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Influence of liming with $Ca(OH)_2$ on nitrogen, phosphorus and potassium content in foliage of vine varieties

K. Trendafilov*, V. Valcheva, S. Todorova

Department of Agriculture and Soil science, Faculty of Agronomy, Agricultural University, 12 Mendeleev, 4000 Plovdiv, Bulgaria

Abstract. *In conditions of combined field experiment the influence of liming with $Ca(OH)_2$ was studied in rates of 1,0, 2,5 and 5,0 t/ha on the input of nitrogen, phosphorus and potassium in the leaves of fertility vines from varieties Sauvignon Blanc, Chardonnay, Cabernet Sauvignon and Merlot, planted on Chromic luvisol. Samples were collected in three consecutive years; the first sampling time is 15 months after the incorporation of lime into the soil and the second and third – at intervals of 12 months. Nitrogen content in foliage established in all measurements from first sampling of leaves showed no significant differences between the variants. In subsequent years higher nitrogen content was found in the leaves of all varieties and the excess, compared to the first year is best expressed in the red varieties, mainly in Merlot variety. There are significant differences between varieties in relation to phosphorus content in air-dried leaves. There is a trend to increase the absorption of phosphorus when applying meliorative lime rates of 1,0 and 2,5 t/ha, while the rate of 5,0 t/ha inhibits the accumulation of phosphorus in leaves.As regards the absorption of potassium similar patterns were found as for phosphorus. No significant difference between the content of potassium in the three consecutive years of sampling was found. Differences in absorption of potassium between the red and white wine varieties are more clearly pronounced than the differences between varieties in relation to content of phosphorus and nitrogen.*

Keywords: liming, nitrogen, phosphorus, potassium, wine grape varieties

Introduction

Liming has a multiform impact on a wide range of components, characterizing composition and properties of soil, and this fact is widely discussed in literature. To the greatest extent liming affects the composition of exchangeable cations, which determine the acid-alkaline equilibrium in soil – Al^{3+}, H^+, Mn^{2+}, Ca^{2+} and Mg^{2+} (Palaveev and Totev, 1970). It leads to change in the degree of base saturation of soil, and simultaneously increases buffer capacity in the acidic soil layers (Trendafilov and Totev, 1992). Application of lime materials causes a reduction in concentrations of easily mobile Al^{3+}, H^+ and Mn^{2+} and increase in exchangeable Ca^{2+} and Mg^{2+}. Simultaneously, liming changes the ratio between calcium and trace metals in mobile forms in soil. The impact of these elements in their easily mobile exchangeable form, although moderate, should affect effectively and in a relatively short period the deep ameliorative horizon, because the uniformity of conditions for development of the root system in the whole root zone is one of the most important quality elements of vineyard terroirs, regardless of their specificity.

Wooldridge and Louw (2010) studied the influence of liming on soil pH and development of vineyards in the sixth growing season, as they tested different rootstocks, varieties and rates of liming (Maskenzie and Cristy, 2005). The authors conclude that liming to full neutralization of soil acidity leads to better development of the root system, but also to an imbalance between generative and reproductive development, which can be overcome by regulation of water regime and pruning. Application of chemical meliorants in acid soils often leads to controversial and sometimes negative results due to imbalance of nutrients in limed soils, bearing in mind the specific requirements of meliorated plants (Weber-Blaschke and Rehfuess, 2002).

The main goal of this study is to monitor the influence of liming in increasing doses on the content of major nutritional macroelements - nitrogen, phosphorus and potassium in the foliage of four grape varieties – Chardonnay, Sauvignon Blanc, Merlot and Cabernet Sauvignon.

* e-mail: trendafilovk@mail.bg

Material and methods

Studies are carried out in the conditions of field experiment in vineyards located on the lands of Svilengrad and the village of Mezek. The main soil type, within the limits of research site is Chromic luvisols with texture differentiated soil profile. In the conditions of the field experiment conducted by us we tested the influence of liming with hydrated lime in three increasing rates in combination with nitrogen, phosphorus and potassium fertilization on the chemical composition of the vines.

The experiment is carried out over three vegetations in already existing vineyards, planted on acid soils which have not been limed before. The trial was set by the method of long plots and in the distribution of variants a control was included without liming and fertilizing, a variant without liming but with combined nitrogen, phosphorus and potassium fertilization and three increasing rates of liming with hydrated lime – 100, 250 and 500 kg/dka. Each of the variants was set in three replications. Different variants are shown in Table 1.

The vineyard is planted with row spacing of 2,20m and space between vines – 1,10m. The experiment was set after the end of the third growing season. All varieties included in the study, were planted on the rootstock Berlandieri X Riparia, Selection Oppenheim 4 (SO4). The area of each experimental plot is 24,2 m^2 and between the variants a guard with width of one row was left. The meliorant and phosphorus and potassium fertilizers were incorporated in the period August-September. After the application of lime, soil was twice harrowed, ploughed at depth of 22–25 cm, again harrowed and

Table 1. Description of the variants in field experiment

Variant	Variety	Rate of hydrated lime (t/ha)	Rate of N (t/ha)	Rate of P_2O_5 (t/ha)	Rate of K_2O (t/ha)
Control	Chardonnay	0	0	0	0
	Sauvignon Blanc	0	0	0	0
	Merlot	0	0	0	0
	Cabernet Sauvignon	0	0	0	0
Fertilization – N,P,K	Chardonnay	0	0.14	1.0	0.60
	Sauvignon Blanc	0	0.14	1.0	0.60
	Merlot	0	0.14	1.0	0.60
	Cabernet Sauvignon	0	0.14	1.0	0.60
Liming	Chardonnay	1.0	0.14	1.0	0.60
		2.5	0.14	1.0	0.60
		5.0	0.14	1.0	0.60
	Sauvignon Blanc	1.0	0.14	1.0	0.60
		2.5	0.14	1.0	0.60
		5.0	0.14	1.0	0.60
	Merlot	1.0	0.14	1.0	0.60
		2.5	0.14	1.0	0.60
		5.0	0.14	1.0	0.60
	Cabernet Sauvignon	1.0	0.14	1.0	0.60
		2.5	0.14	1.0	0.60
		5.0	0,14	1.0	0.60

sub-soiled at depth of 50 cm in order to achieve the best possible homogenization of the meliorant with the soil in active root zone. One month after liming phosphorus and potassium fertilizers were applied in the form of triple superphosphate (1,00 tP_2O_5/ha) and potassium sulphate (0,60 tK_2O/ha), respectively, while nitrogen in the form of NH_4NO_3 (0,14 tN/ha) was applied in February before the next growing season.

The leave samples are taken twice – during the autumn period, 15 months after incorporation of the meliorant, and at the end of the next growing season i.e. 12 months later. Leaf samples were collected from healthy, with no visible damages leaf material as we selected leaves with size typical for the variety, grown from the main shoots. The vineyard is formed as a bilateral cordon with a height of 80cm. Vines in the experimental plots have relatively uniform habit and approximately equal number of fruit-producing shoots.

Leaves samples are analyzed after Kjeldahl wet digestion. Nitrogen is determined after alkaline distillation of an aliquot by Parnas-Wagner apparatus; phosphorus – colorimetric by the vanadate-molybdate method, potassium – by flame photometer (BDS 11374/86).

Results and discussion

The content of nitrogen, phosphorus and potassium in the leaves as a percentage of air dried foliage is presented in Table 2. Average nitrogen content, for all measurements is 2.45% and that corresponds to data from the literature (Kadrev and Peev, 1980). In the second year of measurement higher nitrogen content was established in the leaves of all varieties and the excess to the first year is best expressed in the red varieties, mainly in Merlot. Statistically proven influence of lime material rate on the nitrogen content of leaves was not found. The applied lime rates and liming, average for the two years of the study, determines only 4% of the variation of nitrogen content in the foliage.

Generally, in terms of our experiment, red wine varieties – Cabernet Sauvignon and Merlot, assimilated about 0.25 to 0.30% more nitrogen compared to the white varieties. In comparison with other varieties, the most intensively nitrogen is absorbed in the leaves of Merlot. Data from the analysis of factors influencing nitrogen content in foliage show that the factor variety is the most influenced and forms approximately 30% of the variance of the parameter nitrogen content. In the second place is the year of study (first and second). Factor year forms about 20% of the variation in nitrogen content.

Statistically proven differences between varieties are established about phosphorus content in air-dried leaves. The average phosphorus content measured for all variants is 0.4% P_2O_5. The white varieties and especially Chardonnay assimilated less nitrogen than the red one. There is a trend for increasing phosphorus absorption in the application of meliorative lime in rates of 1,0 and 2,5 t/ha, while the rate of 5,0 t/ha suppressed accumulation of phosphorus in leaves. In contrast to nitrogen, phosphorus does not show significant differences between the two years of the study. Excessive high values of phosphorus absorption are established for the variety Merlot and as they appear only in two of the measurements, results were excluded from the total sample. Perhaps it is a varietal characteristic or a specific physiological response to stress in this variety.

With respect to potassium absorption, the same trends were basically found as for phosphorus (Garcia et al., 1999). A statistically

Table 2. Nitrogen, phosphorus and potassium content in air-dried foliage of varieties Chardonnay, Sauvignon Blanc, Merlot and Cabernet Sauvignon, depending on the rate of liming with hydrated lime

Year	Direction of cultivation	Variety	Hydrated lime (t/ha)	N (%)	P_2O_5 (%)	K_2O (%)
First	White	Chardonnay		2.23	0.30	1.17
			1.0	2.40	0.40	0.80
			2.5	1.90	0.20	0.70
			5.0	2.20	0.20	0.70
		Sauvignon Blanc		2.23	0.43	0.87
			1.0	2.00	0.40	0.90
			2.5	2.20	0.40	0.80
			5.0	2.20	0.40	0.70
	Red	Cabernet Sauvignon		2.40	0.43	1.00
			1.0	2.40	0.50	1.00
			2.5	2.50	0.40	0.80
			5.0	2.40	0.50	1.00
		Merlot		2.40	0.40	1.20
			1.0	2.20	0.40	1.20
			2.5	2.60	0.70	1.50
			5.0	2.80	0.40	1.20
Second	White	Chardonnay		2.53	0.30	1.27
			1.0	2.60	0.40	0.90
			2.5	2.20	0.20	0.80
			5.0	2.60	0.20	0.70
		Sauvignon Blanc		2.43	0.43	0.83
			1.0	2.30	0.40	1.00
			2.5	2.50	0.40	0.90
			5.0	2.50	0.40	0.70
	Red	Cabernet Sauvignon		2.63	0.43	1.07
			1.0	2.80	0.50	1.10
			2.5	2.90	0.40	0.90
			5.0	2.50	0.40	1.00
		Merlot		2.67	0.40	1.20
			1.0	2.40	0.40	1.30
			2.5	2.70	0.70	1.40
			5.0	3.30	0.40	1.30

proven difference between potassium content during the two consecutive years of sampling was not established. The differences in absorption of potassium between the red and white wine varieties are more strongly pronounced than the differences between varieties in terms of phosphorus and nitrogen. As regards the absorption of potassium, red and white varieties form two relatively homogeneous groups. Red wine varieties absorbed in foliage average 1.2%, while the white – 0.9% of potassium. Significant differences within the groups (white and red) are not found. The more intensive assimilation of potassium in the foliage of red varieties is probably due to the necessity of this element in the process of synthesis of colouring substances in red wine grapes.

Conclusion

Content of nitrogen and phosphorus in the foliage depends mainly on the variety differences and on the conditions of vegetation during the year. High rates of the meliorant inhibit accumulation of phosphorus in the leaves. Accumulation of potassium in the vegetative mass depends on the direction of cultivation.

References

BDS11374/86, 2009. Compound feed, protein concentrates and raw materials for them. Rules for sampling and testing methods, Sofia

(Bg).
Garcia M, Daverede C, Gallego P and Toumi T, 1999. Effect of various potassium-calcium ratios on cation nutrition of grape grown hydroponically. Journal of Plant Nutrition, 22, 3, 417-425.
Kadrev T and Peev H, 1980. Agrochemical and physiological bases of the quality of crop production, Sofia (Bg).
Mackenzie D and Christy A, 2005. The role of soil chemistry in wine grape quality and sustainable soil management in vineyards. Water Science and Technology, 51, 27-37.
Palaveev T and Totev T, 1970. Acidity of the soil and Agromethods for its elimination, Monography, Sofia (Bg).
Trendafilov K and Totev T, 1992. Influence of acidification of arable soils in a model semi-equilibrium system on the parameters characterizing harmful soil acidity. Soil Science, Agrochemistry and Ecology, 3,4, 25-30.
Weber-Blaschke G and Rehfuess K, 2002. Correction of Al toxicity with European ash (Fraxinus excelsior L.) growing on acid soils by fertilization with Ca and Mg carbonate and sulfate in pot experiments, Forest Ecology and Management, 167,1/3, Amsterdam: Elsevier Science B.V,173-183
Wooldridge J, Louw P and Conradie W, 2010. Effects of liming to near-neutral pH on Vitis vinifera L. South African Journal Of Enology And Viticulture, 31,1, 34-37.

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Todorov N and Mitev J, 1995. Effect of level of feeding during dry period, and body condition score on reproductive performance in dairy cows,IXth International Conference on Production Diseases in Farm Animals, Sept.11 – 14, Berlin, Germany, p. 302 (Abstr.).

Thesis:

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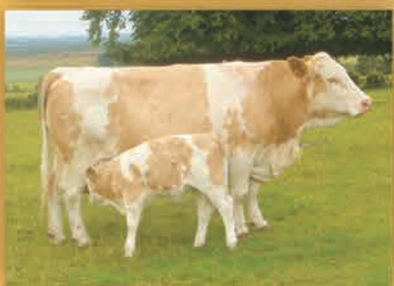

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