THE ROLE OF CLIMATE FACTORS IN THE GENESIS OF SOIL RESOURCES AT LIVEZILE, TIMIS COUNTY, ROMANIA

Ioana MARCHIȘ, Iulia SOPCA, Raluca PERESCU, Casiana MIHUȚ, V.D.MIRCOV

University of Agricultural Sciences Banat Veterninară „King Michael I of Romania"

Timisoara, Arad Way, no. 119, Romania, Phone: +4025627475, Fax: +40256200296,

Corresponding author: casiana_mihut@usab-tm.ro

Abstract*. This paper presents the climate factors that have formed the soil resources of Livezile, Timis County, Romania, i.e. the thermal regime of the area, using data from the Weather Station in Timisoara, Romania. (1) To do so, the first step was to develop a database. We studied the area and its limits and described the climate conditions. (3) The general characterisation of the thermal regime was based on the data from the Weather Station in Timisoara, at an altitude of 90 m, which corresponds to alluvial plain relief.(7) The influence of the main climate factors on soil cover can be expressed as a "De Martonne" aridity index. The studied area belongs to the interval I with aridity index below 26. (8) Due to its geographical location, natural conditions are specific to a divagation plain, subsidence and accumulation, based on which these soils formed and evolved. (2) The rather varied micro-relief, the plain surface has water stagnations, particularly in spring, after the snow melts, and also during heavy rainfalls. (4) The alluvial plain is interrupted, along the Ghilad-Dolaţ-Giera-Şuriani line, by higher crests formed on older alluvia and considered remnants of the low Timis River terrace. This inter-river represents the southern line of saline and alkaline soil formation and spread in Western Romania. In the lower basin of the two rivers, there are extremely favourable conditions for soil formation: here, soils occur dispersed as random patches in the western soils (Livezile-Partoş-Banloc-Ofseniţa) and rarely in chernozems (Dolaţ-Giera) or eutricambosols (Ofseniţa-Soca). Ii the old watercourse divagation areas, particularly along the meanders and small valleys where the sodic mud is at small depth, there are rather frequently island-like parches of saline and alkaline soils (Odăi-Ofseniţa-Dolaţ), whose frequency increases with the distance from the old watercourses (Banloc-Dolaţ-Livezile).(5)*

Keywords: *climate, soil resources, temperature, rainfall, "De Martonne" index*

INTRODUCTION

The studied area is part of the Timis County, Romania, 9.5 km far from Timisoara. The total area measures 5,579.49 ha, and has different use categories. (8)

The Commune of Livezile is located in south-western Timis County, in the Timis River Plain, along the border with Serbia; its eastern neighbour is the Commune of Banloc and its western neighbour is the Commune of Giera. (10)

The characteristic relief is plain. It is made up of a succession of fluvial and fluvio-lacustrine small hills with altitudes ranging between 75.93 m in the south-east and 89.70 m in the south west. These hills have here and there higher mounds most of which have obvious manmade origins.(9)

RESULTS AND DISCUSSION

The characterisation of the thermal regime of the area was done based on the data from the Weather Station in Timisoara, at an altitude of 90 m (Table 1).

Table 1.

Air temperature during 2010-2017 (°C)

Climate data		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Monthly and annual averages		-1,5	0,6	5,7	11,3	16,3	19,4	21,5	20,8	16,8	12,8	6,0	1,0	**10,9**
Decent Decade	Decada I	-0,9	-1,0	4,0	9,5	15,1	18,7	21,2	21,6	18,5	13,2	7,3	2,8	10,83
	Decada II	-1,2	0,4	5,8	11,3	16,5	19,6	21,7	21,0	17,0	11,3	5,6	1,5	10,88
	Decada III	-1,5	1,9	7,8	13,0	17,7	20,5	21,9	19,9	15,1	9,5	4,2	0,2	10,85
Max Average		-0,9	1,9	7,8	13,0	17,7	20,5	21,9	21,6	18,5	13,2	7,3	2,8	12,11
Minimum average		-1,5	-1,0	4,0	9,5	15,1	18,7	21,2	19,9	15,1	9,5	4,2	0,2	9,58
Difference of environments		-0,6	2,9	3,8	4,5	2,6	1,8	0,7	1,7	3,4	3,7	3,1	2,6	2,53
Absolute maximum		16,7	19,7	27,0	32,0	34,5	36,0	39,6	40,0	39,7	30,5	24,8	20,0	40,0
The absolute minimum		-35,3	-27,3	-14,2	-4,8	-0,3	2,2	5,9	5,8	-1,9	-6,8	-17,2	**-8,3**	-35,3
The difference		52,0	46,9	41,2	36,8	34,8	33,8	33,7	34,2	41,6	37,3	42,0	28,3	75,3

The temperatures characteristic of the spring season are particularly important because atmospheric conditions have a decisive influence on winter crop vegetation state and on spring agricultural campaign. Springs are increasingly early and hot but shorter and with wide variations of temperature determined by the cyclone activity in the Mediterranean and the Atlantic on their way to Eastern Europe.

Mean multi-annual summer temperature oscillate around 20°C. The thermal threshold of 16°C is the limit at which all heat-loving plants develop optimally. The days in which the threshold is overrun are over 75 in number.

The upper thermal threshold affecting crops negatively is 32°C. Temperatures above it means scorching heat, drought, and moisture deficit in the air and soil. In the last three decades, extreme situations have endangered mainly the agriculture.

Multiannual mean temperatures in the soil horizon (5-10 cm) are 2-4°C higher than air temperatures during summer (22.7°C and 24.5°C in July and August). In very hot months, in the horizon 5-10 cm of soils with no vegetation, maximum temperatures can frequently be above 55-60°C.

Thermal characteristics of the fall are less important because most crops have reached maturity. Fall thermal mean is above 11°C.

As for the rainfall regime, due to Banat's location on the way of moist air masses from the west and south-west and to the mountains in the east, there is an increase of the amounts of rainfall from west to east between 631 mm and 591.9 mm (Table 2).

Table 2.

Mean monthly precipitations during 2008-2017 at Banloc, Romania (mm)

Period	**Precipitations**											
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
2008	23,6	10,3	45,4	33	42,2	33,1	29	6,1	33,3	2,8	12,4	26,1
2009	22,3	31,1	45,7	110	40,9	149,6	51,4	25,2	155,5	23,5	64,3	13,7
2010	5,7	10,9	7,7	16,2	47,1	74,6	118,9	128,4	49,4	57,9	28,9	68,8
2011	56,9	9,1	7,7	31,6	51,8	47,2	85,6	18,6	67,6	117	32,7	20,2
2012	55,5	35	19	44,2	34,7	43,8	61	84,5	33,4	44	126	49,4
2013	37,3	76	27,9	105,9	32,9	54,8	160,4	253,9	53,3	16,3	12,3	84,2
2014	23,6	38,6	64,7	77,3	34,6	102,3	15,5	133,9	9	16,8	27,2	31,4
2015	39,9	77,4	64	0,4	66,6	56,4	22,3	83,3	65,2	79	85,5	23,4
2016	21,9	8,7	56,8	58,9	57,2	72,6	21,9	29,9	54,8	13,8	55,1	59,4
2017	42,9	38,6	50,8	8,8	42,7	115,6	115,2	56,9	0	87,2	97,8	86
Multiannual media	**33,0**	**34,6**	**39,0**	**48,6**	**45,1**	**75,0**	**68,1**	**82,1**	**52,2**	**45,8**	**54,2**	**46,3**

The distribution of monthly mean rainfalls (mm) is presented below.

The distribution of rainfalls per season is 207 mm in spring, 127 mm in summer, 140 mm in the fall, and 112 mm in winter.

The monthly distribution of rainfalls points to a minimum of 34.6 mm in February and a maximum of 73.4 mm in June. The commune territory is in the 600 isohyet.

The study of the multiannual fluctuations of the rainfall regime shows a clear difference per intervals. Thus, in rainy years, the excess of rainwater is due to a small number of months (3-4) when water amounts are above 80 mm. the rest of the months usually have values close to multiannual means, with some of them droughty.

The frequency of rainy and droughty months according to the Weather Station in Timisoara over 75 years (1920-1994) is shown in Table 3.

Table 3.

Frequency of rainy, droughty months during 1920-1994

Rainy Monday				droughty months			
> 80 mm		> 100 mm		< 30 mm		< 10 mm	
Nr. cases	%	Nr. cases	%	Nr. cases	%	Nr. cases	%
50	6	41	5	208	23	96	11

Monitoring in time exceeding monthly rainfall values (above 80 mm) shows a repetition of intervals every 7-8 years, culminating with dangerous floods every 14-15 years (similar to that in 2015).

The rainfall regime characterised as normal or even exceeding in the 1970s has turned deficitary with negative consequences on agriculture as shown in Table 4.

Table 4.

Water climate balance (mm) (Weather Station in Timisoara)

Specification	**Lunile**												**Annual bilance**
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	
Evap. potentiantet	1,0	3,4	24,3	58,4	79,8	115,6	159,3	137,6	77,5	36,2	14,1	2,9	**710**
Falling precipitation	40,3	34,6	37,5	48,2	62,0	73,4	56,3	47,0	47,2	40,7	44,8	47,2	**580**
The difference (EPT-P)		**-**		**10,2**	**17,8**	**42,2**	**103,0**	**90,6**	**30,3**		**-**		**-294**

As shown in Table 4, during April-September there was a moisture deficit. In establishing the climate balance, to get mathematically correct results, we need to also calculate compensatory indispensable elements (bioclimate features of crops, etc.).

Precipitations during winter (November-March) determine soil moisture in spring, representing the main source of soil water. Rainfall values above 300 mm induce moisture excess, water stagnation and, implicitly, restrictions in soil works.

The precipitations characteristic of the cold season are snows – sporadically in October. The most numerous days with snow are in January and February, after which they decrease gradually until April. The duration of the snow layer is uneven because of its thinness.

At Livezile, during summer, only 30% of the years have had optimal water amounts (200-300 mm). Below 150 mm, no matter the distribution, the area and the year are considered dry, which has happened so far in 20-30% of the cases. With amounts of water above 300 mm during summer, in association with soil physical and hydro-physical features and the land micro-relief, there is moisture excess in only 10% of cases.

Rainfall during the fall are, in general, enough, and they help winter crop establishment. Water amounts in September-October oscillate between 70 and 90 mm, with large variations from one year to another.

Ground water is close to soil surface (0.5-2 m), with very slow drainage and stagnating, which determined a drainage system south from Lanca-Birda over 11.383 ha.

Areas where ground water is 1-2 m deep overlap contact areas between the depression and the hill where there are drained moderate Gleyey soils.

On the hills, ground water is 2-3 m deep in the soil, usually 2.5 m, and it circulates through coarse deposits of sand, loamy-sand with gravel, on which are parental deposits. The lithologic nature of the substrate, the medium texture of the surface deposits and the shape of the relief (hill) ensure a good circulation of the water both vertically and horizontally, which make soils benefit from good natural drainage.

Areas with ground water 3 m deep in the soil are few and small. They correspond to higher areas with soils that are well and intensely drained. The current level of ground water is not natural.

In these climate conditions, the territory of the Commune of Livezile has a soil cover specific to the western part of the Banat's Plain; the main soil types inventoried were alluvial soil, chernozem, phaeozem, eutricambosol, pelosols, vertosol, gley soil, and solonetz.

CONCLUSIONS

The climate map of Romania shows that the studied perimeter is part of the temperate-continental climate at the interference of the ocean-influenced climate and of the sub-Mediterranean influenced climate.

Under the influence of hot air masses from south-west generated by the Mediterranean cyclones, winters are milder (thermal mean in winter is around -1.5ºC). springs are early and with wide thermal variations determined by the activity of the cyclones from the Atlantic. Days with frost are frequent in April and May.

From July to the beginning of September, tropical air masses predominate: mean summer temperature is above 20ºC, mean temperature of July is 21ºC, and mean annual temperature is 10.9ºC.

Falls are longer than springs and have a more constant temperature, with polar temperate maritime air masses causing a slight increase of the rainfalls.

Precipitations range between 412.5 and 790mm, with a multiannual mean of 631 mm at Timisoara.

After Koppen, climate in the studied area is part of the Cfbx climate province. The annual mean of the De Martonne index is below 26.

As a conclusion, we can say that, climatically, the studied perimeter has conditions favourable to all common crops in the area. It is necessary, however, to take into account the deviations from the multiannual mean in both temperature and rainfall, and particularly in their distribution during vegetation.

These deviations can be corrected through proper cropping measures.

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