STUDIES ON SOIL RESOURCES IN GIULVĂZ, TIMIȘ COUNTY

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Abstract. *The paper presents the soil resources of the Giulvăz locality. The soil types are thus described, identification, establishment of the soil quality class, presentation of limiting factors and improvement measures. The following objectives were aimed at: providing a fund of information on the studied area from the point of view of geographical settlement, pedoclimatic resources, respectively identification and presentation of soil types, establishment of the quality class, identification and establishment of limiting factors and improvement measures. The Giulvăz locality is located in the southwestern part of Timiș county, in the interfluve of the Bega and Timiș rivers. Due to its geographical location, two different sectors were formed, each represented by a different pedoclimatic distribution, namely: the central sector, better developed from a pedological and morphological point of view, where soils such as: chernozems and phaeozems were formed and the southern sector, represented by the area between the Timiș River to the south and the area formed by a series of meanders to the north, which appears at an altitude of over 90 m and where eutricambosols, pelosols and vertosols were formed and only accidentally, the other types of soil. In the documentation part, the work presented the natural framework that explains the phenomena and processes that take place in the soil and the way in which these phenomena and processes can be influenced by man in his agricultural production activity. At the same time, the climatic conditions specific to the area are presented, without which we cannot talk about soil and crops. Agriculture is one of the main branches of the Romanian economy that depends very much on the pedoclimatic conditions specific to each area.*

Keywords*: soil resources, pedo-climatic conditions, quality classes, limiting factors, breeding measures*

INTRODUCTION

At the level of Europe, soil resources are very different, depending on the area, spatial variability, climatic conditions, parental materials and their evolution. Thus, the great diversity of Europe's soils reflects the differences in climate, geology, vegetation, land use, etc. (MIHUȚ CASIANA, NIȚA L. 2018; BĂRBĂLAN ANIȘOARA ET AL., 1999; ILIE, L., ET AL., 2012; KAREL IAROSLAV ET AL., 2022; MIRCOV V.D. ET AL., 2019).

In Romania, there is a great diversity of physical-geographical conditions, age and human activity, which has also led to the emergence of an extremely varied soil cover (CASIANA MIHUȚ, ET AL., 2022). There are a number of authors, including CONSTANTIN GRIGORAȘ ET AL., 2007, which in the work "Soils of Romania", describe all 12 classes and 29 types of soil in our country, according to the classification in FLOREA ET AL., 2012.

Thus, being formed in very varied natural conditions, the soils present a great diversity, as well as a different fertility and certain specific characteristics that show us the variable capacity of the terrestrial regions to be a support for plant growth, the quantity and quality of agricultural production and forest biomass. Since each type of soil is different, they require different management and protection measures (FLOREA ANDREI-MIREL, ET AL., 2019; LAȚO K., ET AL., 2009.

The studies presented in the paper provide valuable information, tools, and resources that help all farmers – both organic and non-organic – increase the economic sustainability of their farms (BORCEAN I., ET AL., 1996).

The results of the soil resources assessment in Giulvăz provide an in-depth analysis of the soil and agricultural research to date and the current priorities for research based on a national survey of farmers growing in this area (DAVID, G., ET AL., 2018).

MATERIAL AND METHOD

The paper presented a case study from a locality located in Timiș County (Giulvăz), where the main activity is the cultivation of agricultural plants.

Based on the numerous field trips, the studies carried out in the field and in the laboratory and the study of the specialized bibliography, we obtained a series of theoretical and practical data that we processed and described in the results and discussions part (MUNTEANU I.,ET AL., 2009).

The results obtained and supplemented with a series of information taken from the City Hall, led to a series of useful information (theoretical and practical) that will continue with new studies and research on soil resources in general and the way of occupying these soils in particular, taking into account new trends, agricultural technologies, climate change and the way of adapting varieties and hybrids. All this information will help us to better understand the properties of the soil in general and their evolution in particular according to the pedological and climatic conditions specific to each territory and their influence on the soil cover, the yields obtained and the suitability of the soils for certain crops and modes of use given the population's need for food (OKROS ADALBERT, 2015; RADULOV, I., ET AL., 2011).

Giulvaz commune is located in the south-western part of Timiș county and is bordered to the north by the territory of Peciu Nou commune, to the east and south-east, by the administrative territory of Ciacova, to the west and south-west by the administrative territories of Foeni and Uivar communes (figures 1 and 2).

Figure 1. Representation of the locality Giulvăz in Timiș County

Figure 2. Representation of Giulvăz and its villages

This commune is composed of four localities, Giulvăz having the role of commune capital: Crai Nou, Ivanda and Rudna, which are component villages.

The territory of the commune is located in the low plain area, the Ciacova plain, with altitudes between 80.0 - 90.0 m. The territory of the commune, integrated in the western part of the country, was formed at the beginning of the Quaternary era, following great tectonic turmoil, followed by the retreat of the Pannonian Lake that occupied the vast plain of today's Tisa (PUȘCĂ I., 2002; ȚĂRĂU D., LUCA M., 2002; ȚĂRĂU D., ET AL., 2016).

RESULTS AND DISCUSSIONS

The studies were carried out in the commune of Giulvăz in Timiș County, a commune that is located between the Bega Canal to the north and the Timiș River to the south (fig. 3.).

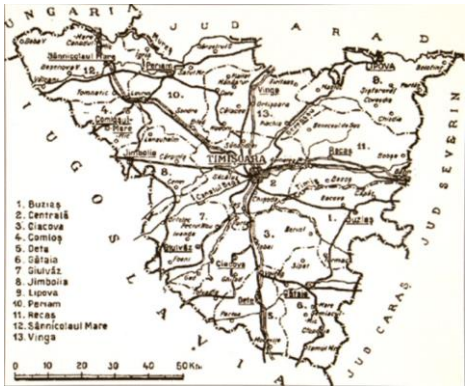

Figure. 3. Settlement of Giulvăz commune in the interfluvium of the Bega Canal and the Timiș River

Due to its location in the interfluvium of the two rivers (the Bega Canal and the Timiș River), two different sectors were formed, each being represented by a different pedoclimatic distribution, namely:

- The central sector, better evolved from a pedological and morphological point of view due to the fact that it is formed in a higher area (about 90 m) and better drained, formed on rich parental materials, represented especially by loesses, which has led to the formation of deep and fertile soils, such as those of the class Mollisols, represented by Chernozem and Phaeozem. In the lower part, in the area of the Timiș interfluvium, there are a series of loessoid materials rich in salts, which led over time to the formation and evolution of solonets, soils rich in sodium but whose fertility is very low, which can also be seen by the way these soils are used.

- The southern sector is represented by the area between the Timiș River to the south (the alluvial sector of the Timiș River) and the area formed by a series of meanders to the North. In this higher altitudinal sector (over 90 m), eutric cambisols, chromic vertisols and chromic vertisols were formed and only accidentally, the other types of soil. These soils have a different evolution from a textural and morphological point of view, here materials such as clay and contractile-swelling clay predominate, which is due to the clay and clay and clay processes present over time. Thus, the presence in this sector of soils that have a rich layer of clay formed "in situ" (on the spot) was found, respectively the formation of eutric cambisol and clay of the type of smectit, montmorillonite and vermiculite, which was found in the chemical and mineralogical composition of the two types of soils present, namely: chromic vertisol and chromic vertisol.

This area has undergone a series of changes over time due to the fact that the Timiș river basin collects (over 90% of the commune's surface) the waters of the drainage canals, which has produced a series of changes in the soil cover. In this area, a series of hydro-ameliorative works were carried out, collection and drainage channels were built, leveling and modeling were carried out in order to collect the surplus water. From these channels for collecting surplus water, channels and collection basins were made, the respective waters being used for irrigation.

On the right bank of the Timiș River, dams were built to protect the surrounding agricultural land from floods.

1.Studies on climate resources

The studied area, due to its geographical position (Banato-Crișana Plain, part of the Western Plain), falls within the southern area of the Low Plain of the Timiș River. This geographical position led to the presence of a temperate-continental climate, represented by shorter and milder winters, which favored the growth and development of a wider assortment of plants.

The climate is characterized by average annual temperatures of 10-11°C, average temperatures of -2°C in January and 22-24°C in July. The average annual amounts of precipitation recorded are 500-600 mm. The prevailing winds are north, northeast, east and southeast.

The average speed is between 1.2 - 3.8m/sec.

The snow has an average thickness of 20-50 cm, the first snow starting in November, the last snow in March.

From a hydrographic point of view, the area of Giulvăz commune is crossed in the southern part by the course of the Timiș River.

2. Studies on soil resources

At the level of the commune, 4 classes and 6 types of soil have been identified, as can be seen from the data presented in table 1. and fig. 4.

Table 1.

Presentation of classes and soil types at the level of Giulvăz commune

Nr. Crt.	Soil class	Type of soil	Occupied area in ha
1.	Mollisols	Chernozem	3285
		Phaeozem	1719
2.	Cambisols	Eutric cambisol	1052
3.	Vertisols	Pellic vertisols	282
		Chromic vertisol	358
4.	Salsodisoluri	Solonetz	1514
Soil associations			698
Total land – cadastral territory			**10296**
Total agricultural land			***8908***

Fig. 4. Representation of agricultural land in Giulvăz locality

As can be seen from the data presented in Table 1., at the commune level the total area is 10,296 ha, of which over 86% (86.52%) is agricultural land. From the point of view of the types of soil identified, the situation is as follows:

- the largest area (3,285 ha) is represented by chernozems;
- in second place, with 1,719 ha are the phaeozems;

- the third place is occupied by Solonetz, with 1,514 ha;
- in fourth place were Eutric cambisols, with 1.52 ha;
- the fifth-ranked Chromic vertisols are spread over 358 ha;
- pellic vertisols, ranked last in terms of area, occupy 282 ha.
- The soil associations, represented by all the types listed above, together occupy 698 ha, but they are scattered interspersed among the other types of soil and occupy small areas in the areas where they have been identified, which, however, overall ranks them in fifth place in terms of total area.

1. ***Chernozem*** is the type of soil that covers 31.90% of the commune's territory, thus occupying the largest area (3,285 ha), as a soil type, with 36.90% of the agricultural area. It has a number of positive properties, in terms of humus content (3.6%), reaction (neutral to low alkaline, pH=7.2-7.4), clay-clay-dusty texture, glomerular structure in Am, degree of saturation in ases of over 90%, which classifies them in class I and II of quality, respectively fertility. They are cultivated with a series of plants, from cereals, technical flats, harrows, oilseeds, vegetables.

There are soils that are easy to work.

2. ***Phaeozem*** is one of the soils present on 16.70% of the territory, with 1,719 ha, occupying the second place in terms of extension, of which over 19.30% is agricultural land. These soils are distinguished by the presence of a richer horizon in clay (Bt), at over 75 cm, having a clayey clay texture on the surface and clay clay in Bt, a content of over 3% humus, a moderately acidic reaction (pH=6.8), granular structure in Am and subangular polyhedral in Bt. They are solutes that fell into the second and third quality classes. They are grown with a number of plants.

These are soils that are relatively easy to work.

3. ***Eutric cambisol*** is found on 1,052 ha, with a spread of 10.22% of the total and 11.81% of the agricultural land. It has a medium texture (sandy clay), the presence of clay formed on the spot (in situ) makes it fall into the class of cambisols, rice being present. BV like rice. Diagnosis. It stands out for the following characteristics: grainy structure in Aocric, humus content of 2.5%; neutral to weakly alkaline reaction. Most eutricambosols have a degree in base saturation of over 60-80% and have been distinguished by the presence of some salts.

These are soils that are easy to work, depending on the presence of the Bv horizon. In those where this horizon appears at a depth of over 25 cm, agricultural work is carried out in good conditions compared to those where this horizon appears in the first 20 cm and which are more difficult to work. In the latter case, cultivated plants encounter problems, because in plants that have a well-developed root system (corn, sunflower, alfalfa, fodder beet and root crops in general), the roots develop more slowly when they meet this horizon.

4. ***Pellic vertisol*** occupies the smallest area of only 282 ha, i.e. 2.74% of the total area and 3.16% of the agricultural area. It stands out for the presence of over 50% of contractile-swelling clay, which is evidenced by the clayey texture of this type of soil, the presence of sliding angles and the gilgai relief. The structure is destroyed in Ao and lamellar at the level of the rice. Bty, a horizon that creates a number of problems in the growth and development of plants. The humus content is 2.2%.

There are soils that are very difficult to work and on which it is generally recommended to grow straw cereals, that is, plants that do not have a well-developed root system, whose growth and development takes place mostly during the period when there are no long periods of high humidity in the soil, associated with periods of soil drying, respectively lack of water. In the other cases, large cracks appear in these soils, as a result of which the roots of the plants break, which leads to poor growth and decreased yields.

5. The ***Chromic vertisol*** have a reduced spread of only 3.47% of the total, respectively 4.0% of the agricultural one, occupying 358 ha within the commune. Their presence is closely related to the presence of clay, the Btyz horizon makes the texture fine (clayey), the humus content is below 2% and the reaction is weakly-moderately acidic.

They are soils that are difficult to work and in difficult conditions, which is why they are used as grassy fields (pastures and meadows).

6. ***Solonetz*** are found on 1514 ha, which represents 1.47% of the total commune and 1.70% of agricultural land. They are the least fertile soils within the studied territory and among the soil types in our country in general. The presence of the Btna horizon makes them have a heavy texture, a destroyed structure, a very low humus content and a degree of base saturation of over 90-05%.

They are soils that are difficult to permeate, compacted, which are very difficult to work and in which the presence of sodium makes the assortment of crops limited. They have a moderately alkaline reaction on the surface and strongly alkaline at the level of the Btna layer. On these soils, attention should be paid to agricultural work. The presence of this characteristic horizon (Btna) on the surface causes sodium to be brought by plowing and further affect the very low fertility of this soil.

The main soil quality classes identified and described above are presented in Table 2.

Table 2.

Quality/fertility classes of cultivated soils (arable)

Cadastral area in ha	Agricultural area in ha	Quality classes, depending on the score obtained (Bonitare note)					Average bonitare note
		I (81-100)	II (61-80)	III (41-60)	IV (21-40)	V (1-20)	
10.296	*8.908*	68	1.859	2.708	1.943	505	50

It can be seen that class III – a is the most representative at the level of the commune, respectively 2,708 ha of soils are found at the level of this class while class I – a is the weakest represented, with only 68 ha.

This means that at the level of the commune there are a series of factors or processes that limit the fertility of these soils.

The main limiting factors are represented by:

- The presence of excess surface moisture, 1,150 ha are weakly affected; 890 ha are moderately affected and 620 ha are strongly affected by excess moisture;
- The presence of excess groundwater moisture, on 4,256 ha are moderately affected and 282 are strongly affected by the groundwater table present at shallow depths;
- The presence of moisture deficit in the soil is manifested in low limits on 496 ha and moderate to high, on 1,511 ha;
- The presence of salts (salting), affects weak – 3,138 ha, moderate – 1,935 ha and strong – 1,514 ha;
- The presence of acidification is weak on 402 ha and moderately on 37 ha;
- The presence of compacted soils, of which 1,063 ha are poorly compacted; 2,436 ha are moderately compacted and 1,860 ha are heavily compacted soils.

As a result of the factors identified in the studied area, it is necessary to take improvement measures, which refer to:

- Taking hydro-ameliorative measures to eliminate excess water (groundwater or stagnant);
- Taking ameliorative measures by adding gypsum and phosphogypsum to salty soils to reduce the degree of salting, by lowering the pH level;

- Carrying out current cultural works, which ensure an optimal water and air regime in compacted soils or soils that are under the influence of excess water;
- Application of manure in doses of 30 t/ha once every 2-3 years in compacted soils to reduce the degree of compaction;
- Carrying out work in optimal humidity conditions (below 60%) to prevent soil compaction;
- Deep loosening on clay soils once every 2-3 years (Phaeozems, pellic vertisols and chromic vertisols).

If these improvement measures are taken, along with a crop rotation and the planting of legumes, especially alfalfa and red clover, the productive potential of the soils improves significantly and the quality of the soil will also be observed in the quantity and quality of the productions obtained.

CONCLUSIONS

Geographically, this locality is located in the south-western part of Timiș County in the Banato-Crișană Plain (West Plain).

From a hydrographic point of view, the commune of Giulvăz is located between two important flowing waters (the Bega canal to the north and the Timiș river to the south).

From the climatic point of view, the area is characterized by a temperate-continental climate, with average annual temperatures of 10.8 degrees C and average annual rainfall of 590 mm/year.

From a pedological point of view, the soil types identified were: chernozems, phaeozems, eutric cambisols, solonetz, pellic vertisols and chromic vertisols, as well as a series of soil associations.

The area of the commune is 10,296 ha, of which 8,908 ha is arable land. Like the area occupied by the soil types identified in the area, the situation is as follows:

- ✓ Chernozems occupy 3,285 ha, respectively 31.90% of the territory, being the representative soil type;
- ✓ The phaeozems occupy 1,719 ha, i.e. 16.70%;
- ✓ Eutric cambisols, have a spread of 1.52 ha;, respectively 10.22%
- ✓ The chromic vertisols are spread over 358 ha, i.e. approx. 3,47%;
- ✓ Pellic vertisols cover 282 ha, i.e. 2.74%.
- ✓ Solonetz occupy 1,514 ha, which represents approx. 1,47%;
- ✓ The soil associations occupy 698 ha.

These are soils that are difficult to work and in difficult conditions.

As regards the main quality classes of the identified soils, the situation is as follows:

-Class I: 68 ha;
-Class a II –a: 1,859 ha;
-Class a III –a: 2,708 ha;
-Class IV: 1,943 ha;
-Clasa a V –a: 505 ha.

The weighted average score (of creditworthiness) obtained by these soils was equal to 50, which placed them in the third class of quality.

The main factors that limit the quality of these soils are:

- excess surface moisture: 1,150 ha are poorly affected; 890 ha are moderately affected and 620 ha are strongly affected by excess moisture;
- excess groundwater moisture: 4,256 ha are moderately affected and 282 are strongly affected by the groundwater table present at shallow depths;

- moisture deficit: it manifests itself in low limits on 496 ha and moderate to high, on 1,511 ha;
- presence of salting: weak – 3,138 ha, moderate – 1,935 ha and strong – 1,514 ha;
- presence of acidification: it manifests itself weakly on 402 ha and moderately on 37 ha;
- presence of the settlement phenomenon: 1,063 ha are poorly compacted; 2,436 ha are moderately compacted and 1,860 ha are heavily compacted.
- The main necessary improvement measures are:
- hydro-ameliorative works to eliminate excess water;
- ameliorative measures by adding gypsum and phosphogypsum to reduce the degree of salting, by lowering the pH level at the solonets;
- current cultural works, to ensure an optimal water and air regime in compacted soils (pellic vertisol, chromic vertisol and phaeozems);
- application of manure in compacted soils to reduce the degree of compaction;
- carrying out agricultural works in optimal humidity conditions to prevent soil compaction;
- carrying out deep loosening works on clay soils (phaeozems, pellic vertisols and chromic vertisols).

If these improvement measures are taken, along with a crop rotation and the planting of legumes (alfalfa and red clover, soybeans, etc.), the productive potential of the soils improves significantly and their quality will be observed and the yields obtained.

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