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COMPARATIVE STUDY REGARDING THE INFLUENCE OF BIOSTIMULATORS ON THE QUALITATIVE AND QUANTITATIVE POTENTIAL OF CABERNET SAUVIGNON

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Abstract

The popularity, the qualitative parameters and the impressive variability proved by the Cabernet Sauvignon variety, offers new ways of approach to the practice of winery and to scientific research. This paper presents a comparative study regarding the influence of some biostimulators on the production and quality potential of the Cabernet Sauvignon variety, in the ecological, pedological and climatic conditions recorded in Urlati wine center, from Dealu Mare vineyard. The experiment proved the application of 3 treatments with these bio-stimulators (Tecnophyt PK, Tecamin BRIX, Tecnokel amino CAB 2), during grape phonological growth, as follows: at the binding of the grapes (berry) 1-2 mm, when the grapes had a diameter of 4-6 mm and when the grapes had 6-8 mm. Observations and detailed determinations regarding the agro-biological and technological behavior were performed in the same time, but the production was especially evaluated in terms of physical-chemical parameters of the grapes, in order to obtain some quality wines, with particular notes. All the obtained results in terms of production, quantity and quality are leading to the idea that the used biostimulator substances had a positive influence, with the remark that for a 5.8% production increase, the quality parameters (sugar, acidity, polyphenols) are situated in the same limits, even higher sometimes, fully justifying their use.

Key words: *biostimulators, ecological factors, phenological, vineyard, variety.*

INTRODUCTION

Cabernet Sauvignon variety owns at present time in our country, the largest cultivated surface with varieties designed to obtain quality red wines, and although they are more cultivated in many wine centers (74), positioned in the hilly Carpathians of Muntenia and Oltenia, the South of Moldavia and Dobrogea as well as in some wine centers in the west of the country, found its second home in Dealu Mare vineyard.

Although adapted to the climate here, Cabernet Sauvignon presents an impressing variability of the phenolic characters in the plantations, various biotypes being detected here, differenced as follows: according to the type of flowers, the length of the inflorescence, the degree of ramification of the inflorescence, the binding percentage of the grapes, the shaking percentage of the already formed flower (42,8%) as well as the undevelopment of the grapes, which in some years, leave a mark on the production.

Starting from this consideration, in the present paper has been analyzed the influence and the effect of foliar application of some biofertilizers, in different stages regarding the growth of the grapes, on the enhancement of the productive and technological potential (Antonacci and Perniola, 2012) of this variety, in the wine year 2011-2012.

The interpretation of the results obtained after this experiment were analyzed under the aspect of production quality parameter definition (production per vine, sugar, acidity), (Pârcalabu, 2010).

MATERIALS AND METHODS

The reasearch was made in the wine center Urlati, which is located in the Dealu Mare vineyard where Cabernet Sauvignon variety was conducted on a semi-high, mixed pruning system, Guyot on a semi-stem pruning system, with a load of 30 buds/vine, at a planting distance of 1,0/2,5 m (Figure 1).

Figure 1. Cabernet Sauvignon variety in the experimental field-wine center Urlati, 2012

Bio-stimulators used (Table 1) have a large action specter including bio-stimulating effects, growing and auxinic regulators, not being toxic for humans, bees, fish, non-cumulative and biodegradable.

Table 1. Phenological study of vine during biofertilizers treatment application

Principal growth stage 7: Development of fruits (BBCH MODIFIED PHENOLOGICAL SCALE FOR COST ACTION FA1003)		
Phenological stage 71: Fruit set: young fruits begin to swell, remains of flower lost (1-2 mm)	Phenological stage 73: Berries groat-sized, bunches begin to hang (4 mm in diameter)	Phenological stage 75: Berries pea-sized, bunches hang (7 mm in diameter)
I treatment **Tecnophyt PK 3 l/ha** Small-berry grape only formats 13.06.2012 	II treatment **Tecamin BRIX 2 l/ha** Grapes with berries 4-6 mm in diameter 30.06.2012 	III treatment **Tecamin BRIX 2 l/ha & Tecnokel amino CAB 2 l/ha** Grapes with berries 6-8 mm in diameter 14.07.2012 

Foliar treatments have been applied according to the experimental protocol, which prefigured applying them in different phenophases of grape growing, as follows: at binding 1-2 mm, when the grapes were 4-6 mm diameter and when the grapes were 6-8 mm diameter (Table 2). During growing period were taken observations on the whole phonological specter, and at the harvesting moment, on a medium sample of 10 grapevines, there were made the following determinations: fertility coefficients (absolute and relative), productivity indexes (absolute and relative – g/sprout), grape number per vine, average weight of a grape, average weight of 100 grapes, production in kilograms/vine, sugar (g/l), acidity (g/l of tartric acid), anthocyanins mg/l, polyphenolic total index, and so on. In order to provide information regarding the quality of the production obtained, it was quantified the term of grape production quality (Pârcalabu, 2010) which was expressed throughout three components: production per vine in kg/vine; sugar concentration of the must g/l; must concentration in total acidity g/l. Dimensioning the grape production quality is made for each variety eventhough in the same wine area are cultivated white wine varieties as well as red wine varieties.

A possibility to obtain quality characteristics independent from the variety is to divide each quality component (P-production, Z-sugar

content, A-acidity content) to the optimal values of each variety P_{opt}, Z_{opt}, $A_{opt.}$ Optimal values in Dealu Mare vineyard – Valea Calugareasca are the multi-annual averages of these values (Pârcalabu, 2010), as follows: sugar – 210 g/l, acidity-4,4 g/l of tartric acid, production – 2,62 kg/vine. Therefore they are defined: Production quality coefficient: c_p defined by the ecuation: $c_p = P/P_{opt}$; Quality coefficient in sugar must content: c_z defined by the ecuation: $c_z = Z/Z_{opt}$; Quality coefficient in must total acidity content c_a defined by the ecuation: $c_a = A/A_{opt}$. Quality vector has in this case, the component $c = (c_p, c_z, c_a)$. The best quality is considered when, on each component quality coefficient exist and has the value close to 1. This being the ideal case, c = (1, 1, 1) or if they are expressed in percentages then this quality will become c = (100%, 100%100%).
In this case the values of quality coefficients are sub-unitary or supra-unitary, we can conclude that, qualitatively speaking, the culture is not at optimal parameters.

Table 2. Applied products features

Experimental values	**Small-berry grape only formats 13.06.2012**	**Grapes with berries 4-6 mm in diameter 30.06.2012**	**Grapes with berries 6-8 mm in diameter 14.07.2012**
Cabarnet Sauvignon (fertilized)	**Tecnophyt PK 3 l/ha** (Potassium phosphate) Total Phosphorus P_2O_5 30% w/w, Total PotassiumK_2O 20% w/w, pH 4; Activation of natural defending mechanisms of the plants, control and prevention of phytopatogenous mushrooms (*Plasmospara viticola*). Inducind phytoalexines synthesis Represents an asimilable and concentrated Potassium and Phosphorus source	**Tecamin BRIX 2 l/ha** Potassium (K_2O) 18% w/w, Boron (B), 0,2% w/w Sea weed extract, rich in auxines and giberelines 10% w/w It enhances the color of the fruits and the sugar content Determines the growth of fruits dimension	**Tecamin BRIX 2 l/ha** & **Tecnokel amino CAB 2 l/ha** Calcium oxide (CaO) 10% w/w Boron (B) 0,2% w/w L-Aminoacides 6% w/w EDTA (Ethylenediamine tetracetic acid) Increases fruit firmness and post-harvesting quality Increases breaking resistance Control over physiological disfunctions associated with the lack of Calcium
Cabarnet Sauvignon (control)	-	-	-

Optimal values in Dealu Mare vineyard, Valea Călugărească are: sugar: 210 g/l, 4.4 g/l tartric acid and production 2,62 kg/vine

To evaluate more easily how quality performant a variety acts inside an area or after applying a technology, it can be introduced the relative quality coefficient (relative to the optimal values), defined by the three components: Relative quality coefficient in production: c_p defined by the ecuation c_{pr} = /P_{opt} = c_p-*1*; Relative quality coefficient in grape must sugar content: : c_z defined by the ecuation: c_{zr} = /Z_{opt} = c_z-*1*; Relative quality coefficient in total acidity grape must content: c_a defined by the ecuation: c_{ar} = / A_{opt} = c_a-*1*.
Quality vector has, in this case the component $c_r = (c_{pr}, c_{zr}, c_{ar})$ (Table 3). Appreciating the quality potential of a variety in accordance to the relative quality coefficient is made taking into consideration the fact that the variety has a greater adaptability area as the relative quality coefficient values recorded are closer to zero.

Table 3. Quality components of grape production analysis

Vectors that define quality parameter			
$c_p = P/P_{opt}$ *	$c = (c_p, c_z, c_a)$	$c_{pr} = /P_{opt} = c_p$-*1*	$c_r = (c_{pr}, c_{zr}, c_{ar})$
$c_z = Z/Z_{opt}$ *		$c_{zr} = /Z_{opt} = c_z$-*1*	
$c_a = A/A_{opt}$ *		$c_{ar} = /A_{opt} = c_a$-*1*	

RESULTS AND DISCUSSIONS

Because of the fact that to both of the experimental variants was applied the same agrotechnics (pruning type, pruning system, load of buds per vine, planting distances, and so on), it is observed that there weren't significant differences regarding the elements that define the fertility of a variety (c.f.a, c.f.r, number of grapes per vine) values obtained for both of the variants being very close (Table 4).

Productivity level was appreciated with the help of the productivity indexes (absolute and relative) that gives informations about the grape quantity on a fertile sprout, and from this point, it is observed that, the fertilized variant obtains higher values (173 g/sprout), in comparation with the control variant (165 g/sprout) because the values of a grape's average weight know the same differences.

The differences more or less significant showed as a result of applying the biofertilizers, in the grape growing phenophase, practically insuring a better growth of the grapes, gradually in the three applying stages (13.06.2012, 30.06.2012, 14.07.2012), as well as a higher grape weight. At the harvesting moment, Cabernet Sauvignon after the three treatments obtains grapes with a higher average weight (92 g), compared to the control variant, difference that is observed in the average weight of 100 grapes. Regarding the production that was obtained and its quality, higher accumulations of sugar are showed at the fertilized variant (219 g/l), comparing to the control with values of only 202 g/l.

Production per vine, also shows such differences, and a plus of 5,8% in case of bio-stimulators treatment was made, can be observed. Surprisingly, comparing the average values of the anthocyans accumulations and the total polyphenol index, it is underlined the fact that, at the control variant these values are superior, comparing to the fertilized variant.

It can be concluded partially that, applying bio-fertilizers to avoid massive flower shaking and a good grape binding and growing, brings a plus of quality production through grape growth, enhances the sugar content and doesn't enhance grape color (at least in the chosen variants Tecnophyt PK 3 l/ha, Tecamin BRIX 2 l/ha, Tecnokel amino CaB 2 l/ha and for vine, especially).

Table 4. Cuantification of the biofertilizers effects on the productive and technological potential of Cabernet Sauvignon variety in the conditions of Urlati vineyard

Experimental variants and specification	**Absolute fertility coefficient**	**Relative fertility coefficient**	**Absolute productivity index (g/sprout)**	**Relative productivity index (g/sprout)**
Cabernet Sauvignon **(fertilized)**	1,78	1,38	173,0	132,48
Cabernet Sauvignon **(control)**	1,89	1,36	165,0	118,4
Experimental variants and specification	**No. of grapes/vine**	**Average weight of a grape (g)**	**Weight of 100 grapes**	**Production (kg /vine)**
Cabernet Sauvignon **(fertilized)**	25	92	96,5	2,210
Cabernet Sauvignon **(control)**	24	87	92,3	2,088
Experimental variants and specification	**Sugar (g/l)**	**Acidity (g/l tartric)**	**Anthocyans (mg/l)**	**Total polyphenolic index**
Cabernet Sauvignon **(fertilized)**	219	4,46	1187,6	
Cabernet Sauvignon **(control)**	202	4,98	1466,7	447,44

Evaluating the parameters that define production quality of Cabernet Sauvignon in accordance to the results obtained after the experiment was realised through dividing each quality component (production, sugar, acidity) at optimal values of each variety, (optimal values or productive potential of the variety are considered average multi-annual values of the closest area, Valea Călugărească (Table 5).

It is observed that, applying some biofertilizers in different growing stages of the grapes, these parameters record values close to 1 (1,042 – for

sugar accumulated in grapes and 1,01 for must acidity) which shows the fact that, the variety reached at the moment of full maturation a technological potential close to the optimal (variety potential). For the production parameter, the value obtained of 0,84 or 84,35% shows that from this point of view, the variety was situated under the optimal parameter.

Appreciating the qualitative potential of the variety in conformity with the relative quality coefficient values underline that, under accumulated sugar quantity and reached acidity, the biostimulators variant records values close to zero, which shows a very good adaptability of the variety and the chosen research variant, based on favorable ecopedoclimatic conditions in which the experiment took place. For the control variant, it is observed that the sugar parameter records values close to 1 (0,96 or 96,19%), underlining the fact that, the variety has reached at the full maturity moment a technological potential very close to optimal (variety potential). For the other two parameters, the production per vine and the grape must acidity, the values recorded are even too low (0,79), even too high (1,13), showing the fact that, from this point of view the variety situated under its potential. For appreciating the qualitative variety potential compared to the relative quality coefficient it is underlined the same tendancy – under the sugar accumulation the control variant records values close to zero (0,04), hierarchically followed by the values recorded by the acidity and the production/vine, with lower values, but not that low so that the differences could be statistically insured.

Table 5. Cuantification of the effects of biofertilizers on quality parameters of Cabernet Sauvignon variety in the conditions of Urlati vineyard

Experimental variants	**Vectors that define quality parameters**			
Cabernet Sauvignon **(fertilized)**	c_p=P/P_{opt} * 0,84	c = (c_p, c_z, c_a) 0,84, **1,042, 1,01** 84,35%, 104,2%, 101,1%	c_{pr} = /P_{opt}= c_p -*1* 0,16	c_r= (*c_{pr}, c_{zr}, c_{ar}*) 0,16,**0,042**, **0,013**
	c_z =Z/Z_{opt}* **1,042**		c_{zr} = /Z_{opt}= c_z -*1* **0,042**	
	c_a=A/A_{opt}* **1,01**		c_{ar} = /A_{opt}= c_a -*1* **0,013**	
Cabernet Sauvignon **(control)**	c_p=P/P_{opt} 0,79	c = (c_p, c_z, c_a) 0,79, **96,19, 1,13** 79,69%, **96,19%,** 113,18%	c_{pr} = /P_{opt}= c_p -*1* 0,20	c_r= (*c_{pr}, c_{zr}, c_{ar}*) 0,20,**0,04**, **0,13**
	c_z =Z/Z_{opt} **0,96**		c_{zr} = /Z_{opt}= c_z -*1* **0,04**	
	c_a=A/A_{opt} 1,13		c_{ar} = /A_{opt}= c_a -*1* **0,13**	

CONCLUSIONS

The results obtained under the aspect of quantity and quality lead to the idea that the biostimulating substances used had a positive influence on Cabernet Sauvignon, observing that at a production rate of 5,8%, parameters that define quality (sugar, acidity, polyphenols) are situated at the same limits, sometimes even higher, justifying their use. Regarding production quality it is underlined the fertilized variant, the deviation from the optimal production being minor – 84,35% and for the accumulated sugar and the grape must acidity the values obtained are closer to 1 showing the fact that the variety reached at the moment of full maturity a technological potential close to the optimal one (variety potential). For the control variant it is observed that the sugar parameter records values close to 1 (0,96 or 96,19%), and for production and acidity the values recorded are even too low (0,79 or 79,69%,) or even too high (1,13 or 113,18%), situating the variety under its optimal potential, but not that far to have and influence on the quality of the wine.

REFERENCES

Antonacci D., Perniola R., 2012. Trattamento con biostimolanti per il miglioramento della qualità dell'uva e della differenziazione a frutto delle gemme in varietà di uve da tavola senza semi. Organisation Internationale de la Vigne et du Vin, Paris, le 13 mars 2012.

Pârcalabu Liliana, 2010 -Cercetari asupra delimitarii unitatilor "terroir" si a sistemului informatic de gestionare cu privire special la central viticol Valea Calugareasca. Teza de doctorat, U.S.A.M.V. Bucuresti, p. 238-242.

Stroe Marinela, 2012-Ampelografie. Editura Ceres, Bucuresti, 2012.

http://www.diprove.unimi.it/GRAPENET/index.php, Cost action FA1003: East-West ollaboration for Grapevine Diversity Exploration and Mobilization of Adaptive Traits for Breeding, PHENOTYPING TRIAL 2012, First circular 12th March 2012.

***-O.I.V. guidelines for studies on the effects of climate change in vitiviniculture and proposed adaptations. Organisation Internationale de la Vigne et du Vin, Paris, le 13 mars 2012.