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# Study regarding Cu contamination of vegetables grown in Ruschita (Caras–Severin county)

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**Abstract** The aim of this study is to measure the levels of Cu found in common vegetables parsley (*Petroselinum crispum*) and carrot (*Daucus carota*) grown in farms located in contaminated mining areas Ruschita (Caras Severin County). Ruschita village is the mining centre of the massif Poiana Rusca. This place has crystalline schist, limestone and sandstone rich in zinc, copper and especially lead. We prelevated vegetables from different distances from the pollution source: 500m, 1000m and 1500m. High correlation was found between „total" soil metal concentration of Cu and their concentration in the parsly and carrot roots.Our results show that parsly and carrot have a similar Cu acumulation in roots. Raising the distance from the pollution source, copper content in soil and vegetables decreased.

**Key words**

copper, contamination, parsley, carrot

Heavy metals are ubiquitous in the environment, as a result of both natural and anthropogenic activities, and humans are exposed to them through various pathways, especially by food chain. The essentiality of Cu is based on his role as metalloenzyme. These metals are cofactor of large number of enzymes. There is a range of intake over which his supply is adequate to the body 0,9 mg Cu /day(1,7).

Depending on the physical and chemical properties of the soil (particularly pH and redox potential), heavy metals are mobilized in the soil solution and are adsorbed by the plants. Some heavy metals reach the soil directly, under the form of fertilisers used as a supplement for plant nutrition or indirectly, as a result of amendaments or other chemical substance applications (herbicides, insecticides, etc.) that contain heavy metals. In the food chain, plants take over the most important amount of heavy metals directly from the soil or indirectly, from irrigation works or from foliar treatments. Humans also take over heavy metals from the plants that they eat fresh or processed. Heavy metals from plant debris and from human and animal wastes (including cadavers) are then recycled into the soil. This process is mainly a geo-bio-chemical cycle of heavy metals on the earth ecosystem (2,4).

Vegetables cultivated in contaminated soils take up heavy metals in large quantities enough to cause potential health risks to the consumers (5).

## Material and Method

The soils samples were taken with agrochemical steel probe, from 0-20 cm deep, within the cultivated area. A mixed sample was made from 10 single samples. Soil samples were air dried, crushed, passed through a 2 mm mesh sieve and stored at ambient temperature for analysis.

Passing out of total metals content from soil to solution can realized by wet proceeding which consists in treating soil samples with mixture of mineral acids (HCl, $HNO_3$, 3:1 ratio) adapted after method 3050B of the United States Environmental Protection Agency(10). The heavy metals contents in edible parts of vegetables were carried out in $HNO_3$ solution resulted by plants ash digestion (6, 8).

Each sample solution was made up with dilute $HNO_3$ (0,5N) to a final volume of 50 mL and analyzed by flame atomic absorption spectrometry. Necessary dilutions were made.

The concentrations of Cu in the filtrate was determined by using flame atomic absorption spectrophotometer with high resolution continuum source (Model ContrAA 300, Analytik Jena, Germany).

## Results

The standard values for Cupper in soil are: normal values(<20 mg/Kg), warning threshold(100 mg/Kg) and intervention threshold (200 mg/Kg) (11).

Maximum limits accepted for Cu in vegetables(roots) is 5,00 (mg Cu /kg fresh matter, ppm) (12).

Our results show that Cu content variation in soil and vegetables is directly correlated.

Raising the distance from the pollution source, copper content in soil and vegetables decreased (Table1 and Figure1).

Table 1

**The mean values of Cu content in soil and in parsley and carrots roots**

| **Pollution source distance** | **Soil total forms** (mg Cu/kg dry matter) | **Parsley roots** (mg Cu/kg dry matter) | **Carrots roots** (mg Cu/kg dry matter) |
|---|---|---|---|
| 500 m | 139,35 | 11,50 | 11,22 |
| 1000 m | 91,85 | 7,20 | 8,00 |
| 1500 m | 29,57 | 6,26 | 5,90 |

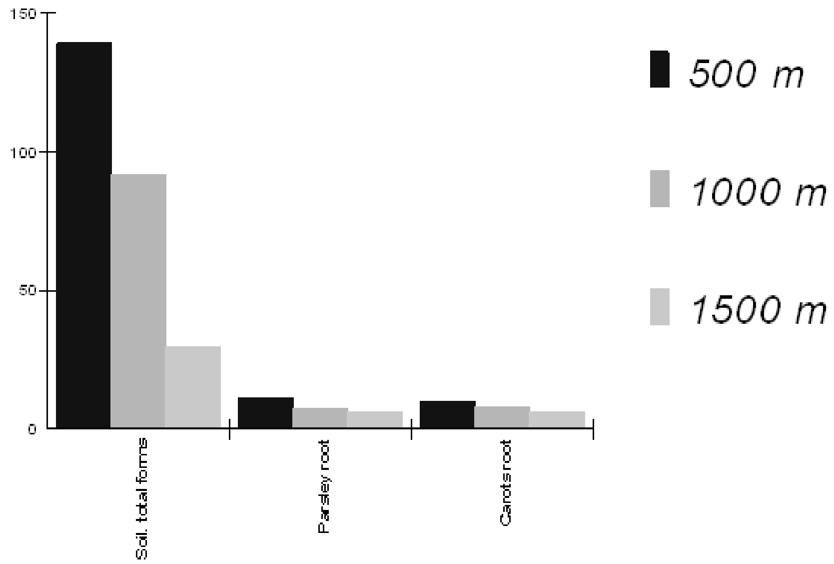


Fig. 1. Graphical Representation of experimental data (mg/kg dry matter)

In Figures 2-3 are presented graphical Scree Plot and PCA case scores representations of experimental data evaluation. We observe from the Figure 1 that parsly and carrots have a similar Cu concentrations in roots(black zone).The Cu content in soil(total forms) is represented by the grey variation area.

Principal components analysis using transformed square-root standardized data:

Transformed data:

| Distance | Soil | Parsley | Carrot |
|---|---|---|---|
| 500m | 11,805 | 4,743 | 4,819 |
| 1000m | 9,584 | 2,683 | 2,828 |
| 1500m | 5,438 | 2,502 | 2,429 |

PCA case scores:

| | Axis 1 | Axis 2 |
|---|---|---|
| Soil | 1.414 | 0.000 |
| Parsley | -0.710 | 0.021 |
| Carrot | -0.704 | -0.021 |

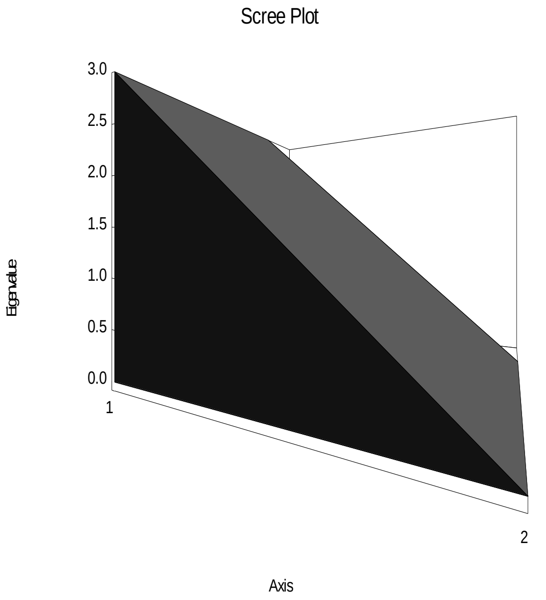


Fig. 2. Graphical Scree Plot representation of experimental data evaluation

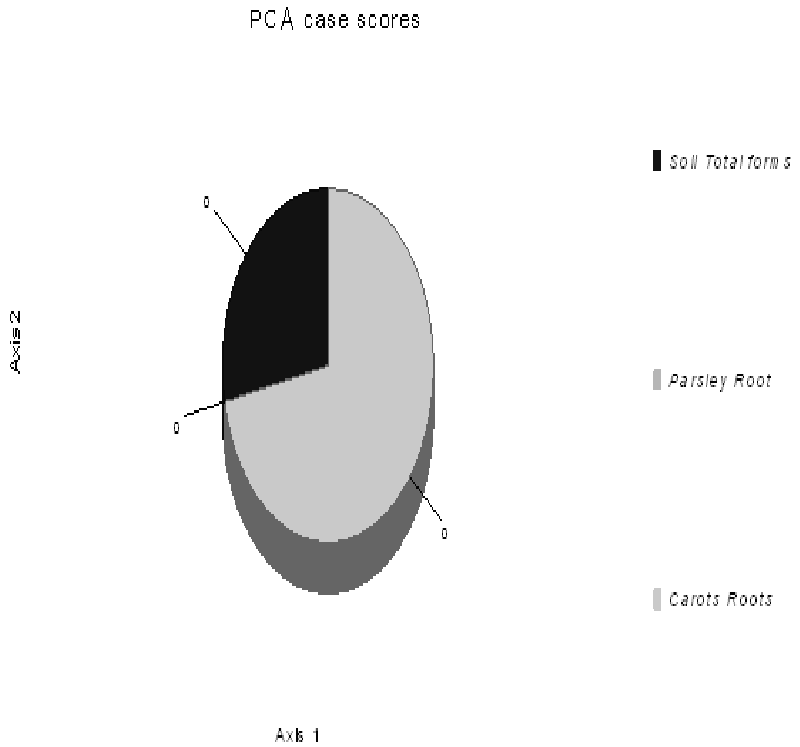


Fig. 3. PCA case scores graphical representation

## Conclusions

The aim of this study was to measure the levels of Cu found in common vegetables parsley (*Petroselinum crispum*) roots and carrot (*Daucus carota*) roots grown in farms located in contaminated mining areas Ruschita village (Caras Severin County).

The conclusions of our research are:

• High correlation was found between „total” soil metal concentration of Cu and their concentration in the parsly and carrot roots.

• Parsly and carrot have a similar Cu acumulation in roots.

• Raising the distance from the pollution source, copper content in soil and vegetables decreased.

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