Microelements in the soils and leaves of tree and shrub from allotment gardens in Rzeszów

Mikroelementy w glebie i liściach drzew owocowych ogrodów działkowych Rzeszowa

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Urban allotment gardens are often used both as a place of recreation as well as sources of food. There is usually a large number of various sources of emissions in urban areas, which can affect the quality of crops.

The aim of the study was to determine the content of selected trace elements in soils and leaves of fruit trees and shrubs from allotment gardens located in the city of Rzeszów.

In June 2013, soil samples were collected from sodded areas at a depth of 0–5 and 6–25 cm (from 9 different allotment gardens of Rzeszów and 2 checkpoints). Tree and shrub leaves were taken with the immediate vicinity of the location of soil samples. The basic physical and physicochemical soil properties were determined in collected material. The material was analyzed to determine the content of Fe, Mn, Cu, Zn, Co, Cr, Ni by atomic absorption spectrometry (AAS) in a flame of acetylene – air. The soil was pre-digested in concentrated chloric acid (VII). Soluble forms were extracted in 1 M HCl by 1 hour shaking at soil:solution ratio 1:10. The plant material was decomposed with microwave mineralizer using concentrated nitric acid (V) with addition 30% H_2O_2.

The tested soils characterized by different granulometric composition and pH from acidic to neutral (pH_{H2O} was in the range 5.98–7.15). They were highly diversified in the content of organic carbon (range 2.9–55.3 g·kg^{-1}, median 42.8 g·kg^{-1} and 18.3 in soil at the depth of 0–5 and 6–25 cm respectively). The contents of Cu, Zn, Co, Cr, Ni does not exceed the limit values according to Polish legislation [Regulation... 2002]. However, taking into account the criteria IUNG [Kabat-Pendias et al. 1993] 13.5% of the samples was characterized by a second level of contamination of zinc and 4.5% contamination of chrome. A lot of attempts were characterized of increased content of heavy metals (first contamination degree): 68.2% with resp. on Cr, 36.4% Zn, 13.6% Ni and 5.6% Cu. Forms soluble in 1 M HCl included average 21% of the total amount of Fe, 62% Mn, 46% Cu, 37% Zn and Co, 21% Ni and 4% Cr. The Zn content in the leaves of the analyzed species of shrubs ranged from 13.5 mg·kg^{-1} and 36.3 mg·kg^{-1}, the arithmetic mean: raspberry – 19.0 mg·kg^{-1}, currant – 26.3 mg·kg^{-1}, respectively. Despite the high zinc content in most soils allotments Rzeszow 81% of the collected samples of apple leaves and 63% of the cherry leaves contain less than 25 mg Zn·kg^{-1}, that can be stated as the deficiency amounts [Kabat-Pendias, Pendias 1993].

The content of the analyzed trace elements in soils allotments Rzeszow do not exceed the prescribed limits but in the case of Cr and Zn could indicate a potential threat to crops. However, more than 60% of the tree leaf samples contained deficient amount of Zn.

Kabat-Pendias A., Pendias H., 1993. Biogeochemistry of trace elements. PWN, pp. 364.
Kabat-Pendias A., Piotrowska A., Witek T., 1993. Evaluation of the soil and plants contamination by heavy metals and sulfur. IUNG, pp. 20.
Regulation of the Minister of the Environment of 9 September 2002 on soil quality standards and ground quality standards. D. of Law No. 165. p. 1358 and 1359.