RESEARCH REGARDING WATER CONSUMPTION AT SOME GRAPE VARIETIES GROWN IN TRANSYLVANIA

CERCETĂRI PRIVIND CONSUMUL DE APĂ LA UNELE SOIURI DE STRUGURI CULTIVATE ÎN TRANSILVANIA

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Abstract: *The aim of this paper was to determine the variations of water consumption of vine in two different areas of Transilvania (Blaj wine-growing center and Cluj Napoca). Fetească regală, Riesling Italian and Muscat Ottonel are grape varieties taken for studies. During the growing season there are three periods represented by the lowest levels of water consumption, during the start of some phenophases: weeping, bud breaking and ripening of grapes. The research carried out confirms the existence of a maximum of water consumption in summer, in shoot growth occurs, regardless of rainfall input. Daily consumption of water by the vines has been established through monthly reporting of the number of days in month, using water balance method in soil.*
Key words: vineyard; soil water balance, water consumption.

Rezumat. *Scopul acestei lucrări a fost de a determina variaţii ale consumului de apă de viţă de vie, în două zone diferite din Transilvania (Blaj şi Cluj Napoca). Soiurile de struguri de luate în studiu sunt: Fetească regală, Riesling italian şi Muscat Ottonel. În timpul perioadei de vegetaţie există trei perioade marcante reprezentate de cele mai scăzute niveluri ale consumului de apă, în perioadele de început a unor fenofaze: plâns, dezmugurit şi pârgă-maturare a strugurilor. Cercetările efectuate confirmă existenţa unui maxim al consumului de apă în timpul verii, la creşterea lăstarilor, indiferent de aportul de precipitaţii. Consumul zilnic de apă de viţă de vie s-a stabilit prin raportarea consumului lunar la numărul de zile ale lunii, în cazul folosirii metodei bilanţului apei în sol.*
Cuvinte cheie: podgorie, bilanţul apei din sol, consum de apă.

INTRODUCTION

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. [2, 6] At harvest, berry size is considered a very important component of determining wine grape quality all over the world. [3, 8] The availability of water during certain periods of berry growth is known to cause changes in grape composition and berry size. These changes include an increase in berry size, and dilution of berry flavour compounds, sugars, and organic acids, and can cause a decrease in tannins and anthocyanins. Water deficit management of vineyards has therefore received much attention, the consequences of which have not been fully elucidated. [5]

MATERIAL AND METHOD

Water consumption at grape varies with variety, phenophases, composition, soil climate, geographic origin, and cultivation practices. This is why we took in study the following grape wines varieties: Fetească regală, Riesling italian and Muscat Ottonel. The grapes have been harvested at complete maturity, from two areas: Blaj and Cluj Napoca.

The term "total water consumption" is the same with "evaporation" used in scientific books and is notes like **∑(e + t), ET or ETR.**

To determinate, the water consumption for a culture is used direct methods, **the water balance from the soil.** To make the water balance from the soil is necessary to put the condition that all water "in", that include all the water sources of the soil, to be equal with all water „out", that include all the water consumption form the soil. That how it is obtains the water balance relation, then results the evapotranspiration calculus formula (water consumption):

Ri + P = ETR + Rf;

ETR = Ri + P– Rf

ETR – the real evapotranspiration or total water consumption (m3/ha);

Ri – the water reserve from the soil at the vegetation start, that is initial water reserve (m3/ha);

P – the useful precipitations sum from vegetation period (m3/ha);

Rf – the water reserve remain in the soil in the moment of the harvest, that is the final resource (m3/ha).

The gravimetric method was used to determinate humidity from the soil. To determinate the initial a finale water resource from the soil in vegetation period, was determinates using gravimetric methods.

This method assumed to dry the soil crop samples from the field and determinate the water from the soil by weighing. To dry the samples was used the drying stove. In the experience, was drawing soil samples, on different depth levels: 0-10, 10-20, 20-40, 40-60, 60-80, 80-100, 100-125 and 125-150 cm, using the values of humidity on the weighted average depth.

These samples were taken from tow control points; the wet of the soil was obtained as an arithmetic media of those repetitions. The next calculus formula was use for the soil humidity:

U% = (Evaporated water/Dried soil mass) x100

RESULTS AND DISCUSSIONS

Total water consumption or evapotranspiration to a culture consists in amount productive consume from transpiration plants and in unproductive losses through evaporation at soil surface. Usually daily water consumption is expressed in mm or m^3/ha/day [1, 4].

Knowledge of the water consumption phenomenon can resolve a number of problems related to positive completion of a year of economic activity, through a series of technological measures that the vine grower can take during the growing season.

Vineyards non-irrigated, which represent the largest surfaces in the country, presented not well-known issues related to the water consumption. Crucial periods of water deficit are of the utmost importance.

The dates for beginning of main phenophases at the grapes varieties, taken in study in year 2008, are presented in the table below. (Table 1)

Table 1

Main phenophases at the grapes varieties taken in study, 2008

Variety / Phenophas	Fetească regală		Muscat Ottonel		Riesling italian	
	Blaj	Cluj Napoca	Blaj	Cluj Napoca	Blaj	Cluj Napoca
Bud Break	20.04.08	22.04.08	21.04.08	25.04.08	24.04.08	28.04.08
Shoot growth	3.05.08	6.05.08	6.05.08	10.05.08	9.05.08	14.05.08
Blooming	10.06.08	15.06.08	11.06.08	17.06.08	13.06.08	19.06.08
Beginning of ripening	08.08.08	15.08.08	06.08.08	13.08.08	11.08.08	11.08.08
Ripening	22.09.08	28.09.08	22.09.08	26.09.08	25.09.08	1.10.08
Harvest	1.10.08	1.10.08	1.10.08	1.10.08	1.10.08	1.10.08

In 2008 the beginning of growing season was between April 20 at Fetească regală variety (Blaj) and April 28 at Riesling italian variety cultivate at Cluj.

Period of shoots growth started in the first decade to all the studied variety in Blaj wine-growing center and it is later with 3-4 days in Cluj.

Shoots growth diminished after beginning of ripening and it was made shoots pruning. Grapes ripening started with Fetească regală variety (Blaj) at September 22 and ends at October 1 to Riesling italian variety cultivate at Cluj. Harvesting has been made in October 1 to all the varieties, in both areas.

During the vegetation period, there are three specific periods to water consumption. Those periods are at the start of growing seasons, buds brake- rising sap and grapes ripening, with the lowest levels of water consumption and the growth of shoots and grapes at the middle of vegetation, phenophase with the highest water consumption. (Fig. 1)

Table 2, present the total water consumption values of vine and for the daily consumption in non-irrigated conditions, in experimental year 2008, at three grape wines varieties: Fetească regală, Riesling italian and Muscat Ottonel.

Total water consumption in the vegetation period was the smallest, 4394.42 m^3/ha, at Riesling italian cultivated in Blaj wine-growing center and the bigger was at Riesling italian cultivated in Cluj Napoca, 5270.75 m^3/ha.

Month with the higher water consumption of vines was July (1425.36 m3/ha at Muscat Ottonel, Cluj Napoca).

The daily consumption of vine, in non-irrigated conditions, in experimental year 2008, at three grape wines varieties: Fetească regală, Riesling italian and Muscat Ottonel is present in table 3.

Table 2

Total water consumption in the vegetation period, 2008

Variety	Nr. of day	Fetească regală		Muscat Ottonel		Riesling italian	
Area		Blaj	Cluj Napoca	Blaj	Cluj Napoca	Blaj	Cluj Napoca
Determination / Months		Total water consumption, m^3/ha	Total water consumption, m^3/ha	Total water consumption, m^3/ha	Total water consumption, m^3/ha	Total water consumption, m^3/ha	Total water consumption, m^3/ha
April	30	625.00	654.49	794.89	668.99	572.67	838.46
May	31	867.22	951.51	990.54	960.17	910.69	699.5
June	30	841.49	1016.00	961.45	1287.72	964.19	985.24
July	31	936.01	1416.72	774.92	1425.36	731.77	1517.92
August	31	709.57	692.66	737.58	266.98	862.47	911.06
September	30	429.85	349.16	265.98	196.21	352.63	318.57
Total	**183**	**4409.20**	**5080.54**	**4525.36**	**4805.43**	**4394.42**	**5270.75**

Table 3

Daily water consumption in the vegetation period, 2008

Variety	Nr. of day	Fetească regală		Muscat Ottonel		Riesling italian	
Area		Blaj	Cluj Napoca	Blaj	Cluj Napoca	Blaj	Cluj Napoca
Determination / Months		Daily water consmuption, m^3/ha/day	Daily water consmuption, m^3/ha/day	Daily water consmuption, m^3/ha/day	Daily water consmuption, m^3/ha/day	Daily water consmuption, m^3/ha/day	Daily water consmuption, m^3/ha/day
April	30	20.84	21.82	26.50	22.30	19.09	27.95
May	31	27.97	30.69	31.95	30.97	29.38	22.56
June	30	28.05	33.87	32.05	42.92	32.14	32.84
July	31	30.19	45.70	25.00	45.98	23.61	48.97
August	31	22.89	22.34	23.79	8.61	27.82	29.39
September	30	14.33	11.64	8.87	6.54	11.75	10.62
Total	**183**	**24.09**	**27.76**	**24.73**	**26.26**	**24.01**	**28.80**

It is noted, that between the two locations where experiences were placed, there are differences in terms of total water consumption in light of variety and depending on month.

Generally, in wine-growing center Blaj water consumption is lower than in the Cluj area both due of lower rainfall during the growing season, but also because the soil easily, clay-sandy, compared to the soil from Cluj with a higher content of clay

The medium daily consumptions were swing between 6.54 mm/day in September at Muscat Ottonel, Blaj to 48.97 mm/day in July at Riesling Italian cultivated in Cluj.

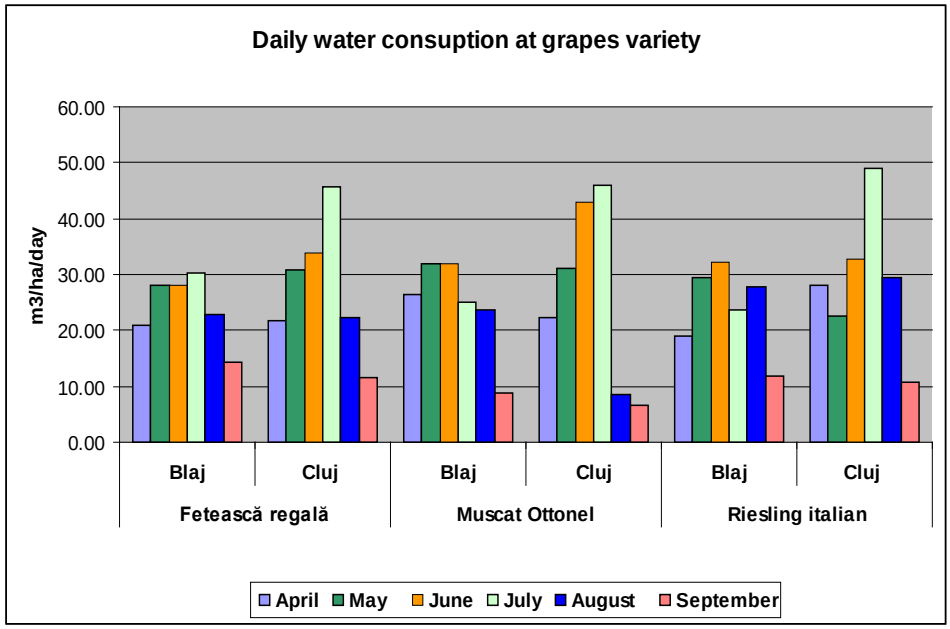

Fig. 1. The evolution of daily water consumption

The graphic also, done correlation between daily water consumption, depending on grape varieties analyzed.

The lower water consumption was recorded in September, at grapes ripening phenophase, to all the grapes varieties and in both places where have been located experiences

Water consumption has increased steadily from spring to summer in the same way with shoots increasing. The highest consumption was reached in July, in period of maximum growth at shoots and at grapes. Exceptions are at the varieties Riesling italian and Muscat Ottonel at which had recorded a slight water consumption decrease in July because of drought and soil type in Blaj wine-growing center.

CONCLUSIONS

1. By knowing the phenomenon of evapotranspiration in some areas of Transylvania, we can establish some links technology, ensuring that production is constant over time in terms of quantity and quality.

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

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

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