SOILS FOR FUTURE UNDER GLOBAL CHALLENGES

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WATER-PHYSICAL, MECHANICAL AND CHEMICAL PROPERTIES OF ARIC REGOSOL FROM POVARDARIE REGION

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INTRODUCTION

For the farmer, the soil, together with the atmosphere, is the environment in which the plant lives and yields. It should provide the root system with all the conditions necessary for its life. The height and quality of yields from vine crops greatly depends on how the soil performs its role. High and stable yields can be obtained only if the vine crops are provided with all the factors at the same time, without interruption during the whole vegetation and in optimal quantities, in accordance with the stages of plant development. The great number of varieties and their adaptation capacity in a variety of environmental conditions enable grape production for wine processing in many countries.

One of the main factors that influence the wine quality is the grapevine varieties. Its properties are recognizable in the wine, particularly when the grape is produced under proper conditions and proper wine processing is applied.

Environmental conditions, primarily the soil and climate where the vine grows, are another aspect influencing the quality and identification of the wine. Owing to the influence of these factors, there are many famous vine regions in the world today, where wines are produced with recognizable quality and specificity. Hence, optimal conditions are required for successful realization of it.

The grapevine belongs to the group of plants that could be grown on various soil types (including soils with reduced fertility), unlike other plants that fail to grow on such soils or have lower yield rate compared to the grapevine. Yet, besides this understanding, the soils have to meet some of the criteria for successful planting and growing vineyards. The cultivation of perennial vine plantations is known to be correlated with great investments, and incorrect selection of grapevine rootstock and varieties will cause negative financial outcome. And since there are no financial results in the first two to three years with possibility of occurrence of chlorosis during the full development of the plants, this should be particularly taken into consideration. Therefore, the pedological researches have especially emphasised significance in accurate selection of grapevine rootstock, varieties, and application of correct agrotechnical measures when expensive perennial plantations are to be cultivated. Mitkova et al. (2009).

Božinović, (1996), points out that many vine growing countries in the world today work intensively on hybridisation and clone selection of grapevine rootstock and varieties in order to create greater number of grapevine rootstock appropriate for various soil and climatic conditions. Certain number of newly developed grapevine rootstock and clones are introduced in our country and are currently under research on their behaviour under different soil and climatic conditions.

Cultivation and growing of vine plantations, worldwide and in our country, is carried out on many types of soils. Having in mind that each soil type is characterised with specific conditions of formation, genesis, properties and productive potential and are important in selection of the grapevine rootstock and varieties, many important activities have been taken in studying of the soils and their properties in the Povardarie region (Ramnik, Bela Voda, Venule, Gumno and Babuna) for suggesting of proper measures for the productivity improvement of the soils on which vineyards would be cultivated and for correct selection of grapevine rootstock and varieties.

The development of agriculture in the Republic of N. Macedonia is related to the analysis of soil-climatic conditions in the given area and the knowledge of the biological properties of different varieties and substrates and the specifics of the production technology.

MATERIAL AND METHODS

In this region 25 basic pedological profiles were excavated and 75 soil samples were taken for further analysis. These maps (Figure 1) show the region from which soil samples were taken. This region is along the river Vardar, and extends into the central parts of the Republic of Northern Macedonia.

Figure 1. Mapa and Povardarie region, Republic of North Macedonia

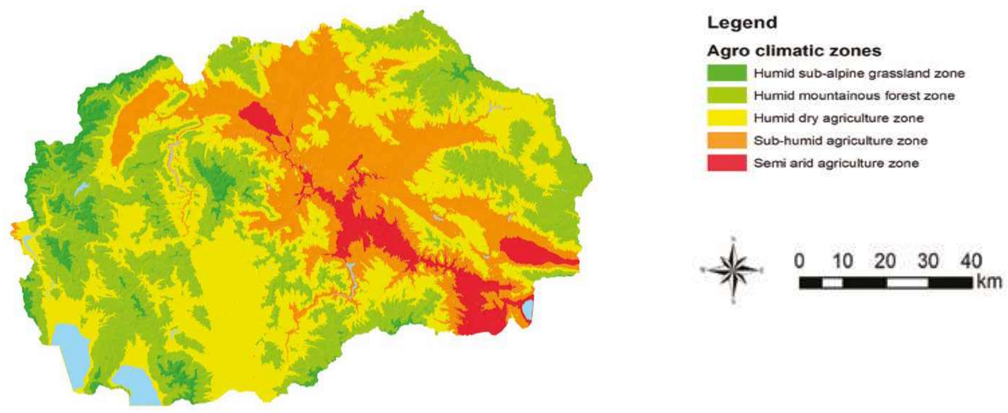
We analysed: the mechanical composition of the soil, determined by dispersing the soil using a 1 M solution of Na4P2O7 x 10 H2O. The fractioning of mechanical elements was carried out using the International Classification; the textured classes with the American Triangle, described by Mitrikeski and Mitkova (2013); Determinates in mechanical composition and chemical properties in soils with standard methods described by Bogdanović et al (1966), Mitrikeski & Mitkova (2006); Džamić et.al. (1996). The determination of moisture retention at a pressure of 0.33 bar, 0.5 bar and 1 bar, was performed applying pressure with a Bar extractor. To determine the retention of soil moisture at higher pressures, the method of Richards (1982). Porous plate extractor, 4.0 bar 6.25 bar and 15 bar was applied, described by Townend et al. (2001; ICARDA 2001; Marinčić, 1971). There has been descriptive statistics (average value, standard deviation and variation coefficient were determined) of the mechanical composition, chemical properties and constants of soil moisture in Microsoft Excel. The correlation between retention of moisture, mechanical composition and humus is determined using the computer program Microsoft Excel.

RESULTS AND DISCUSSION

The water-physical, mechanical and chemical properties of the soil are of great importance to physical, physical-mechanical and chemical properties of the Aric Regosol. The mechanical composition and physical properties of Aric Regosol mostly depend on the nature of the substrate and the content of humus. Acording Mitkova et.al.(2009), Mitrikeski et al (2015), Filipovski (2015) soil genesis conditions, geography and properties are in tight correlation with the environmental conditions, i.e. soil-forming factors. The researched area (a place called Ramnik, Bela Voda, Venule, Gumno and Babuna) belongs to the Veles vineyard region (Povardarie viticultural distric) located in the Vardar river zone, which is a large tectonic basine separating Serbian-Macedonian zone from the Pelagonian Massif. Paleogenic (eocenic) and neogenic (miocenic and pliocenic) clastic sediments are predominant in the Pliocene sediments of Veles basin. They are lithologically heterogeneous, mostly carbonate. The illite is predominant in the claymineralogical composition of one part of these sediments, and montmorillonite in the other. However, they are loose substrates (regolith) where detritiation has been completed and the pedogenesis is rapidly occurring with formation of deep soils.

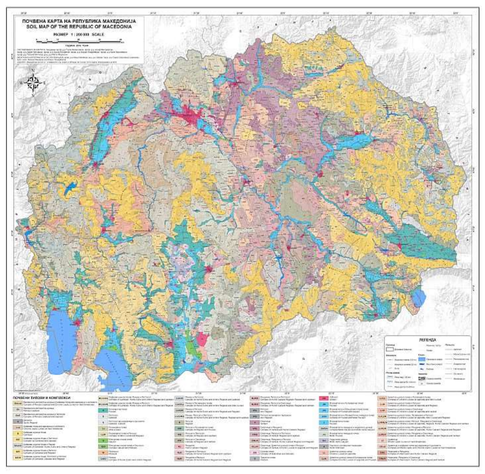
Božinović Z. et al. (2001), Mitkova et al. (2009) underline that Veles viticultural distric, depending on the configuration, i.e. relief and exposition and agroecological conditions is divided into three viticultural districts: Mladost, Venule, and Izvor. The areas in the Ramnik locality are on 290 m. altitude. The researched soils spread in continental- submediterranean region. Climatic elements data of this region are used from the paper of Filipovski et al. (1996a) as well as the climatic diagrams according to Walter, prepared by Rizovski R., presented in the same paper. This region is one of the driest in the Republic of Macedonia with 460 - 583 mm (average 507 mm) of rainfall annually with low De Martonne drought index (19.7-25.4; average 22.6). The index is particularly low (10-15) in July, August, and September. Lang's rain factor is also low in the same months (34.5-46.0, average 40.0). The climate is arid in the three summer months and in September with high potential evaporation (708-781 mm, average 745 mm) and high deficit of humidity (230-352, average 299 mm) (Figure 2.). The climate in this region according to Köppen W., (cited from Ristevski, 1982), is marked as C2fsa.

Figure 2. Agroclimatic and Agroecological zones in North Macedonia



In combination with these pedogenetic factors in the researched areas, and due to the strong anthropogenesis (deep rigoling) these researched soils are described as Rigosol (WRB 2016 Clasification Aric Regosol). Based on the soil map of the Republic of North Macedonia Figure 3, the total area of this soil type is about 40.000 ha. (Filipovski 2015).

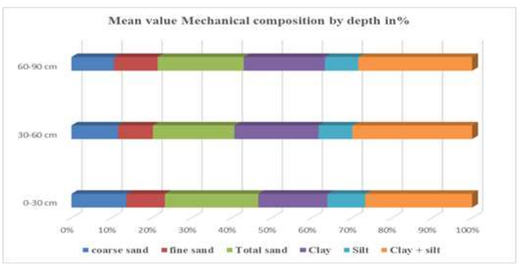
Figure 3. Soil Map in North Macedonia



Mixing of the horizons (A and AC) and formation of anthropogenic horizon can be observed due to the fact that this terrain has been used for vine growing for years and trenching of the soils at depth of 60 cm has been previously carried out. In this newly created horizon P, reduction of the humus content can be observed and presence of CaCO3 moved up from the lower part of the profile as the result of the trenching.

For a better display of the soil texture, all values are shown through graphs with mean values from the analyzed soil samples by depth.

Grafic 1. Mean value Texture of the soils



Graphic 2. Chemical properties Aric Regosol