Spectral response of grapevine (*Vitis vinifera* L.) cultivar Riesling to foliar applications

Péter Bodor-Pesti[1], Gyula Váradi[2], Attila Hüvely[2], Judit Pető[2], Diána Nyitrainé Sárdy[1], Tamás Deák[1], Zsuzsanna Varga[1], Luca Masiero[3], and Erzsébet Krisztina Németh[1*]

[1] Institute for Viticulture and Oenology, Hungarian University of Agriculture and Life Sciences, *nemeth.erzsebet.krisztina@uni-mate.hu

[2] Department of Agricultural Science, Faculty of Horticulture and Rural Development, John von Neumann University, Hungary

[3] Council for Agricultural Research and Agricultural Economy Analysis, CREA, Viticulture Research Centre (Conegliano TV)

This study investigates the effects of different foliar applications on the spectral characteristics of grapevine (*Vitis vinifera* L.) cv. Riesling leaves. In addition to untreated control plants, experimental plots were treated with natural bioactivator extracts and microelements. Leaf samples were collected at the beginning of July and September 2024, referring to E-L33-34 and E-L38 Eichhorn-Lorenz phenological stages. Reflectance measurements were performed on leaf discs of uniform size (r = 10 mm; A = 314.2 mm^2) using a CI-710 Leaf Spectrometer.

The following treatments were applied:

- AS - Active start technology: 100% natural bioactivator from extracts of plant materials, contains amino acids and microelements
- DrG - Dr Green's technology foliar fertilizer with microcrystalline formulations (Start, Energy, Quality)
- PLHU - 3,5% methyl-salicylate, potassium hydrogen bicarbonate, humic and fulvic acid + microelement supplements.
- Control: treated according to the rules of Agri-environment program without nutrient supplementation

The following investigations were carried out:

- Leaf nutrient content was analyzed two times during the vegetation period at flowering (E-L19-23) and ripening (E-L35-38).
- Spectral evaluation: SpectraVue CI-710 Leaf Spectrometer (Cid-Bioscience, Camas, WA, USA).
- Spectral data were analyzed using principal component analysis (PCA), and selected wavebands were utilized to compute vegetation indices, including NDVI, EVI, CI-G, MCARI, NDRE, VARI, and PRI.

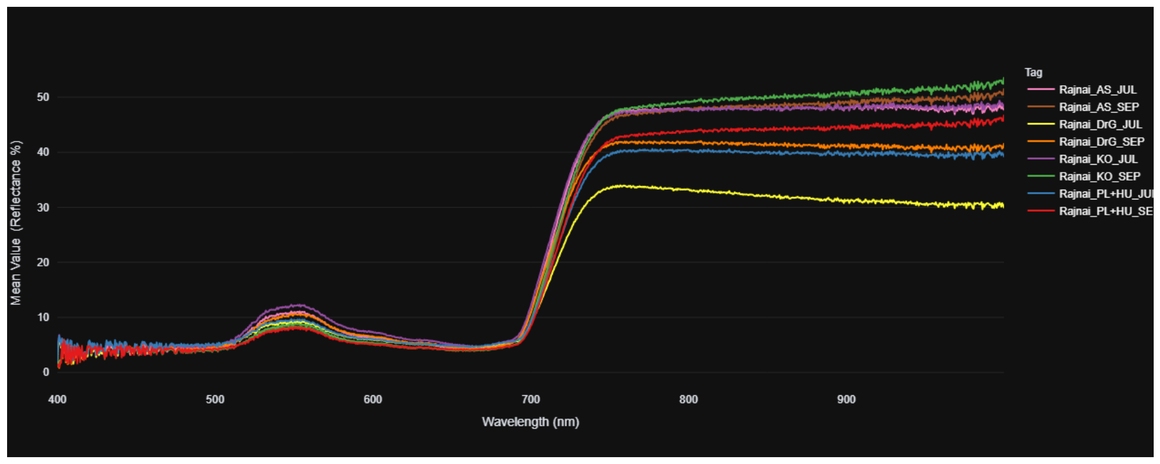

Figure: Leaf reflectance spectra obtained from Control, AS, DrG and PLHU treatments at two phenological stages.

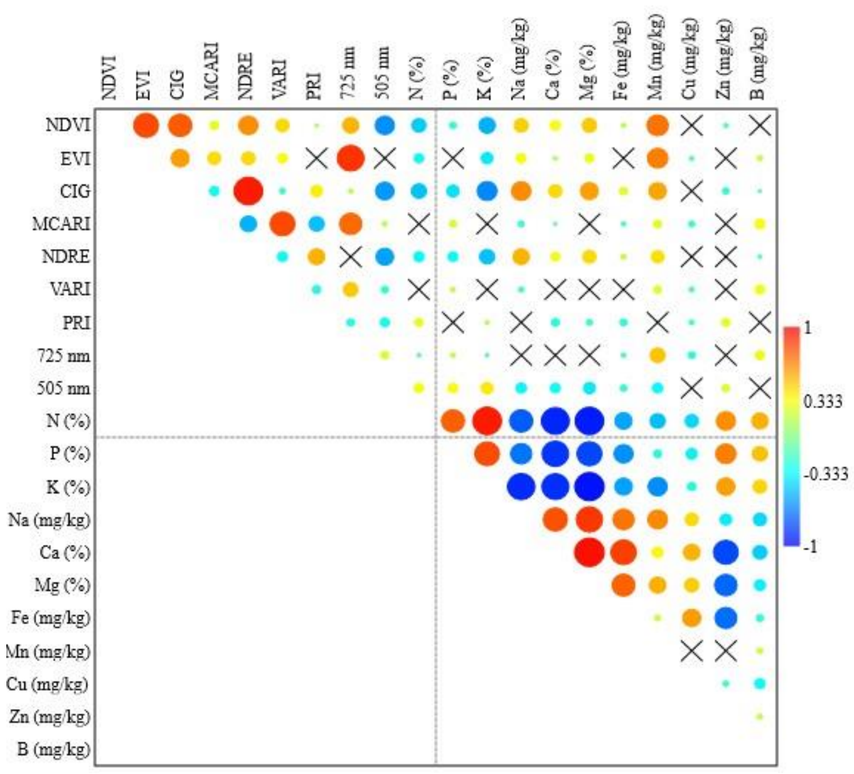

Figure: Pearson correlation among the investigated vegetation indices, wavelengths and the leaf nutrient content

PCA revealed that the first principal component (PC1) accounted for 54.3% of the total variance, while PC2 and PC3 explained 35.5% and 5.5%, respectively. The highest loading for PC1 was observed at 725 nm, whereas for PC2, it was at 505 nm. Analysis of variance (ANOVA) indicated that the applied treatments had a statistically significant effect on the vegetation indices. Noticeable differences were obtained moreover in the regions of 520 to 640 nm, and 740 nm to 1000 nm. According to the PCA we identified two bands: 725 nm and 505 nm, which had the highest loading on the PC1 and PC2 respectively. Statistical evaluations showed that both treatments and phenological stage of the sampling have a significant effect on the vegetation indices and the two selected wavebands. We found that NDVI, CI-G and NDRE had a significant negative correlation with N, P, and K content of the samples, while positive correlation with Na, Mg, Ca and Fe content. Mn content had a positive and significant correlation with NDVI, EVI, CI-G, NDRE and VARI. Results obtained in this study need further verification to get more data on the leaf nutrient content and spectral characteristics of the grapevine.

The study was supported by the Agri-Digital Growth Interreg Central Europe (CE0200761) project.