THE TROPHIC CONDITIONS FOR AGRICULTURAL CROPS, FROM THE MIERSIGULUI PLAIN

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Abstract

The purpose and objective of the research is to study the trophic conditions of agricultural crops in the Miersig Plain from a pedological and climatic aspect, and to define the limiting factors of agricultural production. The climate changes that have occurred in recent years, manifested by changes in the rainfall regime, have determined considerable decreases in agricultural production, for the main agricultural crops in the study area: corn, grass cereal, sunflower, rapeseed.

The thorough knowledge of the climate regime, in the context of the climate changes that have occurred in recent years, allows a better rationing and rotation of agricultural crops, as well as the choice of the assortment of crops with a high degree of adaptability.

Keywords: climatic regime, climatic parameters, soil units, fertility, phreatic moisture, rain moisture, nutritional elements

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INTRODUCTION

The Miersigului Plain, from a geographical point of view, is a subdivision of the Crișurilor Plain, occupying the central and eastern part (Figure 1). It occupies an area of 21496.6 ha, in the localities of Nojorid (Livada de Bihor, Nojorid, Leș, Chișirid, Apateu, Păușa), Sânmartin (Sânmartin, Cihei,), Gepiu (Gepiu, Bicaci), Mădăras (Ianoșda), Tinca (Gurbrdiu, Tinca), Husăsău de Tinca (Miersig, Husăsău de Tinca), southern Oradea.

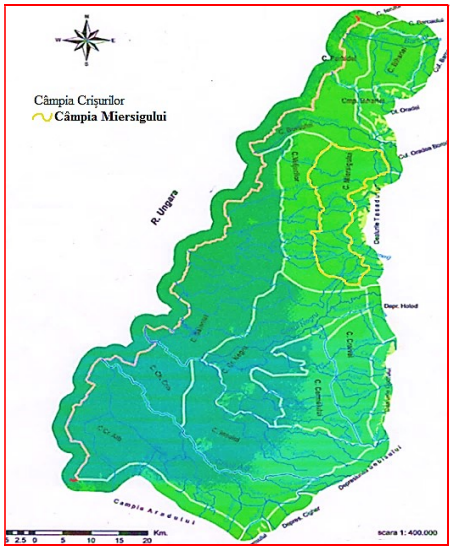


Figure 1. Miersig Plain. subunit of the Crișurilor Plain (Source: processing after G. Posea)

In the Miersig Plain, surface deposits are represented by deluvial, proluvial and deluvial-proluvial deposits.

The most widespread are loessoid deposits, clays, clayey marls, sands and gravels. Ground water is found at critical and subcritical depths in some sectors of the plain, in the area of Husăsău de Tinca and in the southern part of the city of Oradea, in the rest of the territory it is at depths greater than 4-5 m, without influencing the physical properties -chemical and hydric of soils

Figure 3 shows the Map of surface deposits in the Miersigului Plain.

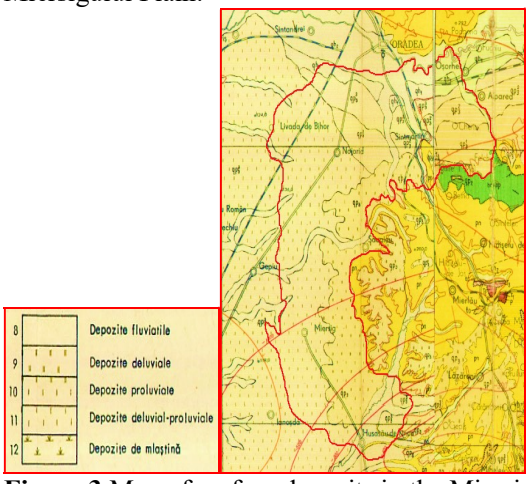


Figure 3 Map of surface deposits in the Miersig Plain

From west to east the altitude of the Miersig Plain from 200 to 260 m

MATHERIAL AND METHODE

The study of climatic parameters: air temperature, soil temperature, precipitation and air current movements was carried out over a period of 4 years - 2019, 2020, 2021, 2022, based on the data provided by ANM Bucharest, for the Oradea Meteorological Station.

1. Air temperature

Being the result of the interaction between solar radiation, atmospheric circulation and the earth's surface, air temperature shows variations depending on altitude, local and general circulation of the atmosphere, microrelief, vegetation, slope, exposure, hydrography. For the research period 2019 – 2022, the average temperature over the 4 years of research was +12.2 ℃, with absolute minimum values of -13.9 ℃ (12.01.202) and maximum values of +38.7 ℃ (23.07. 2022)

Table 1 shows the average annual temperature values for the period 01.01.2019 – 31.12.2022

Table 1. Average annual temperatures for the period 01.01.2019 – 31.12.2022

The year	Medium temperature annually	The minimum value registered	Maximum value recorded
2019	+12,9	-12,1 – 08.01.2019	+36,1 – 12.08.2019
2020	+11,9	-8,8 – 08.01.2020	+34,9 – 30.08.2020
2021	+11,6	-13,3 – 16.01.2021	+37,1 – 16.08.2021
2022	+12,3	-13,9 – 12.01.2022	+38,7 – 23.07. 2022

Figure 3 shows the graph of average annual temperatures recorded in the period 2019 – 2022

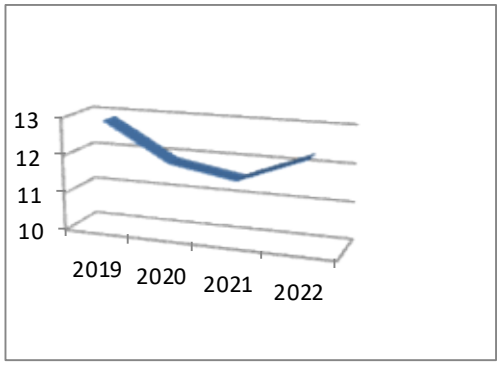


Figure 3. Graph of average annual temperatures

Average monthly temperatures for the entire study period 2019 – 2022 showed minimum values in January of -0.2℃ and maximum values in August of 23.3℃.

Table 2 shows the average monthly temperature values for the period 01.01.2019 – 31.12.2022

Table 2. Average monthly temperature values, period 01.01.2019 – 31.12.2022

Month	Medium value	Minimum value, date	Maximum value, date
I	-0,2	-13,9 – 12.01.22	+14,9 – 01.01.23
II	+4,2	-12,9 – 13.02.21	+18,0 – 03.02.19
III	+6,6	-6,7 – 12.03.22	+20,9 – 13.03.19
IV	+10,8	-3,1 – 11.04.20	+28,6 – 26.04.19
V	+15,2	+2,3 – 04.05.21	+28,4 – 11.05.21
VI	+21,9	+6,3 – 02.06.20	+37,2 – 30.06.22
VII	+22,9	+8,6 – 10.07.19	+38,7 – 23.02.22
VIII	+23,3	+10,2 – 19.08.21	+37,1 – 16.08.21
IX	+17,6	+2,9 – 23.09.21	+32,7 – 01.09.19
X	+12,6	-0,9 – 08.09.19	+27,1 – 04.10.20
XI	+7,5	-3,1 – 22.11.20	+23,9 – 04.11.21
XII	+3,8	-7,0 – 23.12.21	+17,5 – 05.12.20

Figure 4 shows the graph of average monthly temperatures for the study period 2019 – 2022.

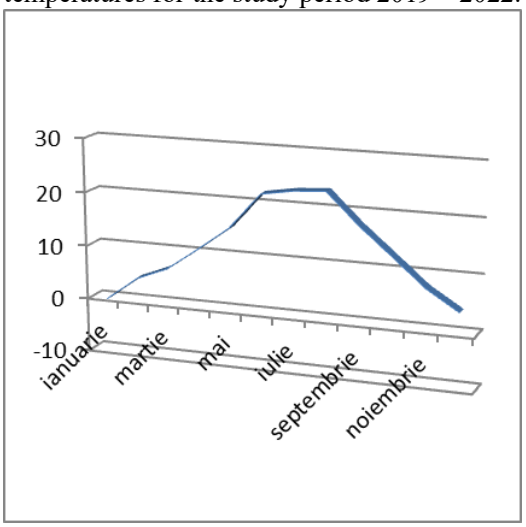


Figure 4. Graph of average monthly temperatures for the period 2019 – 2022

2. Soil temperature

It depends on the amount of energy received from the sun, the thermophysical properties of the soil, the forms of macro and microrelief, the exposure, the type and presence of the vegetal carpet, the presence or absence of the snow cover, the morphological characteristics of the soil.

The average annual temperature of the soil has a value of 11.64

Average monthly temperatures recorded at the soil surface are presented in Table 3

Table 3. Average monthly temperatures recorded at the soil surface (°C) for the period 2019 - 2022 (data provided by ANM)

Oradea Weather Station	
Month	Recorded values
I	-1,1
II	0,4
III	5,5
IV	11,9
V	19,2
VI	23,0
VII	24,6
VIII	23,5
IX	17,2
X	10,8
XI	4,4
XII	0,3

Figure5. Ggraphically shows the monthly variation of average monthly temperatures recorded on the surface of the soil during the period 2019 – 2022.

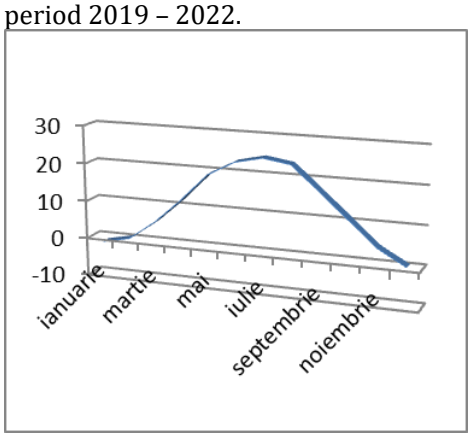


Figure 5. Graph of average monthly temperatures, recorded at the ground surface, for the period 2019 - 2922

The lowest values of the monthly average temperature were -1.1°C in January and the highest 24.6°C in July.

3. Rainfall

The values of the pluviometric regime for the 2019-2022 research period were provided by ANM - Oradea Meteorological Station. For the entire research period 2019 - 2022, the amount of total precipitation recorded was 3198 mm.

Table 4 shows the total amount of precipitation recorded in the period 01.01.2019 – 31.12.2022

Table 4. The total amount of precipitation recorded in the period 01.01.2019 – 31.12.2022

Period	Total amount of precipitation	Share of days with precipitation
01.01.2019 – 31.12.2022	3198 mm	596

The annual precipitations recorded have values between 667 mm and 945 mm, the highest values were recorded in 2020 and the lowest values in 2021.

Table 5 shows the amount of annual rainfall recorded for the study years: 1019, 2020, 2021, 2022.

Table 5. The total amount of precipitation recorded annually, 01.01.2019 – 31.12.2022

Period	Total amount of precipitation	Share of days with precipitation
01.01.2019-31.12.2019	835 mm	158
01.01.2020 – 31.12.2020	945 mm	138
01.01.2021 – 31.12.2021	667 mm	150
01.01.2022 – 31.12.2022	752 mm	150

The graph of annual precipitation for the period 2019 – 2022 is presented in **Figure 6**

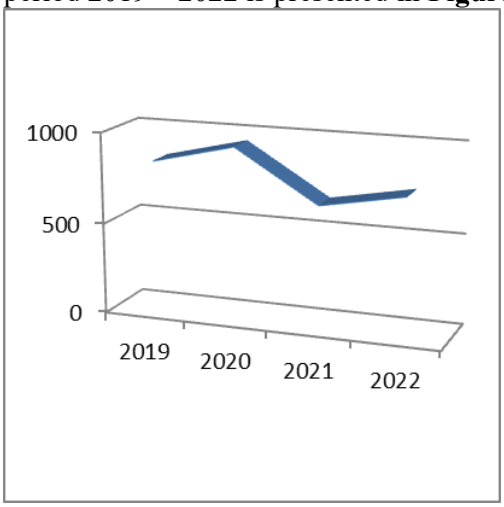


Figure 6. Graph of annual precipitation for the period 2019 – 2022

The amount of monthly precipitation recorded in the period 2019 - 2022 had values between 131 mm and 446 mm, the lowest values were recorded in October and the highest in May.

Table 6 shows the amount of monthly precipitation recorded in the period 01.01.2019 – 31.12.2022

Table 6. Amount of monthly precipitation recorded in the period 01.01.2019 – 31.12.2022

Month	Amount of monthly precipitation	Share of days with precipitation
I	227 mm	68
II	200 mm	48
III	135 mm	33
IV	238 mm	49
V	446 mm	68
VI	410 mm	45
VII	361 mm	39
VIII	139 mm	40
IX	326 mm	44
X	131 mm	33
XI	281 mm	55
XII	305 mm	74

Figure 7shows the graph of the amount of monthly precipitation recorded, at the level of the period 2019 – 2022

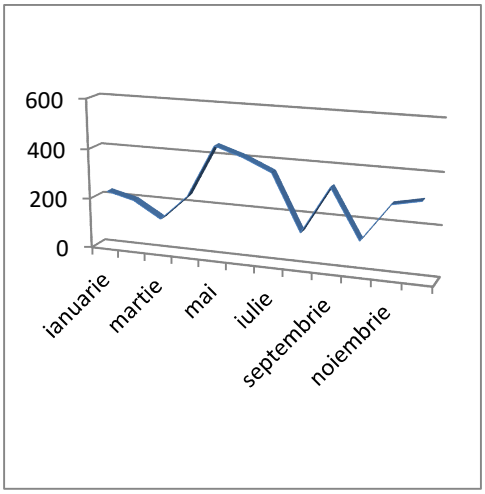


Figure 7. Graph of the amount of monthly precipitation for the period 2019 – 2022

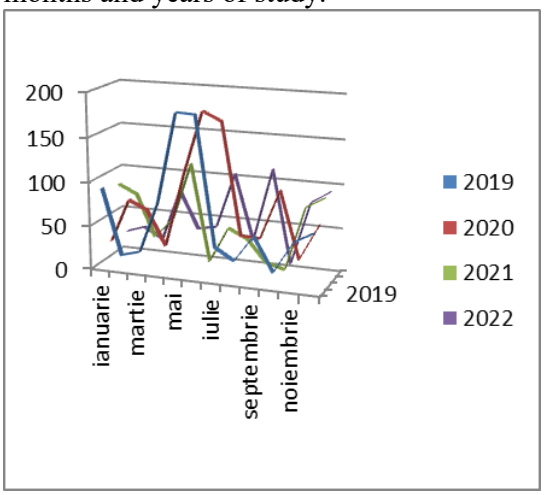
The monthly precipitation recorded in 2019 had values between 17 mm and 183 mm, the lowest values are in February and October, and the highest in May.

During the entire research period, the lowest values of monthly precipitation were recorded in October (6 mm) in the study years 2021 and 2022 and the highest of 183 mm in May 2019.

Table 7 shows the recorded monthly rainfall, by research years: 2019, 2020, 2021, 2022

Month	Recorded monthly precipitation - mm			
	2019	2020	2021	2022
I	92	25	86	24
II	17	75	76	31
III	23	65	28	19
IV	81	26	51	79
V	183	110	117	36
VI	182	182	6,2	40
VII	38	172	47	104
VIII	25	47	37	29
IX	55	46	12	213
X	17	102	6,0	6
XI	53	27	79	79
XII	65	68	92	93

Figure 8 shows the graph of precipitation by months and years of study.



4. The relative humidity of the air

The values of the relative humidity of the air were processed based on the data provided by ANM - Oradea Meteorological Station.

The average relative humidity of the air, per month, expressed in %, at 2 m above the ground, showed the lowest values in April, the highest values characterize the month of February.

Table 8 shows the average relative humidity of the air, per month, expressed in %, at 2 m above the ground, for the period 01.01.2019 – 31.12.2022

Table 8. Average relative humidity of the air, per month, expressed in %, at 2 m above the ground, for the period 01.01.2019 – 31.12.2022

Month	Average value - %	Minimum value - date
I	86	41 – 02.01. 21
II	87	30. – 28.02.19
III	75	13 – 27.03.22
IV	59	15 – 19.04.19
V	62	19 – 23.05.20
VI	70	12 – 21.06.22
VII	66	15 – 22.07.22
VIII	62	18 – 30.08.19
IX	61	20 – 22.09.19

X	67	24 – 24.10.19
XI	74	35 – 19.11.19
XII	86	86 – 20.12.19

The relative air humidity expressed in %, at 2 m above the ground, for the period 01.01.2019 – 31.12.2022, by research months and years, showed the lowest values in July 2022 and maximum values in January and November 2020 .

Table 9 shows the relative air humidity expressed in %, at 2 m above the ground, for the period 01.01.2019 – 31.12.2022, recorded annually.

Table 9. Relative air humidity expressed in %, at 2 m above the ground, for the period 01.01.2019 – 31.12.2022, recorded annually.

Month	Medium value - %			
	2019	2020	2021	2022
I	87	90	85	83
II	76	74	81	74
III	60	65	64	51
IV	62	50	69	68
V	70	66	72	63
VI	66	77	60	55
VII	62	72	61	50
VIII	61	63	62	59
IX	62	64	64	78
X	74	82	66	80
XI	86	90	84	89
XII	86	85	88	87

5. The wind

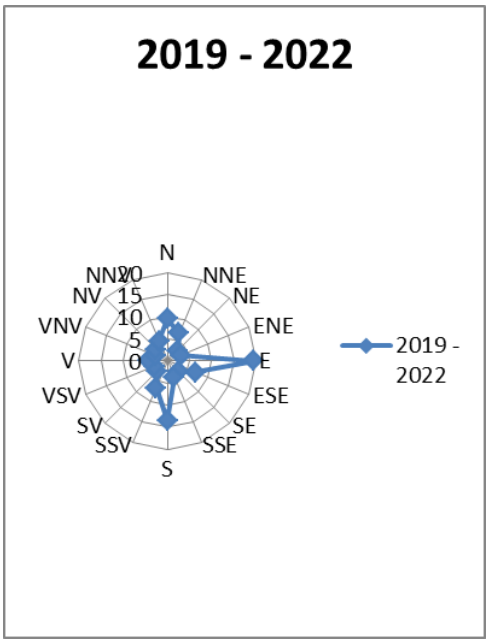
To establish the cardinal direction of the dominant air currents and the frequency, data provided by ANM - Oradea Meteorological Station were used.

Table 10 shows the cardinal direction of air currents and frequency, for the entire study period 01.01.2019 – 31.12.2022

Table 10. Cardinal direction of air currents and frequency, for the entire study period 01.01.2019 – 31.12.2022

Period	N	NNE	NE	ENE
01.01.2019 - 31.12.2022	9.5 %	6.8 %	3.3 %	3.3 %
	E	ESE	SE	SSE
	19.6 %	6.8 %	3.5 %	4.0 %
	S	SSV	SV	VSV
	13.5 %	6.6 %	4.4 %	3.2 %
	V	VNV	NV	NNV
	4.3 %	2.7 %	3.5 %	4.9 %

Figure 9 graphically shows the cardinal direction of air currents and frequency, during the period 01.01.2022 – 31.12.2022.



6. Soil units of the Miersig Plain

The research, identification and spatial delimitation of the soil taxonomic units belonging to the Crişurilor Plain, was carried out in the period 2019-2022, by researching a number of over 30 main profiles, over 80 secondary profiles and over 150 control profiles, located in the field in in accordance with the pedological norms of soil research. The analyzes regarding the physico-chemical indicators of the soil were carried out in the Laboratory of Pedology of the Faculty of Environmental Protection, University of Oradea, and in the laboratories of the Office of Pedological and Agrochemical Studies in Bihor.

Table 11 shows the soil cover of the Miersig Plain (by territorial administrative units), classes, soil types and surfaces. (according to SRTS 2012+).

Table 11. The soil cover of the Miersig Plain (by territorial administrative units), by soil classes and types (according to SRTS 2012+)

Soil type	Distribution area	Ha
Fluvisols (Aluviosol SRTS)	Oradea, Păușa, Miersig, Husasău de Tinca	885,9
Phaeozems (Faeoziom SRTS)	Livada de Bihor, Husasău, Leș, Nojorid	4639,4
Eutric Cambisols (Eutricambosol SRTS)	Leș, Nojorid	934,7
Haplic Luvisols (Preluvosol SRTS)	Sânmartin, Cihei, Oradea,Apateu, Gepiu, Miersig, Husasău de Tinca, Gurbediu	2339,9
Haplic Luvisols (Luvosol SRTS)	Oradea, Sânmartin, Cihei, Chișirid, Păușa, Miersig, Anoșde, Husasău de Tinca, Gurbediu	9211,1
Gleysol (Gleiosol SRTS)	Husasău de Tinca	162,8 ha
Stagnic Cambisols, Stagnic Luvisols (Stagnosol)	Husasău de Tinca, Miersig, Păușa, Oradea, Sânmartin	3304,6

The Miersig Plain occupies a total area of 21496.6 ha, in the localities of Nojorid, Gepiu, Mădăras, Tinca, Husăsău de Tinca, Sânmartin, Oradea. Luvosols have the widest distribution, with 9211.1 ha, followed by faeozoals with 4639.4 ha, stagnosols 3304.6 ha, preluvosols 2339.9 ha, eutricambosols 934.7 ha, alluviosols 885.9 ha, gleiosols 162.8 Ha. The waters occupy an area of 18.2 ha.

Following the processing of the information obtained in the field by performing the main, secondary and control profiles and the correlation with the laboratory analyses, the Soil Map of the Miersigului Plain was drawn up.

Figure 10 shows the soil map of the Miersig Plain

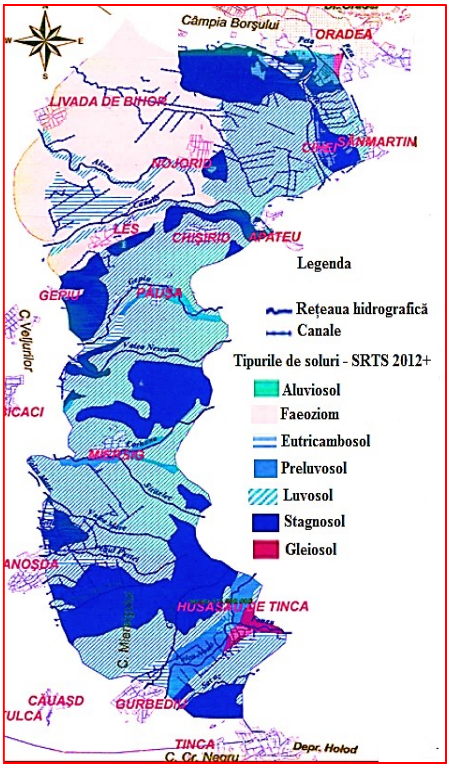


Figure 10. Soil map of the Miersig Plain

RESULTS AND DISCUSSIONS

The main limiting factors of agricultural production in the Miersig Plain are represented by:

* Climate regime
* Excess rain moisture
* Excess phreatic moisture
* Current soil acidity
* Low content in nutritional elements

1. Climatic regime

The climate regime influences the processes of growth, development and fruiting of plants through the main climatic indicators: temperature, precipitation, cardinal direction of air currents and frequency.

Temperature

Temperature is one of the limiting factors of agricultural production in the Miersig Plain. The analysis of the temperature regime was carried out based on the data provided by ANM - Oradea Meteorological Station.

For the research period 2019 – 2022, the average annual temperature had values between 11.6℃ and 13℃. The maximum values (13℃) were recorded in 2019 and the minimum values in 2021 (13℃).

Table 12 shows the average annual temperatures recorded during the research period, 2019 – 2022.

Table 12. Average annual temperatures recorded during the research period, 2019 – 2022.

Period	Average value - ℃
01.01.2019 - 31.12.2019,	+13.0
01.01.2020 - 31.12.2020,	+11.9
01.01.2021 - 31.12.2021,	+11.6
01.01.2022 - 31.12.2022,	+12.4

Figure 11 shows the graph of average annual temperatures recorded during the research period, 2019 – 2022

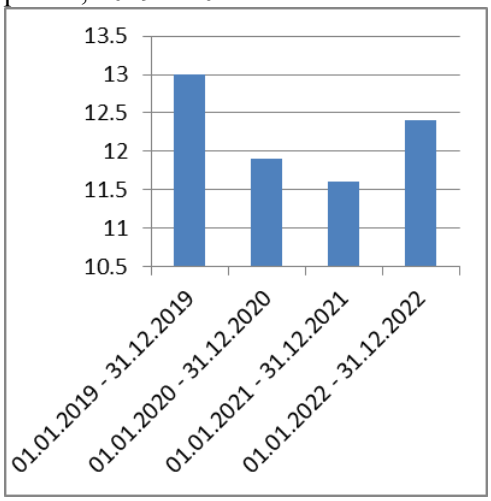


Figure 11. Graph of average annual temperatures recorded during the research period, 2019 – 2022. Average temperatures during the bioactive period April-September (04.01 – 09.30)

for the entire research period they had values between 18.2℃ in the year 2020 and 19.1℃ in the years 2019 and 2022.

The average temperatures recorded during the bioactive period April-September (01.04. – 30.09), for the study years 2019, 2020, 2021, 2022 are presented in **Table 13**

Table 13. Average temperatures recorded during the bioactive period April-September (01.04. – 30.09), for the study years 2019, 2020, 2021, 2022.

Period	Average value - ℃
01.04.2019 - 30.09.2019,	+19.1
01.04.2020 - 30.09.2020,	+18.2
01.04.2021 - 30.09.2021,	+18.3
01.04.2022 - 30.09.2022,	+19.1

Figure 12 shows the graph with the average temperatures recorded during the bioactive period April-September (01.04. – 30.09), for the study years 2019, 2020, 2021, 2022.

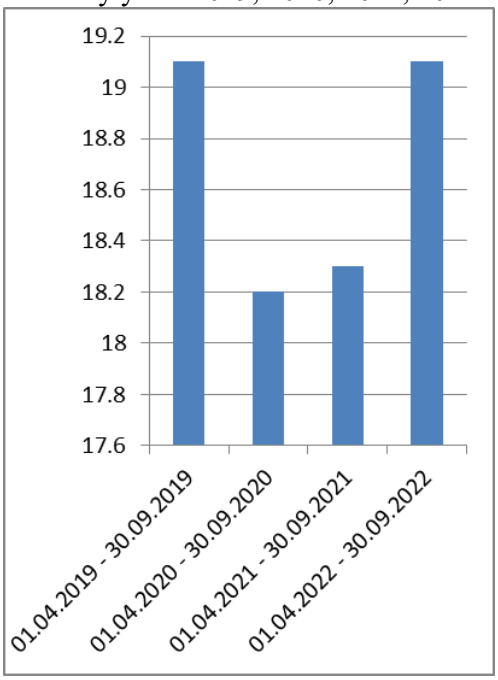


Figure 12. Graph of average temperatures recorded during the bioactive period April-September (01.04. – 30.09), for the study years 2019, 2020, 2021, 2022.

For the period of maximum drought, June – August, the highest average was recorded in 2021 – 22.9℃ and the lowest in 2020 – 21.5℃.

The average temperatures recorded in the summer period June – August (01.06.2019 – 31.08.2022) for the study years 2019, 2020, 2021, 2022 are presented in Table 14.

Table 14. Average temperatures recorded in the summer period June – August (01.06.2019 – 31.08.2022) for the study years 2019, 2020, 2021, 2022.

Period	Average value - ℃
01.06.2019 - 31.08.2019	+22.7
01.06.2020 - 31.08.2020	+21.5
01.06.2021 - 31.08.2021	+22.9
01.06.2022 - 31.08.2022	+23.7

Figure 13 shows the graph of average temperatures recorded in the summer period June - August (01.06.2019 - 31.08.2022) for the study years 2019, 2020, 2021, 2022.

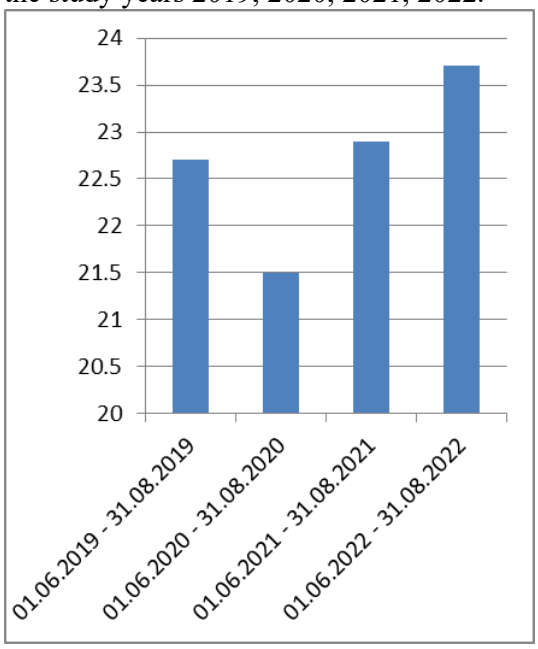


Figure 13. Graph of average temperatures recorded in the summer period June – August (01.06.2019 – 31.08.2022) for the study years 2019, 2020, 2021, 2022

For the entire bioactive period March – October, 2019 – 2022, the average values of monthly temperatures were between 5.0°C and 24.2°C. The minimum values of the monthly average were recorded in March 2021 and the maximum values in August 2022.

Average monthly temperatures from the bioactive period March - October, by research years, are presented in **Table 15**.

Table 15. Average monthly temperatures from the bioactive period March – October, 2019, 2020, 2021, 2022.

Month	Monthly average temperature - ℃			
	2019	2020	2021	2022
III	+8,7	+7,2	+5,0	+5,3
IV	+13,4	+11,2	+8,8	+9,7
V	+14,8	+14,4	+14,6	+17,2
VI	+22,7	+20,0	+22,0	+22,9
VII	+21,5	+21,3	+24,9	+24,0
VIII	+24,0	+23,3	+21,8	+24,2
IX	+18,1	+19,1	+17,3	+16,1
X	+13,7	+12,9	+11,0	+12,9

Figure 14 shows the graph with average monthly temperatures from the bioactive period March – October, 2019, 2020, 2021, 2022

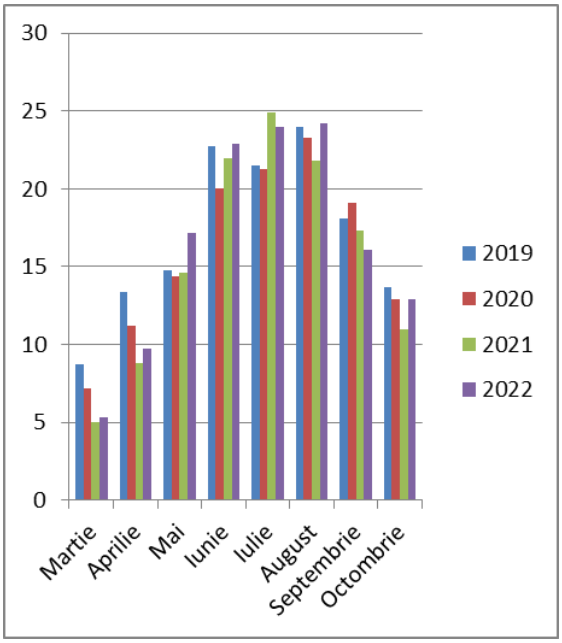


Figure 14. Graph of average monthly temperatures from the bioactive period March – October, 2019, 2020, 2021, 2022

Rainfall

Precipitation directly influences the development and production of agricultural crops, through the annual amount of precipitation, the amount of precipitation from the bioactive period April - October, the amount of precipitation during the summer (maximum drought period) June - August and the distribution over time.

Precipitation values were processed based on data taken from ANM - Oradea Meteorological Station.

For the research period 2019 – 2022, the highest amount of recorded precipitation was 945 mm in 2020 and the lowest was 667 in 2021.

The annual precipitation recorded in the period 2019 – 2022 is presented in **Table 16**.

Table 16. Annual precipitation recorded in the period 2019 – 2022.

Period	Amount of precipitation.	Share of days with precipitation
01.01.2019 - 31.12.2019,	835	158
01.01.2020 - 31.12.2020,	945	138
01.01.2021 -	667	150

31.12.2021,		
01.01.2022 - 31.12.2022,	752	150

The annual precipitation recorded in the period 2019 – 2022 is presented graphically in **Figure 15**.

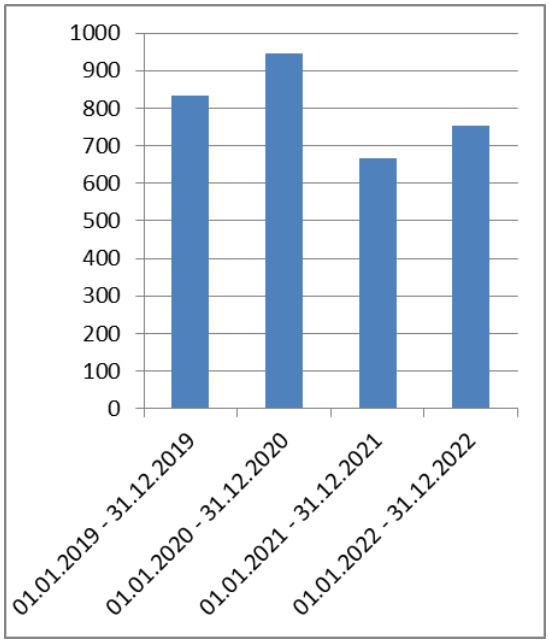


Figure 15. Graph of annual precipitation recorded in the period 2019 – 2022

For the bioactive period March - September ((01.04. - 30.09), for the study years 2019, 2020, 2021, 2022, the amount of recorded precipitation showed minimum values in the year 2921 and maximum values in the year 2020.

Table 17 shows the amount of precipitation from the bioactive period March - September ((01.04. - 30.09), for the study years 2019, 2020, 2021, 2022

Table 17. The amount of precipitation from the bioactive period March – September ((01.04. – 30.09), for the study years 2019, 2020, 2021, 2022.

Period	Amount of precipitation	Share of days with precipitation
01.04.2019 - 30.09.2019,	567	77
1.04.2020 - 30.09.2020,	583	63
01.04.2021 - 30.09.2021,	270	64
01.04.2022 - 30.09.2022,	499	81

The amount of precipitation from the bioactive period March - September ((01.04. - 30.09), for the study years 2019, 2020, 2021, 2022 are shown graphically in **Figure 16**.

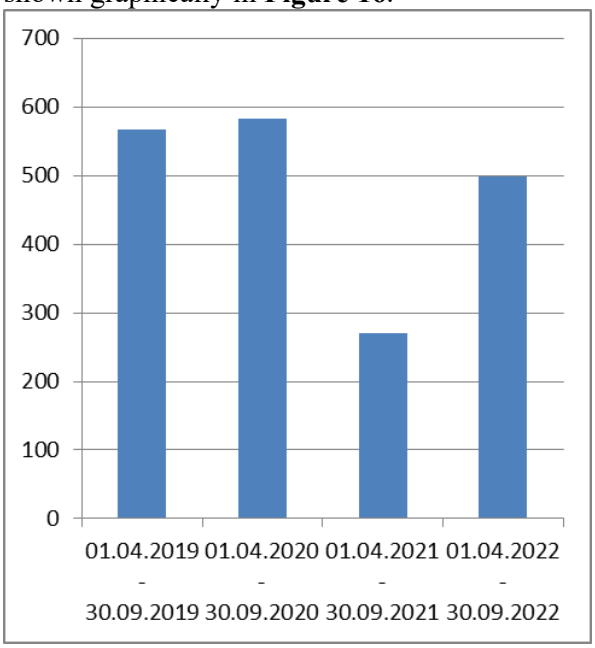


Figure 16. The amount of precipitation from the bioactive period March – September ((01.04. – 30.09), for the study years 2019, 2020, 2021, 2022

The amount of precipitation recorded during the period of maximum drought, June – August (01. 06. 2019 – 31.08.2022) for the study years 2019, 2020, 2021, 2022, showed minimum values in 2021 and maximum values in 2020.

Table 18 shows the amount of precipitation from the summer period, June – August (01.06.2019 – 31.08.2022) for the study years 2019, 2020, 2021, 2022

Table 18. Sum of precipitation in the summer period, June – August (01.06.2019 – 31.08.2022) for the study years 2019, 2020, 2021, 2022.

Period	Amount of precipitation	Share of days with precipitation
01.06.2019 - 31.08.2019,	247	32
01.06.2020 - 31.08.2020,	401	38
1.06.2021 - 31.08.2021,	90	24
01.06.2022 - 31.08.2022,	172	30

In **Figure 17**, the amount of precipitation from the summer period, June – August (01. 06. 2019 – 31.08.2022) for the study years 2019, 2020, 2021, 2022 is graphically represented.

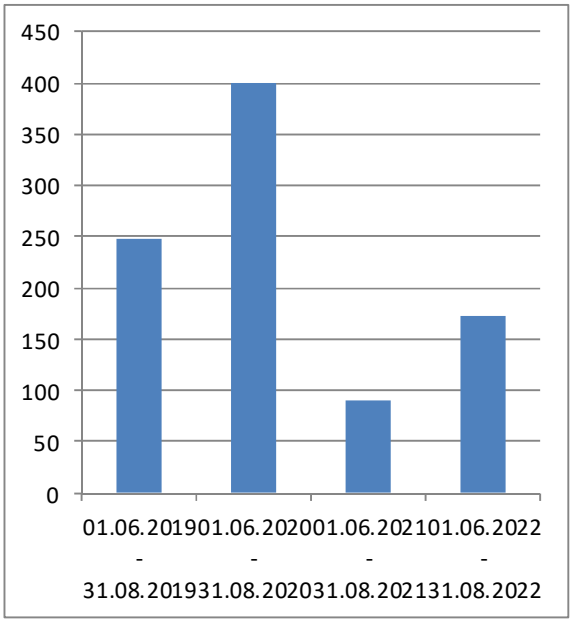


Figure 17. Sum of precipitation in the summer period, June – August (01.06.2019 – 31.08.2022) for the study years 2019, 2020, 2021, 2022

For the period March – October, the average monthly rainfall recorded showed the lowest values in October 2021 – 5.6 mm and October 2022 – 6 mm.

The highest values were recorded in May 2019 – 183 mm, June 2019 – 182 mm and June 2020 – 182 mm.

Table 19 shows the average monthly rainfall recorded by study years, 2019 - 2022

Table 19. Average monthly rainfall recorded by study years, 2019 – 2022.

Month	Amount of monthly precipitation - mm			
	2019	2020	2021	2022
III	23	65	28	19
IV	81	26	51	79
V	183	110	117	36
VI	182	182	6,2	40
VII	38	172	47	104
VIII	25	47	37	29
IX	55	46	12	213
X	17	102	5,6	6

Figure 18 shows the average monthly rainfall recorded by study years, 2019 – 2022.

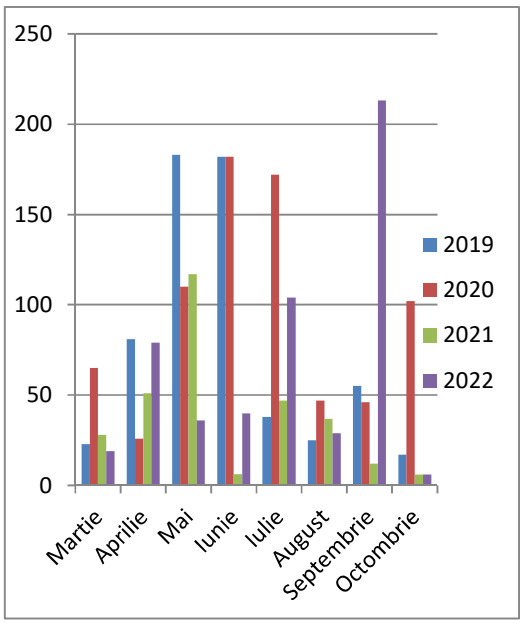


Figure 18. Graph of average monthly rainfall recorded by study years, 2019 – 2022.

Air currents

From the analysis of the meteorological data regarding the cardinal direction of the air currents and the frequency, for the study period 01.01.2019 – 31.12.2020, the air currents in the East direction have the highest frequency, followed by the South and North directions. In **Figure 19**, the cardinal direction of air currents and frequency is graphically represented, during the period 01.01.2019 – 31.12.2022.

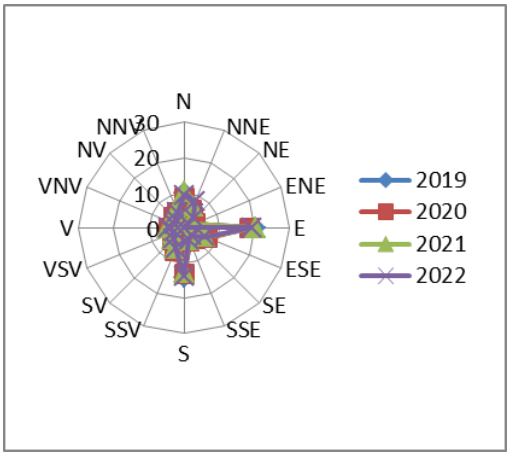


Figure 19. Cardinal direction of air currents and frequency, for the research period 01.01.2019 – 31.12.2022

From the analysis of the meteorological data regarding the cardinal direction of the air currents and the frequency, for the study period 01.01.2019 – 31.12.2020, the air

currents in the East direction have the highest frequency, followed by the South and North directions.

2. Excess rain moisture

Standing water originates from precipitation or surface runoff, temporarily accumulating above a poorly permeable horizon (a B-type horizon with a finer texture than the overlying horizon). It manifests itself on flat or low-lying land with low permeability for water from precipitation.

In Miersig Plain, the water stagnation processes resulting from precipitation led to the formation of 3304.6 ha of stagnosols. The subtypes of soils were identified: Stagnic Cambisols, Stagnic Luvisols, Gleyi – stagni Luvisols

Within the studied area, they occupy smaller, flat or slightly inclined surfaces in the localities: Husăsău de Tinca, Miersig, Păușa, Oradea, Sânmartin.

Based on the maps carried out in the field, the Map of soils with excess rain moisture was drawn up.

In **Figure 20**, the Map of soils with excess rain moisture is presented.

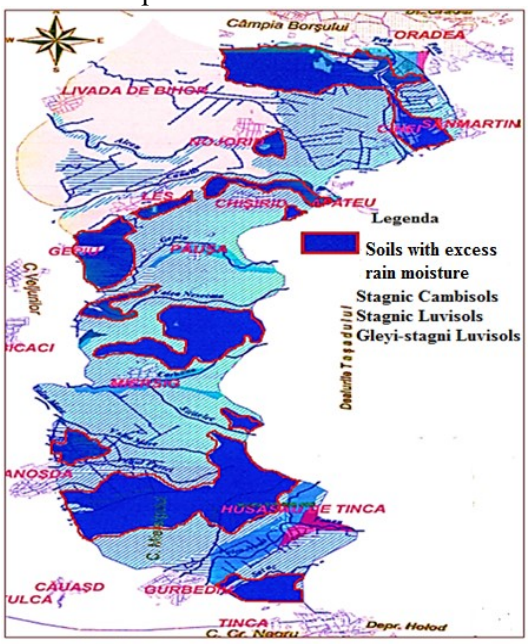


Figure 20. Map of soils with excess rain moisture.

3. Excess phreatic moisture

Ground water acts in the formation and evolution of soils differently depending on the depth at which it is found, the intensity and nature of its mineralization. In areas with groundwater at critical or subcritical depths (depths less than 1.5 - 2 m), with a content of < 3g/l of soluble chloride or sulfate salts, they cause glaciation processes in the soil profile, pedogenesis being oriented in direction of formation of Gleysols. It occupies large areas in the low meadows, with groundwater located at the critical depth of 1-2 m, in the town of Husăsău de Tinca. The total area occupied by Gleyosols is 162.8 ha of Gleyosols.

The subtypes were identified and mapped: Mollic Gleyosols, Fluvic Gleyosols, Haplic Gleyosols. Based on the observations and mapping works carried out in the field, the Map of soils with excess phreatic moisture was drawn up.

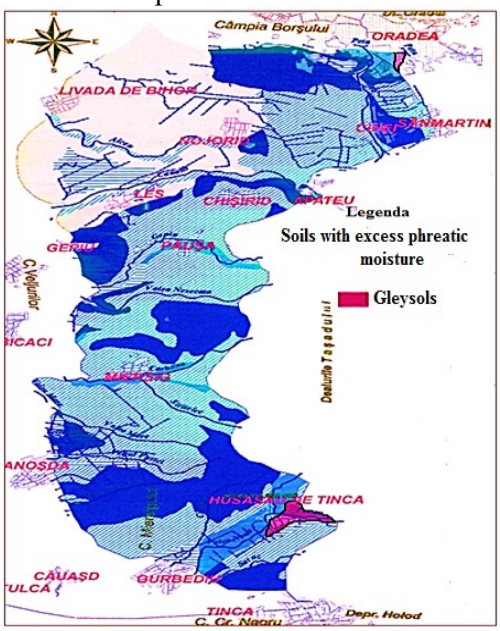


Figure 21. Map of soils with excess water table moisture.

4. Current acidity (pH value)

A large part of the soils of the Miersig Plain have low trophicity due to naturally high acidity (low values of current acidity and high hydrolytic acidity), or "acquired" acidification over time, under anthropic influence. Thus, in the Miersig Plain, out of the total area of 21,496 Ha, 12,485.7 Ha are occupied by soils with moderate and strong acidity.

These soils occupy large areas in the localities: Livada de Bihor, Husăsău de Tinca, Leș, Nojorid, Sânmartin, Cihei, Chișirid, Păușa, Apateu, Ianoșda, Gepiu, Miersig, Gurbediu, Oradea.

Table 20 shows the types of soils that have moderate and strong acidity.

Soil type	Ha	Area	Value

			pH
Eutric Cambisols (EC) Eutricambosol (SRTS 2012+)	934,7	Leș, Nojorid	5,5 – 6,2
Haplic Luvisols (WRB-SR) Preluvosol (SRTS 2012+)	2339,9	Sânmartin, Cihei, Oradea,Apateu, Gepiu, Miersig, Husasău de Tinca, Gurbediu	5,35 – 6,2
Haplic Luvisols (WRB-SR) Luvosol (SRTS 2012+)	9211,1	Oradea, Sânmartin, Cihei, Chișirid, Păușa, Miersig, Ianoșda, Husasău de Tinca, Gurbediu	5,3 – 5,9

Based on the observations and mapping works carried out in the field, the Map of strong and moderate acidity soils was drawn up.

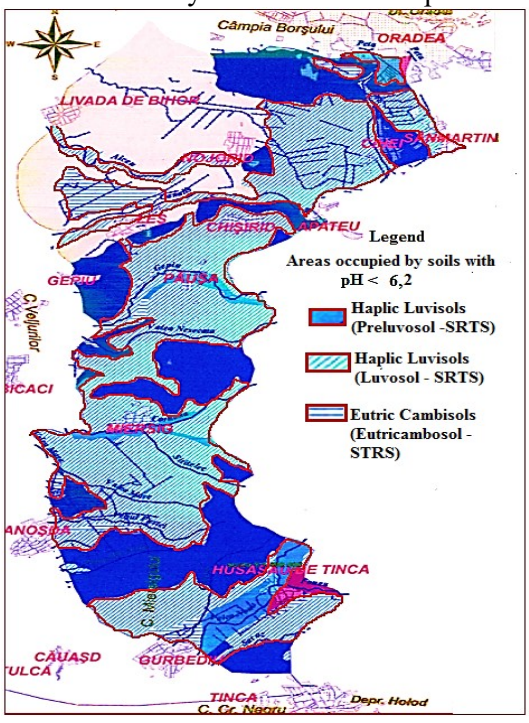


Figure 22. Map of strong and moderate acidity soils.

5. Soils with a low content of nutrients

1. Low and medium soils supplied in total nitrogen

Nitrogen is the most important element in plant nutrition, being the constituent of amino acids, structural and reserve proteins from the vegetative part and seeds, of some metabolic intermediates involved in synthesis and energy transfer, as well as nucleic acids.

The chemical analyzes carried out on the soils of Miersig Plain highlighted nitrogen supply values, expressed in %, between 0.075% and 0.419%, values corresponding to a supply from low to very high.

The low and middle values of total N supply (%) correspond to the soil types: Haplic Luvisols (Preluvosol, Luvosol – SRTS), Eutric Cambisols (Eutricambosol – SRTS), Gleysols (Gleiosol – SRTS), Stagnic Cambisols, Stagnic Luvisols (Stagnosol – SRTS).

Table 21 shows the soils of the Miersig Plain which have a low and medium total N supply.

Table 21. Miersig Plain soils with low and medium supply in total N.

Soil type	Area	Ha	Total N - % medium values
Eutric Cambisols (Eutricambosol SRTS)	Leș, Nojorid	934,7	0,106 – 0,118
Haplic Luvisols (Preluvosol SRTS)	Sânmartin, Cihei, Oradea,Apateu, Gepiu, Miersig, Husasău de Tinca, Gurbediu	2339,9	0.105 – 0,132
Haplic Luvisols (Luvosol SRTS)	Oradea, Sânmartin, Cihei, Chișirid, Păușa, Miersig, Ianoșda, Husasău de Tinca, Gurbediu	9211,1	0,075 – 0,149
Gleysol (Gleiosol SRTS)	Husasău de Tinca	162,8	0,112
Stagnic Cambisols, Stagnic Luvisols (Stagnosol)	Husasău de Tinca, Miersig, Păușa, Oradea, Sânmartin	3304,6	0,110

2. Low and medium soils supplied in P

Phosphorus is an essential element for the growth and development of plants. Following the analysis of the phosphorus

content of the soils of the Miersig Plain, values between 3 and 38 ppm phosphorus content were obtained, values that correspond to a state of supply of to very weak to medium. Soils that have a very weak and weak supply state in mobile P have values between 3 and 17 ppm.

Table 22 shows the soils of the Miersig Plain with poor and very poor P supply.

Table 22. Miersig Plain soils with poor and very poor P supply.

Soil type	Area	Ha	Content, Mobile P ppm
Eutric Cambisols (Eutricambosol SRTS)	Leș, Nojorid	934,7	11,6 - 17
Haplic Luvisols (Preluvosol SRTS)	Sânmartin, Cihei, Oradea,Apateu, Gepiu, Miersig, Husasău de Tinca, Gurbediu	2339,9	10 - 15
Haplic Luvisols (Luvosol SRTS)	Oradea, Sânmartin, Cihei, Chișirid, Păușa, Miersig, Ianoșda, Husasău de Tinca, Gurbediu	9211,1	3,00 - 15
Gleysol (Gleiosol SRTS)	Husasău de Tinca	162,8 ha	17,0
Stagnic Cambisols, Stagnic Luvisols (Stagnosol)	Husasău de Tinca, Miersig, Păușa, Oradea, Sânmartin	3304,6	9.0

3. Low and medium soils supplied in K

The importance of potassium lies in the involvement in the physiological functions of plants: cell division, photosynthesis, in the formation, migration and accumulation of carbohydrates, in the formation of proteins and lipids, enzyme activity, in the water balance in plants, increasing resistance to frost, increasing resistance to diseases and pests .

In order to assess the state of potassium supply of the soils of the Miersig Plain, analyzes were carried out regarding the potassium content of the soils. Values between 40 and 182 were obtained, most agricultural soils showing values between 40 and 130, which correspond to a low to medium supply state.

Table 23 shows the soils of the Miersig Plain with low and medium P supply.

Table 23. The soils of the Miersig Plain with low and medium P supply.

Soil type	Area	Ha	Mobile K ppm
Eutric Cambisols (Eutricambosol SRTS)	Leș, Nojorid	934,7	92 - 120
Haplic Luvisols (Preluvosol SRTS)	Sânmarti, Cihei, Oradea,Apateu, Gepiu, Miersig, Husasău de Tinca, Gurbediu	2339,9	64 - 130
Haplic Luvisols (Luvosol SRTS)	Oradea, Sânmartin Cihei, Chișirid, Păușa, Miersig, Ianoșda, Husasău de Tinca, Gurbediu	9211,1	40 - 130
Gleysol (Gleiosol SRTS)	Husasău de Tinca	162,8 ha	120
Stagnic Cambisols, Stagnic Luvisols (Stagnosol)	Husasău de Tinca, Miersig, Păușa, Oradea, Sânmartin	3304,6	130

Figure 23 shows the Map of poorly and medium soils supplied in N, P, K.

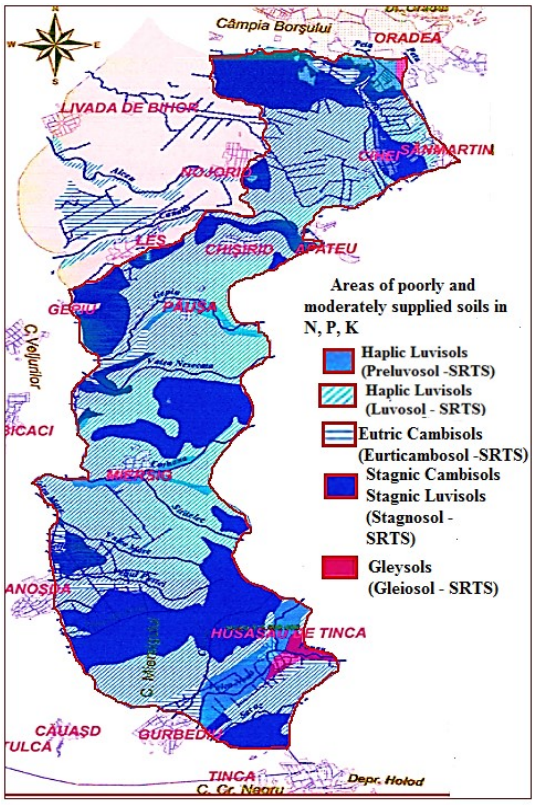


Figure 23. Map of poorly and moderately supplied soils in N, P, K

CONCLUSIONS

The studies and research carried out in the Miersig Plain constitute a real basis for solving some aspects that have been little studied or neglected until now, regarding:
- the rationing of agricultural crops, in the context of current climate changes,
- making maps and sketches regarding the main pedogenetic factors: climate, relief, rock, groundwater.
- making soil maps, in a unitary concept
- obtaining and making maps regarding: soil properties, technological indicators of the soil and maps regarding production capacity
- conservation and rational use of the entire land fund
- knowledge of soil surfaces affected by excess rain or phreatic moisture
- knowledge of soil surfaces degraded as a result of agricultural activities
- knowledge of soil surfaces with strong and moderate acidity
- knowing the soil surfaces affected by the decrease in nutrient reserves
- the improvement of acidic soils follows the knowledge of the physico-chemical properties, the water regime, the nutritional regime and the surfaces occupied by these soils
- improvement of soils affected by excess rain or phreatic moisture
- the organization of the territory

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