AN ASSESSMENT OF HEAVY METALS CONTAMINATION OF SOILS AND VEGETATION NEAR AN AGROTEHNICAL FARM FROM AREA TIMIS

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ABSTRACT

The objective of the study was the determination of the trace metal (Fe, Cr, Zn, Pb) status of soils and vegetables in the vicinity of a livestock (cattle, piggery, sheep and goat and poultry sections) using atomic absorption, spectrophotometry. Vegetable samples taken within the vicinity showed 0.85-0.190 $mgkg^{-1}$ Fe, 0.356-0.549 $mgkg^{-1}$ Zn,0.005-0.432 $mgkg^{-1}$ Cr and 0.017-0.029 $mgkg^{-1}$ Pb. Analytical results indicated that soils and vegetables values were below the WHO critical toxic levels. Statistically, there were significant correlations between trace metals concentrations of the test and control samples. The levels of trace metals were not considered to be toxic for human and animal uses.

INTRODUCTION

Environmental pollution nowadays is a big concern. Anthropogenic activities have altered the environment significantly throughout the world like mining, industry and agriculture [1]. Environmental contaminants are widely distributed in air, water and soils and, therefore, they will have an effect on the trophic chain (vegetables, animals and men) [2]. Heavy metals are of considerable behaviour [3]. Trace quantities of certain heavy elements, such as chromium, cobalt, copper, manganese and zinc are essential micronutrients for higher animals and for plant growth [4]. Lead (Pb), cadmium (Cd), and nickel (Ni) are significant environmental pollutants. Anthropogenic activities, such as agriculture, industry and urban life increase the Pb, Cd, and Ni contents of soils and waters and, therefore, have an effect on the metal contents of vegetables [5]. Vegetables absorb heavy metals from the soil as well as from surface deposits on the parts of vegetables exposed to polluted air [6, 7]. Moreover, the presence of heavy metals in fertilizers contributes an additional source of metal pollution for vegetables [8].

This study is aimed to examine the possible environmental pollution of the livestock vicinity. The soil and vegetable samples were analyzed to document the possible trace metal contamination arising from the poor work management practices in the area.

MATERIALS AND METHODS

Four sites (cattle, piggery, sheep and goat and poultry sections) on a livestock farm were selected in the Timis area. Twelve vegetable samples were collected from the centre of each site in September 2010. The vegetables were cleaned to remove visible soil and then washed with tap and distilled water several times, were allowed to drain, then were oven dried at 100 ^{0}C for 10h. They were then ground in a Kenwood blender. A 5 cm of soil samples was collected from the immediate vicinity of the vegetable roots at depths of 0-10 and 10-20cm.

Vegetable samples

Two grams of each vegetable samples was ashed in a covered Teflon beaker using 20 cm^3 of 1:1 HNO3/HCLO4 acid mixture followed by the addition of 3 drops of HF. This was heated to clear solution and continued until dryness. The cooled residue was dissolved in 5 cm^3 concentrated HCL and the liquor was made up to 50 cm^3 using distilled water.

Soil samples

One gram of the finely ground dried soil samples was mixed with 20 cm^3 (1:1) HCL / HNO_3 acid mixtures and the content was heated until dryness. The residue was extracted using 2M HCL and brought it to 50 cm^3 with distilled water. An SP 1900 atomic absorption spectrophotometer (AAS) equipped with an air–acetylene burner was used to determine the metal contents.

Soil particle size fractions were quantitatively determined by the pipette method [9], soil pH values were measured in water [10]. The soil organic matter was measured using standard procedures [11].

Statistical analyses were performed with SPSS 10. The transfer factor (TF) was computed as the ratio of the concentration of metals in vegetables to that in the soil.

RESULTS AND DISCUSSION

The results of the trace metals analysis of soil and vegetable samples of depths of 0-10 and 10–20 cm are recorded in Table 1. Cattle, piggery and poultry section presented high concentrations of trace metals in the soil at depth of 0-10cm than other depth, while depth of 10–20cm exhibited low concentrations of these metals. Iron and Zinc were found to be the most abundant metals in the samples.

The sequence of metal concentrations in the samples was Zn> Fe> Cr> Pb for cattle and poultry sections and Zn> Fe> Pb> Cr for sheep, goat and piggery sections. The concentrating of metal in vegetables harvested in the livestock soils revealed that trace metal uptake is plant – species dependent. The results obtained here were in agreement with other results [12 -14].

Table 1. Metal contents of soils and vegetables analyzed ($mgkg^{-1}$)

Location	Sample	Fe	Zn	Cr	Pb
Cattle Section	0-10cm	0.617	0.835	0.021	0.052
	10-20cm	0.245	0.687	0.013	0.074
	vegetable	0.069	0.648	0.035	0.013
Control	0-10cm	0.069	0.767	0.023	0.038
	10-20cm	0.405	0.688	0.524	0.022
	vegetable	0.159	0.497	0.433	0.022
Poultry Section	0-10cm	0.278	0.729	0.025	0.024
	10-20cm	0.157	0.538	0.006	0.053
	vegetable	0.259	0.658	0.051	0.037
Control	0-10cm	0.099	0.578	0.053	0.088
	10-20cm	0.447	0.438	0.075	0.153
	vegetable	0.158	0.559	0.103	0.016
Piggery Section	0-10cm	0.189	0.668	0.032	0.047
	10-20cm	0.119	0.679	0.021	0.087
	vegetable	0.259	0.599	0.034	0.023
Control	0-10cm	0.358	0.569	0.014	0.025
	10-20cm	0.378	0.419	0.025	0.017
	vegetable	0.095	0.357	0.018	0.059
Sheep and goat Section	0-10cm	0.149	0.357	0.012	0.045
	10-20cm	0.127	0.426	0.024	0.067
	vegetable	0.201	0.319	0.021	0.019
Control	0-10cm	0.218	0.627	0.017	0.048
	10-20cm	0.289	0.688	0.039	0.077
	vegetable	0.199	0.526	0.015	0.023

$p < 0.001$

CONCLUSION

- Trace heavy metals were analyzed in livestock environment.
- Low values were found in soils and vegetables around the vicinity. It is worthy of note that they were below the WHO permissive levels [15].
- However, it is suggested that regular monitoring of the vicinity should be encouraged this is just to avoid possible consumption of contaminated plant and water.

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