

## STUDIES ON THE INFLUENCE OF THE LOAD CHARGED ON THE TECHNOLOGICAL POTENTIAL OF RED CULTIVATED VINEYARDS IN THE WINE CENTER OF IAȘI COPOU

### STUDII PRIVIND INFLUENȚA ÎNCĂRCĂTURII DE ROD ATRIBUITĂ LA TĂIERE ASUPRA POTENȚIALULUI TEHNOLOGIC AL SOIURILOR ROȘII DE VIȚĂ DE VIE CULTIVATE ÎN CENTRUL VITICOL COPOU IAȘI

NECHITA Ancuța<sup>1\*</sup>, ZALDEA Gabi<sup>1</sup>, ALEXANDRU C.<sup>1</sup>,  
FILIMON R.<sup>1</sup>, FILIMON Roxana<sup>1</sup>, DAMIAN Doina<sup>1</sup>

\*Corresponding author e-mail: ancuta.vasile@yahoo.com

**Abstract.** *The quantity and quality of the grape production depends on the biological potential of the varieties, the favorability of climatic conditions and the eye loads left to be cut. Achieving quality production with healthy grapes, high sugar concentrations and high phenolic content is a priority for viticulturists. In order to determine the influence of the fruit load attributed to cutting on the technological potential of the red varieties cultivated in the Copou Iași vineyard, the varieties Arcaș and Cabernet Sauvignon were studied. Three loads were tested: 20 eyes / bud (T1), 36 eyes / bud (T2) and 28 eyes / bud (M). The T1 variant was highlighted with reduced eye load, which positively influenced the size of the grapes, the accumulations of sugars and the phenolic compound content.*

**Key words:** fruit loads, technological indexes, phenolic potential

**Rezumat.** *Cantitatea și calitatea producției de struguri depinde de potențialul biologic al soiurilor, favorabilitatea condițiilor climatice și de sarcinile de ochi lăsate la tăiere. Realizarea unor producții de calitate, cu struguri sănătoși, concentrații mari de zaharuri și conținut fenolic ridicat constituie o prioritate pentru viticultori. Pentru a determina influența sarcinii de rod atribuită la tăiere asupra potențialului tehnologic al soiurilor roșii de viță de vie cultivate în centrul viticol Copou Iași au fost luate în studiu soiurile: Arcaș și Cabernet Sauvignon. Au fost experimentate trei încărcături: 20 ochi /butuc (T1), 36 ochi /butuc (T2) și 28 ochi /butuc (M). S-a remarcat varianta T1, încărcătură redusă de ochi, ce a influențat pozitiv mărimea strugurilor, acumulările de zaharuri și conținutul de compuși fenolici.*

**Cuvinte cheie:** încărcături de rod, indici tehnologici, potențial fenolic

## INTRODUCTION

The qualitative potential of vine varieties differs according to the area in which they are grown, being heavily influenced by the culture technology used and climatic conditions (Pomohaci *et al.*, 2000). The achievement of constant and high quality wine production is determined by the correct application of the agrofitotechnical complex. Among the agrofitotechnical works that can lead to the

<sup>1</sup>Viticulture and Oenology Research and Development Station in Iasi, Romania

increase of the technological potential of the grapes in the red varieties we mention the yielding cuttings by attributing optimal loads to the biological potential of the variety. Excessive fruit loads cause the imbalance between grape production and vegetative development, the star of a small number of eyes in the vegetation, the decrease of fertility and productivity of horns, the occurrence of discontinuities in the pruning of shoots (Poenaru *et al.*, 1976, Mihalca *et al.*, 1986, Murisier *et al.*, 2005). The reduction of the fruit load is accompanied by a quantitative decrease in production and an increase in quality, different depending on the variety (Pițuc *et al.*, 1992; Țârdea *et al.*, 1992). At the same time, the load attributed to the cutting cannot be much different from the one that optimally exploits the growth vigor (Payan *et al.*, 1991; Irimia and Țârdea., 2004).

In order to determine the influence of the fruit load attributed to cutting on the technological potential of the red varieties cultivated in the Wine Center of Copou Iași, two varieties have been studied for two years (2016 and 2017): Arcaș, variety obtained at SCDVV Iași and Cabernet Sauvignon from the international cultivar.

## MATERIAL AND METHOD

The experimental lots were located in a vineyard plantation established in 2009 on a planted plain with south exposure, chernozem cambic soil with planting distances of 2.2 m between rows and 1.2 m per row, with a strain height of 0.8 m. The field experience was assembled on 6 rows (3 rows / variety) in 3 variants including the control variant, placed in 3 rehearsals. Each variant contained 21 hubs with three loads: 20 eyes / hump (T1); 36 eyes / horn (T2) and 28 eyes / hump (M).

Grape quality was assessed on the basis of physico-chemical analyzes focusing mainly on sugars (g / L), acidity (g / L H<sub>2</sub>SO<sub>4</sub>) and weight of 100 grains (g). The analysis of the mechanical composition of the grapes was performed for the calculation of the technological indices which characterize the quality of the grapes, as well as the technological yields that can be obtained. Thus, at the date of grapes harvesting, the following parameters were determined for each variety: grape weight (g), grape volume (mL), grain number and grain weight (g).

For the evaluation of phenolic compounds in grapes was determined by standard Glories method: the total polyphenolic potential (ApH1 - mg/L), the extractable anthocyanins potential (ApH3,2 - mg/L), the percentage of anthocyanins extractability (AE - %), total polyphenols index (mg/L), the content of tannins in seeds and skins (mg/L) and the maturity of the seeds (MS).

## RESULTS AND DISCUSSIONS

The climatic conditions of the study period (2016-2017) were characterized by: annual average temperatures higher than the multiannual value (9.8°C), namely from 10.8°C in 2017 and 11.0°C in 2016; absolute minimum temperatures below the freezing limit of the vine, between -18,7°C and - 21,0°C; high number of days with maximum temperatures above 30°C (39 days in 2017 and 53 days in 2016); warm summers with absolute maximum temperatures ranging from 34.9°C (2016) to 37.3°C (2017); low rainfall and unevenly distributed during the

vegetation period, respectively 333.8 mm in 2016 and 293.4 mm in 2017 versus 398.1 mm, normal value in The Wine Center of Copou - Iași.

The quality of the grape production of the Cabernet Sauvignon and Arcaș varieties was influenced by the climatic factors which in 2016 were more favorable to the accumulation of sugars (tab. 1).

Table 1

Grape quality at harvest in the climatic conditions of the years 2016 -2017

Variety	Variant	Sugars, g/L		Acidity, g/L H <sub>2</sub> SO <sub>4</sub>		Weight 100 grains, g	
		2016	2017	2016	2017	2016	2017
Cabernet Sauvignon	M=28 eyes	195	182	4.3	4.8	115	123
	T1=20 eyes	204	184	4.2	4.7	118	129
	T2=36 eyes	191	179	4.5	4.9	113	124
Arcaș	M=28 eyes	209	181	3.7	4.3	114	127
	T1=20 eyes	211	185	3.3	4.3	120	132
	T2=36 eyes	185	180	4.2	4.4	115	125

During the two years of study, the varieties have accumulated more than 180 g/L sugars in the wort, highlighting the Arcaș variety. In both varieties, the fruit load exerted a significant influence on the accumulation of sugars and the decrease in acidity. Amplification of the fruit load led to a decrease in the concentration of must in sugars, the highest values being T1 (20 eyes / hub) and the lowest in the T2 (36 eyes / hub). Also, the acidity values have decreased with the reduction in fruit load. The weight of 100 grains recorded lower values in 2016 and higher in 2017, and according to the fruit load, both varieties have recorded higher at T1 variant (20 eyes / hub).

After analyzing the mechanical composition of the grapes (tab. 2) it was visible the fact that at the moment of complete maturation, which concluded with the harvest, the medium weight of a grape was different with the type, between 128 and 209 g for Arcaș, 132 and 177 g for Cabernet Sauvignon.

Table 2

Mechanical analysis of the grape at harvest

Variety	Variant	Weith of a grape (g)		Volume of grape (mL)		No. grains		Bunch weight (g)	
		2016	2017	2016	2017	2016	2017	2016	2017
Cabernet Sauvignon	M=28 ochi	138	177	130	168	117	152	6.17	9.17
	T1=20 ochi	150	132	143	127	132	116	6.17	5.17
	T2=36 ochi	133	152	123	143	125	133	6.67	6.67
Arcaș	M=28 ochi	149	155	140	150	148	131	8.17	6.67
	T1=20 ochi	128	175	120	170	119	143	6.67	7.17
	T2=36 ochi	131	209	125	199	116	154	6.00	9.00

The technological characteristics of the grapes were evaluated according to index composition of the grape, berry index, berry composition, berry structure, grape must yield and yield index (tab. 3 and tab. 4).

Table 3

Technological indices of the grapes at harvest in 2016								
Variety/ Variant	Index composition of grape	Index graines	Index composition of grain	Grain structure			Grape must yield (%)	Yield index
				% skins	% seeds	% pulp		
<b>Cabernet Sauvignon</b>								
M	21.4	84.7	2.6	21.6	5.9	72.5	77.7	3.5
T1	23.3	88.2	2.8	20.4	5.9	73.8	76.6	3.3
T2	18.9	94.6	2.5	22.4	6.1	71.5	77.5	3.4
<b>Arcas</b>								
M	17.2	99.8	2.4	19.0	10.3	70.7	76.6	3.3
T1	18.2	93.0	2.4	20.1	9.5	70.6	79.5	3.9
T2	20.8	99.2	2.9	17.0	8.8	74.2	79.4	3.8

Table 4

Technological indices of the grapes at harvest in 2017								
Variety/ Variant	Index composition of grape	Index graines	Index composition of grain	Grain structure			Grape must yield (%)	Yield index
				% skins	% seeds	% pulp		
<b>Cabernet Sauvignon</b>								
M	18.8	85.7	3.9	15.6	4.9	79.5	79.5	3.0
T1	25.4	87.9	2.9	20.6	4.8	74.6	74.6	4.0
T2	29.3	89.7	3.4	18.2	4.5	77.4	77.4	3.7
<b>Arcas</b>								
M	27.2	86.1	4.5	12.5	5.7	81.8	79.7	3.9
T1	22.9	82.1	4.9	8.8	7.8	83.4	79.3	3.8
T2	22.7	73.7	3.9	14.1	6.3	79.6	79.1	3.8

The grape composition index had values ranging from 17.2 to 27.2 in Arcas, respectively from 18.8 to 29.3 in Cabernet Sauvignon, which allows us to say that the grapes were well established in all three variants, there is no correlation with the fruit load attributed to the cutting.

Grain index values were close to the maximum limit in 2016, and between 93.0 and 99.8 for the Arcas variety and between 84.7 and 94.6 for Cabernet Sauvignon. In 2017, due to less favorable climatic conditions, the values were lower, between 73.7 and 89.7.

The bean composition index had small values (2.4 - 4.9) below the 5th limit, indicating a higher proportion of skins and seeds than normal, due to rainfall and water scarcity accessible from the soil near the level of wilting coefficient during the vegetation period.

The values of the parameters that characterize the structure of the grain were higher in the skins ranging between 17.0% and 22.4% in the year 2016 and lower in 2017, respectively between 8.8 and 20.6%. In the case of seeds, the values are above the maximum limit of 5%. As for the amount of pulp, the percentages are below the 73% minimum for both varieties in 2016, which are affected by drought and over 79% in 2017, which resulted in a wort yield of 74.6

and 79.7%.

Anthocyanic potential varies primarily according to variety, grape maturation and climatic conditions of the viticultural area (tab. 5 and tab. 6). Thus, at harvest, the anthocyanin content (ApH1) reached values between 1103.48 mg / L and 1597.0 mg/L in 2016, namely values between 994.52 mg/L and 1340.0 mg/L in 2017.

Table 5

**Phenolic potential of Cabernet Sauvignon grapes**

Parameters determined	M=28 ochi		T1=20 ochi		T2=36 ochi	
	2016	2017	2016	2017	2016	2017
ApH1 (mg/L)	1145.36	994.52	1125.2	980.79	1103.48	985.52
ApH3,2 (mg/L)	304.2	164.51	298	164.51	293.32	142.78
AE (%)	73.44	83.46	73.52	83.23	73.42	85.51
Total polyphenols (mg/L)	17.8	11.0	18.2	10,0	18.2	10.4
Skin tannins (mg/L)	12.16	6.58	11.92	6.58	11.72	5.71
Seed tanins (mg/L)	59.04	37.42	60.88	33.42	61.08	35.89
Seeds at maturity (%)	82.9	85.04	83.6	83.55	83.9	86.27

Table 6

**Phenolic potential of Arcaș grapes**

Parameters determined	M=28 ochi		T1=20 ochi		T2=36 ochi	
	2016	2017	2016	2017	2016	2017
ApH1 (mg/L)	1576.84	1323.36	1597.0	1340.0	1559.76	1324.49
ApH3,2 (mg/L)	420.6	335.23	406.64	338.34	400.4	315.06
AE (%)	73.33	74.67	74.54	74.75	74.33	76.21
Total polyphenols (mg/L)	21.6	12,0	22.2	12.6	22.4	10.8
Skin tannins (mg/L)	16.84	13.41	16.28	13.53	16.0	12.6
Seed tanins (mg/L)	69.56	34.59	72.52	36.87	73.6	30.6
Seeds at maturity (%)	80.5	72.06	81.7	73.15	82.1	70.83

The Arcaș variety has a higher anthocyanin potential compared to Cabernet Sauvignon, the two varieties are being characterized as having good (800-1000) and excellent (> 1200) anthocyanic potential. The different fruit loads attributed to the cutting had a small influence on the anthocyanic potential of the grapes, higher values being recorded in the T1 variant (20 eyes). Extractability of anthocyanins from grape grains (EA%) showed close values for the two varieties, the results confirming that anthocyanin extractability is a characteristic of the variety. The studied varieties presented in 2017, a reduced content of anthocyanins and total polyphenols, compared to the previous year, due to climatic conditions less favorable to phenolic maturation. They contain enough quantities of polyphenols in the grain so with adequate technology provide a good colour of the wine.

The largest quantities of tannin have been identified in seeds, confirmed by specialty literature (Țârdea, 2010). In tannins, the tannin content is much lower, especially in the Arcaș variety with values between 16.0 and 16.84 mg / L (2016), respectively between 12.60 and 13.53 mg / L (2017).

Regarding the phenolic seed maturation (MP), the analysis of the obtained

results highlights the decisive role of the genetic factor, the highest values being recorded in the Cabernet Sauvignon variety (82.90 – 86.27%).

## CONCLUSIONS

1. During the two years of study, the technological potential of the Arcaș and Cabernet Sauvignon varieties was influenced both by the climatic factors and by the fruit loads attributed to the cutting.

2. Sugar accumulations were superior to T1 variant (20 eyes/hub) and lower to T2 variant (36 eyes/hump), and the total acidity values of the wort were reduced compared to previous years, aspect due to the increased pedological drought and high temperatures. Also, the 20 eye/hub loads have positively influenced the accumulation of phenolic compounds in grapes.

3. The studied varieties contain sufficient amounts of polyphenols in the grain skin to ensure with the use of adequate technology the proper colour of the wines. As highlighted, the Arcaș variety has a qualitative technological potential superior to the genitor variety Cabernet Sauvignon.

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