DETERMINATION AND INTERPRETATION OF INDICATORS OF SOIL FERTILITY IN GALATI COUNTY VINEYARDS

DETERMINAREA ŞI INTERPRETAREA UNOR INDICATORI DE FERTILITATE A SOLURILOR ÎN PLANTAŢIILE VITICOLE DIN JUDEŢUL GALAŢI

***CONTOMAN Maria*[1], *MURARIU Mariea*[2]**
e-mail: mcontoman@ugal.ro

Abstract. *Fertility is a soil ability to provide conditions for plant growth and development through the accumulation of vegetation factors (light, water, air, heat, nutrients and biological activity) and ensuring that these factors are used in plentiful quantities. Fertility is the result of all soil properties (physical, mechanical, physical, mechanical, hydro, chemical, biological and environmental) factors interact with all the vegetation and the crop is being studied by other disciplines (Pedology, Agrochemistry etc.). It is important the unitary approach from the agrotechnical point of view, systemic soil fertility to its conservative modeling, with emphasis on the requirements of crop plants. Soil fertility can be characterized by a series of indicators for systematic, can be divided into four groups: agrophysical, hydro, agrochemical, agrobiological. The study was conducted in plantations in the center of the vineyard Smulţi, ujorului Hills.*

Key words: fertility, indicators, soil properties**.**

Rezumat. *Fertilitatea este însuşirea solului de a asigura condiţii pentru creşterea şi dezvoltarea plantelor prin acumularea factorilor de vegetaţie (lumină, apă, aer, căldură, elemente nutritive şi activitate biologică) şi asigurarea condiţiilor pentru ca aceşti factori să fie folosiţi în cantităţi îndestulătoare. Fertilitatea fiind rezultanta tuturor proprietăţilor solului (fizice, mecanice, fizico-mecanice, hidrofizice, chimice, biologice şi ecologice), în interacţiune cu toţi factorii de vegetaţie şi plantele cultivate este studiată şi de alte discipline (pedologie, agrochimie etc.). Din punct de vedere agrotehnic este importantă abordarea unitară, sistemică a fertilităţii solului în vederea modelării conservative a acesteia, cu accent pus pe cerinţele plantelor de cultură. Fertilitatea solului poate fi caracterizată printr-o serie de indicatori care, pentru sistematizare, se pot încadra în patru grupe: agrofizici, hidrofizici, agrochimici, agrobiologici. Studiul s-a efectuat în plantaţii din centrul viticol Smulţi din podgoria Dealurile Bujorului.*

Cuvinte cheie: fertilitate, indicatori, proprietăţile solului.

INTRODUCTION

Pedological factors, together with the climatic influence the processes of growth and fructification, the quantity and quality of vine production, plantation longevity, resistance to diseases and stress factors etc. Knowing the characteristics of the soil in details has a special importance for proper placement of varieties,

[1] ”The Lower Danube” University of Galati, Romania
[2] Pedological and Agrochemical Studies Centre, Galati, Romania

using the most suitable rootstocks for the rational application of fertilizer and agro-technical measures (L. Dejeu, 2004).

The vineyard soil fertility is the main feature, which expresses its ability to meet the needs of the vine with water and nutrients (I.C Alexandrescu, P. Pițuc, M. Oşlobeanu, L. Jianu, 1994). The assessment of fertility of soil for the cultivation of vines is made starting from the specific characteristics of local soil and climate. These features are ecologically specific elements, by determining the productive potential of soil, are also elements of fertility (C. Chirita, 1974).

MATERIAL AND METHOD

Studies were conducted in two vineyards located in the center of the vineyard hills Smulți Bujorului Galați County. The soil samples were collected in three repetitions, the depth: 0-100 cm in each parcel.

Sampling, preparation and carrying out analysis was according to the ICPA methodology.

RESULTS AND DISCUSSIONS

Characterization of the vineyard climate center Smulți

Corni vineyard is located in the geomorphologic center unit of Covurlui Plateau, located in the center of Galati county.

In the classification given in the geographical monograph of Romania (1967) in south-eastern section Covurlui plateau climate is included in the continental climate of the steppe lands to the interpenetration of climate forest district, subdistrict Moldavian Plateau (11 BSp2), entering the vineyard classification 11 B Ps (x) continental steppe climate.

Climate is determined by geographical location, topography and microrelief region of the atmosphere general circulation is dominated advecții summer temperate oceanic air from the direction of V and NW. On land, hot, dry summers and cold winters, marked by strong blizzards, and the frequent interruptions caused by warm, humid air showers determining intervals of heating and melting snow.

Bioactive duration exceeds 160 days and weather conditions are favorable for growing vines.

Thermal resources particularly influence quality grape production, active or useful heat balance determines the degree of favorability or unadvantageous of years of harvest.

Table 1

Characterization of viticultural climate center Smulți

Annual Period		The vegetation Period			Oenoclimatic index capacity
Average temperature	Rainfall amount	Amount global temperatures	Sunstroke	Rainfall amount	
^{0}C	mm	^{0}C	ore	mm	4765
10,1	531	3304	1511	300	

Vegetation. The territory studied area belongs to the steppe vegetation. The area is mostly covered by agricultural land, meadows and vineyards also and forests.

Soil. Genesis and characteristics of the soils under study are a consequence of the interaction of natural conditions.

Soils that meet the specific vineyard center steppe territory, predominantly various types of chernozem (typically cambic, argic).

Determination and interpretation of soil fertility indicators agro-physical

Predominant soil type is cambic chernozem zone belonging to the cernisoils class whose general morphology is presented through a series of layers formed on loess clays Am-AB-Bv-B/Cca noted that by its stratigraphic characteristics and have printed some porous rock soil characteristics was formed, the perfection of these qualities with a fundamental climatic conditions.

Soil texture. Due to the high ecological plasticity of vine varieties can be grown on all types of textures, from sand to clay soils. The best conditions for growth, development and production to meet intermediate textured soils (sandy loam, silty, sandy-clay).

Medium texture soil of the area offers favorable conditions for grapes growing and for both for the wine quality and consumer of the current and table grapes.

Table 2

Characterization of soil texture

Depth cm	Granulometric fractions (% by mass of mineral soil)				
	Roughly sand	Fine sanf	Dust	Clay	Natural clay
Amk(0-30)	22,6	21,1	28,7	22,2	31,00
ABk(31-50)	20,8	28,1	30,9	23,9	29,95
Bvk(51-68)	19,0	29,7	39,6	22,3	25,55
B/Ck(69-119)	17,8	44,3	28,8	32,2	24,00
Cca>119	30,5	37,6	19,8	21,1	19,85

Soil texture can be considered sandy-clay for the fact that in the top layer of soil and even in the deepest is a relatively high content of fine sand and coarse sand, which together formes 43.7% of soil mass (table 2). Relatively high content of sand size particles makes soil highly permeable and provide a favorable ventilation oxidoreduction conduct processes and root system activity and bacterial flora.

Soil structure. Fertility of land is closely linked to its structural condition. Soil structure engraves a number of features such as porosity and elasticity, thereby affecting fertility. Well structured soils store more water, air, heat and nutrients to make available to the vines.

Vine plantations studied are located on land from hilly areas, terraces, and therefore are less structured soils.

Soil porosity. Large pore diverse largely conditions the water regime, air temperature, nutrients, Roots penetration into the soil depends largely on the porosity and degree of soil compaction.

Its optimal values for vines are between 46 and 52%, the largest or the smallest have a negative influence on growth of roots and shoots. For normal growth of roots the soil aeration porosity must have a minimum of 10%. At low levels of aeration porosity decreases both production and quality.

Values from soil porosity in the study provides favorable conditions for the development of root system vines (table 3).

Apparent density values preferred by most plants varies between 1.0 to 1.4 g/cm3 culture. It is considered that the soil is too loose when the apparent density below 1.0 g/cm3 and is too harden when it is over 1.4 g/cm3. Values determined in the planting taken in the present study shows that soil has a moderate hardening phenomenon.

Determination and interpretation of hydro indicators of soil fertility.

The hydro indicators of soil fertility used in agricultural practice are: hydro indications and soil water relations, water movement in soil, water permeability (infiltration, filtration), the ability to retain water (useful water reserve), capillary rise of water (intake to phreatic soils) etc. (A . Lăcătuş, 1990).

Table 3

Constants of soil hydro

Apparent density g/cm3	Field water capacity Cc %	Wilting coefficient Co%	*I.U.A. %	*Minimum threshold min P. %	Porosity%	
					Total	The aeration
1,35	22,79	8,45	14,34	15,62	51,88	22,88

*I.U.A. = active humidity range = Cc – Co
*Minimum threshold Pm = Co - 1 / 2 (Cc - Co)

Hydro soil constants (table 3) shows that it has a total porosity and high degree of aeration and a low value wilting coefficient, explained by clay and sandy soil texture.

Hydro soil constants presented in table 3 shows that soil have physical properties favorable for growing vines.

Determination and interpretation of agrochemical soil fertility indicators

Determined agrochemical indicators are: soil reaction, nutrient content, ability to hold and exchange of ions in soil solution etc.

Soil reaction is one of the most important properties of soil as an environment for plant growth. Vine has a great ecopedological plasticity, it can be cultivated within a pH range of 5.5 to 8.5 (L.Dejeu, 1984, quoted of Oşlobeanu et al., 1991).

Due to the presence of carbonates from the soil surface as it is normally present a slightly alkaline reaction from top to bottom, about 70 cm deep reaching pH 8 (table 4).

Table 4

Characterization of soil agrochemical

Depth [cm]	pH in H_2O	$CaCO_3$%	Humus %	Nt %	P_{AL} ppm	K_{AL} ppm
0-20	7,40	2,42	2,250	0,100	60,96	287,6
20-40	7,53	2,71	1,726	0,080	17,71	247,6
40-60	7,87	3,64	1,171	0,070	14,96	230,3
60-80	8,06	22,54	0,672	0,023	12,11	193,3
80-100	8,14	28,64	0,572	0,013	6,37	182,0

Mobile nutrient content (accessible or assimilable) is an essential plant growth factor (D. Davidescu Velica Davidescu, 1992).

Research in this area shows that vines growth and fructification normaly, soil must contain the following quantities of macroelements (NPK) per 100 g soil: 0.1 to 0.2 g total N, P_2O_5 10-20 mg, 25 -40 mg K2O.

Specific nutrient consumption per unit of product is an indicator that summarizes the interaction factors and the economic ecosystem and has show a high practical utility.

The data presented in table 4 shows that total nitrogen from soil humus corresponds to the percentage found in each of those horizons. He manages to link the structural units as sandy-clay particles, this effect being due to the presence of calcium carbonate in the presence of which involved humus particles constituting a single bond linking the structural units.

Supply conditions from medium to good has relatively moderate potassium phosphate in easily accessible forms for plant and quantity of humus from the soil are barely satisfactory plantations under study correspond to the development from multiple views vines and has production of crops relative high and has superior quality. Retention capacity and ion exchange in the soil solution is the main property of soil colloids.

Particular emphasis has cationic adsorption or retention of physical - chemical (non-specific sorption or cation exchange), which is the ability of cations from diffuse layer from soil colloids can be changed in terms of equivalence to the cations from soil solution.

Tabel 5

Main agrochemicals indices

T-ml/100 g sol	V%	IPC	IN
16,6	100	1,77	3,0

Because of the sandy clay texture soil has a low cation exchange capacity, base saturation degree almost entirely due to the presence of carbonates from the surface and has a power index decreased chlorosis (1.77) explained by the fact that in the layer surface and deeper until the C horizon of the carbonate content is

low, which does not influence the development of vines roots and does not give has chlorosis characteristics to soil (table 5).

Determination and interpretation of agrobiological indicators of soil fertility

Among the agrobiological indicators determined only humus that can be considered a basic criterion in assessing the degree of fertility of different soil types, their production capacity, in the end of their productive potential. Most authors argue that soil the must be used for viticulture in the horizon 0-20 cm humus content of 2-3% (F. Hasselbach, 1976, G. Götz, 1979 F. Champagnol, 1980 Oşlobeanu quoted in 1991).

Dejeu L. (2004) shows that restrictive vines in soils with a humus content below 1.2% and those with less than 3%.

The data in table 4 shows that the soil has a moderate to satisfactory content of humus in the surface horizon, 20 cm thick, it obviously decreasing profile, being found even at the depth horizon C, which is explained by the fact that the acids Humic leachate, under the influence of relatively poor rainfall have precipitated their path leaching under the influence of calcium carbonate that are present from the surface layer, they can easily be put out on the horizon C. Therefore soil fertility taken in the study area is favorable for growing vines.

CONCLUSIONS

1. Knowledge of soil fertility indicators helps us to achieve a consistent approach to the correlation between soil fertility, agro-technical requirements of plants and measures to be applied to achieve higher quality grape production.

2. Calculated soil fertility indicators for vineyard soils from the center shows that they have a moderate to low fertility, which involves taking steps to improve it.

REFERENCES

1. **Alexandrescu I. C., P. Pițuc, M. Oşlobeanu, L. Jianu, 1994** – *Mică enciclopedie de viticultură*. Editura „Glasul Bucovinei" Iaşi.
2. **Davidescu D., Velicica Davidescu, 1992** - *Agrochimie horticolă*. Academy Press, Bucureşti.
3. **Dejeu L., 2004 -** *Vineyard practice.* Editura Ceres, Bucureşti.
4. **Lăcătuş A., 1990** – *Fizica solurilor*. Editura Ceres, Bucureşti.
5. **Oşlobeanu M., Macici, Magdalena Georgescu, V. Stoian, 1991 -** *Zonarea soiurilor de viță de vie în România.* Editura Ceres, Bucureşti.