

The natural potential and the suitability for the grapevine growing of Buziaş, Recaş and Miniş areas

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Abstract The research was carried out between 2013-2015 and aimed at the pedological and climatic characterization of three famous wine-growing areas from the western part of Romania (Recaş, Buzias-Silagiu, Miniş). Although it is known that the climatic potential of these areas is very favourable for grape growing, yet the recent climate changes make the suitability of certain varieties to be very different.

Recas wine-growing area is famous for high-quality wines obtained from both red varieties such as Cabernet Sauvignon, Pinot noir, Merlot and Burgund, as well as white varieties: Riesling Italian, Feteasca Regala and Muscat Ottonel. The table grape varieties that prevail in this centre are: Chasselas dore, Muscat de Hamburg and Muscat de Adda.

The wine-growing area of Silagiu is focused on producing high quality white and aromatic wines, with the predominantly Italian Riesling, Sauvignon Blanc and Muscat Ottonel. In this area are also produced high quality red wines such as Cabernet Sauvignon, Pinot noir, Merlot and Burgund. The assortment of table varieties is limited to those with maturing periods III and IV.

In Miniş wine-growing area are grown varieties for high quality red wines such as Cabernet Sauvignon, Pinot Noir, Cadarca, Merlot, Burgund, and varieties for top quality white wines such as: Italian Riesling, Feteasca Regala, Muscat Ottonel.

In Măderat wine-growing area prevails white varieties suitable for table wines, represented by Mustoasa de Măderat, considered a local variety and Fetească Regală. However, there are also obtained red table wines out of Burgundy, Oporto and Sangiovese varieties, as well as high quality white wines on relatively small areas such as from the Italian Riesling, Fetească Regală and Muscat Ottonel varieties. If we refer to the range of table grapes, they belong to the ages III-IV: Chasselas dore, Chasselas rose and Muscat de Hamburg.

Vitis vinifera grapes are a distinct phenological crop, with several important stages of development: bud burst, flowering, ripening and harvesting (grapes maturity). The time periods between these phenological stages varies greatly with the grapevine variety, climate and geographic location [5]. More important than the actual date of each phenological phase is actually the interval between them (the duration of the phenological phases), which is an indication of the climatic course in that period. Short intervals are associated with optimal conditions that facilitate rapid growth and physiological differentiation. Long intervals between phenological stages indicate less favourable climatic conditions and a delay in growth and maturation [1].

The Buzias-Silagiu wine-growing region is part of the five wine-growing areas in the Banat area,

located in south west Romania and south-eastern Timis County.

As far as geomorphology is concerned, on the Silagiu hills, on the plateaus and at the middle of the slopes, at an altitude of 200-300 m and a slope of 12-18%, arising on a surface of about 30-40% slightly gleyed soils and pre-alluvial soils formed on loam and carbonated clay. Between 180 and 250 m, on a surface of 20-30% , alluvial reddish-brown soils are present [6].

The multiannual average of the oenological index is 4.744,72 which recommends the Buzias-Silagiu wine-growing area for the growing of grape varieties for red wines. Due to this advantage, this wine-growing area was allowed to produce protected designation of origin quality wines harvested at full maturity (DOC - CMD) and protected designation of origin quality

Key words

vine, grape variety, pedological characterization, climatic characterization, wine region

wines harvested late (DOC – CT), dry, medium dry and medium sweet categories.

The testimony of the Minis-Măderat vineyard, as one of the oldest vineyards on the Romanian territory dates back to the first half of the 11th century. Bishop Gerard de Cenad mentions in his work "Deliberatio", written between 1030 and 146, the practice of viticulture in the area for the production of wine for consumption, underlining that "the un-weeded vine is invaded by weeds that destroy it" [7].

In the Minis-Măderat area, the annual precipitation is 626.5 mm (with a minimum of 423 and a maximum of 879.1 mm), of which about 410 mm are accumulating during the vegetation period.

In time, droughts were recorded (1958, 1985, 1993, 2000, 2003, 2015), but among the poorest in the precipitations was 2000 when only 382 mm fell in total and 236 mm during the vegetation period. On the other hand, the most rainy year was 1980 with a rainfall of 722 mm during the vegetation period.

Material and Method

The research was carried out between 2013-2015 and targeted the pedological and agrometeorological characterization of the researched areas (Recaș, Miniș, Buziaș). It also presented the

statistics of the areas cultivated with grapevines on the Arad and Timis counties, on which territory the studied areas are situated.

For the general climatic characterization of the biological material areas, the data recorded at the agrometeorological stations of the vineyards of Recaş, Miniș, Buziaș-Silagiu were used.

Obtained results

The western part is an important wine-growing region of Romania, being considered a region with a long tradition and long experience in the grapevine growing, where the grapevine finds favorable conditions both for wine and table grapes growing. [3]. The main wine-growing areas in this region are: Recaş, Silagiu, Teremia, Tirol and Minis wine-growing area, but only Recaş, Miniș and Buzias are a part of the current research. [2, 4].

The areas occupied by fruit bearing vines in the two reference counties (Timis and Arad), according to the information provided by the Statistics Institute Timiș (www.timis.insse.ro) and the Institute for Statistics Arad (www.arad.insse.ro) are shown in Table 1.

Table 1

The surface of the fruit bearing vineyards in the year 2015 (hectars)

County	Fruit bearing vineyards		Grafted and indigenous vines		Hybrid vines	
	Total	Of which private property	Total	Of which private property	Total	Of which private property
Arad	2019	2019	1934	1934	85	85
Timiș	2530	2530	2494	2494	36	36

In most cases, the areas recorded in the year 2015 are occupied with grapevines of noble varieties, but there are also areas occupied with direct producing hybrids.

Table 2

The evolution of fruit bearing vineyards during 2005-2015 in Arad county (hectares)

Years	Fruit bearing vineyards	Grafted vineyards
2005	2524	2104
2006	1714	1510
2007	1158	1154
2008	1203	1128
2009	1491	1416
2010	2185	1282
2011	1509	1396
2012	1465	1460
2013	1510	1509
2014	2056	1970
2015	2019	1934

Following the evolution of the fruit bearing vineyards in the territory of Arad County, there can be

noticed a decrease of these areas in 2015 compared to the ones recorded in the year 2005. However, as shown

in the table, the downward trend is not maintained all the years, and there have been years of increases in these areas due to the reconversion program for vineyards that have funded the restoration of vineyards.

WINE-GROWING CENTRE RECAȘ

Recaș is located relatively in the center of Timis County, on DN 6, 24 km from Timisoara and 36 km from Lugoj. Recaș has a tumultuous relief, dominated by slopes, varied expositions, leading to

obvious erosion processes and creating various conditions for the growing of the grapevines.

Winter temperatures are mild and do not affect buds, heliothermic resources are favourable (I.H. 2.03), and water resources are slightly lower (C.H. 1,1).

Between 1 September and 31 October 2013, the reported rainfall was low (40-80 l / m²), locally in the north-west of Banat, and optimal (81-150 l / m²) in the south-west of Banat.

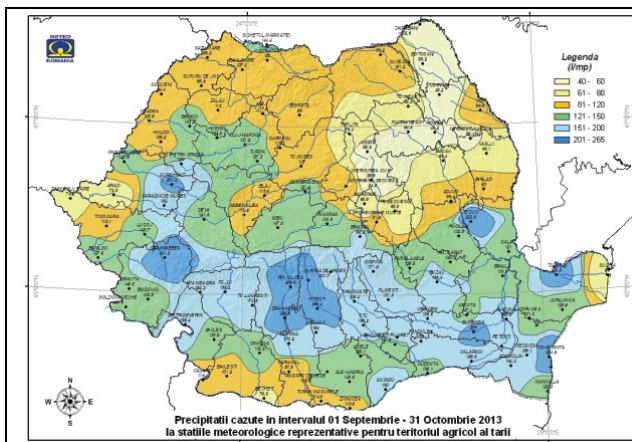


Fig.1 Precipitation recorded between September and October 2013

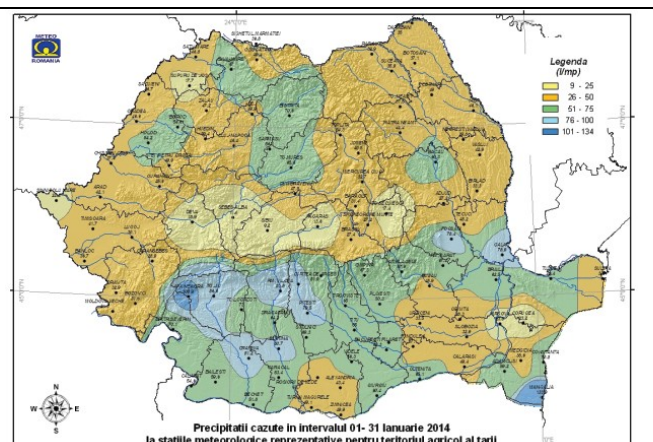


Fig.2. Precipitation recorded in January 2014

In the first part of January 2014, a higher air temperature prevailed, in to a higher extent than normal, after which a sharp cooling of the weather occurred at the end of the period.

The precipitation between the 1st and the 31st of January 2014 was reduced in quantity (9-25 l / m²) locally in the western Banat and normal (26-50 l / m²) in most of Banat (Figure 2) .

The colder weather than usual at the beginning of February 2014 has entered a gradual heating process. Precipitations reported between February 1 and 28, 2014 were: (11-25 l / m²), on extended surfaces of Banat and elevated (26-35 l / m²) in the north of Banat (Figure 3).

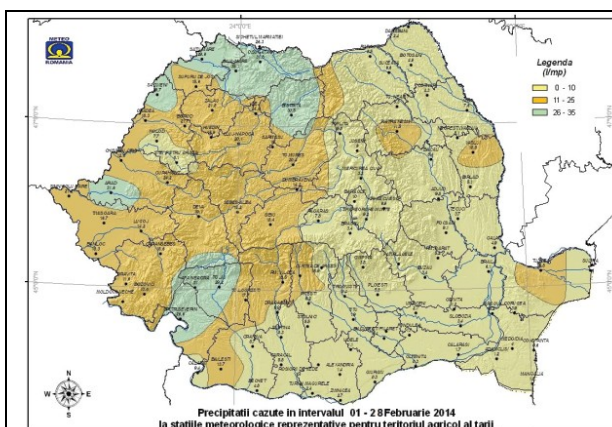


Fig.3. Precipitation recorded between February 1 and 28, 2014

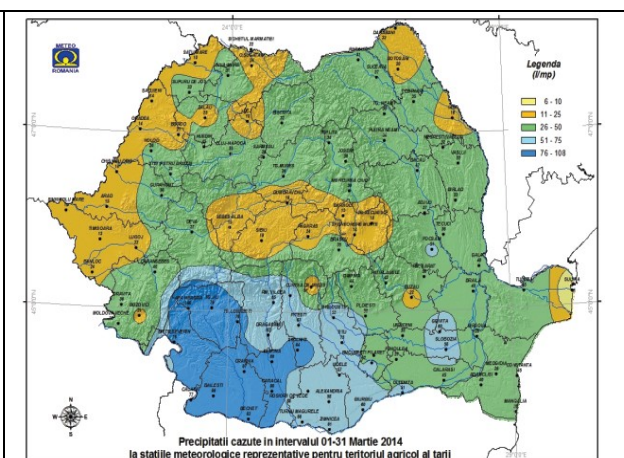


Fig. 4. Precipitation recorded in March 2014

In Banat, from the analysis of "cold units" / $\Sigma t_{med.} \leq 0^{\circ}C$, the mild winter character (<200 units of cold) is highlighted. In most vineyards, the grapevines were in the state of biological rest.

In March 2014, a higher air temperature prevailed over the entire country's agricultural area. The thermal potential of the winter-spring transition period is expressed by the spring index ($\Sigma T_{med} \geq 0^{\circ}C$), computed between February 1 and April 10, 2014. For almost the entire agricultural territory of the country, the spring index totalled 401-675 units of heat, which

signifies an early and very early spring. The precipitation recorded between March 1 and 31, 2014 was normal (11-25 l / m²) in most of Banat and elevated (26-50 l / m²) in south-eastern Banat (Figure 4).

Between 1 November 2013 and 31 March 2014, it was pointed out that in Banat the precipitation was deficient <200 l / mp (very dry, dry and moderately drainage rainwater regime) (Figure 5).

The grapevine was under the "weeping" phenophases, and budding in all the vineyards.

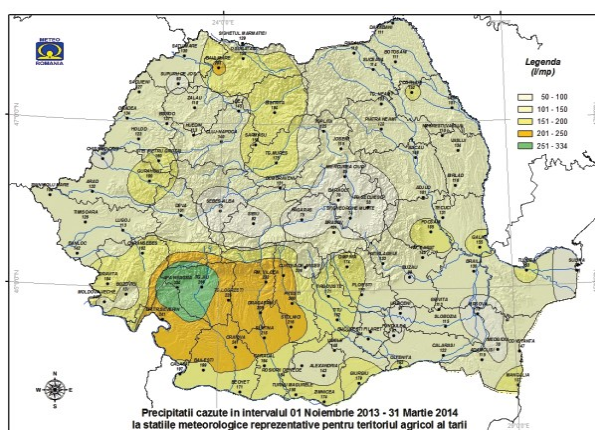


Fig. 5 Amounts of precipitation recorded during the accumulation of water in the soil (November 2013-March 2014)

In the wine-growing center Recaş, the dominant soils are the forest brown soils and the gleyed or clogged soils formed on loams and clay, on carbonated loams and marl. These soils generally provide good conditions for grapevine growth and development, having a porosity of 40-55% and a clay content of 14-35%. Groundwater is located at depths ranging from 1.5-3 m and low in chloride and phosphate.

WINE-GROWING CENTRE BUZIAŞ-SILAGIU

The Buzias-Silagiu wine-growing area is located in south-western Romania in the south-eastern part of Timis County.

The climate is temperate continental moderate, with Mediterranean and oceanic influences.

Spring is early, short and hot, but low temperatures were recorded in April and May as a result of cold air invasions from northern and northwest of Europe.

Atmospheric precipitation ranges between 700-800 mm per year with a 655 mm multiannual average. The largest amount of precipitation falls in May and June.

Characteristic of the area are pseudogleyed luvisc soils that have evolved on loam deposits and clays.

The surface texture is medium (sandy-loam, silt-loam and silt-clay) with a high percentage of coarse sand and medium-fine (clay-loam) and fine (sandy-clay) on the profile.

The soil reaction is slightly acid-neutral or slightly alkaline with values ranging between optimum limits for grapevine growing, 5.5-8.5. Groundwater is at a depth of 10 m. Total porosity is 45-50%, optimal for grapevine growing.

In the period when the crops are using the maximum water quantity (June, July and August), the precipitations were optimal (201-300 l / m²) in most of Banat and elevated (301-400 l / m²) in the south of Banat (fig. 6).

The air and soil temperatures were favourable for the growth and development processes in vineyards in most cultural areas. In all vineyards, prevailed the phases of leaves and shoots growing, and the accumulation of sugar in the berries.

On the whole, in the first days of August 2014, the air temperatures were higher than usual, after which a significant cooling of the weather occurred in most of the agricultural regions. During August 2014, the precipitation recorded at the meteorological stations was normal (26-50 l / m²) on extended surfaces in the south-western Banat and elevated (51-100 l / m²) in most of Banat (Fig. 7).

During the agricultural year 01 September 2013- 31 August 2014, the precipitation regime was deficient (350-600 l / m²- dry and moderately dry) in the western Banat, optimal (601-700 l / m²) in the centre of Banat, abundant (701-800 l / m²) in the south of Banat and overflow (801-1332 l / m²) in some areas from the south of Banat.

In agricultural areas where soil moisture deficiencies have been maintained, the ripening

processes in the vine were still hampered, being observed the partial and total yellowing / drying of the canopy, the under-dimensioning of the fruiting elements (small and dehydrated berries), with negative effects on the quality and quantity of the productions. In spite of these climatic shortcomings, in most wine-growing plantations, grain ripening and sugar accumulation have been recorded.

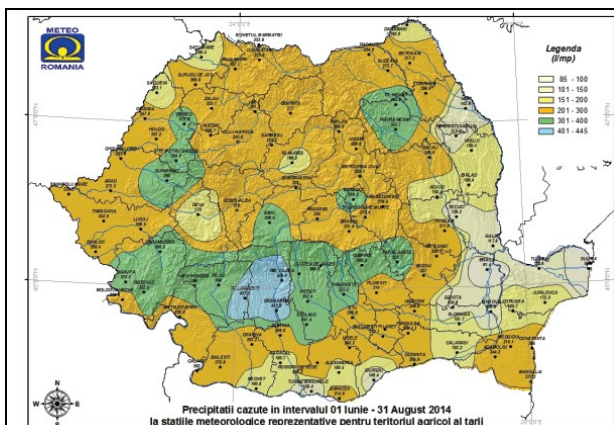


Figure 6. Precipitation recorded between June and August 2014

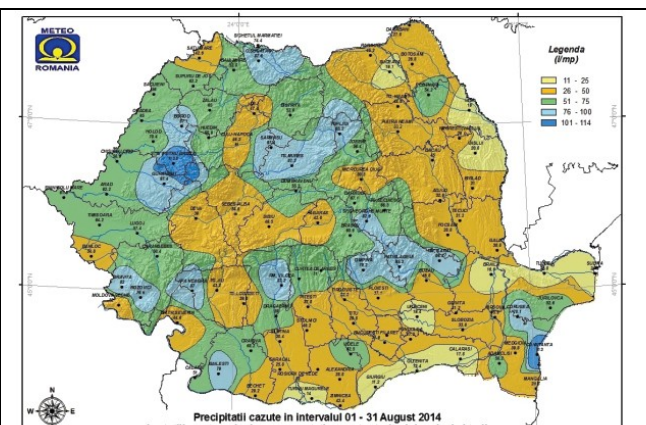


Figure 7. Precipitation recorded in August 2014

Due to the oenoclimatic favourability, Silagiu wine-growing area was allowed to produce quality wines with protected designation of origin – harvested in full maturity period (DOC - CMD) and protected designation of origin wines (DOC - CT), harvested late, categories dry, medium dry and medium sweet.

WINE-GROWING AREA MINIȘ-MĂDERAT

Minis wine-growing area is located in the western part of our country at an altitude of 176 m, being known as a very favourable area for grape growing. The wine-growing region is located 20 km east of the city of Arad and includes Minis and Măderat wine-growing areas. Between the two wine-growing areas there are large ecoclimatic differences, so there are differences in assortment.

The ecological characteristics of the Minis vineyard are influenced by the natural shelter provided by the Zărand Mountains, the south-eastern exposition and the inclination of the slopes (15-30%) in conjunction with the edaphic peculiarities.

The Minis-Măderat wine-growing region generally has a temperate continental climate with Mediterranean influences, subordinated to the influences specific to the climate of central Europe. The average annual temperature is 11.4 °C, the sum of annual precipitation 626.5 mm, the sum of annual global temperatures 4124.9 °C, the sum of sunshine hours 1955, the sum of insolation hours 1605, the sum of the active temperatures 3666.7 °C and the sum of useful temperatures is 1557,9 °C. The number of vegetation days ranges from 143 to 256.

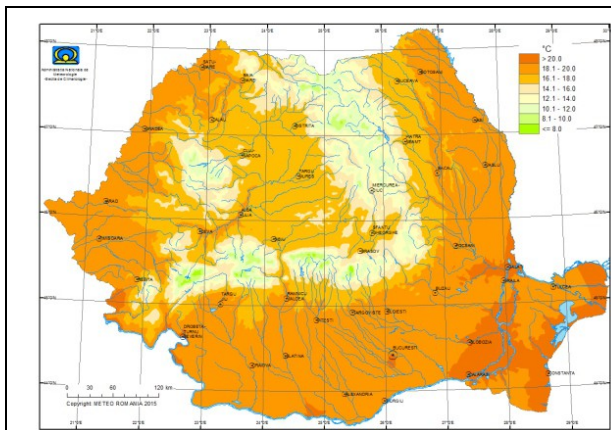


Fig. 8. Average annual air temperature - 2015

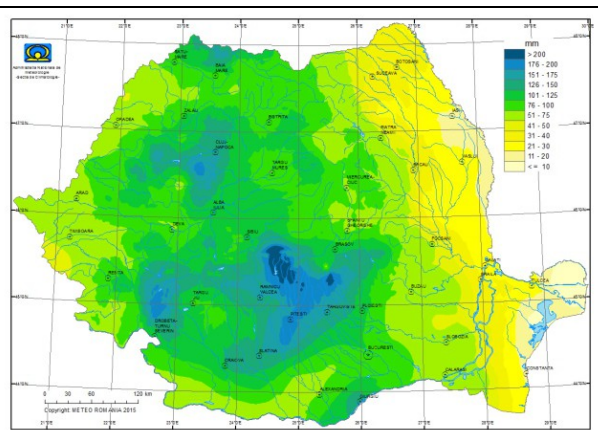


Fig. 9. Annual precipitation rate - 2015

Various soil units are encountered throughout the vineyard due to the variability of the soil formation factors. The soils predominant in the Minis vineyard belong to the following classes: unevolved, truncated or degraded soils, mollisols, luvisols, cambisols, and in the part of Cuvin depression even hydromorphic soils. The lithic regosol and brown eumezobasic soil are frequent on high hills and slopes with a 15-25% inclination, have a short profile of 30-70 cm and a medium content in the skeleton, in some places with underlying rocky rocks, characteristic of the southern area of the vineyard (Barațca, Păuliș, Miniș and

Ghioroc). The generous ecoclimatic conditions typical of the vineyard allow the cultivation of a wide assortment of table and wine grape varieties.

In Table 3 we present in synopsis the ecological resources and the heliothermic index and the hydrothermal coefficient for the wine-growing areas of western Romania. From the analysis of the presented data it is obvious that the reference area satisfies from the point of view of the ecological resources the biological necessities of the majority of varieties grown in Romania.

Table 3

Pedoclimatic resources							
Wine-growing centre	The heliothermic index (IH)	Hydrothermal coefficient (CH)	Temperature °C			Altitude (m)	Types of soil
			The absolute minimum	The absolute maximum	Multi-annual average		
Recaș	2,03	1,1	-31,8	40,6	10,6	167	Brown luvic, Brown-argile-illuvial
Buziaș-Silagiu	2,01	1,4	-30,4	41,4	10,8	169	Brown eumezobazic, brown- argile-illuvial regosols
Miniș	2,10	1,2	-25,2	41,8	11,4	176	Brown eumezobazic, tipical, brown argile-illuvial

Conclusions

The effectiveness of grapevine growing depends crucially on crop technology and on how the pedological and climatic resources of a wine-growing area meet the biological needs of cultivated varieties.

The action of climatic factors on the different varieties is manifested both individually and in complex, which is why the pedoclimatic resources of a wine-growing area must be analysed both at the individual level of each factor as well as in the complex by the climatic indices that quantify the combined action of pedo-climatic factors.

From the analysis of the sum of minimum negative air temperatures below the critical resistance limits of agricultural crops ($T_{min} \leq -10^{\circ}C$), a harsh (31-50 units of frost) and very harsh (more than 50 units of frost) winter was pointed out on extended areas in the centre of Banat.

Mostly of the north and south of Banat, the frost recorded a moderate intensity (11-30 units of frost), which characterizes a normal winter.

Between February 1-28, 2015, normal quantities of precipitations (26-50 l/m²) were recorded on large areas of Banat, while in the north-west of Banat the amounts of precipitation were reduced quantitatively

(10-25 l/m²). In the south-western part of Banat there have been significant precipitations (51 – 75 l/m²) and even abundant locally (76-96 l/m²).

In all three wine-growing areas, winter climatic conditions allowed for deep and optional resting to take place without significant deviations, which shows that all three regions provide favourable and very favourable conditions for unprotected grapevine cultivation.

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