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

MACRO AND MICRONUTRIENTS DISTRIBUTION IN CALCARIC ALUVIOSOIL

Aurora DOBRIN[1*], Mihaela ZUGRAVU[1], Andrei MOŢ[1], Iulian Bogdan MUȘAT[2], Roxana CICEOI[1]

[1]Research Centre for Study of Food and Agricultural Products Quality, University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, Bucharest, Romania; [2]Faculty of Agriculture, University of Agronomic Sciences and Veterinary Medicine of Bucharest,
*aurora.dobrin@qlab.usamv.ro

Keywords: ICP-MS, macronutrients, micronutrients, soil fertility

INTRODUCTION

- Macro and micronutrients are very important for physiological and metabolic processes in plants. Nitrogen, phosphorus, and potassium are the primary nutrients for plants and are often deficient in cropped soils. Reduced concentrations of nutrients are found in sandy soils, as alluvial soils, (prone to leaching, micronutrient deficiencies of iron, manganese, copper, zinc, and boron), soils with high pH (affect the availability of iron and manganese) or soils intensively cropped.
- Crop rotation, the addition of bio-products, as organic amendments, organic fertilizers or microbial inoculants, environment protection and good agricultural practices etc. are used to balance the nutrients soil content and availability (Mikula et al., 2020; Dhaliwal et al., 2019; Ionescu et al., 2016; Rashid et al., 2016; Madjar et al., 2014; Vlahova et al., 2014; Nagacevschi, 2013).
- In this study we used ICP-MS technique to quantify few of the macro and micronutrients in a calcaric aluviosoil soil profile in 2019, as this method has higher sensitivity, selectivity and detection limits than other elemental analysis techniques. The results will be used in the further years to identify correlations between the dynamic of these total contents at different soil depths and the soil microbiota, including the added microbial inoculants used in tomato crop technology.

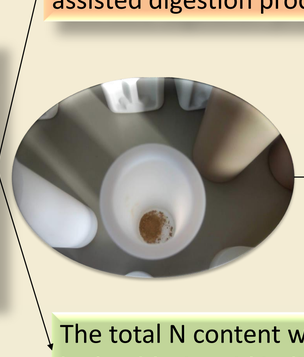
MATERIALS AND METHODS

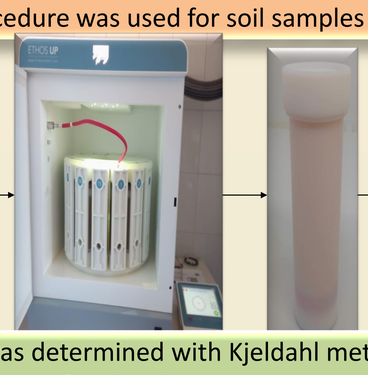
The experiment was conducted in the organic research plot from Vegetable Research and Development Station Buzău, România

The soil samples were taken at six depth intervals (0–20 cm, 20-40 cm, 40–60 cm, 60-80 cm, 80-100 cm and 100-120 cm).

The macro, microelements and total N content analysis were made in the **Research Centre for Study of Food and Agricultural Products Quality, University of Agronomic Sciences and Veterinary Medicine of Bucharest.**

The microwave extraction method was used after EPA Method 200.2 and Method 3050 using both solvents nitric acid and hydrochloric acid. Microwave-assisted digestion procedure was used for soil samples preparation.

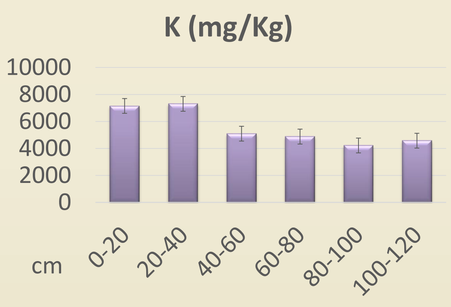


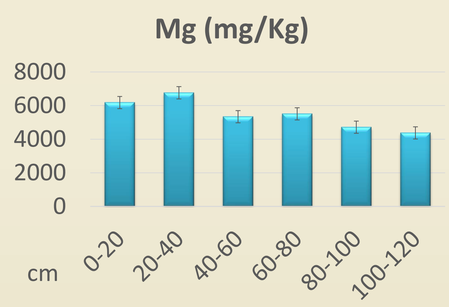


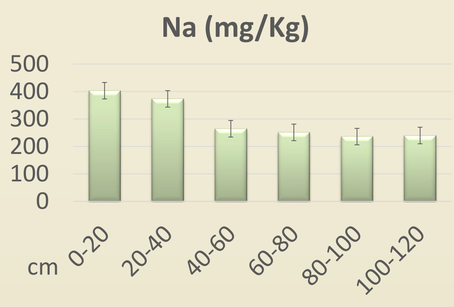
Quantification at ICP-MS (MassHunter Workstation software)

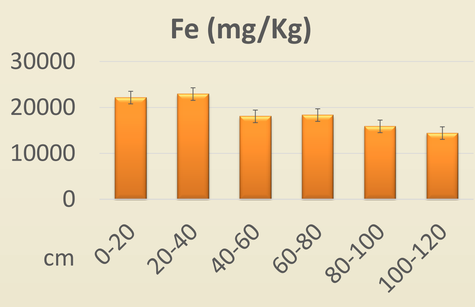
The total N content was determined with Kjeldahl method, using 0.1 N hydrochloric acid indicator for titration.

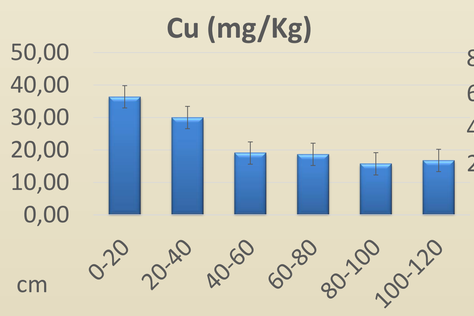
RESULTS AND DISCUSSIONS

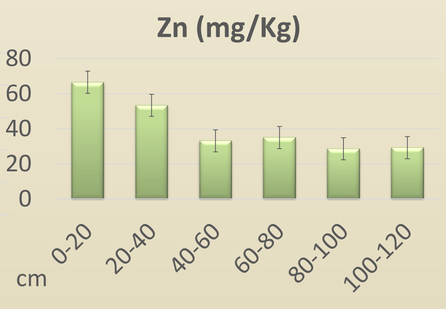


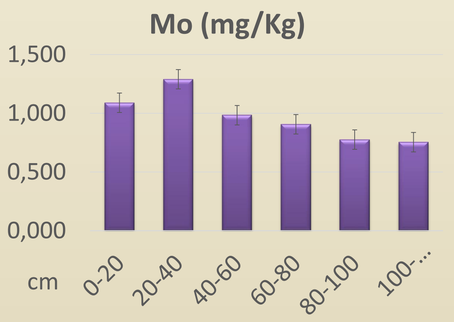












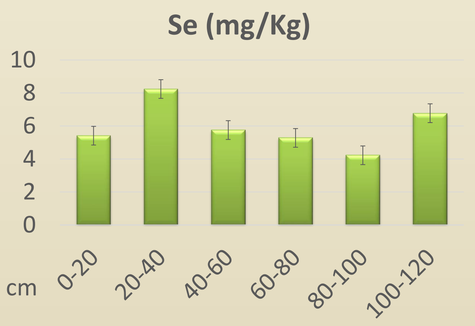
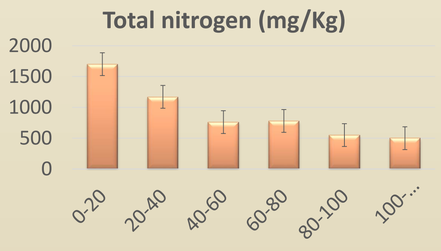


Table 1. Correlation between Ca, K, Mg and Na content in soil profiles in 2019

	Ca	K	Mg	Na
Ca	1			
K	0.732	1		
Mg	0.746	0.865	1	
Na	0.643	0.966	0.742	1

Table 2. Correlation between analysed microelements content in soil profiles in 2019

	Zn	Cu	Fe	Se	Mo
Zn	1				
Cu	0.998	1			
Fe	0.895	0.896	1		
Se	0.296	0.340	0.407	1	
Mo	0.781	0.799	0.954	0.614	1



CONCLUSIONS

- Soil fertility is one of the most important issues for modern agriculture today and the way we use the technological resources to maintain its health and prevent environmental pollution will deeply impact the generations of tomorrow.
- The fertilizations must be realized only considering the existing content of nutrients in soil, the physical and chemical processes that may lead to variations of available and unavailable forms and the requirements of the cultivated crops.
- Our analysis revealed that ICP-MS is a high throughput and reliable technique that allows fast analysis of the total content of nutrients in soils, providing results comparable with those obtained by other laborious techniques and may provide fast answers to farmers and valuable information about the nutrients dynamic in the plants rhizosphere through the cropping season.

ACKNOWLEDGEMENTS

This work was supported by a granPN-III-P1-1.2-PCCDI-2017-0301 of the Romanian Ministry of Research and Innovation, CCCDI-UEFISCDI, project number / 28PCCDI, within PNCDI III.

REFERENCES

- Dhaliwal, S. S., Naresh, R. K., Mandal, A., Singh, R., Dhaliwal, M. K. (2019). Dynamics and transformations of micronutrients in agricultural soils as influenced by organic matter build-up: A review. Environmental and Sustainability Indicators, 1-2, 100007.
- Ionescu, N., Popa, C.B., Chirilă, R., Drăgoi, S. (2016). New bio-products efficiency in sustainable agriculture. AgroLife Scientific Journal, Volume 5, Number 2, 79-84, ISSN 2285-5718.
- Madjar, R., Scăeţeanu, V.G., Peticilă, A., Tudor, M. S. (2014). Evaluation of nutrients availability by applying fertilizer at different doses in soil column. Scientific Papers. Series A. Agronomy, LVII, 46-53.
- Mikula, K., Izydorczyk, G., Skrzypczak, D., Mironiuk, M., Moustakas, K., Witek-Krowiak, A., Chojnacka, K. (2020). Controlled release micronutrient fertilizers for precision agriculture – A review, Science of The Total Environment, 712, 136365, ISSN 0048-9697.
- Rashid, M.I., Mujawar, L.H., Shahzad, T., Almeelbi, T., Ismail, I.M.I., Oves, M. (2016). Bacteria and fungi can contribute to nutrients bioavailability and aggregate formation in degraded soils. Microbiological Research, 183, 26-41, ISSN 0944-5013.
- Vlahova, V., Popov, V. (2014). Impact of biofertilisers on vegetative growth and leaf gas-exchange of pepper seedlings (*Capsicum annuum* L.) in organic farming. AgroLife Scientific Journal, 3, Number 1, 156-162I, SSN 2285-5718.
- EPA Method 3050B Acid digestion of sediments, sludges, and soils , Revision 2, December 1996, https://www.epa.gov/sites/production/files/2015-06/documents/epa-3050b.pdf.
- EPA Method 200.2, Revision 2.8: Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements, Revision 2.8, EMMC Version, https://www.epa.gov/sites/production/files/2015-08/documents/method_200-2_rev_2-8_1994.pdf.