# EVALUATION OF COPPER CONTENT IN SOIL AND ZEA MAYS L. GRAINS, IN A ROMANIAN POLLUTED AREA

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## Abstract

The heavy metal contamination of soil is one of the most pressing concerns in the debate about food security and food safety in Europe. Maize, also known as corn, constitute a staple food in many regions of the world. The aim of this paper was to determine the capacity of maize (*Zea mays* L.*)* grainstoaccumulate Cu, in order to evaluate the potential risk for human consume and to obtained informations regarding the soil pollution in this area. The studied area was Tarnaveni (Mures County, Romania). In soil, the copper content, calculated on the dry basis, ranged from 13.17 ppm to 52.96 ppm for 0-20 cm depth and from 14.01 to 44.82 ppm for 20-40 cm depth. The soil copper contents are exceeding the value of 20 ppm (the normal contents in soil, for Romania) but do not exceed the value of 100 ppm (the Alert threshold values for Romania). Regarding the copper content ($mgKg^{-1}$ dry weight) in corn, the values are between 4.87 to 25.40 ppm, and five from seven samples exceed the permissible limit of copper for plants (10 mg/kg recommended by WHO). This study allows to obtain informations regarding the copper pollution level in this area.

## Introduction

The heavy metal contamination of soil is one of the most pressing concerns in the debate about food security and food safety in Europe [9].

Maize, also known ascorn, constitute a staple foodin many regions of the world. Maize crop presents a high yield potential. Maize meal is also used as a replacement for wheat flour, to makeother baked products.

Literature contains numerous data on the distribution of copper in soil and plants cultivated in different geographical areas [1,2,3,4,5]. The crop of *Zea mays* L. is heavy-metal tolerant, has high metal accumulating ability in the foliar parts with moderate bioaccumulation factor. So, maize is capable of continuous phytoextraction of metals from contaminated soils by translocating them from roots to shoots [11].

The main man-made releases of copper are from coal-fired power stations, metal production, waste incinerators, sewage treatment processes and from the application of agricultural chemicals.

Excess copper in soils is toxic to some micro-organisms, disrupting nutrient-cycling and inhibiting the mineralisation of essential nutrients such as nitrogen and phosphorus[12].

The permissible limit of copper for plants is 10mg/kg recommended by WHO [10].

The aim of this paper was to determine the capacity of maize (*Zea mays* L.) grainstoaccumulate Cu, in order to evaluate the potential risk for human consume and to obtained informations regarding the soil pollution in this area.

## Experimental

The prelevations points are located in Tarnaveni area (Mures County, Romania).Soil and maize samples were collected from seven familiarly farms located in the studied area. From each prelevation points (PP) were collected soil (0-20 cm and 0-40 cm depth) and maize samples.

The minerals determination was made by FAAS. After calcination we made the solubilisation of the inorganic matter in nitric acid 0.5 N up to 50 ml. The solutions obtained were used for FAAS determinations [7]. Determination of pH has been accomplished in watery suspension in report with the soil: water of 1:2.5.

## Results and discussion

The pH of soil in prelevations points soil varies between 6.56 to 8.73.

The results regarding copper content in soil and maize, were expressed in ppm ($mgKg^{-1}$dry weight).

In Table 1 are presented, for copper, the Normal contents in soil, the Alert threshold values for Romania and the Intervention threshold values for Romania (Order 756/1977) [8].

**Table 1.** Heavy metals total contents in soil (mg/kg DW)

| Heavy metals total contents in soil (mg/kg DW) | | |
|---|---|---|
| NC* | ATV** | ITV*** |
| 20 | 100 | 200 |

* Normal contents in soil, for Romania(Order 756/1977) ;
**Alert threshold values for Romania(Order 756/1977) ;
***Intervention threshold values for Romania (Order 756/1977)

The Cu contents ($mgKg^{-1}$ dry matter) in maize (*Zea mays* L.)grains and corresponding soils are presented in Table 2. Each value in the tabel is an average of 3 replicates.

In soil, Cu ranged from 13.17 ppm to 52.96 ppm for 0-20 cm depth and from 14.01 to 44.82 ppm for 20-40 cm depth.

According to Table 1 and Table 2, the copper soil contents are exceeding 20 ppm (the normal contents in soil, for Romania) but do not exceed 100 ppm (the Alert threshold values for Romania).

Regarding the copper content ($mgKg^{-1}$ dry weight) in corn, the values are between 4.87 to 25.40 ppm, and five from seven samples exceed the permissible limit of copper for plants (10 mg/kg recommended by WHO).

**Table 2.** Average values mg/kg dry weight (ppm) of total copper contents in maize grains and corresponding soils

| ***Prelevation Point*** | **Soil pH** | | **Cu(ppm) in soil** | | **Maize grains** |
|---|---|---|---|---|---|
| | 0-20 cm | 20-40 cm | 0-20 cm | 20-40 cm | Cu(ppm) |
| PP1 | 8.68 | 8.73 | 13.17 | 14.01 | 19.83 |
| PP2 | 8.23 | 8.15 | 47.29 | 43.75 | 22.74 |
| PP3 | 7.87 | 7.98 | 52.96 | 44.82 | 20.01 |
| PP4 | 7.97 | 7.74 | 27.56 | 29.14 | 4.87 |
| PP5 | 7.67 | 7.74 | 23.14 | 21.61 | 5.64 |
| PP6 | 7.95 | 8.13 | 27.06 | 29.95 | 25.40 |
| PP7 | 6.56 | 6.58 | 29.64 | 29.77 | 13.57 |

Analysing the Figure 1, we can conclude that the Cu contents in the soil influences the evolution of the copper maize contents for all seven locations.

Our research is in accord with other studies [5, 6,11].

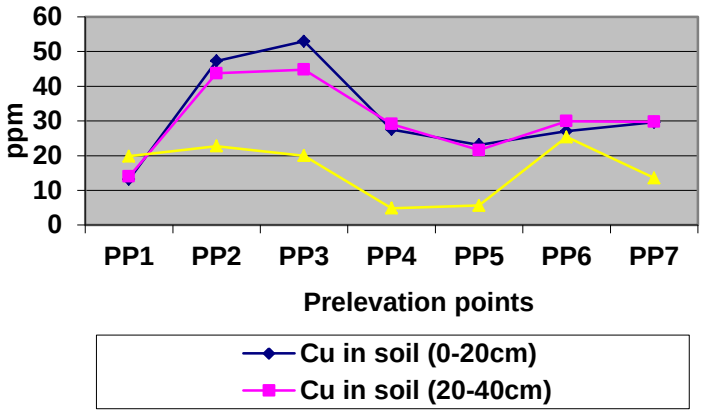


**Figure 1.** Graphical representation of Cu contents in maize and corresponding soil
*Legend:* PP =Prelevation Point

## Conclusion

In soil, copper ranged from 13.17 ppm to 52.96 ppm for 0-20 cm depth and from 14.01 to 44.82 ppm for 20-40 cm depth.
The copper soil contents are exceeding the value of 20 ppm (the normal contents in soil, for Romania) but do not exceed 100 ppm (the Alert threshold values for Romania).
Regarding the Cu contents ($mgKg^{-1}$ dry weight) in corn, the values are between 4.87 to 25.40 ppm, and five from seven samples exceed the permissible limit of copper for plants (10 mg/kg recommended by WHO).
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