THE EVOLUTION OF THE SOIL FERTILITY IN THE BORŞ TOWN, BIHOR COUNTY, IN THE PERIOD 1987 - 2021

Octavian BERCHEZ[1#], Alina STANCIU[1], Daniela BERCHEZ[2]

[1]University of Oradea, Faculty of Environmental Protection, Gen.Magheru st., no.26, 410048, Oradea, Romania
[2] Teacher, Emanuel Gojdu National College, Oradea, Romania

RESEARCH ARTICLE

Abstract

The town of Borş occupies a total area of 43.4 Km2, of which about 35.4 Km2 are occupied by agricultural land. In order to study the evolution of soil fertility, analyzes were carried out in the period 2020-2021 on the main trophic indicators of the soil: the pH value, the phosphorus content and the potassium content. The analyzes were performed only at the level of the arable layer. In order to estimate the evolution of the soils, the cartograms drawn up on the entire surface, based on research and laboratory analyzes in 2020, the cartogram of PH values, the cartogram of the state of potassium supply and the cartogram of the state of phosphorus supply were compared with the cartograms of the same indicators, drawn up at the level of 1987.

Keywords: fertility, TEO units, cartograms, supply status, soil units
#Corresponding author: berchez_octavian@yahoo.com

INTRODUCTION

The town of Borş is located in the N-W part of Romania, in the western part of Bihor county. Together with the localities: Biharia, Paleu, Cetariu, Ineu, Oşorhei, Sânmartin, Nojorid, Săntandrei, Toboliu and Girişul de Criş, it is part of the metropolitan area of the city of Oradea (Fig. 1, 2)

Figure 1. **The town of Borş. Location within Bihor county**

Figure 2. **The metropolitan area of the city of Oradea**

From a geographical point of view, the town of Borş is located in the Borşului Plain, a subdivision of the Crişurilor Plain. The Borşului plain occupies the soil surfaces from the south of Crişul Mic to Crişul Repede, the altitude is 98 - 110m, it extends through the Crişului Repede meadow to Oradea, with altitudes of up to 120m. On the diagonal of the Diocese of Bihor - Santăul Mic the altitude it is 110m, with the character of an intermediate plain, on the valley of Crişului Mic, on the right of Crişului Repede and along the border, the plain has the character of a meadow (fig. 3)

Figure 3. **Crișurilor plain. Borș Plain, location within Crișurilor Plain**

Figure 4. **Borș Plain**

The Borşului Plain occupies a total area of 15516 ha, in the localities of Borş, Biharia, Cetariu, Oradea, Sântandrei, Girişu de Criş, Toboliu. Large areas are occupied by alluviosols, 7229 ha, faeosols 4463.9 ha, gleiosols 2776.6 ha, eutricambosols 605 ,2 ha, preluvosols 216.3 ha, luvosols 129.2 ha, solonets 1.3 ha, About 223.3 ha are occupied by valleys, canals, waters. (fig. 5 – the soils of the Borş Plain are shown)

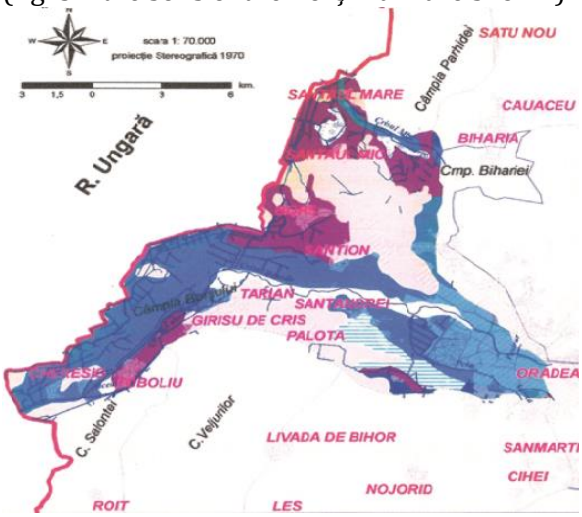

Figure 5. **Soils of the Borşului Plain**

In the town of Borş, the relief morphostructural units are: the alluvial plain and the terraces. The alluvial plain represents an old meadow of the Crişul Repede river, presenting an undulating relief due to the numerous old abandoned meanders (currently with many marshy areas) and sandy gravels. The alluvial plain occupies the largest area and occupies the central and western part of the township. The terrace occupies the north-eastern part of the town, with the southern slope of Crişul mic, with a difference in level of 2-3 m. It is presented in the form of a flat relief, gradually decreasing to the north and west, towards the alluvial plain. The parent materials on which the soils were formed and evolved are alluvial in nature, with textures ranging from sandy to clayey.

From a hydrographic point of view, the study territory belongs to the Crişul Repede basin, the Crişul Repede river is located in the southern part of the study territory at a distance of 2 Km. The flowing waters with a permanent flow are represented by the Crişul Mic river that crosses the territory of Borş from east to west, being a tributary of the Crişul Repede river.

The groundwater is found at different depths, in the alluvial plain it is located at depths between 0.6 and 2 m, and in the terrace areas at 3-4 m depth. The aquifer layer with the highest flow rate is at a depth of 4.8 m, with a flow rate of 10.75 l/s.

The average annual temperature is 10.5°C, with the average temperature of the hottest month – July, of 21.2°C and the average temperature of the coldest month – 1.5°C.

The sum of the temperatures that are achieved during the vegetation period (March 1 - October 31) is 3540°C. Early autumn frosts usually occur in October and late spring frosts in March, rarely in April, occasionally in May.

Average annual precipitation is 635 mm. The most frequent winds are from the south, north and southeast.

MATERIAL AND METHOD

In the terrace areas and the higher areas of the alluvial plain, soil units were formed represented by: Fluvisols, Phaeozems and Eutric Cambisols..

Most of the alluvial plain is occupied by the types of soils: Fluvisols and Phaeozems. In the low-lying areas of the alluvial plain, with water table at critical or subcritical depth, Gleysols and gleyic subtypes of other soil types have formed. In Table 1, soil units from Borş are presented.

Table 2 shows the values of the main chemical soil indicators per soil unit, determined at the level of 2021

Table 1

Soil unit from Borş township

Soil Unit	Relief	Material of solification	Water level (m)
Haplic phaeozems	terrace	lossoid material	3
Gleyi-luvic phaeozems	terrace	lossoid material	2
Haplic phaeozems	terrace	lossoid material	3
Mollic Cambisols	terrace	lossoid material	2
Fluvi-eutric Cambisols	alluvial plain	material aluvionar.	0,9
Eutric Cambisols	terrace	lossoid material	2
Gleyi-eutric Cambisols	alluvial plain	alluvial material	1,2
Gleyi-mollic Cambisols	alluvial plain	alluvial material	1,2
Gleyic Phaeozems	alluvial plain	alluvial material	1,0
Mollic Gleysols	alluvial plain	alluvial material	0,9
Mollic Fluvisols	alluvial plain	alluvial material	3,0
Gleyi-mollic Fluvisols	alluvial plain	alluvial material	2,0
Gleyic Fluvisols	alluvial plain	alluvial material	1,2
Arenic Fluvisols	meadow	alluvial material	3,0
Eutric Fluvisols	meadow	alluvial material	3,0

Table 2

The values of the main chemical soil indicators per soil unit, determined at the level of 2021

Soil Unit	pH	$CaCO_3$ %	Humus %	total N %	mobile P mg/100g soil	mobile K mg/100g soil
Haplic phaeozems	6,0	0,2	2,39	0,11	0,8	6,1
	5,65	0,2	1,99	0,09	1,2	8,6
Gleyi-luvic phaeozems	5,8	0,2	2,38	0,11	7,6	11,8
Haplic phaeozems	7,2	0,4	4,08	0,19	1,00	3,3
Mollic Cambisols	6,5	-	2,40	0,21	5,2	6,5
Fluvi-eutric Cambisols	7,8	-	2,35	0,09	3,6	7,6
Eutric Cambisols	7,3	0,2	3,70	0,21	3,7	8,6
Gleyic Phaeozems	7,00	0,4	2,47	0,13	3,9	11,4
Mollic Gleysols	6,95	0,4	2,78	0,13	6,8	12,4
Mollic Fluvisols	7,4	-	3,67	0,17	14,4	24,8
Gleyi-mollic Fluvisols	7,10	-	4,21	0,21	5,1	10,5
Gleyic Fluvisols	6,10	-	2,64	0,17	1,4	7,2
Arenic Fluvisols	5,9	-	1,14	0,09	1,2	4,7
Eutric Fluvisols	6,4	-	3,72	0,19	1,9	6,1

RESULTS AND DISCISSION

The evolution of soil fertility potential could be established following the creation of maps: Map of pH values, Map of soil supply in K and map of soil supply in P. The maps were drawn up at the level of 1987 and 2021 respectively. The maps drawn up at the level of 1987 were made on the basis of the documentation made available by OSPA Bihor, while the cartograms drawn up for the year 2021 were based on the research, studies and analyzes carried out in the period 2020 - 2021. In Figure 5 and 6, the cartograms of the pH values for the year 1987 are presented comparatively and the year 2021.

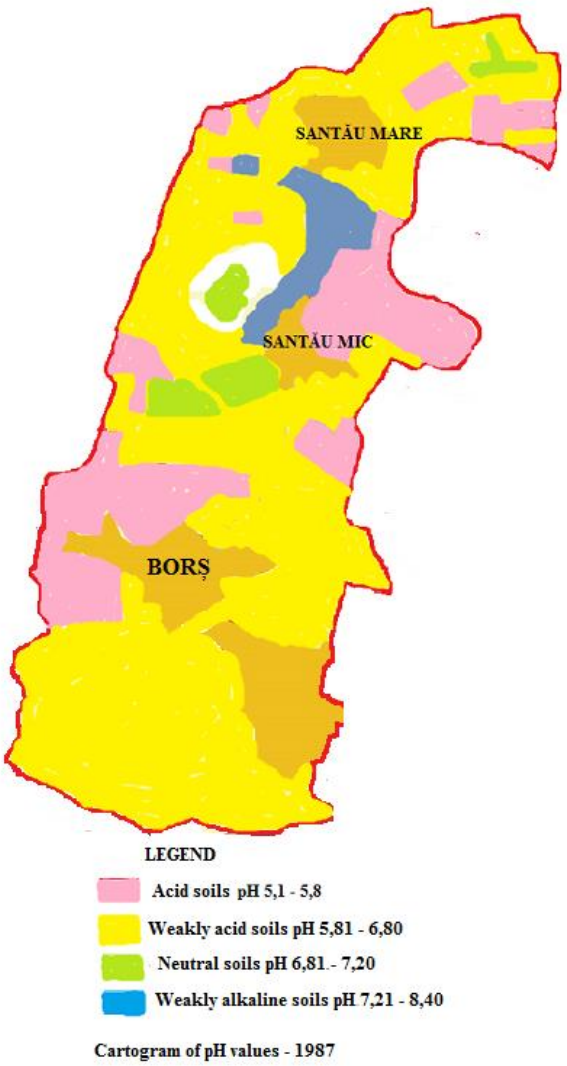

Figure 6. **Cartograms of pH values for the year 1987**

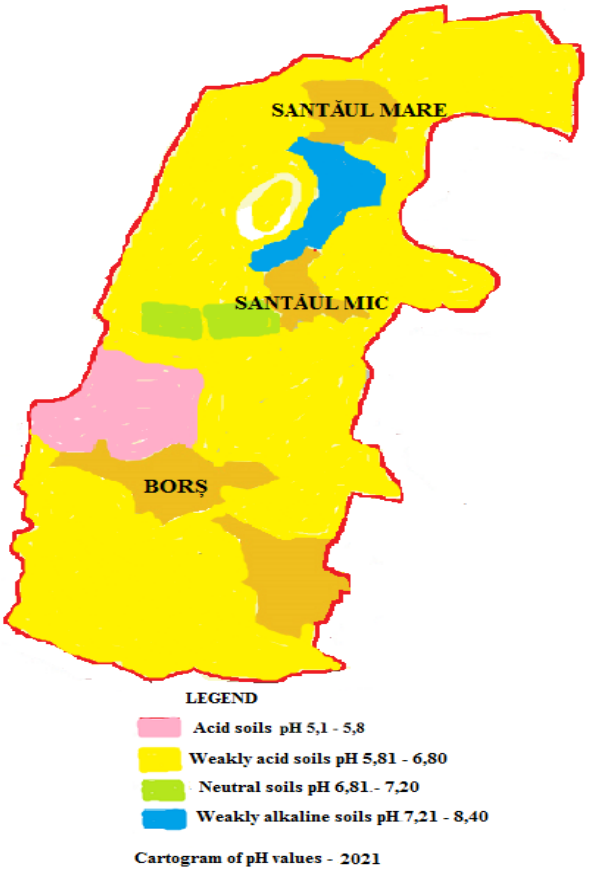

Figure 7. **Cartograms of pH values for the year2021**

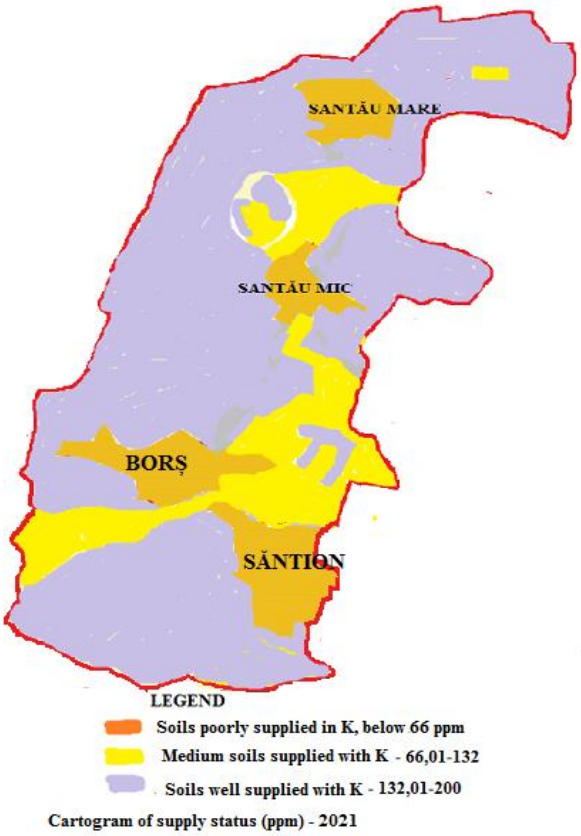

Figure 8. **Cartogram of K supply status (ppm) - 1987**

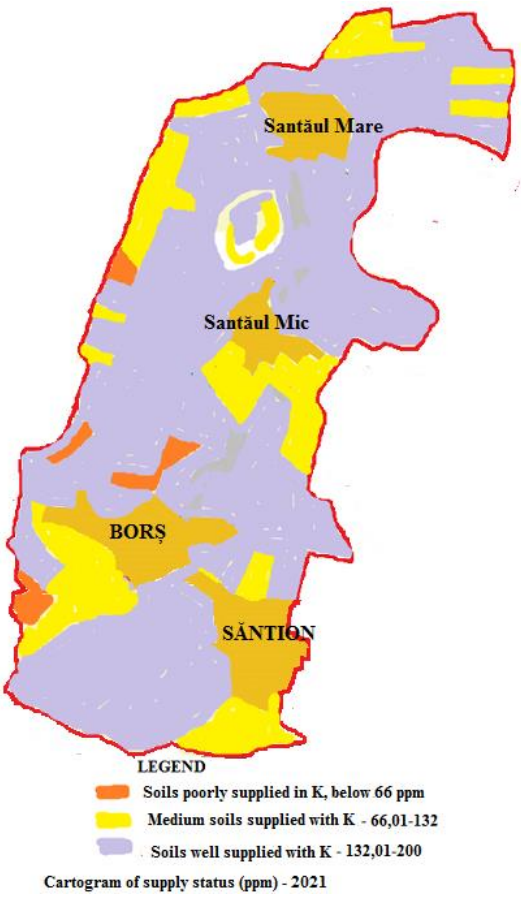

Figure 9. **Cartogram of K supply status (ppm) – 2021**

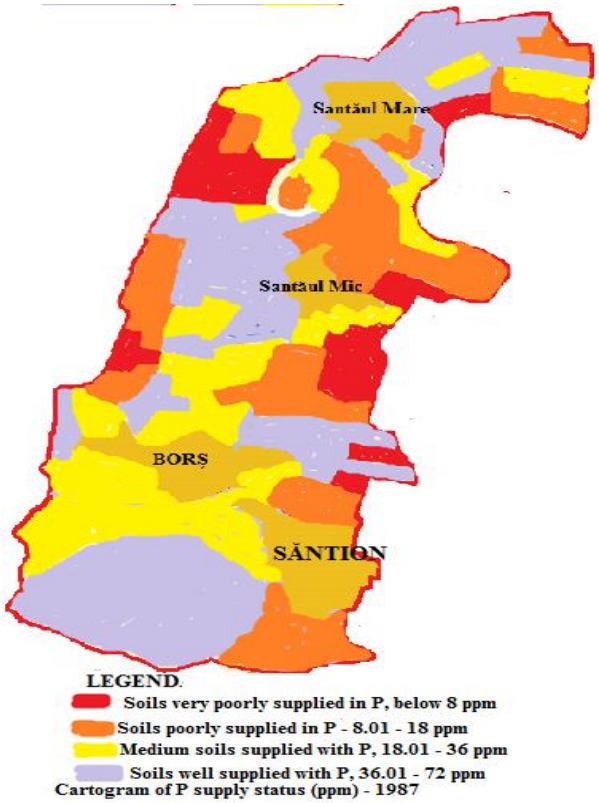

Figure 10. **Cartogram of supply status (ppm) - 1987**

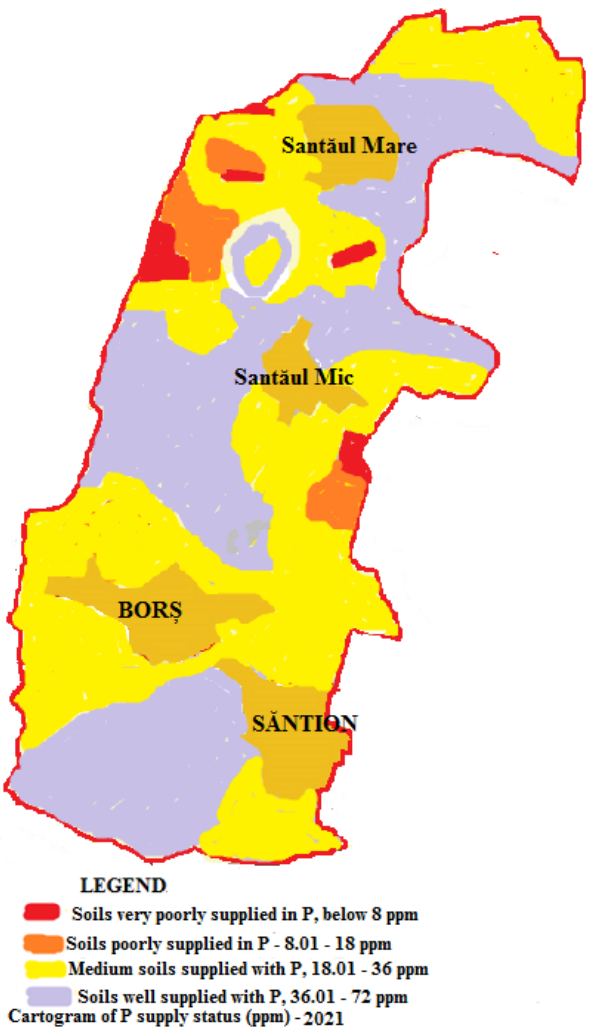

Figure 11. **Cartogram of P supply status (ppm)- 2021**

CONCLUSIONS

1. Conclusions regarding the evolution of the pH value during the period 1987 – 2021

Compared to 1987, a decrease in areas with acidic soils (pH 5.1 – 5.8) and an increase in areas with slightly acidic soils (pH 5.81 – 6.80) can be noted. The areas occupied by neutral and weakly alkaline soils generally occupy the same areas. The change in pH values over time is mainly due to the ameliorative works carried out by administration of carbonate amendments.

2. Conclusions regarding the evolution of soil potassium supply, in the period 1987 – 2021.

Compared to 1987, at the level of 2021, the areas with well-supplied soils in potassium decrease and the areas of medium-supplied soils increase. At the same time, the appearance of soils poorly supplied with potassium is noted.

Conclusions regarding the evolution of soil phosphorus supply, in the period 1987 – 2021.

At the level of 2022, there is an increase in the areas with well and medium soils supplied with

phosphorus and a decrease in the areas with poorly and very poorly supplied soils.
The changes made between 1987 and 2021 regarding the supply of soil with nutrients for plants are mainly due to the application of an undifferentiated agricultural technique on crops and the administration of organic and chemical fertilizers in doses uncorrelated with the specific consumption of plants and the soil's reserve of nutrients.

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