The International Conference of the University of Agronomic Sciences and Veterinary Medicine of Bucharest
AGRICULTURE FOR LIFE, LIFE FOR AGRICULTURE
June 4 – 6, 2020, Bucharest, Romania

ASSESSMENT OF HEAVY METALS CONTENT IN CALCARIC ALLUVIAL SOIL FROM BUZAU COUNTY UNDER RESTRICTION OF ORGANIC FARMING

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Keywords: heavy metals, organic farming, Buzau County, tomato.

INTRODUCTION

Heavy metals form a separate group of pollutants, especially due to properties such as long residual and half-life, soil residence time (> 1000 years), as well as bioaccumulation and bioamplification in food chains. However, some of these metals, such as cobalt (Co), copper (Cu), chromium (Cr), iron (Fe), magnesium (Mg), manganese (Mn), molybdenum (Mo), nickel (Ni), selenium (Se) and zinc (Zn) are essential micronutrients for organisms, being necessary for different physiological and biochemical mechanisms (WHO, 1996). However, excessive amounts of these metals can cause adverse reactions in plant and animal organisms. Other metals such as lead (Pb) and cadmium (Cd) have no established biological functions and are considered non-essential. As the European Union has not established general heavy metal limits for soils, each country has its own legislation. The present study evaluates the content of mineral elements on a field under conversion to organic farming, treated with microbial inoculants. As the applied microbial treatment can change the soil composition, the analysis of the heavy metals was made as a safety measure, decreasing or increasing the concentration of them being a possible side effect. For this reason, we must ensure that the site remains within the limits required by law.

MATERIALS AND METHODS

The present study follows the evolution of the heavy metal content in a calcaric alluvial soil from Buzau county - Romania, which was treated with microbial inoculants. The field is in conversion to organic farming, and it was planted with Florina 44 tomato variety in 2019. Soil samples were taken from topsoil (0-20 cm), from several points of tomato field, in two stages: in summer (July - month 7) and in late autumn (November - month 11), denoted as Exp3 and Exp4.. The samples were analyzed following the diagram below (Figure 1):

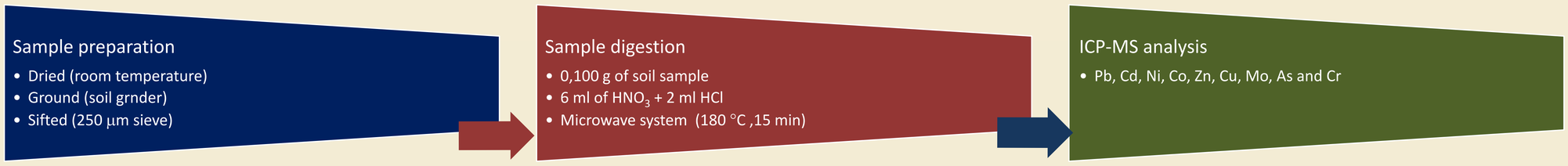
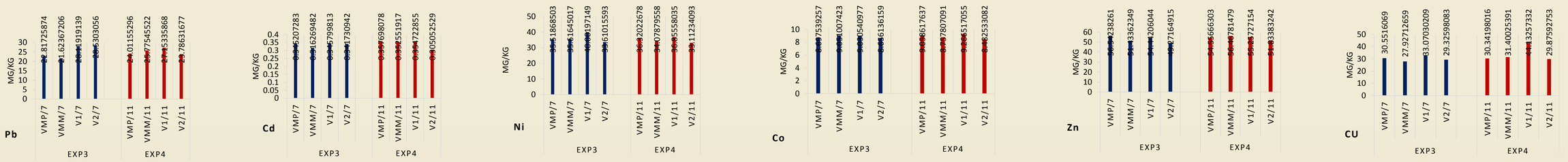


Figure 1. Method diagram

RESULTS AND DISCUSSIONS

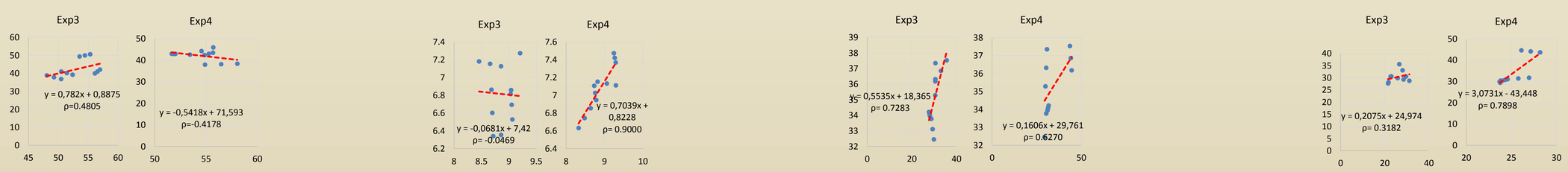
This study aims to determine if the microbial treatment applied to the soil produces significant changes on heavy metals content, and if these changes break the law in force. The results are presented in figure below (Figure 2). Furthermore, some correlations between these values are shown (Figure 3).



Applying T-test for the two groups of data (Exp3 and Exp4) (α=0.05) for each metal separately, it can be observed that there are no significant differences between the two sets of samples.

It is important to note that the heavy metal concentrations varied insignificantly. This result was rather expected, beside the fact that none of the values exceeded the maximum limit according to law.

Figure 2. Heavy metal content for the two stages



Change of direction between Exp3 and Exp4 on Zn and Cr correlation

Occurrence of new correlation between Co and As on Exp4

Maintenance of the same direction between Exp3 and Exp4 on Cu and Ni correlation

Maintenance of the same direction between Exp3 and Exp4 on Cu and Ni correlation

Figure 3. Correlations between some elements.

CONCLUSIONS

- Regarding the heavy metal content of the soil, between the two sampling periods, no significant difference was observed in any of the elements analysed in this study. Also, none of the elements exceeds the maximum legal limit after the microbial treatment.
- There was observed some changes, meaning that after the treatment, the positive correlation between Zn and Cr content has been reversed to negative correlation. Also, a new strong positive correlation emerged between Co and As after the microbial treatment.
- The Cu and Ni content kept the same positive correlation for both stages of sampling, but at a lower level for the second stage.
- The values for Pb and Cu kept also a positive correlation for both stages of sampling, but much stronger for the last taken samples.

ACKNOWLEDGEMENTS

This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI-UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0301/28PCCDI, within PNCDI III.
The analyses for this study were made using the infrastructure of **Research Center for Studies of Food Quality and Agricultural Products, University of Agronomic Sciences and Veterinary Medicine of Bucharest.**