

ASSESSING OF THE STATE OF FERTILITY IN THE VINES, UNDER THE INFLUENCE OF THE FERTILIZATION CHEMICAL, IN THE CONTEXT OF AGRO-ECO- PEDOLOGICAL CHARACTERISTICS OF THE VINEYARD OF HUSI, ROMANIA

EVALUAREA STĂRII DE FERTILITATE A SOLULUI LA VIȚA DE VIE, SUB INFLUENȚA FERTILIZĂRII CHIMICE, ÎN CONTEXTUL AGRO- ECO-PEDOLOGIC AL PODGORIEI HUȘI, ROMÂNIA

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Abstract. *The fertilization of vine plantations aims at amplifying and intensifying the productive capacity of fruitful vineyards, in close correlation with the effect-efficiency-effort triad. A system of balanced fertilization, which can ensure efficiency and economy, and also keep the environment free of pollutants, requires knowledge of interrelations between soil, plant and fertilizer material. Obtaining some higher and stable grape crops can be achieved by knowing all the factors involved in growth and vine development, starting with genetic, biological, agro-phyto-technical factors and continuing with the eco-pedologic ones that may be considered restrictive. The paper shows the evolution of some forms of accessible nutrients and of some agrochemical soil indices under the influence of additional fertilization in a vineyard from a relatively homogeneous area in terms of pedologic factors, respectively Husi Vineyard. The fertilizers used were Cx 15-15-15 and Cx 5-15-25, use fractionally in two phenophases, bursting of buds and intense growth of the shoots, in doses of 100 150 and 200 kg/ha a.s. At the end of vegetation, in 2014, there were determined and analyzed the content of soil with phosphorus and potassium, accessible forms, humus content, degree of saturation in bases, carbon content, micro-elements content - B, Zn, Cu, Mn. The use of phasal fertilizer led to the improvement of phosphorus and potassium content, up to values of 57 and 420 ppm respectively (200kg/ha a.s.), comparable to the optimum values. The other agrochemical indicators varied in relation to dose and NPK ratio, confirming the effect of basic fertilization in completion to the additional fertilization.*

Key words: additional fertilization, fertility, accessibility

Rezumat. *Fertilizarea plantațiilor de viță de vie, urmărește amplificarea și intensificarea capacității productive a viilor roditoare, în strânsă corelație cu triada efort-efect-eficiență. Un sistem de fertilizare echilibrat, care să asigure randament și economicitate, cu păstrarea mediului ambiant liber de poluanți, presupune cunoașterea interrelațiilor dintre sol, plantă și materialul fertilizant. Obținerea unor recolte superioare și stabile de struguri, se poate realiza prin cunoașterea tuturor*

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factorilor implicați în creșterea și dezvoltarea viței de vie, începând cu factorii genetici, biologici, agrofitehnici și continuând cu cei ecopedologici, care pot fi considerați restrictivi. Lucrarea prezintă evoluția unor forme de elemente nutritive accesibile și a unor indici agrochimici ai solului, sub influența fertilizării suplimentare la vița de vie, într-un areal viticol relativ omogen sub aspectul factorilor pedologici, respectiv Podgoria Huși. Fertilizanzii folosiți au fost Cx 15-15-15 și Cx 5-15-25, utilizați fractionat, în două fenofaze, dezmușurit și creștere intensă a lăstarilor, în doze de 100, 150 și 200 kg/ha s.a. La încheierea vegetației, în anul 2014, s-au determinat și analizat conținutul solului în fosfor și potasiu, forme accesibile, IN, conținutul de humus, gradul de saturație în baze, conținutul de carbonați, conținutul de microelemente B, Zn, Cu, Mn. Utilizarea îngrășămintelor faziale, a determinat îmbunătățirea conținutului de fosfor și potasiu accesibil, până la valori de 57 și respectiv 420 ppm (200kg/ha s.a.), valori comparabile cu optimul. Ceilalți indicatori agrochimici au variat în raport cu doza și cu raportul NPK, confirmând efectul fertilizării de bază în completare cu fertilizarea suplimentară.

Cuvinte cheie: fertilizare suplimentară, fertilitate, accesibilitate

INTRODUCTION

The fertilization of crops is one of the important links in the technological chain of plant production which has recently gained considerable valences taking into consideration the obtainability of high productions, in the context of economic crisis and of raw materials but also in terms of food security, and at the same time keeping and preserving the environment. From this perspective, creating and maintaining an environment of adequate and balanced nutrition for the crop, represent goals of global and national research. The use of fertilizers, in balanced doses and reports, provide plants optimal nutrition for obtaining production at the expected level but also guarantee the preservation with nutrients in accessible forms and least waste possible of this environment (Davidescu, 1992). Priorities are the studies and tests of conventional and unconventional fertilizers (Volf, 2004, 2007, 2012) that meet these goals and can be promoted widely, without the danger of environmental pollution and without illness risk for the human body. (Trincă, 2009).

MATERIAL AND METHOD

The researches were conducted in a plantation of vines belonging to SC Vincon Vrancea, Husi Vineyard, Farm No. 18. In 2014 an experience was set up using complex fertilizers, administered to the Chaselas dore variety. The soil where the experience was placed is a cambic chernozem type, with a pH_(H2O) of between 7.5 and 8.0. The experimental polygon has an area of 1.9 ha and was fertilized with 150kg/ha a.s. of superphosphate and 200 kg/ha a.s. of 30% calcium bicarbonate in the autumn of 2013. The experience targeted the administration of two kinds of solid complex fertilizers, produced by SC Arvi Agro SRL company Cx 15-15-15 and Cx 5-15-25 in doses of 100, 150 and 200 kg/ha a.s. The fertilizers were administered radicularly and incorporated, fractionally, in two phases of vegetation at *bursting of buds* and intense growing of the shoots. At the setting up of the demonstrative plot and at the end of vegetation there were taken sampled soil from two depths: 0-20 cm

and 20-40 cm. There were determined: pH_(H₂O) – potentiometric method, P-AL ppm and K-AL ppm - Egner-Riehm-Domingo, other agrochemical indices of soil (SB me, Ah me, V% IN, carbonates% - volumetric and gas-volumetric methods) and a series of microelements, B - colorimetric method with carmine red, Zn and Cu – spectrophotometric method with atomic absorption active Mn - Scollenberger method.

RESULTS AND DISCUSSIONS

The determinations and analyzes done on soil samples were compared with the unfertilized control, but also with values in optimal intervals (limit), cited in the specialized literature for soils with wine vocation.

The values determined at the end of vegetation for the pH determined in aqueous suspension, for most samples, had the same range of variation as the initial doses, between 7.5 and 8.0 and pointed out that they are specific to this complex chemical factors of the studied soil.

The content of mobile phosphorus and potassium (P-AL and AL-K, ppm)

Comparing the values of evolution of mobile phosphates in the soil to the control sample, we noticed that the administration of both types of complex fertilizers there was registered an improvement in their level. In the version 200kg/ha a.s. the P-AL content reaches 57 ppm for Cx 15-15-15 and 55 ppm, respectively for Cx 5-15-25 with a difference from the control sample of 34 and 32 ppm respectively. The recorded values certify an average provision of soil with accessible phosphorus, not reaching the optimum though (tab. 1).

The values of the content in accessible potassium, progressively increasing with the doses of fertilizers administered, for both types of fertilizers. The Cx 5-15-25 version, dose of 200 kg/ha a.s. exceeds the control sample by 70 ppm K-AL, situating the value above the necessary optimum (tab. 1).

Table 1
Content of accessible phosphorus and potassium (P-AL, K-AL – ppm)

Variant of fertilization (kg/ha s.a.)	Fertilizer			
	Cx 15-15-15		Cx 5-15-25	
	P-AL,ppm	K-AL,ppm	P-AL,ppm	K-AL,ppm
Control	23	350	23	350
100	31	370	30	380
150	42	385	40	400
200	57	390	55	420

The fertilization with complex fertilizers in the two moments of vegetation, burst of buds and intensive growth of offshoots, has influenced a number of agrochemical indices of the soil (tab. 2). These indices do not suffer significant increases from the control sample. The degree of saturation in bases V% is to be highlighted, which exceeds the optimum required in all variants (70%) but also the carbon content which gradually declines when administering of complex fertilizers for both types, which is beneficial for the mineral nutrition of vines.

Table 2

Values of content in humus H-%, IN, SB-me, degree of saturation in bases V-%, carbonates, CO₃ -%

Variant of fertilization (kg/ha s.a)	Fertilizer									
	Cx 15-15-15					Cx 5-15-25				
	H %	IN	SB, me	V,%	CO ₃ %	H %	IN	SB, me	V,%	CO ₃ %
Control	2.25	2.08	20.4	92.6	6.80	2.25	2.08	20.4	92.6	6.80
100	2.30	2.16	21.3	94.0	6.50	2.28	2.13	20.9	93.5	6.40
150	2.27	2.14	22.6	94.6	6.55	2.35	2.22	21.6	94.8	6.45
200	2.31	2.19	23.7	94.9	6.30	2.39	2.27	23.6	95.1	5.38

It stands out the tendency of improvement of soil in nitrogen through the IN nitrogen index but also of SB, in inverse correlation with carbon contents for both types of complex fertilizers and for all doses used.

Variation of micro-elements in soil

For vine nutrition, an important role is held by the micro-elements, which are consumed in extremely small quantities. Being insufficient or in excess in the soil, they can be translocated at these levels in the plant, which may cause malfunctions of general metabolism. The boron reaches optimal values of 52 ppm for 200 kg/ha a.s. Cx 15-15-15 and exceeds the optimum, 62 ppm respectively, for the same Cx 5-15-25 dose, which can be explained by the different ratio of NPK fertilizers and the way in which it unlocks the boron from the soil (tab. 3). It is important to notice the decreasing values of zinc in relation to the dose, for both types of fertilizers, in correlation with the increase in phosphorus content. However, the zinc exceeds the optimum level in all variants of fertilization. Copper and manganese decrease in comparison to the doses used but exceed the optimum, so that they remain at a level of alert.

Table 3

Content in microelements – ppm

Variant of fertilization (kg/ha s.a)	Cx 15-15-15				Cx 5-15-25			
	B, ppm	Zn, ppm	Cu, ppm	Mn, ppm	B, ppm	Zn, ppm	Cu, ppm	Mn, ppm
Control	0.35	4.6	29	108	0.35	4.6	29	108
100	0.40	4.1	25	95	0.44	4.0	25	90
150	0.45	3.9	27	90	0.57	3.5	22	84
200	0.52	3.3	25	84	0.60	2.8	20	81

Compared to the optimal levels cited in the specialized literature, the values and the nutrient content of agrochemical indices of the soil were improved (tab. 4). We highlight the contribution of accessible phosphorus and potassium brought through the additional fertilization using complex fertilizers (fig. 1, fig. 2). The content of accessible phosphate stands at values of 57 ppm (average assurance)

for Cx 15-15-15 dose of 200 kg/ha a.s. and the affordable potassium exceeds the optimum, respectively 420 ppm for Cx 5-15-25 in doses of 200 kg/ha a.s.

Table 4

Comparative values of nutrients and some agrochemical indices from the soil with optimal levels (limit) for vine culture

Indicator	Optimum content	Dose values							
		Cx 15-15-15				Cx 5-15-25			
		Control	100 Kg/ha	150 kg/ha	200 Kg/ha	Control	100 Kg/ha	150 kg/ha	200 Kg/ha
P-AL,ppm	70	23	31	42	57	23	30	40	55
K-AL,ppm	400	350	370	385	390	350	380	400	420
H, %	3	2.25	2.30	2.27	2.31	2.25	2.28	2.35	2.39
V, %	70	92.6	94.0	94.6	94.9	92.6	93.5	94.8	95.1
IN	4	2.08	2.16	2.14	2.19	2.08	2.13	2.22	2.27
SB, me	25	20.4	21.3	22.6	23.7	20.4	20.9	21.6	23.6
Carbonate, %	8	6.80	6.50	6.55	6.30	6.80	6.50	6.55	6.30
B, ppm	1	0.35	0.40	0.45	0.52	0.35	0.44	0.57	0.60
Zn,ppm	1.2	4.6	4.1	3.9	3.3	4.6	4.0	3.5	2.8
Cu, ppm	3	29	25	27	25	29	25	22	20
Mn, ppm	40	108	95	90	84	108	90	84	81

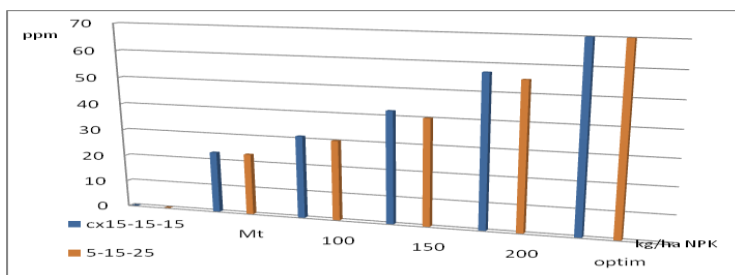


Fig. 1 Evolution of P-AL (ppm) under the influence of phasal fertilization

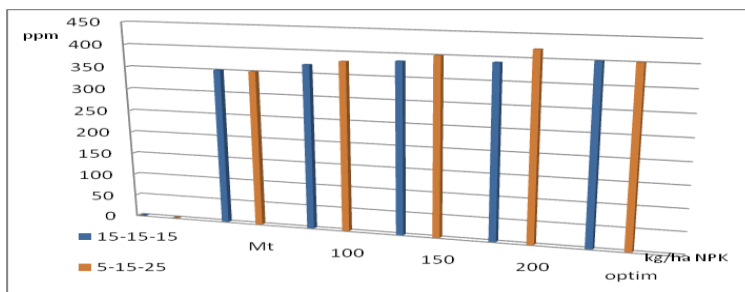


Fig. 2 Evolution of K-AL (ppm) under the influence of phasal fertilization

CONCLUSIONS

1. The fertilization of vines from Husi Vineyard with complex fertilizers in two phenol-phases of vegetation, considered decisive for the overall metabolism of plants, on a background of a basic fertilization led to the improvement of soil fertility.

2. Both types of fertilizer, Cx 15-15-15 and Cx 5-15-25, led to ensuring an adequate potassium and phosphate fund for the vine nutrition, version 200 kg/ha a.s., thus accumulating quantities comparable to the normal amount.

3. The content of nitrogen from the soil, expressed through IN, suffered slight variations, compared to the administered dose of fertilizer and with the NPK ratio of complexing the fertilizer, but even at maximum doses, it does not reach the optimum.

4. Among the micronutrients, it stands out the trend of decrease in zinc content, as they grow the administered doses of fertilizers as a result of phosphate fund mobilization but also the regulation of the content of copper, this descending significantly when increasing the doses of fertilizers.

5. The need for additional fertilization of vines with complex fertilizers, in NPK balanced doses and reports, in critical phases of vegetation is confirmed by the level of macro and micronutrients in accessible forms which tend to stabilize around optimal values of mineral nutrition.

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