Scientific Papers. Series A. Agronomy, Vol. LXII, No. 2, 2019
ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785

RESEARCH OF TERRAINS IN KARNOBAT PLAIN AND ASSESSMENT OF THEIR SUITABILITY FOR PERENNIAL PLANTATION GROWTH

Violeta VALCHEVA, Nedialka YORDANOVA, Krasimir TRENDAFILOV

Agricultural University of Plovdiv, 12 Mendeleev Blvd, 4000, Plovdiv, Bulgaria

Corresponding author email: violeta8@mail.bg

Abstract

The study was carried out on terrains located in Ginot and Vodenichane villages, on a total area of 152.2 hectares. As a result of the study in the investigated terrains, were established the following soil differences - Pelic vertisols, Peli-gleyic vertisols, Chromi-eutric cambisols, Eutric regosols, Rankers.
The lands of Ginot village occupies a total area of 39 hectares in the high western part and 10 hectares in the lower eastern part, which borders the river Tarnavska. In the western part the terrain was well drained, including the areas of the relatively shallow gully in a direction from the northeast to the southwest.
The following massifs were studied on the land of the village of Vodenichane: M 160 occupied a high and generally drained terrain, where the deep and well developed soils occupy about 24% and the rest occupied with shallow and stony soils; M 100 is a complex landscape which can be divided into drained and not drained parts. The slightly drained and not drained part of the terrain occupied an area of 9 hectares in the eastern part of the site; M 210 - the whole area was a low not drained or slightly drained area. The groundwater level was high.

Key words*: soils, erosion, fertilization, amelioration.*

INTRODUCTION

The aim of the study was to make soil characteristics of terrains located in Karnobat plain and to assess their suitability for growth of perennial plantations. The areas are on the periphery of a powerful Andesite basin. However, the distribution of the Andesite mantle is limited by the Pre-Balkan depth gap and the main soil-forming rocks of the study area are limestone, partly carbonate pliocene clays and deluvial transfer products originate from limestone rocks. The origin of deluvial materials and pliocene clays determine a relatively heavier soil texture of the soil variations in the area.
In order to properly solve a number of production problems related to the efficient use of agricultural lands, it is necessary to know the physico-geographic features of the area where the soil-climate and the microclimatic conditions of the plots determine the different development, growth and specific qualities of the cultivated crop (Almaliev et al., 2016).

MATERIALS AND METHODS

The study was carried out on terrains located in Ginot and Vodenichane villages, on a total area of 152,2 hectares. In the course of this study, soil samples were taken from the terrain by soil probe, the sample points was located within the boundaries of the terrain in a square. The soil samples were taken at three depths of 0-25; 25-50 and 50-75 cm.
After standard preparation, the soil samples were analyzed to establish the following parameters: soil texture with photo sedimentograph (Trendafilov et al., 2017), Hydrological characteristics of the soil (Trendafilov et al., 2017), Soil density by the paraffin method, relative density - picnometric, pH in aqueous extraction (Arinushkina, 1970), total and alkaline earth carbonate - gasometer by Schäniger method (Arinushkina, 1970), active calcium precipitate with $(NH_4)_2C_2O_4$ by Druinnot-Gallet (NO1085/NFX31-106), humus content by Turin method (Trendafilov et al., 2017), water-soluble salts (BDS ISO 11265: 2002), total nitrogen in the soil (BDS ISO 11261: 2002), the mobile forms of phosphorus and potassium (GOST 26209-91/01.07.93).

RESULTS AND DISCUSSIONS

As a result of the study in the investigated terrains, were established the following soil differences - Pelic vertisols, Peli-gleyic

vertisols, Chromi-eutric cambisols, Eutric regosols and Rankers.
Part of the studied soils (Pelic vertisols, Peligleyic vertisols, Chromi-eutric cambisols) in terms of its morphology have a well-developed and deep soil profile specific of the respective soil diversity. The other soil differences - Eutric regosols, Rankers are underdeveloped soils formed on solid silicate rocks (andesite).

Chromi-eutric cambisols
The average content of physical clay is an indicator that largely determines not only the normal development of the vine plants, but also the quality of the obtained wines. At a depth of 0 to 75 cm it was about 47%. The content found in this indicator showed, that the soil texture was not a constraint on the suitability of the soil for growth of vineyards.
The average soil pH found for the entire studied object was slightly acidic about 6.7. Therefore, the established pH was within the optimum range and will allow for the normal growth of the root system.
The content of calcium carbonate ($CaCO_3$) in the top soil horizons was very low - on average about 0.26% and increased in profile depth. The highest $CaCO_3$ values within the entire object were about 16%. The average content of active calcium in Chromi-eutric cambisols was very low - 1.20%. The data from the soil analyzes showed, that the carbonate content in the soil did not require a pad with very high resistance to alkaline earth carbonates and active calcium.
The humus content of the top soil horizon of Chromi-eutric cambisols was about 2.60% and assessed as average. At a depth of 50-75 cm it decreased to about 0.40%. It can be expected, that relatively low humus content will be found in the deep ploughed soil horizon - about 1.50%.
The soil is poorly stocked with phosphorus and relatively well with potassium. The apply rate of triple superphosphate for stock fertilization before deep plough was about 1.3 t/ha. Pre-fertilization with potassium was not necessary.
Pelic vertisols
The physical clay content of up to 75 cm depth was about 53%. These values showed that the soil texture was a significant limitation factor on the suitability of the soil for vineyards growth in most of the area occupied by Pelic vertisols and this require appropriate ameliorative activities.
The pH indicator for the entire object was about 7.1. The established soil reaction was not a restriction on the vine growth.
The total carbonates average for the object was about 6.25%. The active calcium content average for the area occupied by Pelic vertisols was 3.25%. The maximum value of active calcium for the studied soil variety was about 20.15%. The diversity of indicator values found within the object was very high. The chlorosis rate index at a depth of 50 cm in some of the samples reached 30 and in this case, it was not necessary to select a pad with a high chlorosis resistance.
The humus content in the top soil horizon of the studied Pelic vertisols was about 3.3% and was estimated as high. At a depth of 50-75 cm humus content decreased to 1.0%. It can be expected that an average humus content of about 2.3% will be found in the tillage horizon, which was estimated as good.
The soil was relatively well stocked with absorbable phosphorus and potassium. The phosphorus rate before tillage was about 700 kg/ha of triple superphosphate. Stock fertilization before planting with potassium was not necessary. After stock fertilization, phosphorous fertilizers should not be applied until the fourth year, when the vines start partial fruitfulness.

Eutric regosols
The average physical clay content at depths of up to 75 cm was about 50% and decreased in the depth of the profile. At a depth of 50-75 cm clay content was sandy clay loam and was not limitation factor on the suitability of the soil for vineyards growth.
The average pH value found for the entire studied object was 7.0 and was not a limitation factor for the normal growth of the vine.
The content of $CaCO_3$ in the top soil horizons was very low - about 0.50%. At a depth of 50-75 cm, it was average about 11% and varies up to12%. The amount of active calcium reached a maximum of 16%. The low content of easily absorbable iron, combined with the relatively high content of active calcium, results in a high chlorose force index. This requires the choice

of a pad that is characterized by high chlorosis resistance.
The humus content in the top soil horizon of Eutric regosols was about 2.10%, which was estimated as average. The humus content decreased to 0.40% to a depth of 50-75 cm. It can be expected low humus content of the tillage horizon about 1%.
The soil was well reserved with phosphorus and potassium. The applied rate before tillage was about 300 kg/ha of triple superphosphate. Stock fertilization with potassium was not necessary.

Peli-gleyic vertisols
The average content of physical clay up to 75 cm depth was about 64%. The established values of this indicator was reason to conclude that the soil texture was a very substantial limitation factor for the vineyards growth. Peli-gleyic vertisols occupy a very small area. It was necessary to apply appropriate ameliorative activities to improve the general physical condition of the soil.
The pH indicator for the entire studied object was an average of about 7.0. The soil reaction found in the analysis was within the optimum range for the normal growth of the root system of the vine.
The content of calcium carbonate in the horizon with a depth of 25-50 cm was average about 8.5%. Total carbonates averaged about 3%.
The average active calcium content was very low - about 1.0%, varies up to 2.0%. The chlorose force index was very low, up to a maximum of 8.
The amount of organic matter in the top soil horizon of Peli-gleyic vertisols was about 3.70%, which was estimated as high. At a depth of 50-75 cm the humus content decreased to an average of 1.0%. It can be expected that the average of humus content of the tillage horizon will be around 2.60%, which can be estimated as good.

Rankers
The average content of physical clay at a depth of 0 to 75 cm was 34.2% and decreases to the depth of the profile. Soil texture in the topsoil and subsoil horizons was sandy clay loam. The texture coefficient was an average of 1.07.
The total soil porosity was assessed as satisfactory. The optimal field moisture was low - an average of 20.72%. In the topsoil horizon optimal field moisture was higher - 22.52%.
The average value of the $pH_{(H2O)}$ indicator found for the entire study object was 6.68 with a confidence interval of 6.36 to 6.99.
Content of total alkaline-earth carbonates was not found.
The active calcium content was not determined due to deficiency of $CaCO_3$.
The humus content of the topsoil horizon of the studied Rankers (shallow, poorly developed on silicate rocks) was 1.30% and was estimated as low. The humus content decreases to 0.63% at a depth of 25-50 cm and to 0.18% at a depth of 50-75 cm.
The soil was poorly stocked with total nitrogen in the studied Rankers. The established content of absorbable phosphorus determines the soil as a average stocked with phosphorus. The soil was well stocked with absorbable forms of potassium.

CONCLUSIONS

The lands of Ginot village occupies a total area of 39 hectares in the high western part and 10 hectares in the lower eastern part, which borders the river Tarnavska. In the western part the terrain was well drained, including the areas of the relatively shallow gully in a direction from the northeast to the southwest.
Restrictions on the land use in this outline derive from the shallow soil profiles and the near situated to the surface soil-forming rock, especially in the part of the terrain bordering the forest to the south.
The shallowest lands within this sub-object occupy an area of 3.5 hectares, representing about 18% of the entire object. This area should be abandoned as unsuitable for the growth of perennial crops, except for some species that have a low strictness with regard to profile depth. In areas where Peli-gleyic vertisols was distributed, it was necessary to carry out a deeply ameliorative soil loosening, one way in the direction of the slope, from the west to the east, to the river Tarnavska.
Part of the lands in the Vodenichane village occupied a high and generally drained terrain where the deep and well-developed soils were about 24% and the rest was occupied with

shallow and stony soils - Eutric regosols and Rankers. Limitation of the suitability of the terrain for crops growth was the pinching of groundwater in its central part. This was related to the formation of a continuous or periodic surface runoff in the path of the deep-cut gully crossing part of the object in a direction southeast to the northwest where the water flowed into a roadside drainage channel. The usage of the terrain requires the repair of the route of surface runoff in order to minimize the area of the terrain affected by lateral spills of surface running water. In order to be efficiently used, the area occupied with Peli-gleyic vertisols, require performing the following ameliorative activities: - construction of a drainage system, deep ameliorative loosening in the direction of the machine movement, coordinated with the routes of drainage suction, current alignment.

The suitability of the listed soil differences for the growth of perennial crops was limited. This is due to a variety of factors came from the soil profile speciality, the degree of drainage and the peculiarities of the landscape. Despite the fact that they belong to different taxonomic units and differ significantly in regard to their formation, composition and properties, within the study the listed soil differences were united as soils requiring ameliorative intervention before their use for the needs of vineyards growth in the area (Trendafilov et al., 2016). Profile depth and the high degree of rockyness in part of the studied terrains were a limitation for their usage of perennials growth with a deep root system. A particularly strong limitation of land use had in the area occupies by Rankers.

REFERENCES

Almaliev, M., Trendafilov, K., Valcheva, V. (2016). Research on soil and climatic conditions for creation of orchards in the area of Radomir town. *Ecology and Health, House of Science and Technology-Plovdiv*, 105–112.

Arinushkina, E.V. (1970). Guidelines for chemical analysis of soils, Ed. MSU M.

BDS 17.4.4.07-97 Nature protection. Soil. Method of Determination of Harmful Acidity.

BDS ISO 11261: 2002. Soil quality - Determination of total nitrogen - Modified Kjeldahl method.

BDS ISO 11265: 2002. Soil quality - Determination of the specific electrical conductivity.

GOST 26209-91/01.07.93. Determination of mobile compounds of phosphorus and potassium by Egner-Riem method (DL-method).

NO1085/NFX31-106 - Qualité des sols. Détermination du calcaire actif - 1982-05-01-0301-Norme Homologuée.

Trendafilov, Kr., Valcheva, V., Popova, R. (2017). Guidance for exercises in soil science. *Academic Publishing House of Agricultural University, Plovdiv*.

Trendafilov, K., Valcheva, V., Almaliev, M. (2016). Particularities of the complex of forest Sungulare valley defining the unique specifity of the area for growth of wine grape varieties. *18th Danuble-Kris-Mures-Tisa (DKMT) Euroregional conference on Environment and Health, Novi Sad Serbia*, 118–126.