Original scientific paper
Poster presentation

SPATIAL VARIABILITY OF SOIL FERTILITY BASED ON ELECTRICAL CONDUCTIVITY IN A SMALL-SCALE VINEYARD

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ABSTRACT

This study investigates spatial variations of soil fertility in terms of chemical properties, macro- and microelement content, and granulometric composition within a small vineyard (1.2 ha). The research was conducted during the 2020 growing season at the Experimental Field of the Faculty of Agriculture, University of Novi Sad, located in Sremski Karlovci. The vineyard, planted with the Grašac (*Riesling Italico*) variety, was subdivided into 20 quadrants to enable a spatially explicit characterization of soil variability. Soil samples were collected at two depths (0–30 cm and 30–60 cm). Laboratory analyses included pH (H_2O and KCl), organic matter (OM), total organic carbon (TOC), calcium carbonate ($CaCO_3$), cation exchange capacity (CEC), available phosphorus (P) and potassium (K), available micronutrients (Mn, Fe, Zn, Cu, B), and granulometric composition.

Spatial analyses were complemented by high-resolution geophysical measurements obtained with the Topsoil Mapper (Geoprospectors GmbH), which records soil electrical conductivity across four cumulative depth intervals, providing dense sensor datasets with pronounced spatial variability. Based on electrical conductivity, the vineyard was delineated into two management zones: Zone I (higher EC readings, 13 subplots) and Zone II (lower EC readings, 7 subplots).

Overall, the soil exhibited low levels of organic matter, available P and K, Zn, and B. Reduced fertility was consistently observed in Zone II across most parameters. Notably, available phosphorus and potassium tended to be higher in Zone II, although these differences were not statistically significant. Statistically significant differences between the two management zones were identified in several soil properties, including pH, $CaCO_3$, organic carbon, and the sand and silt fractions of the granulometric composition. The greatest variability was detected in the 30–60 cm soil layer.

Principal component analysis (PCA) highlighted strong correlations among key soil characteristics, including pH, $CaCO_3$, total nitrogen, CEC, TOC, clay content, and enzyme activity across the two management zones.

Further research is needed on vineyards at larger scales, where greater spatial variability is expected. The results underscore the potential benefits of precision viticulture and advanced soil analytics for vineyard management and winemaking.

Key words: soil fertility, spatial variability, electrical conductivity, vineyard

ACKNOWLEDGMENT

This study was conducted as a part of the Project "Optimization of grape production through comprehensive mapping of grape. VinMap" (PoC 5154) Proof of Concept program of the Innovation Fund of the Republic of Serbia. This research was also supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, grant number: 451-03-136/2025-03/ 200032.

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