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The influence of vine growing area on grapes production for red wines with protected designation of origin

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Abstract From ancient times, the grapevine and the wine have joined human existence. Along with bread and vegetable oil, they are part of the sacred triad of mankind. The use of wine is recorded in various sculpted, engraved, painted and drawn scenes and is mentioned in ancient writings - hieroglyphic, arrow-headed writing. With Romania's entry into the European Union, funds were granted through programs specifically designed for the development of wine-growing areas. Therefore, the expansion of areas cultivated with varieties for quality red wines is part of the trend of viticulture development in Romania, in line with increasing competitiveness, both nationally and internationally. Through research undertaken in three locations in North-West Romania (Lechinţa, Mica and Camăr), we bring a contribution to the development of viticulture in the area. The relaunch of the North Carpathian area for cultivation of vines, in this area in decline in recent decades, with grape varieties for red wines, is a result of the plant's adaptation to global climate change.

Key words

production, hectars, vinegrape, wine

Currently, the cultivation of grapevines in conditions of economic efficiency is possible in regions where the annual average temperature is between 9 and 20°C [2]. The areas cultivated with grapevines have an insular distribution [8], the largest areas being concentrated between the parallels of 35 and 51 degrees north latitude and those of 25 and 38 degrees south latitude [9]. The decrease in the area cultivated with grapevines in recent years was due to economic measures, which led to the deforestation of large areas of vineyards in European Union countries (Spain, France, Italy), social measures (Hungary, Romania), aspects seen on the other continents also [6].

Nowadays, on a continentals level, the majority of vineyards are in Europe 67.7%, followed by Asia and South America, the proportion being maintained in the cultivation of black grapes too [7, 4].

In Romania, the viticultural areas delimited for the production of quality wines with protected designation of origin, PDO, represent 15.1% of the total area cultivated with grapevines destinated for wine production.

The South-East development region is the largest grapewine area cultivated for PDO wines (44.5%), followed by the regions: North - East (18.9%), South - Muntenia (11.0%), Center (11.0%), South - West Oltenia (9.3%). In 2009, the largest areas cultivated with grapevines, for other wines, were registered in the regions: South - East (39.2%) and South - West Oltenia (20.5%) [12].

The study shows that in Western and North-Western Romania, around 11 000 ha were cultivated in 2009 with grapevines and a production of 577.32 q (Table 1) red wines was reached. Once reported to the European Union, these areas can change their assortment structure or location (from plain to hill), however they can't increase change their size

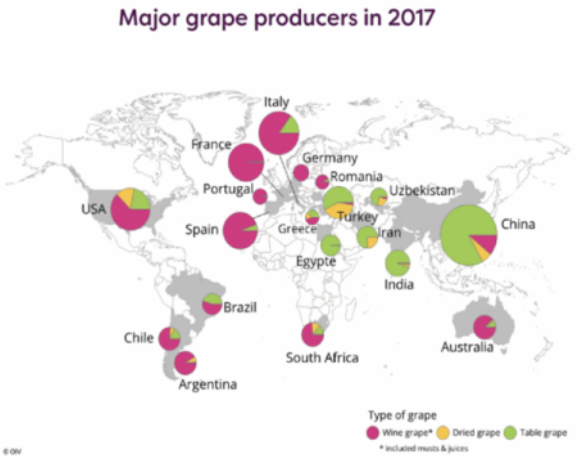

Fig. 1. Distribution of vine cultivation worldwide, source: [10]

Table 1

The content of C vitamin in hot pepper fruits at consumption maturity

Specification	um	Satu Mare	Bihor	Sălaj	Arad	Timiş	Caraş Severin	TOTAL
Vineyards	ha	2 968	627	1 968	1 425	3 376	531	**10 985**
Wine grapes yield	q	89 040	20 160	39 360	71 270	344 220	13 270	**577 320**

Source: ONVPV [11]

Material and Method

To study the influence of cultivation area on the quality of varieties, a bifactorial experiment was organized. The experience was followed during two years (2016-2017). The production was analyzed in q/ha, and the statistical processing was performed with the ANOVA program.

Factor A with 3 graduations, three varieties:

- a1 – *Merlot*
- a2 – *Fetească neagră*
- a3 – *Pinot noir*

Factor B with 3 graduations, location:

- b1 – Lechinţa-Bistriţa
- b2 – Mica-Mureş
- b3 – Camăr-Sălaj

For the classification of wines in the PDO, the standardization of the winegrapes load must be taken into account, not to exceed the rules specified in the specifications. Table 2 shows the limits for each variety and each PDO in the experimental locations.

Table 2

Maximum wine grapes production limits for obtaining wines protected by PDO/ DOC - CMD

Variety	PDO Crişana	PDO Lechinţa	PDO Târnave
Merlot	max 100 q/ha	max 120 q/ha	max 120 q/ha
Fetească neagră	max 80 q/ha	max 120 q/ha	max 120 q/ha
Pinot noir	max 80 q/ha	max 120 q/ha	max 120 q/ha

Source: ONVPV [11]

Results and Discussions

Analyzing the unilateral influence of the variety used in the experiment, it can be seen that both *Merlot* and *Fetească negră* varieties registered a very significant deficit of wine grape production -3.10 q/ha and -0.55 compared to the average of the experience taken as witness. *Pinot noir* had an increase in grape production (3.65 q/ha) compared to the very significant average of the experiment (Table 3). The *Pinot noir* variety (2.28 kg/ grapevine plant) registers high values in other wine centers [5], 46.1 q/ ha, in Miniş [5]. For 2017, the results obtained in terms of the influence of the variety on wine grapes production (table 3), show the highest production for the *Merlot* variety of 95.5 q/ha, which recorded a very significant increase in production (12.53 q/ha), compared to the average of the experience considered as witness.

Table 3

Unilateral influence of cultivar on the wine grapes yield

Cultivar	Year							
	2016				2017			
	Total average yield		± D %	Significance of difference	Total average yield		± D %	Significance of difference
	q/ha	%			q/ha	%		
Merlot	73.39	95.9	-3.10	000	95.85	115.0	12.53	***
Fetească neagră	75.94	99.3	-0.55	000	75.24	90.3	-8.07	000
Pinot noir	80.14	104.8	3.65	***	78.85	94.6	-4.46	000
Average	76.49	100.0	0.00	Wt.	83.31	100.0	0.00	Wt.
DL/*LSD* 5			0.02				0,38	
DL/*LSD* 1%			0.04				0,88	
DL/*LSD* 0.1%			0.11				2,82	

In Table 4 we analyzed the influence of location on wine grape production. The average wine grape production taken as witness was 76.49 q/ha. The conditions in Mica-Mureş and Camăr-Sălaj had a negative influence on the grapevine culture in 2016. A decrease in the average production of the yields in the two locations can be observed, being -16.75 q/ha, respectively -26.50 q/ha, these differences compared to the total average production which was considered as witness and was very significant negative. The place of vineyard establishment, recorded in Table 4, negatively influenced the wine grape production in 2017, only in

Mica-Mureş where a harvest of 44.60 q/ha was obtained. In Lechinţa and Camăr, the wine grape yields were 119.52 q/ha, respectively 85.38 q/ha, and provided statistical differences compared to the average of the experience considered as witness, the significance being very significant for both locations.

Table 4

Unilateral influence of the grapevine growing zone on wine grape yield

Grapevine growing zone	Year							
	2016				2017			
	Total average yield		± D %	Signific. of difference	Total average yield %		± D %	Signific. f difference
	q/ha	%			q/ha	%		
Lechinţa -Bistriţa	119.74	156.5	43.25	***	119.52	143.5	36.20	***
Mica -Mureş	59.74	78.1	-16.75	000	44.60	53.5	-38.72	000
Camăr- Sălaj	49.99	65.4	-26.50	000	85.38	103.0	2.51	***
Average	76.49	100.0	0.00	Wt.	83.33	100.0	0.00	Wt.
DL/*LSD* 5			0.03				0.14	
DL/*LSD* 1%			0.05				0.21	
DL/*LSD* 0.1%			0.08				0.60	

In order to understand the influence of the experimental factors in the three years of experience, we used the Duncan test for processing the obtained data. The results were summarized in Table 5 where we can track the situation for each year and the combination of experimental factors. For the three years, there are statistically assured differences. In 2016, the Lechinţa-Bistriţa location has high yields regardless of variety, but the best variant is Lechinţa/ *Pinot noir*, with the highest grape production 119.95 q/ha. The lowest values are obtained for the Camăr/ *Merlot* variant of 34.11 q/ha. Regarding 2017, the highest production is obtained in the Lechinţa/ *Pinot noir* variant, followed by Lechinţa/ *Fetească neagră* (119.93 q/ha, 119.77 q/ha), not being statistically assured values. The lowest were in Mica/ *Feteasca neagra* 26.85 q/ha.

Table 5

Synthesis of grape production (quintals / ha) in years of experience

Variant	Year 2016* Yield (q/ha)	Year 2017** Yield (q/ha)
Lechinţa/*Merlot*	119.43 C	118.85 B
Lechinţa/*Fetească neagră*	119.82 B	119.77 A
Lechinţa/*Pinot noir*	119.95 A	119.93 A
Mica/*Merlot*	66.62 D	70.44 F
Mica/*Fetească neagră*	47.16 H	26.85 H
Mica/*Pinot noir*	65.44 E	36.50 G
Camăr/*Merlot*	34.11 I	98.24 C
Camăr/*Fetească neagră*	60.83 F	79.12 E
Camăr/*Pinot noir*	55.03 G	80.12 D

*DS 0.05-----0.06
**DS 0.25-----0.26

Conclusions

In 2016, the highest production of grapes per hectare for Lechinţa/*Pinot noir* variant was 119.95 q/ha and the smallest production was obtained for the Camăr/ *Merlot* variant with 34.11 q/ha. In 2017, the highest production was reached by the Lechinta/ *Pinot noir* variant, of 119,93 q/ha, and the lowest value was in the Mica/ *Fetească neagră* variant, 26.85 q/ha.

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