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PARTICULARITIES OF THE COMPLEX OF FOREST SOILS OF SUNGURLARE VALLEY DEFINING THE UNIQUE SPECIFICITY OF THE AREA FOR GROWTH OF WINE GRAPE VARIETIES

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Abstract
Within the complex of forest soils in Sungurlare area can separate soil differences, formed as a result of specific for the region soil formation process, in which are formed the red soils with different profile differentiation. Some of them are formed by dry conditions and taxonomic concern to Cambisols, others formed by wet conditions in areas without drainage concern to Luvisols. The suitability of this soil differences for vineyards is limited. This is due to various factors, arising from the particularities of the soil profile or landscape and the degree of drained. Chromic Luvisols in the studied area were with very low organic matter content. Relatively with higher humus content were eroded Chromic Luvisols. This is explained by the process of the remove of part of the humus to illuvial-metamorphic horizon. In non eroded and slightly eroded soil profiles, pH was average in range from 4,8 to 5,6 and gradually increase in the deeper profile horizons. With the increase of erosion degree of of the terrains, pH was neutral to slightly alkaline. With the available data could estimate, that the acidity was not a limiting factor of the suitability of Chromi-eutric Cambisols for the growth of vineyards in Sungurlare area.
Key words: *forest soils, wine grape varieties, vineyards*

Introduction

Sungurlare Valley occupies terrains with an altitude of 180 to 222m. The investigated terrains in this study, covers parts of different types relief, located in areas with an altitude of 186 to 325m. The most perspective in terms of opportunities for the creation of vineyards are terrains with an altitude of 230 to 270m. Favorable areas for the growth of viticulture with an altitude above 270m was found only in the valley of Prilep village. The variety of soil conditions in Bulgaria is large and in terms of opportunities for wine viticulture in recent years was formed specific areas for production of quality wines, which according to the methodology for determination of areas for their production (Mihalev Trendafilov, 2005) should cover certain requirements regarding to the location of vineyards. In this sense, the location determines the specificity, and the specificity is due to the advantages and disadvantages of the region, including its soils. In this terms of ameliorative influences on the soil conditions could be accepted insofar as no change the specific and proven for some wine region advantages of the landscape. The acidity in the soil usually occurs simultaneously with more or less pronounced deficiency of calcium or magnesium, or both elements in exchangeable form in the soil. Calcium is the main antagonist on the exchangeable forms of aluminium, hydrogen and most of the metal ions in the composition of the soil sorption complex. In strongly

acidic and weakly buffered soils, Ca may be in deficit as nutrient element in the plants. So strong calcium deficiency is very rare, but should be considered when interpreting the data for Ca content in the soil. This is determined by the important physiology-biochemical functions of Ca, mainly related with the process of photosynthesis, by regulating the state and the electoral permeability of the plasma membranes with neutralizing and buffering reactions of the cytoplasm (Kadrev and Peev, 1980). For probable deficit of Ca, as the nutrient element was reported in soils, contain exchangeable Ca in concentration less than 2 meq/100g (Palaveev and Totev, 1970).

Materials and methods

The aim of this study was to establish a change in the content of total carbonates by Scheibler method (Arinushkina, 1970), active Ca precipitable with $(NH_4)_2C_2O_4$ by Druinnot-Gallet (NO1085/NFX31-106), organic matter by Turin method (Trendafilov Popova, 2007), soil reaction (Arinushkina, 1970), and soil texture with fotosedimentograf (Trendafilov and Popova, 2007) resulting from the erosion and degradation processes restricting the soil functionality. Compared are the results of studies on the composition and properties of forest soils with preserved soil depth and partly accumulated with such, whose profile is impaired in different degrees as a result of massive erosion transfer. It was found the influence, which soil-erosion processes affected on the suitability of the relevant soil types for growth of vines. In cases, when the processes of gully erosion were already developed, the project for creation of vineyards must include reinforcement of the terrain. In the presence of harmful acidity conducted chemical amelioration to neutralize the acidity. Normal growth of intensive cultivation of vineyards on the shallow or very highly eroded forest soils demands a normal nutrition regime with macro and microelements.

Results and discussion

Chromic luvisols

Organic matter of Chromic luvisols

Chromic luvisols in the studied area was very poor of organic matter content. Relatively with higher humus content was the eroded in different degrees Chromic luvisols (Table 1). This is explained by the tranfer process of part of the humus to illuvial-metamorphic horizons. Furthermore, possibly part of not eroded Chromic luvisols are actually old accumulated Chromic luvisols, with a secondary developed process of acreage erosion. Accumulated horizons of Chromic luvisols in the area are with much lower humus content, compared to the profiles with not accumulated weathering material. High humus content was found only as an exception within the complex of Chromic luvisols.

Table 1. Average content of organic matter in Chromic luvisols of the studied terrains in Sungurlare area

Degree of erosion	Organic matter content	Total
Not eroded	*Average Humus % 0-25 cm*	1.14
	Average Humus % 25-50 cm	0.87
	Average Humus % 50-75 cm	0.63
Slightly eroded	*Average Humus % 0-25 cm*	1.36
	Average Humus % 25-50 cm	1.12
	Average Humus % 50-75 cm	0.70
Average eroded	*Average Humus % 0-25 cm*	1.30
	Average Humus % 25-50 cm	1.08
	Average Humus % 50-75 cm	0.85
Highly eroded	*Average Humus % 0-25 cm*	1.46
	Average Humus % 25-50 cm	1.01
	Average Humus % 50-75 cm	0.62
Accumulated	*Average Humus % 0-25 cm*	1.18
	Average Humus % 25-50 cm	1.00
	Average Humus % 50-75 cm	0.59
Total Average Hummus % 0-25 cm		1.30
Total Average Hummus % 25-50 *cm*		1.05
Total Average Hummus % 50-75 *cm*		0.71

Soil reaction (pH) of Chromic luvisols

The reaction of Chromic luvisols was slightly acidic. In some profiles, however pH was about 3.00. Especially likely the probability to establish highly acidic and harmful to the vine acidity in the terrains of low to average eroded Chromic luvisols (Table 2).

Content of total carbonates and active calcium of Chromic luvisols

Almost all Chromic luvisols were non-carbonate and active calcium contain was low within the whole profile (Table 3). In some individual terrains, where spread heavily eroded Chromic luvisols, the content of carbonates and active calcium can reach high values, but they are not typical for this soil difference. It can be assumed, that the content of total carbonates and active calcium is not a factor, which limits the suitability of Chromic luvisols for the growth of vineyards in Sungurlare area.

Table 2. Average and minimum pH values for eroded in different degree Chromic luvisols in Sungurlare Area

Degree of erosion	pH values	Total
Not eroded	*Average pH 0-25 cm*	5.99
	Minimum pH 0-25 cm	5.10
	Average pH 25-50 cm	6.28
	Minimum pH 25-50 cm	5.90
	Minimum pH 50-75 cm	6.35
	Average pH 50-75 cm	6.57
Slightly eroded	*Average pH 0-25 cm*	5.23
	Minimum pH 0-25 cm	3.00
	Average pH 25-50 cm	5.67
	Minimum pH 25-50 cm	3.80
	Minimum pH 50-75 cm	4.10
	Average pH 50-75 cm	5.78
Average eroded	*Average pH 0-25 cm*	5.95
	Minimum pH 0-25 cm	4.20
	Average pH 25-50 cm	6.36
	Minimum pH 25-50 cm	5.10
	Minimum pH 50-75 cm	4.60
	Average pH 50-75 cm	6.41
Highly eroded	*Average pH 0-25 cm*	5.31
	Minimum pH 0-25 cm	4.50
	Average pH 25-50 cm	5.83
	Minimum pH 25-50 cm	5.10
	Minimum pH 50-75 cm	5.00
	Average pH 50-75 cm	6.21
Accumulated	*Average pH 0-25 cm*	5.71
	Minimum pH 0-25 cm	5.10
	Average pH 25-50 cm	5.93
	Minimum pH 25-50 cm	3.80
	Minimum pH 50-75 cm	5.40
	Average pH 50-75 cm	6.38
Total Average pH 0-25 cm		5.61
Total Minimum pH 0-25 cm		3.00
Total Average pH 25-50 cm		6.00
Total Minimum pH 25-50 cm		3.80
Total Minimum pH 50-75 cm		4.10
Total Average pH 50-75 cm		6.19

Table 3. Distribution of total carbonates and active calcium, depending on the degree of erosion of Chromic luvisols profiles

Degree of erosion	Contents of carbonates and active calcium	Total
Not eroded	*Average CaCO3 % 0-25 cm*	0.00
	Average CaCO3 % 25-50 cm	0.00
	Average CaCO3 % 50-75 cm	0.00
	Average Ca % 0-25 cm	0.26
	Average Ca % 25-50 cm	0.26
	Average Ca % 50-75 cm	0.99
Slightly eroded	*Average CaCO3 % 0-25 cm*	0.17
	Average CaCO3 % 25-50 cm	0.57
	Average CaCO3 % 50-75 cm	0.83
	Average Ca % 0-25 cm	0.35
	Average Ca % 25-50 cm	0.56
	Average Ca % 50-75 cm	0.62
Average eroded	*Average CaCO3 % 0-25 cm*	0.00
	Average CaCO3 % 25-50 cm	1.18
	Average CaCO3 % 50-75 cm	1.47
	Average Ca % 0-25 cm	0.29
	Average Ca % 25-50 cm	0.76
	Average Ca % 50-75 cm	0.48
Highly eroded	*Average CaCO3 % 0-25 cm*	0.00
	Average CaCO3 % 25-50 cm	0.00
	Average CaCO3 % 50-75 cm	0.00
	Average Ca % 0-25 cm	0.19
	Average Ca % 25-50 cm	0.25
	Average Ca % 50-75 cm	0.39
Accumulated	*Average CaCO3 % 0-25 cm*	0.00
	Average CaCO3 % 25-50 cm	0.00
	Average CaCO3 % 50-75 cm	0.00
	Average Ca % 0-25 cm	0.28
	Average Ca % 25-50 cm	0.31
	Average Ca % 50-75 cm	2.31
Total Average CaCO3 % 0-25 cm		0.05
Total Average CaCO3 % 25-50 cm		0.54
Total Average CaCO3 % 50-75 cm		0.71
Total Average Ca % 0-25 cm		0.30
Total Average Ca % 25-50 cm		0.51
Total Average Ca % 50-75 cm		0.90

Chromi-eutric cambisols

Table 4. Average content and distribution of organic matter in Chromi-eutric cambisols profile of Sungurlare area

Organic matter content	Total
Average Humus % 0-25 cm	1.59
Average Humus % 25-50 cm	1.23
Average Humus % 50-75 cm	0.98

Table 5. Minimum and average pH values for Chromi-eutric cambisols profiles of Sungurlare area

Degree of erosion	pH values	Total
Not eroded	*Minimum pH 0-25 cm*	5.39
	Minimum pH 25-50 cm	5.33
	Minimum pH 50-75 cm	6.4
	Average pH 0-25 cm	5.52
	Average pH 25-50 cm	5.75
	Average pH 50-75 cm	7.05
Slightly eroded	*Minimum pH 0-25 cm*	4.86
	Minimum pH 25-50 cm	5.33
	Minimum pH 50-75 cm	6.28
	Average pH 0-25 cm	5.58
	Average pH 25-50 cm	6.1
	Average pH 50-75 cm	6.78
Average eroded	*Minimum pH 0-25 cm*	5.82
	Minimum pH 25-50 cm	5.36
	Minimum pH 50- cm	6.7
	Average pH 0-25 cm	5.82
	Average pH 25-50 cm	5.36
	Average pH 50-75 cm	6.7
Highly eroded	*Minimum pH 0-25 cm*	6.8
	Minimum pH 25-50 cm	7.1
	Minimum pH 50-75 cm	6.2
	Average pH 0-25 cm	6.8
	Average pH 25-50 cm	7.1
	Average pH 50-75 cm	6.2

Continued Table 5		
Total Minimum pH 0-25 cm		4.86
Total Minimum pH 25-50 cm		5.33
Total Minimum pH 50-75 cm		6.2
Total Average pH 0-25 cm		5.61
Total Average pH 25-50 cm		5.97
Total Average pH 50-75 cm		6.87

Organic matter of Chromi-eutric cambisols

Chromi-eutric cambisols are poorly stocked with organic matter. The average content of organic matter within the humus-accumulative horizon was 1,59% and relatively smoothly decreased down the profile (Table 4). The humus stock, however, exceed the stock of organic matter for Chromic luvisols from the same area. The degree of erosion of the soil profile and terrain features (slope, altitude, etc.) have no influence on the content of organic matter.

Soil reaction (pH) of Chromi-eutric cambisols

Within the distribution of Chromi-eutric cambisols in Sungurlare area was found mainly slightly acidic reaction of the top and lower horizons. In not eroded and slightly eroded soil profiles, pH was average in range from 4,8 to 5,6 and gradually neutralize in the lower horizons of the profile. With the increase of erosion degree of of the terrains, pH was neutral to slightly alkaline (Table 5). With the available data could estimate, that the acidity was not a limiting factor of the suitability of Chromi-eutric Cambisols for the growth of vineyards in Sungurlare area.

Content of total carbonates and active calcium of Chromi-eutric cambisols

Chromi-eutric cambisols within Sungurlare area not contain carbonates. The content of active calcium was low - to 0,6 % in the top horizon and to 2 % in the deeper parts of the soil profile (Table 6). The active calcium, established in the terrains of distribution of Chromi-eutric cambisols in Sungurlare area was not a restriction on the suitability of the soil for growth of vines.

Table 6. Average active Ca content in Chromi-eutric cambisols profiles of Sungurlare area

Degree of erosion	Average calcium content	Total
Not eroded	*Average Ca % 0-25 cm*	0.58
	Average Ca % 25-50 cm	1.38
	Average Ca % 50-75 cm	2.13
Slightly eroded	*Average Ca % 0-25 cm*	0.61
	Average Ca % 25-50 cm	1.21
	Average Ca % 50-75 cm	1.80
Average eroded	*Average Ca % 0-25 cm*	0.61
	Average Ca % 25-50 cm	1.98
	Average Ca % 50-75 cm	2.73
Highly eroded	*Average Ca % 0-25 cm*	0.51
	Average Ca % 25-50 cm	0.41
	Average Ca % 50-75 cm	0.20
Total Average Ca % 0-25 cm		0.59
Total Average Ca % 25-50 cm		1.28
Total Average Ca % 50-75 cm		1.91

Conclusion

The suitability of the studied soil differences for vineyards was limited. This was due to various factors, arising from the particularities of the soil profile, the degree of drained, or the landscape features. Nevertheless, that belongs to different taxonomic units and differ significantly in terms of the formation, composition and properties, in the context of this study the studied soil types were united as soils requiring ameliorative action, before their suitability for the needs of viticulture in Sungurlare area.

In the complex of Chromic luvisols for growth of vines can be concluded, that despite some limits, resulting from the acid reaction, the degree of soil erosion and the depth of the soil profile for the part of the terrains, Chromic luvisols are the main soil resource for the growth of vineyards within the Sungurlare area. When appropriate farming practices, erosion protection and models of organic-mineral fertilization, they are suitable for growth of vines for wine production.

Chromi-eutric cambisols with undifferentiated or slightly differentiated profile, under appropriate weather conditions and in pursuant with the particularities of the soil model of fertilization and agrotechnics are one of the most suitable soils for the growth of vineyards in Sungurlare area.

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