SOIL AND NUTRITIONAL SURVEY OF GREEK VINEYARDS FROM THE PREFECTURE OF MACEDONIA, NORTHERN GREECE, AND FROM THE ISLAND OF SANTORINI

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Abstract:

Context and purpose of the study-*Vitis vinifera* L. is one of the most important cultures for the soil and climate conditions of Northern Greece and Santorini. However, very little information is provided with regard to its nutritional requirements and critical levels of nutrient deficiencies and toxicities. The aim of this study was to provide an integrated nutritional survey for the Greek conditions of wine and table varieties.

Materials and Methods- During the period 2012-2017 a high number of soil and leaf samples were collected (from Western and Central Macedonia, and from Santorini) and analyzed, to determine soil fertility and nutrition of Greek vineyards.

Results- Soil results showed that pH varied from approximately 4 to 8.30, organic matter from 0.36% to 7.80%, NO_3-N from 0.4 to 81.6 ppm, P from 0.4 to 206 ppm, and exchangeable K and Mg varied from 54 to approximately 1000 ppm, and from 13 to 1608 ppm, respectively. DTPA extractable Fe, Zn, Mn and Cu fluctuated from approximately 1 to 200 ppm, 0.10 to 40 ppm, 0.78 to 60 ppm, and from 0.30 to 176 ppm, respectively. Finally, extractable B varied from 0.10 to approximately 16 ppm. With regard to foliar nutrient concentrations, wine and table varieties from Central Macedonia showed leaf N levels from 2.3 to 3.3% dw, and from 1.92 to 3.02% dw, respectively. Phosphorus varied from 0.15 to 0.47% dw, and K from 0.40 to 1.86% dw, and from 0.66 to 1.95% dw for wine and table varieties, respectively. Foliar Ca for wine and table varieties varied from 1.15 to 3.26% dw, and from 0.67 to 2.84% respectively, while Mg fluctuated from 0.12 to 0.44% dw, and from 0.14 to 0.61% dw, respectively. Leaf B fluctuated from 12 to 86 ppm, and from 18 to 106 ppm, respectively. Foliar Zn for wine varieties varied from 7 to 77 ppm, and for table varieties fluctuated from 9 to 34 ppm. Manganese varied from 23 to 1622 ppm, while Fe and Cu fluctuated from 39 to 179 ppm, and from 7 to 1057 ppm, respectively. Based on these data and on the classification provided in literature, it can be concluded that approximately 75% of the vineyards from Western Macedonia showed slight N deficiency, while 20-75% suffered from severe K deficiency. In addition, 30-50% and 35-80% of the vineyards of Kastoria showed B and Zn inadequacy, respectively. Finally, in most cases, very high Mn and Cu levels were found. It is believed that these data offer a useful insight and provide a valuable agronomic tool towards a sustainable nutrient management in the Greek vineyards.

Keywords: *Vitis vinifera* L., nutrient deficiency, nutrient toxicity, organic matter, wine varieties, table varieties

1. Introduction.

Soil and nutritional survey of Greek vineyards from the prefecture of Macedonia, Northern Greece, and from the island of Santorini

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Introduction and Objectives

Vitis vinifera L. is one of the most important cultures for the soil and climatic conditions of Northern Greece and Santorini. However, very little information is available on its nutritional requirements and critical levels of nutrient deficiencies and toxicities. The aim of this study was to provide an integrated nutritional survey for the Greek conditions of wine and table varieties.

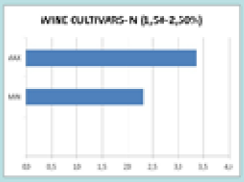
Materials and Methods

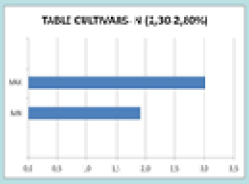
During the period 2012-2017 a high number of soil and leaf samples were collected (from Western, Central and Eastern Macedonia, and from Santorini) and analyzed, to determine soil fertility and nutrition of Greek vineyards. Soil and leaf sample analyses were conducted according to standard protocol methods.

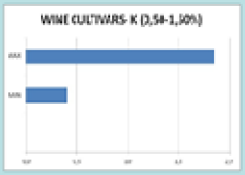
Results and Discussion

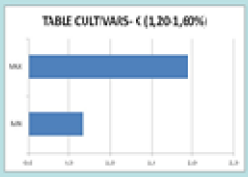
In the following diagrams, the minimum and maximum values per nutrient are shown, together with the optimum range of sufficiency (inside parentheses).

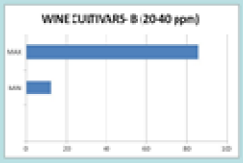
From the below first two diagrams, it is concluded that slight N deficiency was appeared in approximately 75% of the table cultivars, but not for the wine cultivars.

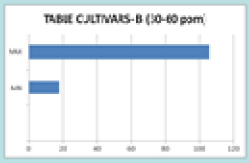


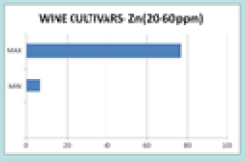


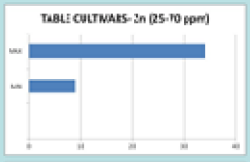


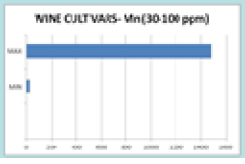


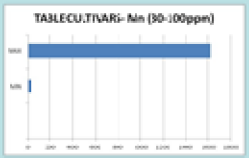


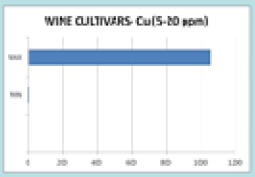


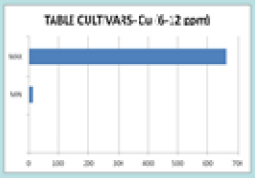


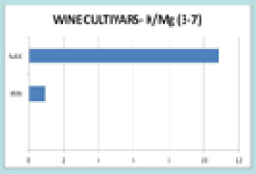












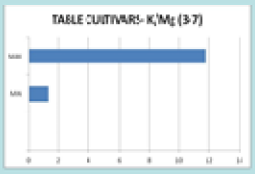


Table 1. Minimum and maximum values, as well as optimum range of soil properties in Greek vineyards

Soil properties		Minimum	Maximum	Optimum range
pH		4.00	8.30	6.80-7.50
Organic matter	%	0.36	7.30	>2%
CaCO3		0.00	67.20	<10%
NO3-N	ppm	0.40	81.60	20-40 ppm
P (Olsen)		0.40	208.00	15-25 ppm
Exchangeable Ca		380.13	>2000	300-750 ppm
Exchangeable Mg		13.08	1608.00	50-100 ppm
Exchangeable K		54.08	1008.00	It depends on % clay, sand and loam (from 75-280 ppm)
Fe (DTPA)		1.00	200.00	7-25 ppm
Mn (DTPA)		0.78	60.00	12-25 ppm
Zn (DTPA)		0.10	40.00	1.0-2.5 ppm
Cu (DTPA)		0.30	120.00	0.8-1.5 ppm
B (hot water)		0.10	16.00	0.5-1.0 ppm

For the Table cultivars of Western Macedonia, it was found that up to 75% of them showed severe K deficiency (<1% dw), while for the wine cultivars the corresponding percentage was approximately 20%. For more than 30% of vineyards, the ratio K/Mg was imbalanced (either >7 or <3). Especially in the cases where K/Mg is >10, Mg deficiency may occur. In these cases, two foliar applications with $MgSO_4$, or $Mg(NO_3)_2$, is usually advised (Nikolaou, 2001).

Boron was in inadequacy (<20 ppm) for approximately 30% of the wine cultivars, and for about 50% of the Table genotypes (<30 ppm). Foliar Zn was below the critical level of deficiency for wine (<20 ppm) and Table genotypes (<25 ppm) for approximately 35% and 80% of the vineyards, respectively. Finally, more than 15 and 50 times higher to critical Mn and Cu levels for toxicity, respectively, were found. This should concern the growers for possible damages due to excess use of Mn and Cu-containing products for plant protection.

With regard to soil properties, a significant percentage of samples from vineyards has low to very low organic matter content (<2%). This finding should preoccupy the producers, in order to adopt more sustainable agronomic practices for enhancement of organic C. Finally, although the variation in micronutrients' concentrations were wide, only a limited percentage (approximately 10-15%) of vineyards showed insufficient soil micronutrients' concentrations.

Literature Cited

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