Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 21, Issue 1, 2021
PRINT ISSN 2284-7995, E-ISSN 2285-3952

MANAGEMENT OF SOIL RESOURCES IN GIARMATA, TIMIŞ COUNTY, ROMANIA

Anișoara DUMA COPCEA, Nicoleta MATEOC SÎRB, Casiana MIHUȚ, Lucian NIȚĂ, Teodor MATEOC, Simona NIȚĂ, Corina SÎRBU, Ramona ȘTEF, Daniela SCEDEI

University of Agricultural Sciences and Veterinary Medicine "King Mihai I of Romania" from Timisoara, 300645, 119 Calea Aradului, Romania, Phone: +40256277001, Fax:+40256200296, Emails: duma_anisoara@yahoo.com, nicoletamateocsirb@uasb-tm.ro, casianamihut@yahoo.com, lucian_nt@yahoo.com, teodormateoc@usab-tm.ro, nitasimona70@yahoo.com, corinasirbu06@yahoo.com, chirita_ramona@yahoo.com, dana_olaru78@yahoo.com

Corresponding author: nicoletamateocsirb@uasb-tm.ro

Abstract

The aim of this paper is to present the qualitative assessment with a view to the sustainable development of the land presented (land that occupies the largest share) of the studied area. The methods used to carry out this work were: the characterization of the area studied in terms of natural conditions; the assessment of the productive capacity of the soil with a view to the most accurate sustainable use. The study material used for the elaboration of this paper is the land belonging to the Giarmata territorial administrative unit (6,119 ha) and the Pedological study of the Giarmata City Hall. As regards the agricultural land of the commune, it consists of the following uses: arable 4,859 ha (77.2%), pastures 834 ha (13.3%), meadows 121 ha (1.9%), and orchards 305 ha (4.8%). With regard to the classification of the area studied in quality classes (fertility), for the category of use "arable", the situation is as follows: 1st class – 128 ha (2.6%), 2nd class – 913 ha (18.8%), 3rd class – 2852 ha (58.7%), 4th class – 850 ha (17.5%), and 5th class – 116 ha (2.4%). For the proper development of the agricultural land under study, action will be taken as appropriate by carrying out the work of deep watering or subsoiling, the introduction of long-term crop rotation, the introduction of breeding crops, and the establishment of an adequate load of grazing livestock.

Key words*: *sustainable development, agricultural land, fertility, crops, Giarmata

INTRODUCTION

Maintaining and improving soil fertility is a major concern of all countries, primarily to ensure the food needs of the ever-growing population. [5], [17], [18].

The conservation and maintenance of soil natural fertility have been and are supported and promoted by researchers and specialists, in view of the current requirements for the development of sustainable agriculture.[1], [16].

In the context of sustainable agriculture, soil protection, conservation, the achievement of an environment conducive to the development of crops should also be based on the knowledge of the physical condition of the soil, in addition to chemical and biological ones. [2], [13], [14].

In modern and efficient agriculture, soil is the main means of production which, if used rationally, ensures the production of quality and economically cost-effective agricultural produce. [4], [11], [15].

Soil still is the indispensable element on whose knowledge is based the assessment of the management opportunities provided by agricultural land, but for any applied interpretation regarding the use or exploitation of soil resources one needs to know the other environmental factors in their interaction and conditioning. [7], [9], [12].

This is achieved through the concept of "terrain" that integrates four distinct aspects, namely: -the ecological aspect related to the conditions of plant development; -the technological aspect related to the possibilities and way of working the soil; -the economic aspect related to the soil's production capacity and resistance to use; -the geographical aspect related to the agricultural landscape.[8],[10]. Agricultural science and practice have proven that soil fertility can be continuously enhanced by agrotechnical, agrochemical, and land improvement measures, thereby fighting the theory of soil depletion taken into cultivation or the so-called law of soil decreasing fertility. [5], [6], [9]. Actual (economic) productivity will depend on the level of soil cultural fertility, the suitability of the climate and the level of technicality and investments. [1], [4], [10]. There are numerous and extensive cases of strong growth of soil fertility through organic fertilization and improvement works, as there are also numerous and widely extensive cases of decreased natural fertility through the degradation of the physical, chemical, and biological properties of the soil as a result of a wrong system of agriculture. [2], [3], [7].

In the intensive farming system, there is lasting and fleeting cultural fertility depending on the level of fertilization, irrigation, and rationally-made agrotechnical work [3], [1]. This means that, once the additional investments are interrupted, the level of productivity will decrease, thus depending on the complex of technical, economic, and social factors [8].

MATERIALS AND METHODS

Located in the central-northern area of Timiş County (45°83’ north latitude and 21°32’ east longitude), on DJ 691, Giarmata, the seat of the commune of the same name, is located 11 km from the municipality of Timisoara and, through DC 58, 1.3 km from Timişoara International Airport. The municipality of Giarmata covers an area of 7,150 ha, of which 6,292 ha represent agricultural land and 43.5 ha represent forest land. Giarmata is located on the south-eastern margin of the Vinga Plain, with a general north-easterly orientation to south-west. The Vinga Plain has average altitudes between 100 and 150 m, very wide interfluves sprinkled with depressive areas, poor fragmentation, and less relief energy. The study on the sustainable development of agricultural land in Giarmata were carried out in 2019 on different types of soil and agricultural crops. Based on the study and the information collected, the area studied comprises a number of 10 types and 38 subtypes of soils, namely: -*Aluviosols*: molic (mo), gleic (gc), gleic-salinic (gc-sc) – UT 1-4, 88.66 ha, 1.41%; -*Chernozems*: cambic-gleic (cb-gc), gleic-salinic (gc-sc), vertic-gleic (vs-gc) – UT 5-8, 146.45 ha, 2.33%; -*Faeozioms*: clinogleic (cl) – UT 9-10, 18.89 ha, 0.30%; -*Eutricambosols*: typical (ti), molic (mo), alluvial (al), molic-gleic (mo-gc), aluvic-gleic (al-gc), aluvic-stagnic (al-st), aluvic-salinic (al-sc), molic-gleic-salinic (mo-gc-sc), aluvic-gleic-salinic (al-gc-sc)– UT 11-25, 795.43 ha, 12.64%; -*Preluvosols*: typical (ti), molic (mo), vertic (vs), stagnic (st), reddish-molic (mo-rs), molic-stagnic (mo-st), vertic-stagnic (vs-st), gleic-stagnic (gc-st) – UT 26-71, 3,578.16 ha, 56.86%; -*Pelosols*: gleic (gc), stagnic (st), stagnic-gleic (st-gc), gleic-salinic (gc-sc), gleic-salsodic (gc-ss) – UT 72-85, 454.64 ha, 7.23%; -*Vertosols*: gleic (gc), gleic-salinic (gc-sc), gleic-salsodic (gc-ss) – UT 86-93, 827.88 ha, 13.16%; *Gleisols*: molic (mo), pelic (pe) – UT 94-96, 242.88 ha, 3.86%; -*Stagnosols*: typical (ti), vertic (vs), vertic-gleic (vs-gc) – UT 97-100, 96.45 ha, 1.53%; -*Erodosols*: pelic-calcic (pe-ka) UT 101-103, 42.97 ha, 0.68%. For the analysis of sustainable development, the soils with the highest weight were studied, namely Preluvosol, Vertosol and Eutricambosol for different agricultural crops. The process of evolution of *preluvosols* was carried out with an intensity dictated by the bioclimatic zone, the age of the relief form, its appearance, and the nature and origin of the soil genesis materials. This soil covers an area of 3,578.16 ha, 56.86%. Subtypes of Preluvosol from Giarmata: typical preluvosol, vertic preluvosol, batigleic preluvosol, stagnic preluvosol, molic-batigleic preluvosol, vertic-stagnic preluvosol. *Vertosols*. Soils in this class cover an area of 454.64 ha in Giarmata, 7.23 % of the area under investigation. They are divided into several subtypes depending on the excess water and on the water shape that affects excess soils. The subtypes of vertosol from Giarmata: typical vertosol, batigleic vertosol, stagnic vertosol. *Eutricambosols* are, generally, relatively young or rejuvenated soils in different stages of debasification (but their degree of saturation in bases falls below 53%). They are conditioned by the nature of the soil genesis rock or by the conjuncture of bioclimatic conditions. There are soils that have evolved only on rocks rich in bases (clays, marls). They cover an area of 795.43 ha, 12.64%. Subtypes of eutricambosol in Giarmata: typical eutricambosol, batigleic eutricambosol, stagnic eutricambosol, stagnogleic eutricambosol.

RESULTS AND DISCUSSIONS

Soil suitability for different agricultural crops

Table 1. Soil suitability for wheat, maize and sunflower

Soil type	Wheat		Maize		Sunflower	
	Soil assessment grade	Fertility class	Soil assessment grade	Fertility class	Soil assessment grade	Fertility class
Preluvosol	73	III	65	IV	65	IV
Vertosol	33	VII	22	VIII	23	VIII
Eutricambosol	58	V	45	VI	43	VI

Source: Calculated by author.

Table 2. Soil suitability for sugar beet and potato

Soil type	Sugar beet		Potato	
	Soil assessment grade	Fertility class	Soil assessment grade	Fertility class
Preluvosol	58	V	52	V
Vertosol	19	IX	11	IX
Eutricambosol	32	VII	28	VIII

Source: Calculated by author, 2020.

Table 3. Soil suitability for plum and apple

Soil type	Plum		Apple	
	Soil assessment grade	Fertility class	Soil assessment grade	Fertility class
Preluvosol	64	IV	45	VI
Vertosol	20	IX	15	IX
Eutricambosol	52	V	59	V

Source: Calculated by author, 2020.

Table 4. Soil suitability for cherry, sour cherry and apricot

Soil type	Cherry		Sour cherry		Apricot	
	Soil assessment grade	Fertility class	Soil assessment grade	Fertility class	Soil assessment grade	Fertility class
Preluvosol	64	IV	64	IV	64	IV
Vertosol	15	IX	15	IX	11	IX
Eutricambosol	47	VI	47	VI	41	VI

Source: Calculated by author, 2020.

1.Suitability of soils for wheat, grain maize and sunflower Preluvosol for wheat is grade 73, 3rd fertility class; for grain maize and sunflower, its grade is 65, 4th fertility class, compared to vertosol whose grade is 33 and 7th fertility class in wheat and 8th fertility class for grain maize and sunflower. *Eutricambosol* values are specific to the 6th fertility class.

The reduced values are due to the following limitations: *Preluvosol* has: -reduced limitations due to the humus reserve; -moderate limitations due to acidity; -severe limitations due to soil compaction. *Vertosol* has: -reduced limitations due to alkalisation; -reduced limitations due to the content of $CaCO_3$; -reduced limitations due to the physical property of the soil-texture; -severe soil due to compaction limitations.

2. Suitability of soils for sugar beet and potato

Preluvosol has values for the 9th fertility class. These values are due to the following limitations: -moderate limitations due to soil acidity; -reduced limitations due to the humus reserve. Humus is mostly made up of a complex of organic compounds with a complex molecular structure. -severe limitations due to soil compaction. *Vertosol* for sugar beet and potato has 9th fertility class values. These values are due to the following limitations: -moderate limitations due to humus reserve; -reduced limitations due to $CaCO_3$ content; -reduced limitations due to the physical characteristic of the soil-texture; -reduced limitations due to alkalisation; -severe limitations due to soil compaction.

3.Suitability of soils for fruit (plum, apple, cherry, sour cherry and apricot). As for plum and apple, preluvosol has the grade 64 and the 4th fertility class for plum and the grade 45 and the 6th fertility class for apple, respectively. This soil has the following limitations: -reduced limitations due to soil salinisation; -reduced limitations due to the humus reserve; -severe limitations due to soil compaction. These values are penalized for the following limitations: -moderate limitations due to humus reserve; -reduced limitations due to $CaCO_3$ content; -reduced limitations due to physical properties of the soil-texture; -severe limitations due to soil compaction. For cherry and apricot, preluvosol has a grade of 64 and a 4th fertility class. This soil has the following limitations: -moderate limitations due to soil acidity; -reduced limitations to the humus reserve; -severe limitations due to soil compaction.

As regards eutricambosol, for all the crops studied the characteristics and limitations are as follows: -the total cationic exchange capacity varies greatly, depending on the nature of the clay, but it is generally lower (less than 10 me/100g soil); -the degree of saturation in the bases is high in horizon A (50-85%), after which the depth gradually decreases, meaning that the pH decreases, from 6.8-6.0 to 5.8-5.1; -the higher values of the chemical characteristics in horizon A reflect an intense bioaccumulation with all the lack of bases and nutrients of the initial rock. Along with the active aeration process, under the impulse of specific climatic conditions, alteration is much more active than in other similar altimetric areas of the country, with clay formation at the expense of rock silicates. Rock disaggregation and alteration products are frequently moved on the slopes, towards their basis, gravitationally or by the sill waters, which explains the polystratification of the bedspreads.

CONCLUSIONS

Following the analysis of limiting factors and the calculation of the bonus notes, the determination of fertility classes, the following can be highlighted:

-to reduce the soil reaction within optimum limits, periodic calcium amendment shall be carried out;

-the amendment dose will be determined according to the recommendations in the agrochemical mapping;

-among the fundamental properties of the soil having a relatively more determinable function, the content of $CaCO_3$ influences the growth and fruiting of plants in direct relation to the intensity of phenomena;

-texture plays an important role in ensuring the necessary conditions for growing and bearing plants (it achieves rooting depending on texture) as other soil properties widening or limiting their production capacity;-since texture is hard-to-change itself over time, the optimal time to carry out the work needs to be taken into account;

-soil compaction is linked to the granulometric composition reaching maximum values within the clay soils lacking structure, being influenced by the content of water, of humus, and by the nature of cations.

For the sustainable development of agricultural land in Giarmata, Timiş County, Romania, action will be taken as appropriate by carrying out deep-ground or subsoiling works, introducing long-term crop rotation, introducing breeding crops, and establishing an adequate load of grazing livestock.

REFERENCES

[1]Brinzan, O., Drăgoi, M., Bociort, D., Ţigan, E., Mateoc-Sîrb, N., Lungu, M., 2020, A Market-Based Economic Instrument to Better Use Water in Agricultur, Sustainability, 12(4): 1473.

[2]Bucată, I.V., Diaconescu, Ș., Gieraths, J, Weiller, W, 2003, Agricultura ecologică (Organic farming), Alma Mater Publishing House, Bucharest, pp. 28-30.

[3]Chirita, R., Lauer, K.F., Sarpe, N., 2004, Control of Johnson grass in maize with new broad-spectrum herbicides in Western Romania, Zeitschrift fur pflanzenkrankheiten und pflanzenschutz, Journal of plant diseases and protection, Special Issue 19: 725-731.

[4]David-Feier, S., Mateoc–Sîrb, N., Mateoc, T., Bacău, C., Duma Copcea,A., Mihuț, C., 2020, Agriculture and sustainable soil use in Timiş county, Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development 20 (1): 207-214.

[5]Duma Copcea, A., Mihuț, C., Popa, D., 2018, Studies regarding minimum soil tillage, Scientific papers - Series Management Economic Engineering In Agriculture and Rural Development, Vol.18(1): 153-156.

[6]Deacu, E., 2017, Romania has a high agricultural potential, but it si lacked of productivity (România are potenţial agricol ridicat, dar îi lipsește productivitatea), Adevarul.ro, Accesed on 5 November 2018.

[7]Gavrilescu, C., Florea, A., David, S. , Popescu, A., Mateoc –Sîrb, N., 2016, Agri-food organic products - A fast increasing market, Journal of Biotechnology, 231, S: S94-S94.

[8]Goșa, C.I., Mateoc –Sîrb, N., 2014, Agricultural lands bonitation and estimation of crop production in Almajului Valley, Caras-Severin county, Geoconference on Water Resources, Forest, Marine and Ocean Ecosystems, 2: 11-14.

[9]Grad, I., Mănescu, C., Mateoc, T., Mateoc-Sîrb,N., 2014, Studies on the agriculture systems practiced in Romania, Scientific Papers Series Management Economic Engineering in Agriculture And Rural Development, 14(1): 139-142.

[10]Lato, K. I., Popa, M., Lato, A., Corches, M., Radulov, I., Berbecea, A., Crista, F., 2019, Economic efficiency of main soil types from West region of Romania for various agricultural crops, Journal of Environmental Protection and Ecology 20, (2): 1022–1028.

[11]Mateoc –Sîrb, N., Zagoni, A., Mateoc T., Sârb, G.S., Manescu, C., Câmpan, C., Dornea, M., 2013, Increasing the economic efficiency of arricultural farms through the cultivation of energetic plants and production of biofuels, Current Opinion in Biotechnology, 24, (1): S139-S139.

[12]Mateoc –Sîrb, N., Mateoc T., Manescu, C., 2014, Research on the labour force from Romanian agriculture, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 14 (1): 215-218.

[13]Mihuţ C., Okrös, A., Iordănescu, O., 2012, Research on the soils of Western Romania, XI Wellmann International Scientific Conference, Review on Agriculture and Rural Development, Scientific Journal of University of Szeged, (Hungary)Faculty of Agriculture, 1(1): 591-600.

[14]Nița L., Grozav, A., Rogobete, Gh., 2019, Natural and Anthropic Soil Acidification in the West of Romania, Jurnal revista de Chimie, 70 (6): 2237-2240.

[15]Popa, M., Laţo, A., Corcheş, M., Radulov, I., Berbecea, A., Crista, F., Niţă, L., Laţo, I., K., Popa, D., 2016, Quality of some soils from the west region of Romania, AgroLife Scientific Journal – 5 (1):174-177.

[16]Popescu, Agatha, Stoian, E., Serban, V., 2019, Oil seeds crops cultivated area and production in the EU-28 -trends and correlations, 2008-2018, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 19 (4): 265-272.

[17]Toth, A., Mateoc-Sîrb, N., David, S., Mateoc, T., Mănescu, C., Venig, A., Sârb, Gh, 2016, Organic agriculture: An opportunity for sustainable development of Romanian villages, Journal of Biotechnology, 231S: 83.

[18]Ţărău, D., Niţă, L, David, Gh. ,2020, Știinţa solului în mileniul III, Agricultura Banatului 4 (145): 25-38.