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The Influence of Soil Upkeep upon the Properties of Cambic Chernozem on the "Bujoru Hills" Vineyard (Covurlui Plateau)

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Abstract. Recent specialty literature has pointed out both the advantages and the disadvantages of soil upkeep systems in vine plantations practiced in the world with a view to the ecological conditions in vineyards: black field, herbicide treatment, sod establishment with annual and perennial cultures and mixed systems in a given spatio-temporal succession (Agulhon, 1999). Physical, chemical and biological properties of cambic chernozem were influenced by different types of ground maintenance. Analytical data resulting from researches show us that they are different regarding the influence of soil tillage upon its characteristics. Values of soil attributes that characterize the depth profile registers a decrease in the depth profile, with noticeable differences between the annual work as black field and other types of soil maintenance. Soil biological activity depends on the climatic conditions and its technological management. This research aims at the dynamics of soil microorganisms which ensure the nitrogen circuit. The results of this research may stand as background for certain conclusions of practical importance.

Keywords: cambic chernozem, physical properties, soil maintenance

INTRODUCTION

Edaphic factors, along with the climatic ones, influence processes of growth and fructification of the vine, the quantity and quality of production, plantation longevity, resistance to disease and bad weather.

As a result of ground preparation before planting (cleaning, terracing, leveling) and since a plantation land occupies it for about 30 years, soils are heavily modified in terms of horizon reversals and of aero-hydric, heat and nutrient regimes as well (Bernaz and Dejeu, 1999, Davidescu and Davidescu, 1999).

Vine itself may, to some extent, modify the organic matter content and other soil properties.

Poor soil structure, its compaction, lack of ventilation in excess humidity can lead to anaerobic conditions and adversely affect the metabolism of grapes, while iron remains inactive, resulting in the appearance of chlorosis.

Cultivating the intervals between the rows of vines with green manure or perennial herbs improves soil structure and promotes the multiplication of organisms, facilitates the easy movement of machines, allowing for application to plant health and transport crop treatments in due time, especially during the rainy periods of the year.

The presence of vegetation and lack of regular upkeep work positively influences soil biological activity. In sprayed soils as compared to the grassy and upkept soils, there was a decrease of microorganisms useful activity.

Researches show the effect of the maintenance of soil physical, chemical and biological properties on cambic chernozem at the Bujoru Viticulture Research Station

experimental field, based on tests conducted on soil samples taken from the experiences of long-term soil tillage.

Studies on the influence of different cultural practices on some physical and chemical properties were done, unlike those on the biological changes.

MATERIAL AND METHODS

The influence of maintenance on the characteristics of cambic chernozem was studied four variants of a long-standing experience at the Bujoru Viticulture Research Station, Galati County.

Experimental variants:

V_1-black field (spring and autumn plowing+2-3 superficial tillages);
V_2-green manure (oats +peas, sowing alternate, early spring);
V_3-lasting of green (*Bromus inermis,* alternate sowing);
V_4-application of a herbicide.

In the study, A_1 variant (black field) was taken as reference and is considered standard maintenance work.

To investigate the physical, chemical and biological properties, soil samples were collected from five depths, corresponding to pedogenetic horizons, as well as sub-plowed and plowed layer.

The soil studied is Cambic Chernozem (SRTS -2003) of Covurlui Plateau and has the following characteristics (Tab. 1).

Tab. 1

Physico-chemical properties of cambic chernozem

Horizon/depth-cm	Clay %	Dust %	Sand %	Humus%	pH $_{H2O}$	V%
Am	31.00	28,7	43.70	1.92	7.33	100
A/Bv	29.95	30,9	48.90	1.59	7.48	100
Bv	22.55	39,6	55.7	1.26	7.50	100
B/C	24.00	28,8	62.00	0.96	7.57	100
C	19.85	19,8	68.10	-	7.63	100

RESULTS AND DISCUSSION

Soil test results are presented in Tab. 2-4.

Regarding the differentiation effect on the soil characteristics of its work, a number of important aspects may be highlighted.

Amid the general characteristics of land shown above, the main physical and agrochemical properties have registered a number of specific variations.

Physical properties. Apparent density (AD) recorded lower values for field work that black soil, compared to the other options, but between them the differences are small and less significant (Avenard *et al.*, 2003, Alexandrescu *et al.*, 1994)

In all versions there is an increase of the apparent density values from surface to depth, a compacting of the soil under soil tillage depth being visible, depending on the version (Ailiesei, 1980, Stefanic *et al.*, 1998).

In the case of works alternation for variants 2 and 3, the values obtained are intermediary (Tab. 2.a).

Tab.2

Physical test results performed on soil samples from experimental variants

a. Apparent density

Depth-cm/variant	V_1	V_2	V_3	V_4
0-10	1.26	1.24	1.31	1.24
10-20	1.29	1.25	1.40	1.26
20-30	1.29	1.27	1.39	1.27
30-40	1.31	1.29	1.40	1.30

b. Total porosity

Depth -cm/variant	V_1	V_2	V_3	V_4
0-10	46.83	46.73	47.11	47.34
10-20	45.59	45.55	46.56	46.89
20-30	44.83	44.73	45.50	45.75
30-40	43.54	43.63	44.64	44.74

c. The degree of compaction %

Depth-cm/variant	V_1	V_2	V_3	V_4
0-10	2.68	3.05	0.85	0.84
10-20	3.08	3.85	1.25	1.16
20-30	4.02	3.75	1.72	1.02
30-40	5.25	3.44	1.98	1.68

Total porosity (TP) has registered correlated values with the ones of apparent density, so it was higher in variant 1 (black field). Total porosity values ranged depending on maintenance work (Tab. 2.b).

The degree of soil compacting (GC) reflects the values of apparent density (DA) and total porosity (TP), resulting in a differentiation between variants and the depth of soil analyzed (Tab. 2.c).

Chemical properties. Soil reaction(pH) is adjusted according to the method of work. In this sense, the pH values are higher in the variants with biological and chemical maintenance. No change is observed in the different layers of soil reaction (Tab. 3.a).

Humus content. Annual and perennial crops cover the soil through their incorporation into soil or left as mulch on the surface have contributed to the improvement of organic matter and nutrients(Tab. 3.b). Humus content has decreased from surface to depth. Among soil maintenance options, V_2 (green manure) and V_1 (black field) stand out. Analyses have shown lower values for V_4 (herbicides) andV_3 (lasting of green).

Total nitrogen content decreases from surface to depth, without significant differences between maintenance versions and it is shown in Tab. 3.c.

Mobile phosphorus content recorded similar values between variants, with the lower values in the 40-60 cm depth (Tab. 3.d).

Mobile potassium content showed higher values for variants 2 and 4, that is to say for lasting of green and when using herbicides. Lower values are found in variants worked annually as blackfield, compared to other methods of maintenance (Tab. 3.e).

Tab.3

Chemical test results performed on soil samples from experimental variants

a. Soil reaction (pH)

Depth-cm/variant	V_1	V_2	V_3	V_4
0-10	7.6	8.5	8.5	8.5
10-20	7.7	8.6	8.5	8.5
20-30	7.7	8.6	8.6	8.6
30-40	7.9	8.6	8.6	8.6

b. Humus content (%)

Depth-cm/variant	V_1	V_2	V_3	V_4
0-10	2.24	2.43	1.79	1.59
10-20	2.01	2.23	1.59	1.43
20-30	1.92	1.98	1.36	1.28
30-40	1.82	1.62	1.26	1.25

c. Total nitrogen content **(**ppm)

Depth-cm/varianta	V_1	V2	V_3	V_4
0-10	60.0	71.0	36.0	66.0
10-20	54.0	40.0	29.0	31.0
20-30	49.0	31.0	28.0	25.0
30-40	39.5	19.0	19.0	21.0

d. The content of mobile phosphorus (ppm)

Depth-cm/variant	V_1	V_2	V_3	V_4
0-10	108.5	110.5	108.5	112.5
10-20	96.5	106.0	93.5	115.5
20-30	79.0	88.5	85.5	91.0
30-40	74.5	66.5	76.5	84.5

e. The content of mobile potassium (ppm)

Depth-cm/variant	V_1	V2	V_3	V_4
0-10	354.5	273.0	264.0	356.5
10-20	270.0	240.0	240.0	291.5
20-30	234.5	228.0	236.0	258.5
30-40	221.0	197.5	217.5	233.0

Biological properties**.** The maintenance practices have influenced soil biological activity.

The researches carried out by many specialists came to discover the link between organic matter in various stages of decomposition in soil and its population, as well as the concentration of bacteria in the vicinity of plants (Kiss *et al.*, 1991).

Measurements of soil microbiology have focused on the activity of microorganisms that provides nitrogen circuit in the soil (Tab. 4).

Tab. 4

Biological properties of soil due to soil maintenance

Microorganisms (1 g soil)/ variant	V_1	V_2	V_3	V_4
Total microflora	25.10^5	25.10^6	$9.5.10^6$	45.10^4
Aerobic-nitrogen-fixing bacteria	250	950	250	250
Anaerobic-nitrogen-fixing bacteria	400	950	900	0
Ammonification bacteria	45.10^4	15.10^9	25.10^7	75.10^5
Nitrous bacteria	95	2500	450	45
Nitric bacteria	1500	4500	450	45
Denitrification bacteria	25	180	25	45

Microorganisms were positively affected by mechanical (V_1) and biological soil maintenance (V_2, V_3) and suffered a clear decrease in herbicide use.

Therefore, values of soil attributes that characterize the depth profile registered a decrease in the depth profile, with noticeable differences between the annual work as black field and other types of soil maintenance. Black field and green manure alternation has a favorable effect on soil characteristics.

CONCLUSIONS

The trend of degradation of soil characteristics on depth profile, with visible differences for blackfield maintenance.

Green fertilizers upkeep improves the physical, chemical and biological soil properties and they reduce the compaction phenomenon by reducing the number of soil processing activities.

Biological maintenance causes a tendency to improve the physical, agrochemical and biological properties as compared with the witness V_1 (black field).

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