

## Comparative Researches Regarding the Behavior of Some Wine Grape Varieties Cultivated in Different Areas of Transylvania

Anca BABEȘ<sup>1)</sup>, Viorel BUDIU<sup>1)</sup>, Nastasia POP<sup>1)</sup>, Maria ILIESCU<sup>2)</sup>,  
Claudiu BUNEA<sup>1)</sup>, Anamaria CĂLUGĂR<sup>1)</sup>, Florentina CIOBANU<sup>1)</sup>

<sup>1)</sup> University of Agricultural Sciences and Veterinary Medicine, Faculty of Horticulture,  
3-5 Manastur Street, 400372, Cluj-Napoca, Romania; ancababes@usamvcluj.ro

<sup>2)</sup> Research and Development Station for Viticulture and Enology Blaj, 2 Gh. Baritiu St.,  
515400 Blaj, Alba, Romania; marina\_iliescu@yahoo.com

**Abstract.** The aim of this paper was to determine the behavior of some wine grape varieties regarding the variations of: fertility, yield and water consumption of vine in two different areas of Transylvania (Blaj wine-growing center and Cluj Napoca). Wine grape varieties taken for study are 'Fetească regală', 'Riesling italian' and 'Muscat Ottonel'. Vines water consumption has been established, using water balance method in soil. Generally in Cluj-Napoca, where climatic conditions for cultivation of vines are less favorable than in the wine-growing center Blaj, have being obtained lower values to all parameters at all varieties, less the water consumption which is higher in Cluj Napoca, due to abundant rainfall. Correlation between real evapotranspiration (RET) and grape production is linear, distinctly significant, indicating a strong dependence of grape production with water consumption of vine.

**Keywords:** wine grape variety, fertility coefficients, productivity indices, grape production, vine water consumption

### INTRODUCTION

Grape vines enjoy to all the attention in the countries with climatic conditions that correspond to vines biological requirements, because for wine industry the grapes represent a valuable raw material in obtaining of various products: must, wine, juice, special wines and wine distilled type brandy. The wine and products of wine are appreciated due to their content: energizing, invigorating, vitaminizing, mineralizing, plus the dietetic and therapeutic qualities (Van Zyl and Van Huyssteen, 1980).

In modern viticulture, to obtain a stable grape production, high in terms of quantity and quality, without affecting the vine resistance to disease, pests and other factors critical nature is determined by a correct application of complex agro-phytotechnical. Chaining and correct execution of these measures provides a superior valorization of fructification potential at grape varieties (Condei *et al.*, 1994). Water is one of the most important environmental factors influencing growth, yield and grape composition of grapevines and is therefore critical for the quality of wine (Babeș, 2010; Dejeu, 1985)

A number of related factors influence water requirements: climate, soil type, planting density, shape leading, cultural work, and graft-rootstock combination (Jones and Davis, 2000). This need can be expressed by the efficiency of water valorization, necessary given by different mathematical formulas. Therefore, to produce a kilo of grapes, vines consume between 250-300 liters of water, up to 400 liters of water, or 700 liters of water (Mccarthy, 1985).

## MATERIALS AND METHODS

Researches have followed the behavior to three white wine grape varieties recommended for cultivation in Transylvania ‘Fetească regală’, ‘Riesling italian’ and ‘Muscat Ottonel’. In both experimental locations of Transylvania (Blaj wine-growing center and Cluj Napoca), the studied varieties, grafted on rootstock: Selection Riparia x Berlandieri Crăciunel 2, are grown in the classic culture system, at a planting distance of 2.0 x 1.2 m.

The studies regarding the determination on vine water consumption, in not irrigated condition, and monitoring the production results at all grape varieties, were made in a series of experiences using the method subdivided parcels, located in two areas.

Using formulas were calculated the coefficients of fertility: absolute (Cfa) and relative (Cfr) and the productivity indices: absolute (Ipa) and relative (Ipr).

To determine the water consumption in experimental fields was used the method of soil water balance (a direct method). In order to determine the consumption of water by direct method was determined in advance the soil moisture by gravimetric method

Statistical interpretation of results was based on variance analysis regarding the influence of experimental factors on the yields achieved and the water consumption at vines. Interpretation of results has been done by calculating the limit differences and of the correlation coefficient between determined elements.

## RESULTS AND DISCUSSION

Following the direct transformation carried out in successive stages in vine plant, the fertility lead to achievement of grapes production, which is the main element in assessing the value of a variety. The correlation that exists between growth and fructification, expresses the production capacity of grape variety, the interdependence between these two phenomena, given that the fructification is achieved by growth and is conditioned by it.

Comparing data from experimental fields (Fig.1. and Fig. 2.) can be observed a similar behavior at the grape varieties, in both areas of culture, regarding the agrobiological characteristics taken in study: coefficients of fertility, productivity indices and grapes production. Generally in Cluj-Napoca, where climatic conditions for cultivation of vines are less favorable than in the wine-growing center Blaj, have being obtained lower values to all parameters at all varieties.

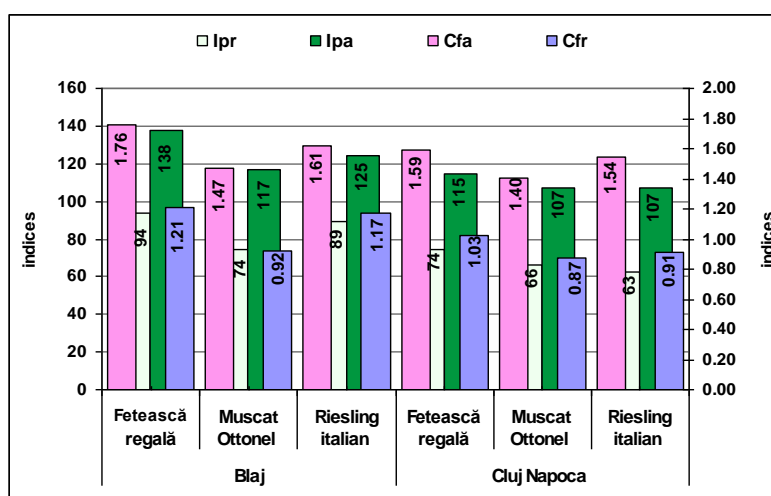


Fig. 1. Influence of the cultural area and variety on the fertility coefficients and productivity indices (mean values 2006-2008)

Besides the influence of variety and place of culture on the fertility coefficients and productivity indices, due the degree of aging of plantations, where experimental fields have been placed, the mean values of those indices, are near the lower limits specified in the literature (Indriaş *et al.*, 2001; Dobrei *et al.*, 2008; Rotaru, 2009).

Regarding the influence of variety and place of culture on the production of grapes, a comparison of experimental years 2006-2008, shows that the highest production of 11020 kg/ha was recorded at variety ‘Fetească regală’, (Blaj, 2008) and the lowest production of 3106 kg/ha was obtained at ‘Muscat Ottonel’ in 2006, to Cluj-Napoca (Fig. 2.).

Climatic conditions determine the differences on the varieties behavior in the two areas, so in Blaj wine-growing center all varieties have achieved maximum production in 2008, while in Cluj-Napoca the highest yield was obtained in 2007 at varieties ‘Riesling italian’ (7546 kg/ha), ‘Fetească regală’ (7147 kg/ha), and in 2008 at ‘Muscat Ottonel’ (4116 kg/ha).

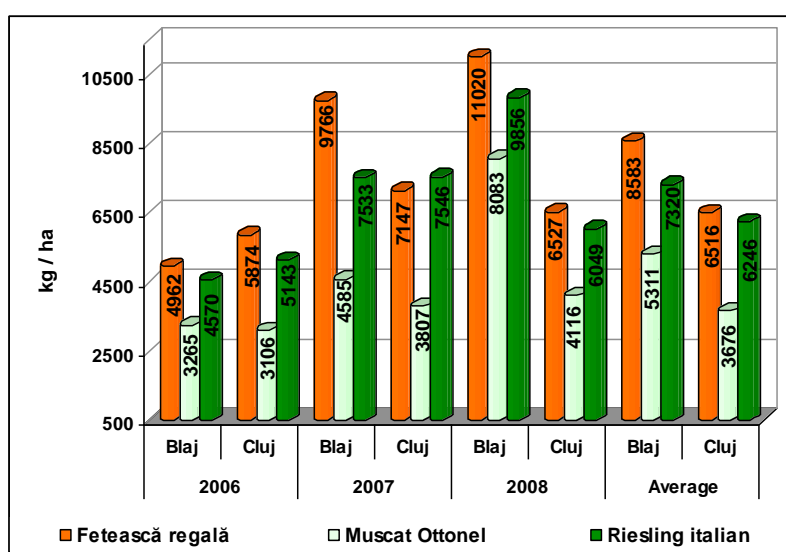


Fig.2. Influence of the cultural area and variety on grapes production during 2006-2008

Results concerning the influence of the culture place on grapes production to varieties: ‘Fetească regală’, ‘Muscat Ottonel’ and ‘Riesling italian’, were analyzed statistically, using an experimental scheme that corresponds to a series of experiences bifactorial (3 varieties x 2 places) repeated during the experimental years, 2006-2008. Size of dispersion in the analyzed variants was determined using F test.

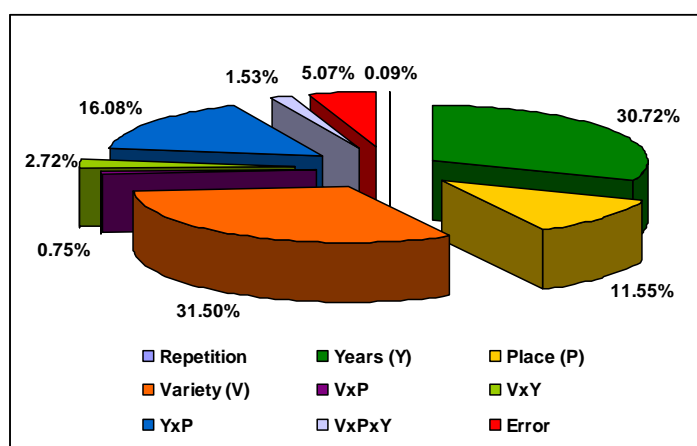


Fig. 3. Percentage distribution of the variability factors influence on grapes production

The percentage distribution of influence of variability factors on grapes production in the studied period is presented in figure 3. It notes a high influence on grape production given by the genetic characteristics of varieties with a percentage of 31.5% and by the climatic conditions in the analyzed years of 30.72%, followed to a quite high difference by percentage of interaction variety x place of culture of 16.08%, while the location of experiences has an influence by 11.55%.

From the statistical analysis of combined influence of factors (variety, growing area and year) on grape production, it is noted that the witness, variety ‘Fetească regală’ obtained the highest production of grapes, 7549 kg/ha, followed by ‘Riesling italian’ with a production close to the ‘Fetească regală’ (6783 kg/ha) to a difference distinct negative. ‘Muscat Ottonel’ had a lower production with 767 kg/ha, difference being very significant negative compared to the witness (Tab.1.). Analyzing the varieties behavior compared with the experience average, as a result of combined influence of factors taken into study, one can say that the best results were obtained at the variety ‘Fetească regală’ where grape production has exceeded the average experience, with 1274 kg/ha the difference being is very significant positive. At ‘Riesling italian’ difference was not significant (508 kg / ha) and the ‘Muscat Ottonel’ it is found an average lower than the average experience, with 1782 kg/ha, in this case, the difference being from point of view statistically very significant negative.

Tab. 1

Combined influence of the factors Variety x Place x Year, on mean grape production, (2006-2008)

Variety	Mean production, kg/ha	Relative production, %	± d to Fetească regală, kg/ha	Signification of difference (e)	Relative production, %	± d to experience average, kg/ha	Signification of difference (e)
Fetească regală-Mt	7549	100	-	-	120	1274	***
Muscat Ottonel	4494	60	-3056	ooo	72	-1782	Ooo
Riesling italian	6783	90	-767	oo	108	508	-
Experience average-Mt	6275				100	-	-
DL 5%				543			543
DL 1%				738			738
DL 0,1%				989			989

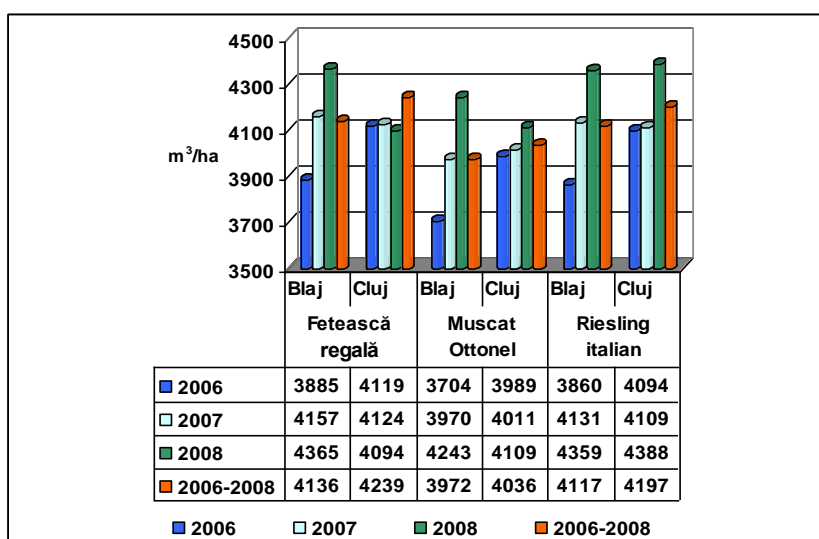


Fig.4. Influence of the cultural area and variety on vine water consumption during 2006-2008

The comparative results regarding the variety influence and culture area on total water consumption, in experimental years 2006-2008 are presented in figure 4. The influence of climatic conditions lead to differences between the water consumption of varieties cultivated in the two locations, generally, water consumption is higher in Cluj-Napoca compared to Blaj, due to more abundant rainfall during the vegetation period. Among the analyzed varieties the biggest water consumption by 4388 m<sup>3</sup>/ha, was registered in 2008, at Cluj-Napoca to 'Riesling italian' variety and the lowest water consumption (3704 m<sup>3</sup>/ha) was achieved in 2006 at 'Muscat Ottonel', in Blaj wine-growing center. Mean difference (2006-2008) of water consumed by vines in Cluj-Napoca compared to Blaj is higher with 80 m<sup>3</sup>/ha at 'Riesling italian' and with 64 m<sup>3</sup>/ha 'Muscat and is lower with 23 m<sup>3</sup>/ha to 'Fetească regală' (Fig.4).

Tab. 2

Combined influence of the factors Variety x Place x Year,  
on vine water consumption, in years 2006-2008

Variety	Medium RET, m <sup>3</sup> /ha	Relative RET, %	± d m <sup>3</sup> /ha	Signification of difference	
				Against(e)	Against(i <sub>S x L x A</sub> )
Fetească regală-Mt	4187,2	100,0	-	-	-
Muscat Ottonel	4047,3	96,7	-139,9	ooo	Ooo
Riesling italian	4169,3	99,6	-17,8	-	O
DL 5%				44,9	16,8
DL 1%				63,0	27,8
DL 0,1%				88,9	52,1

From the statistical analysis (Tab. 2.), concerning the combined influence of variety, culture area and year on water consumption during 2006-2008, it is noted that the witness variety recorded the highest average consumption of water (4187.2 m<sup>3</sup>/ha). This is followed by 'Riesling italian' with a very similar water consumption to 'Fetească regală' (4169.3 m<sup>3</sup>/ha) and by 'Muscat Ottonel' with a lower water consumption compared to witness.

In conditions of experimental years, the results interpretation take into consideration the significance of the difference against the error (s), but also against the factors interactions (i<sub>S x L x A</sub>). In both cases, is found a vine water consumption to a not significant difference by the witness at variety 'Riesling italian', while at 'Muscat Ottonel' the consumption is lower with 139.9 m<sup>3</sup>/ha compared to witness, the difference being very significant negative.

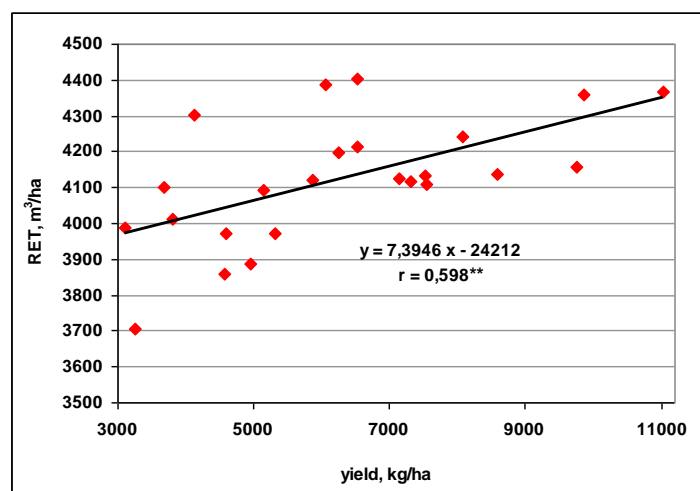


Fig. 5. Correlations between grapes production and RET values

Correlation between grapes production of and real evapotranspiration (RET-vine water consumption during vegetations period determined by soil water balance method), in 2006-2008, to varieties 'Fetească regală', 'Muscat Ottonel' and 'Riesling italian' is represented in figure 5.

In graphic is shown the right and the regression equation (y) the corresponding to the correlation between analyzed the parameters. Correlation between real evapotranspiration (RET) and grape production is linear, distinctly significant, with a value of correlation coefficient (r) of 0.598 \*\*, which indicating a strong dependence of grape production with water consumption of vine.

## CONCLUSIONS

It was shown that, in various conditions of the microclimate, the water consumption of vine has led to considerable changes of the grape yield.

Climatic conditions determine the differences on the varieties behavior in the two areas, so in Blaj wine-growing center all varieties have achieved maximum production in 2008, while in Cluj-Napoca the highest yield was obtained in 2007 at varieties 'Riesling italian', 'Fetească regală' and in 2008 at 'Muscat Ottonel'.

The total water consumption of vine, grown without irrigation, has been in direct connection with the amount of precipitation, fallen during the vegetation period.

Due to more abundant rainfall during the vegetation period, vine water consumption is higher in Cluj-Napoca compared to Blaj wine-growing centre.

Correlation between real evapotranspiration (RET) and grape production is linear, distinctly significant indicating a strong dependence of grape production with water consumption of vine.

## REFERENCES

1. Babeș, Anca, V. Budiu, Nastasia Pop, C. Bunea and Anamaria Călugăr (2010). Considerations regarding water consumption at some grapes varieties in Blaj wine-growing center. Journal of Horticulture. Forestry and Biotechnology. Vol. 14(3):5-10.
2. Condei, Ghe. et al. (1994). Cercetarea efectelor combinate ale unor verigi tehnologice asupra soiurilor *Vinifera* pentru vinuri de calitate superioară în principalele podgorii și centre viticole din România. Anale I.C.V.V. vol. XIV:301-317.
3. Dobrei, A., Liliana Rotaru and Morelli S., (2008). Ampelografie. Editura Solness. Timișoara;
4. Indriaș, Adriana and Luminița Vișan (2001). Principalele soiuri de struguri de vin cultivate în România. Editura Ceres. București.
5. Jones, G.V. and R.E. Davis (2000). Climate influences on grapevine phenology, grape composition, and wine production and quality for Bordeaux, France. American Journal of Enology and Viticulture. 51: 249-261.
6. Mccarthy, M. (1985). The effect of irrigation on grape quality. In: Symposium in Irrigation, salinity and grape quality. Australian Society for Viticulture and Enology, Adelaide. Australia. p.35-49.
7. Rotaru, Liliana (2009). Soiuri de viță de vie pentru vin. Editura Ion Ionescu de la Brad. Iași.
8. Van Zyl, J.L. and L. Van Huyssteen (1980). Comparative studies on wine grapes on different trellising systems. II. Microclimate studies, grape composition, and wine quality. South Africa Journal of Enology and Viticulture. 1: 15-25.