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RESEARCH ON QUALITATIVE AND QUANTITATIVE PERFORMANCE OF GERMAN ORIGIN VARIETIES IN ECOPEDOCLIMATIC CONDITIONS OF THE EXPERIMENTAL FIELD U.S.A.M.V. BUCHAREST

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Abstract

It is well known that the area of culture defines fundamentally the phenotypic, agrobiological and technological manifestations, also the quantity and quality of varieties of grape-vines. They practically, by the values of the main elements that define their degree of adaptation, can achieve better results compared with the area in which they formed or were naturalized. In this study we analyzed six varieties of German white wine: 'Rhine Riesling', 'Müller Thurgau', 'Silvaner', 'Bacchus', 'Ortega' and 'Phoenix', which are found in the experimental, teaching and research field within U.S.A.M.V. Bucharest. The research was conducted in wine-year 2012-2013 and target tracking these sorts in terms of quantitative and qualitative performance in the production and also the veg-productive balance. The results obtained highlight the fact that the varieties had a good rapport between production and the wood removed at pruning, as evidenced by values 4,04-8.82 (Index of Ravaz) and 11,58 – 24,38% (Vegetative and productive balance index - VPBI).

Key words**:** *balance, grapevine, index of Ravaz, maturity, varieties.*

INTRODUCTION

The varieties of grape-vines, regardless of origin, force, production capacity, production direction, are characterized by morphological variability and enhanced technology, given by their genetics, but also that they are influenced by a large climatic factors and agrotechnical factors, thus manifesting differently depending on the area of culture. Therefore, in studies that aims adaptation of the varieties of grape-vines in areas different from their place of origin, increasingly more attention is given to outstanding research aimed at showing how they manifest veg-productive, as direct result of physiological processes and cultural practices applied (Belea, 2008). The study focused on tracking the behavior of six varieties of German origin, Rhine Riesling, Silvaner, Müller-Thurgau, Bacchus, Phoenix and Ortega, in south area of Romania. The varieties come from the same vineyard where they emerged as basic varieties, but in Romania, except the first two, were rarely investigated and the less cultivated. The varieties are distinguished by a high degree of similarity between them, having in common a certain genetic lineage, as follows: the first three are found as genitors variety of Bacchus and Müller-Thurgau variety is a result of crossing between Rhine Riesling and Silvaner. In addition, Phoenix is a hybrid variety obtained between Bacchus and Villard Blanc variety and the Ortega variety is a cross between Müller-Thurgau and Siegerrebe (Table 1). Data were extracted from Vitis International Variety Catalogue (www.vivc.de). The study was discussed based on two reasons: to determine and assess the quantitative and qualitative performance of varieties in an area different from home and veg-productive balance assessment using indicators (Index of Ravaz, Vegetative and productive balance index - VPBI). To calculate these indicators, balanced loads of buds are left behind cuts, in order to link the photosynthetic capacity of the plant to the number and weight of the grapes, which regulates the two activities (vegetative and productive) and thus improve production quality. By properly sizing the number of buds

and appropriate allocation of production elements, the ratio of the processes of growth and fructification are effectively adjusted in favor of the latter, it is increased or maintained the longevity of plantation and is obtained large crops of grapes, economic and relatively stable. Watching the relationship between the influence of fruit load on the quantity and quality of crop at Müller-Thurgau, Rhine Riesling and Silvaner varieties during the years 1976-1981 in conditions of Germany (Kiefer and Crusius 1984 quoted by Belea, 2008) have obtained variable production as follows: Müller- Thurgau variety, if awarded a load of 15 buds /m^2 was obtained an average of 20.61 t/ha, compared to 12.56 t/ha at a load of six buds/m^2.

The Rhine Riesling variety, production increased from 7.65 t/ha at a load of six buds/m^2 to 12.55 t/ha in 15 buds/m^2, and the variety Silvaner, production ranged from 9.26 t/ha and 14.99 t/ha. Basically, the allocation of large loads of buds/vine, increased, grape production without experiencing loss of quality. Were found, however, significant reductions on organoleptic and analytical quality during the years when productions were recorded over 15 to 23 t/ha.

Table 1. Genetic origin of studied varieties

Prime name	Rhine Riesling	Silvaner	Müller-Thurgau	Bacchus	Phoenix	Ortega
Variety number *V*IVC	10077	3865	8141	851	9224	8811
Country of origin of the variety	Germany	Germany	Germany	Germany	Germany	Germany
Species	*Vitis vinifera* L.	*Vitis vinifera* L.	*Vitis vinifera* L.	*Vitis vinifera* L.	*Vitis vinifera* L.	*Vitis vinifera* L.
Pedigree as given by breeder/bibliography	-	-	Riesling Weiss x Silvaner Gruen	(Silvaner Riesling) x Müller Thurgau	Bacchus x S.V. 12-375	Müller Thurgau x Siegerrebe
Pedigree confirmed by markers	- x Heunisch Weiss	- x Heunisch Weiss	Riesling x Madeleine Royale	(Silvaner x Riesling) x Müller Thurgau	-	Müller Thurgau x Siegerrebe
Prime name of pedigree parent 1	-	-	Riesling Weiss	Silvaner x Riesling	Bacchus Weiss	Müller Thurgau Weiss
Prime name of pedigree parent 2	-	Heunisch Weiss	Madeleine Royale	Müller Thurgau	Villard Blanc	Siegerrebe
Year of crossing	-	-	1882	1933	1964	1948
Last update	11.02.2015	11.02.2015	30.01.2015	29.09.2014	29.09.2014	29.09.2014

MATERIALS AND METHODS

The research was conducted in 2012-2013 wine year, in the experimental field of U.S.A.M.V. Bucharest and the varieties that are object of these research were applied the same technology culture: Guyot on semi-stem type cutting, planting distance of 2.2/1.2 m, with a load of 32 buds/vine (12 buds/m^2) considered optimal for obtaining quality white wines.

Climatic data focused on daily observations regarding the evolution of parameters - temperature, precipitation, insolation, which helped calculating climatic indexes that define the level of favorability of an area: - real heliothermic index (IHr), hydro-thermic coefficient (CH), vine plant bioclimatic index (Ibcv), oenoclimatic aptitude index (IAOe), and also Huglin index calculus. Huglin index (HI) is calculated from April the 1st to September the 30th in the northern hemisphere and is defined as follows:

$$IH = \sum_{01.04}^{30.09} \frac{[\![(Tm-10)+(Tx-10)]\!]}{2} \times k$$

T*m* = Medium air temperature (ºC)

T*x* = Maximum air temperature (ºC)

k = Day length coefficient in relation with latitude, with values between 1,02-1,06 for latitudes of 40-50º and for Romania ($44,1^0$ – $46,0^0$) this has the value of 1,04.

The benchmark index in viticulture is widely used in France because it provides information about the potential heat in the vineyard, showing importance in appropriate choice of product, on the one hand and is positively

correlated with the amount of sugars accumulated in grapes, on the other hand. The values of this indicator in different wine regions causes a general classification of these areas and establishing minimum temperature necessary to conduct the vegetative cycle of varieties of grape-vines in that area, (Huglin, 1978, Tonietto and Carbonneau, 2004). From this perspective, recent research conducted at the Bavarian Research Center for Viticulture and Horticulture state established a minimum standard Huglin's index for fructification of investigated varieties, as follows: IH is 1300^0C for Ortega variety, 1400^0C for Müller-Thurgau varieties, Phoenix and Bacchus, 1600^0C Silvaner variety, Rhine Riesling variety 1700^0C (Ulrike and Schwab, 2011), 1700 ^{0}C for Chardonnay and Syrah variety almost 2100^0C. The minimum limit for grape-vine is considered by some authors to an IH = 1600^0C (Laget et al., 2008).

During the experience, observations and determinations were made used in determining the elements of fertility and productivity, with special focus on those who have shown interest in calculating the vegeto-productive index balance covered by this study: average weight of a grape, 100 berries weight, production/vine, sugars (g/l), total acidity (g/l tartaric acid).

To assess the balance between production of grapes and vine growth, in practice, is used Ravaz index in formula: IR = Production/removed wood.

In general, values of this indicator varies within wide limits from 1.2 to 27.7, values between 5-7 are being considered ideal; for varieties with medium vigor, the IR is ideal between 4-6; varieties with reduced vigor take the value 8; values lower than 3 and bigger than 10 should be avoided, since it causes big vigor or delays in maturation and reduced quality, as appropriate. (Celotti et al., 2001).

The relation between growth and fruiting was established using vegeto-productive balance index (VPBI). It highlights the percentage share of the vegetative part, expressed by weight of removed wood at pruning to achieve total production and it represents the ration between „weight of wood removed at pruning x 100/grapes production + removed wood" expressed in kg/vine (Maccarone and Scienza, 1996). If grape varieties are for quality wines, the result must be within the 22.1 to 33.5% (Celotti et al., 2000) at Cabernet Sauvignon and 18 to 23% (Dejeu et al., 2003) at Feteasca regala.

RESULTS AND DISCUSSIONS

The analysis of climatic elements for the wine year 2012-2013 was performed by comparing the defining climatic elements of this year with the annual average of the last 10 years (2001-2011), due to the frequency of extreme weather events and the lack of constancy of the values recorded.

The values of the four synthetic indexes (Table 2) shows that when the thermal resources are high, the water resources are low and the most fluctuating indicator is the bioclimatic one, whose spectrum is within the 9,9- 14.32.

Table 2. Evolution of climatic elements (2001-2013)

Specification		Average	Year	Year
		2001-2011	2012	2013
Agroclimatic indices	The hydro-thermic coefficient CH)	0,75	0,97	0,50
	The real heliothermic index (IHr)	1,3	1,08	1,38
	The viticultural bioclimatic index (Ibcv)	9.9	11.2	14,32
	Index of the oenoclimatic aptitude (IAOe).	5231	5075	6493
	Huglin index	2392	2739,7	2358,2

Regarding the development of Huglin index values, it is noted that tends to increase, which exceeds the multiannual average in 2012, reaching a peak of 2739.76, conditions in which the vineyard, characterized by a warm temperate climate in general (IH4), acquires the appearance of a warm climate type (IH5) - (IS1, IH5, IF3).

The observations made show that the area in which the didactic-experimental field of U.S.A.M.V. Bucharest is found is favorable for growing varieties of grape-vines studied (registered in the south of Romania), and the elements of microclimate positively put their mark on the behavior of the studied varieties, although varieties are adapted to a cooler

climate. Assigning the same number of buds per vine 32 buds/vine highlights their differentiated behavior in terms of quality and quantity of production, but its performance touch the limit required to obtain quality white wines (Table 3).

Table 3. Evolution of quality parameters on the experimental varieties

Varieties	Average weight of a grape (g)	Weight of 100 berries (g)	Yield (kg/ vine)	Sugar (g/l)	Acidity (g/l tartaric)
Rhine Riesling	90,17	132	4,68	226,69	7,56
Müller-Thurgau	92,17	203	4,83	238,38	6,52
Silvaner	113,39	177	4,12	230,32	6,61
Bacchus	80,66	209	2,85	201,21	5,57
Phoenix	91,92	220	2,86	205,45	5,38
Ortega	119,68	174	2,99	212,89	5,67

The appreciation is based on their accumulated sugar levels, on the background of a pretty balanced acidity. The data show a highlight in quality of the varieties Rhine Riesling (226.69 g /l), Müller-Thurgau (238.38 g/l) and Silvaner (230,32g /l), but no other varieties are in imbalance, the minimum being registered at Bacchus variety (201.21 g /l). Appreciation of balance between the production of grapes and vine growth, made using Ravaz index, indicates that the most varieties are found in a balance with a slight imbalance registered at varieties Silvaner, Phoenix, Ortega, even the values are within the ideal highlights from this point of view (5-7).

Basically, wine year 2012 -2013 was a good wine year, favorable to the development and fruiting of varieties analyzed so they have been in steady growth and fruiting (Table 4).

Analysis of vegetation and productive balance index - VPBI (%) shows that varieties are in a veg-productive balance because they are close to the normal range of grape varieties for quality white wines (Table 4).

Highlighting the percentage share of the vegetative part of the vine to achieve the production of grapes, this index ranged from 11.58 to 24.38%.

We can say that the balance between vegetative growth and fruiting capacity was greater tilted in favor of fructification, except variety Silvaner, where the index (24.38%) is in the average necessary to obtain high quality wines. Therefore, the higher the values recorded are, the more favorable and positive correlation is for the accumulation of large amounts of sugars in grapes.

Table 4. Overview of Ravaz index and vegetative and productive balance index – VPBI (%)

Experimental varieties	Index of Ravaz	Vegetative and productive balance index – VPBI (%)
Rhine Riesling	5,92	16,34
Müller-Thurgau	8,56	11,58
Silvaner	3,81	24,38
Bacchus	8,82	13,92
Phoenix	4,43	20,6
Ortega	4,04	14,85

Highlighting the percentage share of the vegetative part of the vine to achieve the production of grapes, this index ranged from 11.58 to 24.38%. We can say that the balance between vegetative growth and fruiting capacity was greater tilted in favor of fructification, except variety Silvaner, where the index (24.38%) is in the average necessary to obtain high quality wines.

Therefore, the higher the values recorded are, the more favorable and positive correlation is for the accumulation of large amounts of sugars in grapes.

Following the evolution of accumulated sugars according to the Huglin index in 2012-2013 vine year (Figure 1) there is a positive direct correlation in all varieties, and in addition, it was observed an increase from varieties potential, in general (Hillebrand et al., 1997). This is explained from the genetic origin of Varieties, the area of culture and not least less favorable climatic conditions.

Comparing the index values of Huglin from the areas of origin (Germany) with those recorded in the area of culture where the experience took place, we observe that Rhine Riesling variety accumulates 200 g/l sugars, index of Huglin being 1700^0C in cool area, making it possible to obtain white table wines; at 2358,2 ^{0}C value

of the same index in the south area of Romania, the amount is much higher - 226.69 g/l, which makes it possible to obtain quality white wines. This can be seen in other studied varieties, which leads us to affirm that the southern areas of Romania create the possibility of obtaining quality white wines from varieties of grapes analyzed.

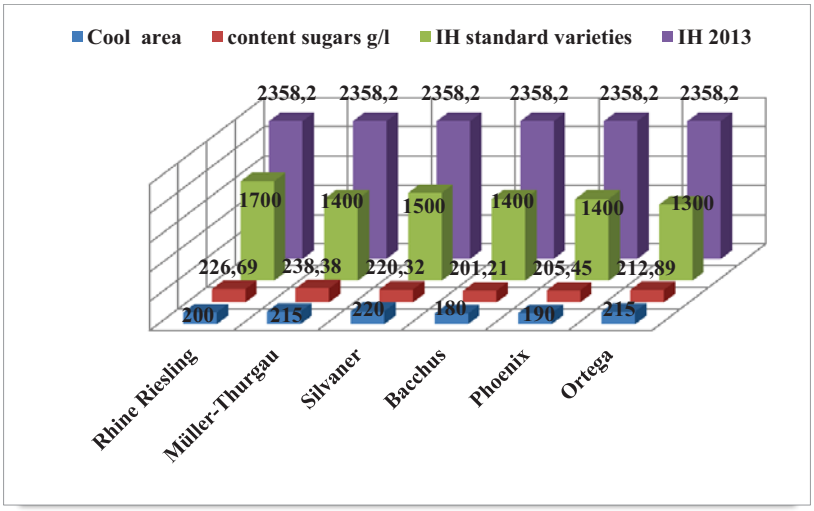

Figure 1. Correlation between Huglin index values and sugar contents g/l

CONCLUSIONS

The area in which took place the experience is favorable for cultivating the studied varieties (the entire south area of Romania) and specific factors (annual temperatures average, the ones from the vegetation period of grape-vines, rainfall) have a positive contribution on the behavior of the studied varieties.

The varieties are distinguished by a high degree of similarity between them in terms of quantitative and qualitative performance based on the genetic lineage, as follows: the first three are found as genitors of Bacchus variety and Müller-Thurgau variety is a result of interbreeding Rhine Riesling x Silvaner's.

Assigning the same number of buds per vine 32 buds/vine highlights their differentiated behavior in terms of quality and quantity of production, but their performance reach the limits necessary to obtain quality white wines.

Following the results, the varieties of german origin - Rhine Riesling, Müller-Thurgau, Silvaner, Bacchus, Phoenix and Ortega are in veg-productive balance in climate conditions of south area, and therefore can be successfully introduced into the wine culture in southern Romania, with great possibilities of obtaining outstanding production quantitatively and qualitatively.

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