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Influence of microclimate on Kallmet grape varietiy in two different cultivation areas, on technological parameters for wine production

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Abstract

Geographical position, average annual temperatures, solar radiation and other components of climate directly affect the quality of the grapes cultivated in a certain area. According to scientific data and current studies, is known that the quality of wine is related to the quality of the grapes used for its production. For this study we have taken Kallmet cultivar in the vegetation year 2016-2017, cultivated in two different areas Koplik and Rrëshen, located in northen Albania, they are part of the Mediterranean climate with soft-wet winter and hot-dry summer. Both of these areas are similar to the average annual temperatures and 24-hour temperatures but they have differences in solar radiation. Koplik has Irradiation on horizontal plane 4470 Wh/m^2/day, and Irradiation on optimally inclined plane 5180 Wh/m^2/day; while Rreshen has Irradiation on horizontal plane 4390 Wh/m^2/day, and Irradiation on optimally inclined plane 5050 Wh/m^2/day. Grapes obtained from these two cultivation area are collected in the technical maturity, then we have done the mechanical and physical-chemical analysis according to Reg. CE 2676/90, CIM of Wine and Must Analysis OIV, to determine the important technological parameters for wine production such as: mechanical construction of grape clusters, sugar content (Total Soluble Solids) in °Brix, Total Titratable Acidity, pH and Phenolic Compounds. The results show that in the sample of grape taken in Rrëshen we have higher level of sugar content TSS 25°Brix, and lower TTA 4.95 gr/L ac.tartrik, the ratio peel/pulp 0.41; while in the Koplik sample we have lower level of sugar contenet TSS 20.6°Brix, and higher TTA 5.92gr/L ac.tartrik, ratio peel/pulp 0.27. After that have passed in vinification according to the protocol. It results that the wine obtained from Rrëshen grapes has a better structure and a higher aromatic profile.

Keywords: Wine; Grape; Kallmet; Irradiation;Temperature.

1. Introduction

Geographical position, average annual temperatures, solar radiation and other components of climate directly affects the quality of the grape that is cultivated in a certain area. According to scientific data and current studies we can say that the quality of wine is related to the quality of the grape used for its production. The Effect of Climate is a major factor in wine production. Vines are grown in a wide variety of climatic situations. [1]. Each of the main wine-producing regions can be characterized by mean climatic conditions [2]. These climatic conditions are a major driver of wine typicity in relation to its origin [3]. Among environmental factors, climate has a greater impact on vine development and fruit composition compared to soil and grapevine variety [4]. In a given wine-producing region, climatic conditions vary from one place to an other and from a year to the other. Growers have chosen plant materials (variety, clone, and rootstock) according to local climatic conditions in order to optimize the compromise between yield and quality. Viticultural practices can be modified to adapt to climatic variability among vintages[5]. Temperature also affects fruit ripening. Sugar accumulation increases with temperature [6], but certain secondary metabolites, like anthocyanins, are negatively affected by high temperature [7]. Grape acidity, in particular the malic acid content, decreases in high temperature [6]. As long as

water is not a limiting factor, vine photosynthesis increases with light intensity until one-third of maximal radiation and then levels off [8]. Contradictory results have been published on the impact of light on grape phenolics, probably because it is difficult to separate the effect of light from that of temperature. In a field study with an adapted experimental design, [9] showed that the amount of anthocyanin in grape skins increases with light but is negatively affected by high temperature. Wine quality can be impaired when alcohol level is too low but also when the alcohol level is too high. Today it has become more common to harvest grapes with a potential alcohol level of over 14%, which, for most wines, is too high for optimum quality. Regarding acidity, the most relevant indicator is must and wine pH. Wines are perceived as being rounder, sweeter, and less aggressive when pH increases, most consumers consider this a positive change. However, wines can lack freshness when pH is too high, and it can also impair stability. However, other factors, such as fruit exposure, also play an important role in grape aroma content [10]. It is frequently observed that wines produced in warm climates from vines with dense canopies can show a vegetal character. We have seen that 1,1,6-trimethyl-1,2-dihydronaphthalene (TDN), the compound responsible for petrol flavors in wines produced from Riesling grapes, increases with temperature during the berry-ripening phase [11]. Contrasting results are reported for aromas from the terpenol family. Linalol content in berries is impaired at high temperatures, while no detrimental effect is shown on geraniol content [12]. Massoia lactone (5,6-dihydro-6-pentyl-2(2H)-pyranone) is the characteristic aroma of figs and coconut that can be found in wines produced from overripe fruit. In Bordeaux, has been found more massoia lactone in Pomerol wines, produced from a majority of Merlot grapes, in warm vintages, whether they are dry (2003) or wet (2007) [13].

2. Material and Methods

For this study we have taken Kallmet cultivar in the vegetation year 2016-2017, cultivated in two different areas Koplik (Location: 42°12'47" North, 19°26'37" East) and Rrëshen (Location: 41°46'3" North, 19°52'36" East), located in northern Albania, they are part of the Mediterranean climate with soft-wet winter and hot-dry summer. Grapes obtained from these two cultivation area were collected in the technical maturity according to its protocol, taking Average sample grapes three times during the period of maturation. In the technical maturity is also observed the maximum coloration typical of Kallmet cultivar. Harvesting is carried out by hand minimizing possible damage and losses in the juice. The average sample of the grape amount underwent to the mechanical and physical-chemical analysis according to Reg. CE 2676/90, CIM of Wine and Must Analysis OIV, to determine the important technological parameters for wine production such as: mechanical construction of grape clusters, sugar content (Total Soluble Solids) in °Brix, Total Titrable Acidity, pH. After that have passed in vinification according to the protocol for red wine production. Basic analytical determinations. The following basic analytical determinations were performed on the grapes for each sampling date. Soluble solids: Soluble solids content was determined by the refractometric method of must analysis (Reg. CE 2676/90, Compendium of International Methods of Wine and Must Analysis OIV, 2006). Total acidity: total acidity was determined according to the method given in Reg. CE 2676/90 and in Compendium of International Methods of Wine and Must Analysis OIV, ed. 2006. pH: The pH was determined according to Reg. CE 2676/90 and in Compendium of International Methods of Wine and Must Analysis OIV, ed. 2006. Average weight of acine: the mean weight of the acine was calculated by weight ratio of 100 acines (g) / 100. The 100 berries were randomly taken from the sample of grapes taken in the field. Percent by weight of the skins: the percentage by weight of the skins was calculated from the weight ratio of the skins / weight of the berries x 100. Percent by weight of grape seed: the percentage by weight of grape seed was calculated from the weight ratio of grape seed / weight of the grapes x 100. The amount of grape taken in study was 100 kg for each cultivation area (Koplik and Rrëshen) which was split into two 50kg lots each. The 4 experimental tests were destemed/crushed and treated with a dose of 5g/hl SO_2. All trials were inoculated with a 20gr/hl dose of *S. Cerevisiae* commercial yeast and fermented. This is the first year of of this project that will go on for other 4 years.

3. Results and Discussion

Both of these areas are similar to the average annual temperatures and 24-hour temperatures but they have differences in solar radiation. Koplik has Irradiation on horizontal plane 4470 Wh/m^2/day, and Irradiation on

optimally inclined plane 5180 Wh/m^2/day; while Rreshen has Irradiation on horizontal plane 4390 Wh/m^2/day, and Irradiation on optimally inclined plane 5050 Wh/m^2/day. The results show that in the sample of grape taken in Rrëshen we have higher level of sugar content TSS 25°Brix, and lower TTA 4.95 gr/L ac.tartrik, the ratio peel/pulp 0.41; while in the Koplik sample we have lower level of sugar contenet TSS 20.6°Brix, and higher TTA 5.92gr/L ac.tartrik, ratio peel/pulp 0.27.The grapes from Koplik finished the fermentation earlier due to lower content of sugars.

Table 1. Zonal characteristics according: re.jrc.ec.europa.

	The highest temp. (°C)	Lower temp. (°C)	Average annual temp. (°C)	24-hour temp.(°C)	Irradiation on horizontal plane (Wh/m^2/day)	Irradiation on optimally inclined plane Wh/m^2/day
Koplik	29.5	8.0	18.0	15.9	4470	5180
Rreshen	28.6	9.1	18.2	15.8	4390	5050

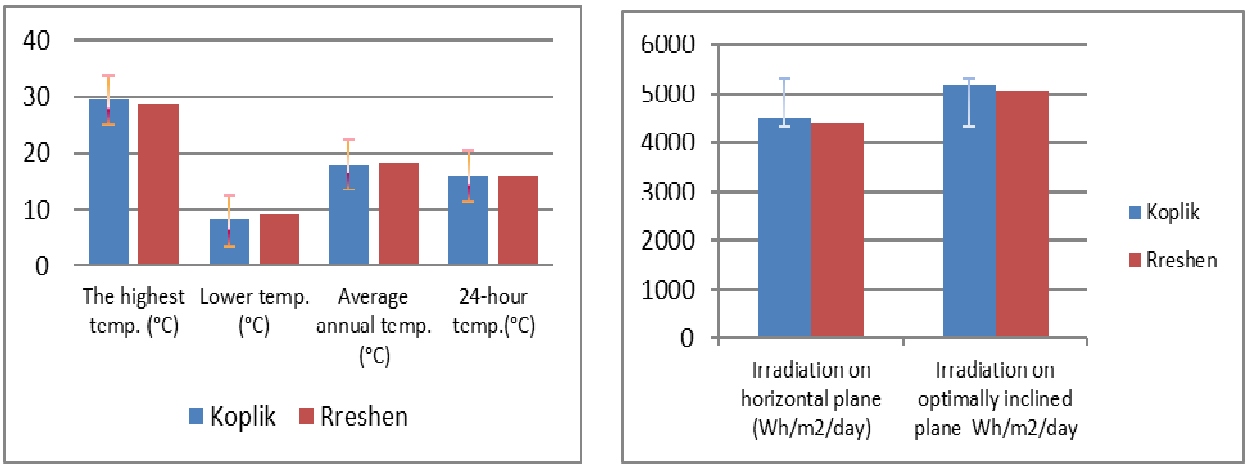

Figure 1. Zonal characteristics

Table 2. Grapevine Phenology characteristics and timeline

Stage	Characteristics	Timeline Cv.Kallmet-Koplik	Timeline Cv.Kallmet-Rreshen
Bud Break	New growth, leaves, flower buds	March – First week of April	March – First week of April
Florasion	Flower growth	Early June	Early June
Veraison /Maturation	Grape color change, sugar accumulation, growth, synthesis of tannins, ripening	End of July	End of July
Harvest	Grapes harvested and crushed to make wine.	Harvest: Mid- September	Harvest: Mid- September

Table 3. Mechanical analysis of grapes

Cv. Kallmet in Koplik area							
Nr	Weight of cluster	Weight of brake	Weight of grape berry	Weight of 100 grape berry	Weight of peel	Weight of the seeds	Weight of pulp
Mes.	199.7	5.34	194.27	213.5	35.8	11.61	130.51
Min	138.1	2.27	135.8	213.2	35.7	11.57	130.23
Max	255.2	7.73	249	214	36	11.7	131

Stdev	58.79	2.79	56.69	0.44	0.17	0.08	0.43

Cv. Kallmet in Rreshen area

Nr	Weight of cluster	Weight of brake	Weight of grape berry	Weight of 100 grape berry	Weight of peel	Weight of the seeds	Weight of pulp
Mes.	130.267	7.217	123	134.86	36.86	9.03	89.03
Min	102.1	3.39	92.6	134.8	36.8	9	89
Max	166.3	9.45	157.4	135	37	9.1	89.1
St.Dev.	32.84	3.33	32.59	0.12	0.12	0.06	0.06

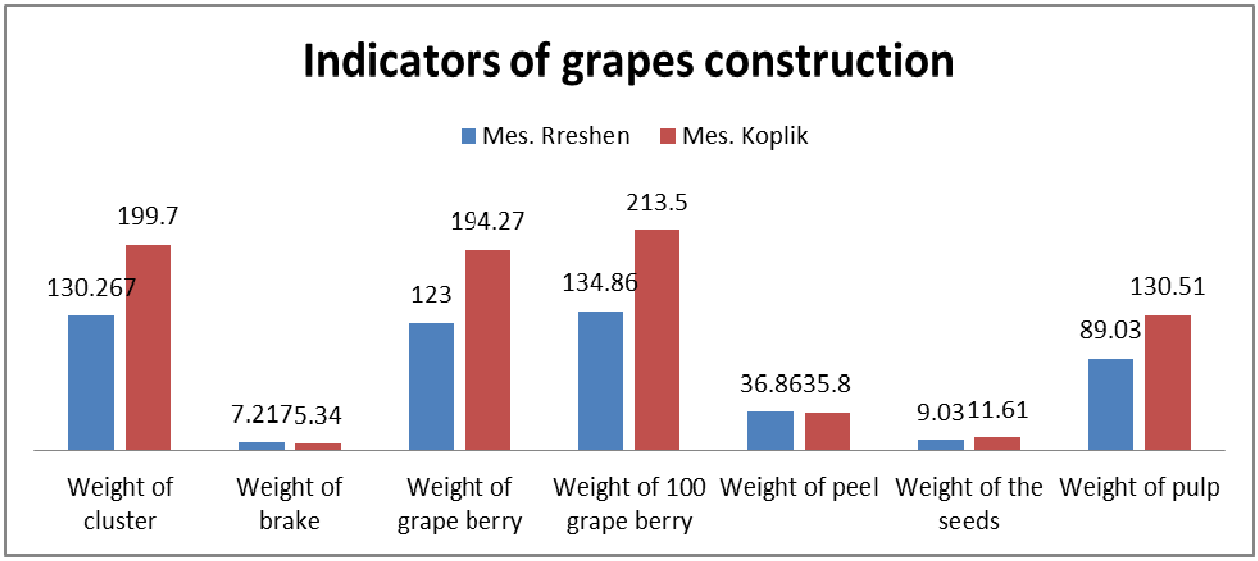

Figure 2. Indicators of grapes construction

The results show that in the sample of grape taken in Rrëshen we have higher level of sugar content TSS 25°Brix, and lower TTA 4.95 gr/L ac.tartrik, the ratio peel/pulp 0.41; while in the Koplik sample we have lower level of sugar contenet TSS 20.6°Brix, and higher TTA 5.92gr/L ac.tartrik, ratio peel/pulp 0.27.

Table 4. Physical-chemical indicators of must.

	Temp.° C	TSS°Brix	pH	Ratio peel/pulp	Maceration time (Day)	TTA gr/L ac.tartrik
Cv.Kallmet Koplik	23	20.6	3.57	0.27	11	5.92
Cv.Kallmet Rreshen	23	25	3.85	0.413	7	4.95

As we can see from the indicators, but also in the organoleptic assasement of grape must from the Koplik area, we notice the varietal aromas but low levels of sugar, which means that the expression of these aromas during the fermentation will be delayed by the low sugar content as an aromatic precursor, unlike the same cultivar obtained from the Rreshen area. Also, the low value of the peel / pulp ratio will affect the fermentation duration expressed even with 11 days maceration (for cv. Kallmet from Koplik) and without the creation of a good aromatic structure and profile. Both cultivars have undergone vinification according to the protocol for red wine production.

4. Conclusions

Both areas taken in the study, even though they are part of the Mediterranean climate, show differences between each other, a difference which is more noticeable to the horizontal and the optimum planar radiation. These

macro-climatic factors have directly affected the micro clima of cv. Kallmet in the study areas by giving grapes with different technological parameters for wine production. In the Koplik area, both of these indicators are lower and this is expressed in the quality of the grapes grown there, unlike the same variety cultivated in Rreshen. The low sugar level and maceration duration will yield a non-alcoholic wine with a poorly structured and less aromatic texture than grapes from Kallmet cultivar obtained in the Rreshen area. It results that the wine obtained from Rrëshen grapes has a better structure and a higher aromatic profile.

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