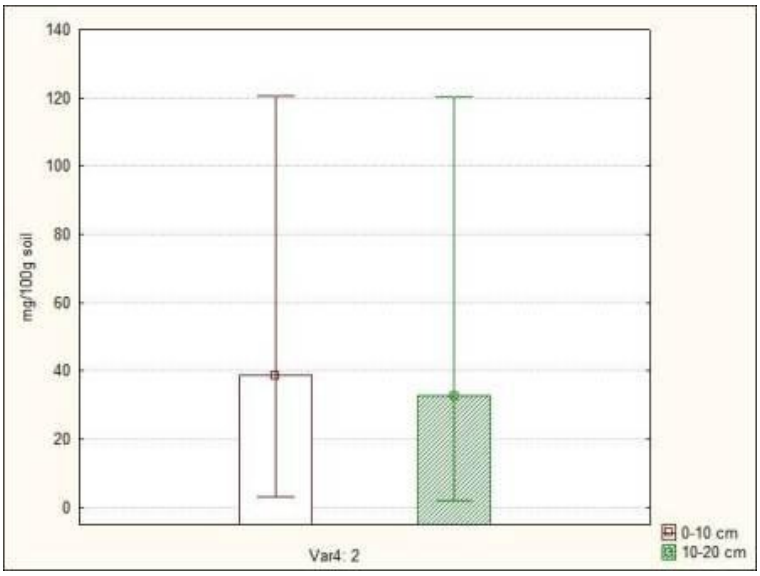

Figure 3. The mean P content in the two investigated soil layers. Error bars are representing the minimum and maximum values.

According to the calcium content examination 92% of values are classed in below 2.6 g Ca/kg category. Extreme values are rare, the dispersion is precise. The magnesium results have the same tendencies. The results of the two soil layers are similar with no extreme values. The majority of the samples (86%) are between 0.08-0.4 g Ca/kg.

The ethylene-diamin-tetra-acetous (EDTA) and diethylene-triamin-penta-acetous (DTPA) values in the downtown were above 3.5 mg Zn/kg soil (*Figure 4*). We discovered high zinc values in many samples that we collected from the bank of Gyöngyös brook. Because of this the maximum value presented in the sample at the Gyöngyös bank of Bogáti alley (106.66 mg Zn/kg) in the upper level and in the lower layer in the sample at the Gyöngyös bank of Gayer park (127.71 mg Zn/kg). It is interesting that the maximum values of iron concentration were in this same sampling dots (Bogát alley 1541.1 mg Fe/kg, Gayer park 1732.9 mg Fe/kg).

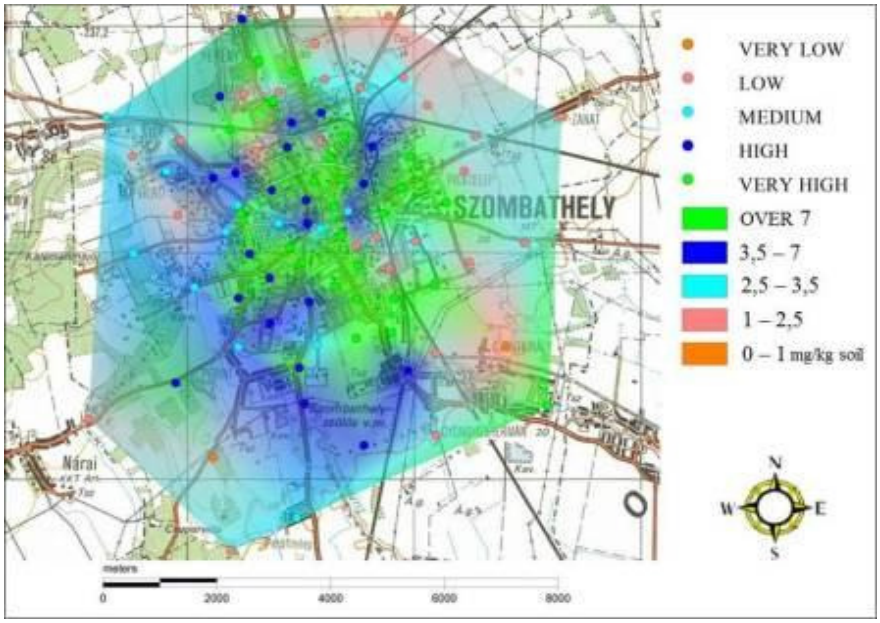

Figure 4. The zinc values (mg/kg soil) in the lower part (10-20 cm)

In case of EDTA/DTPA copper content 67% of samples was beyond 3 mg/kg value in the 0-10 cm depth part, while this scale was 61% in the 10-20 depth layer. We found 6 samples above 15 mg Cu/kg soil value in the upper layer, the maximum value was 30.64 mg Fe/kg, the extreme values were not characteristic.

In our researches the iron and the manganese results in the two soil layers were similar. 50% of the iron values in all layers were between 0-100 mg Fe/kg soil (*Figure 5*). We measured two extreme iron values in the same sampling dots, as at zinc. We found an extreme result in the upper layer at Gyöngyös bank of Csititó (1072.2 Fe/kg) and in the lower layer in the sample at the Gyöngyös bank of Bogát alley (1549.8 mg Fe/kg).

63% of the manganese values were in all layers between 0-100 mg Mn/kg soil. We measured extreme manganese content in the sample of Emlékmű, that value was in the upper soil sample 551.5 mg Mn/kg soil and in the lower layer it was 641.9 mg Mn/kg soil.

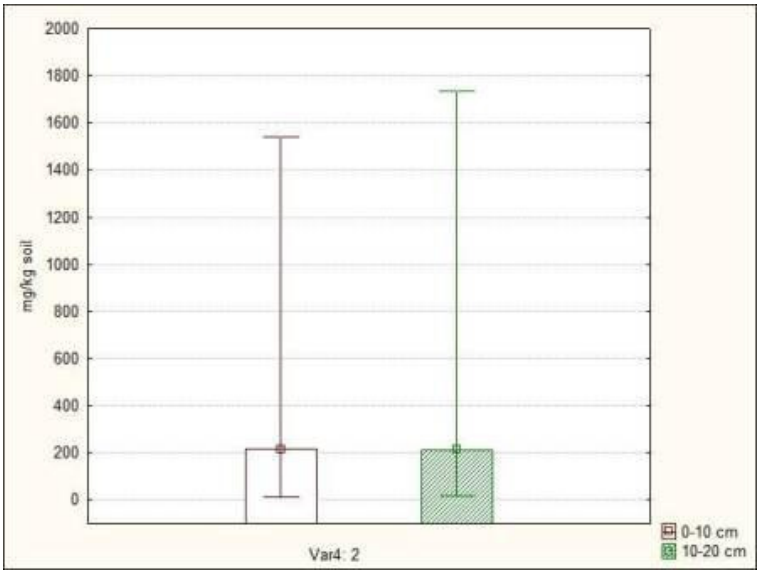

Figure 5. The mean Fe content in the two investigated soil layers. Error bars are representing the minimum and maximum values.

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