Nutrient interactions in grapevine

Interakcja składników pokarmowych u winorośli

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The knowledge of the soil-plant elements interaction is a key factor for improving efficiency of nutrients uptake. Therefore, the aim of the study was to investigate the correlation between essential plant nutrients in soil and grapevine tissues. The experiment with 4 year-old grapevines cultivars (13 different) was carried out in "Garlicki Lamus" vineyard located in Garlica Murowana (near Krakow, Poland, 19°56'E and 50° 08'N) in 2010–2013. The vineyard soil was characterized as a silty clay loam with a total organic matter of 1.68%. The available soil macroelements content (mg dm^{-3} of soil) were measured after 0.03 mol dm^{-3} CH_3COOH extraction and the amount of soluble soil microelements (mg kg^{-1} of soil) were extracted with 1 mol dm^{-3} HCl. During the subsequent seasons the samples of leaf petioles and blades were taken three times i.e. at full bloom time on June 15th, July 15th and August 15th. After wet microwave digestion in HNO_3 the collected samples were examined for the nutrients concentration using ICP-OES technique. Soil and plant samples were taken annually, three times: on June 15, July 15 and August 15.

Generally, we found more significant soil-plant nutrient correlations for leaf petioles than blades (Table 1). So, it could be assumed the petioles as more apropriate/responsive indicative plant part for testing mineral nutrient status in vines. The least significant correlations were proved for the 1st date of leaves sampling (June 15). The nutrient concentration for young, not fully developed leaves were not correlated with soil available nutrient content. It may be concluded that (for south Poland climatic conditions) the early season for tissue sampling and analysis is not an appropriate one.

A positive relationship was ascertained between soil N-NO_3 amount and some element leaf concentration: N, S, Mg and B, Cu, Zn content in blades, as well as, for S in petioles. Soil ammonium was positively linked with Cu and Zn as measured in blades.

The available soil Ca content was significantly correlated with blades N and S amount, while the negatively correlation between soil Ca *vs*. petiole P and K was proved. Soil K was positively related with petioles Si. Synergistic associations were found for soil Mg and petioles nitrogen concentration. On the contrary, we observed the commonly known antagonism between soil Ca concentration and blades potassium content.

The level of soil soluble P concentration was positively linked with petioles N and S. The same was observed for P content in grapevines' blades. A positive relationship was found between soil S-SO_4 and blade N and S amount, while the reverse was true for soil S *vs.* blades K.

We also revealed a positive relationship between soil B and petiole B, Zn and Fe content. The some antagonisms of soil boron concentration against petiole and blade Mn were also ascertained.

Soil available Cu content was positively correlated with petiole Cu and Fe, while the Cu antagonism was found for blade Zn, Mn and petiole Zn amounts. Soil iron level was positively linked with B and Zn as measured in vines' petioles. However the antagonism we found between soil Mn and B, Zn (blade) as well as Zn (petiole). Soil Zn level was positively related with B and Fe leaf content (both petiole and blade).

A positive interaction was shown between soil electrical conductivity (EC) *vs.* petiole (N, S-SO_4) and vs. blade (N, S and Mg) amount. EC was negatively interrelated with blade P and K level. The soil reaction (pH) was negatively correlated with blade Mn concentration.