BIOMETRIC DETERMINATION ON CANOPY AT SOME GRAPE VARIETIES CREATED AT R.D.S.V.V. BLAJ, IN TÂRNAVE VINEYARD

DETERMINĂRI BIOMETRICE ASUPRA APARATULUI FOLIAR LA UNELE SOIURI DE VIŢĂ DE VIE, CREATE LA S.C.D.V.V. BLAJ, PODGORIA TÂRNAVE

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Abstract. *The grape varieties created at S.C.D.V.V. Blaj (Astra, Blasius, Selena) are characterized by medium growth vigor, but higher than Fetească regală, which was the control variety. The three bud loads (25, 35, 45 buds/block vine) significantly influenced the following studied elements: leaf area/vine, total leaf area/ha, exposable leaf area/ha, excess leaf area/ha, foliar index and the direct exposure degree of vine canopy to solar radiation (%). The largest leaf area/vine was recorded at variety Blasius (14.17 m^2/vine) at a bud load of 45 buds/vine and the lowest at Fetească regală (4.96 m^2/vine) at a load of 25 buds/vine. Leaf area/vine and excess leaf area/ha were significantly influenced by bud load. The studies had demonstrated that exposable leaf area depended on the training form, of the height and width of canopy. The leaf index and the degree of exposure of canopy to solar radiation had varied widely between varieties and have been recorded the significant negative correlations.*

Key words: grapevine varieties, canopy, foliar index, leaf area

Rezumat. *Soiurile studiate: Astra, Blasius, Selena, obţinute la S.C.D.V.V. Blaj, se caracterizează printr-o vigoare de creştere mijlocie, dar mai mare faţă de soiul martor, Fetească regală. Cele trei încărcături de rod aplicate la tăierea în uscat (25, 35, 45 ochi/butuc) au influenţat semnificativ următoarele elemente luate în studiu: suprafaţa foliară/butuc, suprafaţa foliară totală, suprafaţa foliară expozabilă, suprafaţa foliară excedentară/hectar, indicele foliar şi gradul de expunere directă a aparatului foliar la radiaţia solară. Cea mai mare suprafaţă foliară/butuc s-a înregistrat la soiul Blasius (14,17 m^2/butuc) la încărcătura de rod 45 ochi/butuc, iar cea mai mică la Fetească regală (4,96 m^2/butuc) la 25 ochi/butuc. Suprafaţa foliară şi excedentară a fost semnificativ influenţată de încărcătura de rod. Suprafaţa foliară expozabilă a depins de forma de conducere, înălţimea şi lăţimea peretelui foliar. Indicele foliar şi gradul de expunere directă al aparatului foliar au variat în limite largi atât între soiuri, mai ales în funcţie de sarcina de rod, înregistrându-se corelaţii semnificativ negative.*

Cuvinte cheie: soiuri pentru vin, aparat foliar, indice foliar, suprafaţă foliară

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INTRODUCTION

An scientific interest and a major practical importance are represented by knowing the relations established between growth and fructification at vine. This constitute the premise of biological scientific foundation in vine agro-technical management, which aimed the directing of growth process to achieve a good quality production (Pop, 2010).Vine canopy plays the role of "power plant"of the vine. Its efficacy is determined by capturing sunlight and distributing the energy to different organs (shoots, inflorescences etc.). Canopy size can be appreciated by measuring the foliar leaf area (Spayd, 2002).

Abnormal growths at vine affects plant light exposure and its microclimate, with direct consequence on quantity and quality of harvest (Smart et al., 1990). On average, at the vines on the trellis monoplane, outer layers of leaves directly exposed to light can capture two thirds of the sunlight, while the shaded leaves captures only one third of solar radiation. These two areas are considered physiologically functional. According to Roussilion, 2001, the leaves inside the canopy have a physiological efficiency that can be neglected. Rachid et. al. (2009) argues that ensuring an optimal balance between the leaf area surface and bud load is a condition which must be assured by vine management, related to the fact that the nutrition area, the training system and the pruning level involves changes on photosynthetic activity, influencing sugar accumulation and favoring the wood ripening.

MATERIAL AND METHOD

At R.D.S.V.V. Blaj the researches were conducted during 2010, on Astra, Blasius, Selena and Feteasc㠠regală grape varieties grafted on Kobber 5BB. In 2001, the plantation was established, with vines planted at distance of 2.2/1.2 m. The gaps percentage was 15% resulting about 3219 vines/ha less of each variety. Vines are trained in Guyot with periodic replacement cordons and in spring are pruned in 25, 35 and 45 buds/vine, distributed on spurs with 2 buds and canes of 10-12 buds.

In the second week of August, after shoots topping, was measured height and width of vine canopy and also were measured the holes in leaves wall, due to the absence of vine blocks from plantation. Also, leaves were harvested from each variety and on each variant of bud load, to calculate the leaf area/vine by the fresh weight method. Fresh weight of discs method is a destructive method, but leaf area calculation can be done with an accuracy of 95% (Sepulveda, 1983).

Leaf area/hectare (m^2/ha) was calculated by multiplying the average of leaf area/vine by number of vines/hectare. In vine practice, one of the most foliar indicators used is the ***exposable leaf area*** (ELA, m^2/ha). It represents the leaf surface that can be exposed to the sun on hectare and it is calculated according to formula proposed by Dufourcq et Bonnisseau, 2002:

$$ELA\ (m^2/ha) = 10000 / E \times (1 - t / D)\ ExLA$$

where: 10000 / E = total length of the rows of vines/ha of plantation;

(1 - t / D) = the gaps in plantation;

ExLA = exterior leaf area (m^2/m)

Excess leaf area (m^2/ha) was calculated by difference between total leaf area/hectare and exposed leaf area/hectare (m^2/ha).

Foliar index (FI) express leaf density in vine canopy. It is calculated by the report between external leaf area (ExLA) and total leaf area (TLA), on a meter of row.

Optimum values of the foliar index are between 0.75 to 1.00. Lower values than 0.75 indicates a high density of leaves and higher values then 1.0 characterizes a rarely vine canopy, which do not correctly evaluate the space of trellis system (Maigre et Murisier, 2002). Foliar index was calculated using to next formula (Irimia, 2006):

$$FI = (1 - t / D) \times ExLA / TLA$$

where: (1 - t / D) = gaps in vine canopy (m^2/m row);
ExLA = external leaf area (m^2/m row);
TLA = total leaf area (m^2/m of row.

The degree of exposed leaf area (DELA, %) express the percentage leaf area exposed to direct solar radiation (IRIMIA, 2006):

$$DELA (\%) = ExLA \times 100 / TLA$$

Statistical analysis of data was by variance analysis, Duncan test and also were calculated the coefficients of correlation between two variables (Ardelean, 2007).

RESULTS AND DISCUSSIONS

During winter, in Târnave vineyard there are frequently low temperatures, often below resistance limit of vine, so is necessary to use a semi-protective system of culture, especially Guyot with arms replaced periodically. In Blaj wine-growing center, during growing season of 2010, the climatic conditions expressed by precipitation and temperatures with values bigger than the multiannual averages, favored luxuriant growth of vine canopy.

The combined influence of variety and bud load on the leaf area/vine it is presented in table 1. From statistically point of view, the differences between the four varieties are significant, recording an average of 10.19 m^2 leaf area /vine at Blasius variety, followed at significant difference by Selena variety with 9.03 m^2/vine. The lowest value of leaf area was registered on varieties Astra (7.15 m^2/vine) and Fetească regală (7.11 m^2/vine), results statistically equal.

Table 1

Combined influence of variety and buds load on the leaf area per vine

Bud load / Variety	25 buds/vine	35 buds/vine	45 buds/vine	Variety average (A)
Astra	5.91 k	6.45 j	9.09 c	7.15 O
Blasius	8.10 f	8.31 e	14.17 a	10.19 M
Selena	6.82 i	7.88 g	12.38 b	9.03 N
Fetească regală	4.96 l	7.81 f	8.55 d	7.11 O
Bud load average (B)	6.45 B	7.61 B	11.05 A	-

DS 5% for two averages A (variety) = 0.43 – 0.46
DS 5% for two averages B (bud load) = 2.00
DS 5% for two averages AxB (variety x bud load) = 0.25 – 0.27
* difference between two values followed by at least one common point is insignificant

Regarding the bud load/vine at 45 buds was recorded an average leaf area of 11.05 m^2/vine followed at significant difference by 7.61 m^2/vine at 35 buds per vine and by 6.45 m^2/vine at a load of 25 buds. Analyzing the twelve variants, resulted from the interaction of variety and the bud load, it can be observed that the largest leaf area (14.17 m^2/vine) was registered on Blasius variety at a load of 45 buds/vine and the lowest to Fetească regală (4.96 m^2/vine) at 25 buds/vine.

Between all possible combinations resulted from the interaction of the two factors (variety x bud load) differences are significant (table 1).

Knowing the leaf area per vine, it was calculated leaf area per hectare. Total leaf area/hectare increased with bud load, but leaf area increasing was not proportional to with the increase of bud load. Among the four varieties, the largest leaf area per hectare was registered to Blasius variety at all three bud loads (23917.17 m^2/ha - 25 buds/vine; 26717.70 m^2/ha 35 - buds/vine, 45162.57 m^2/ha - 45 buds/vine). At the opposite side was Fetească regală variety with a leaf area per hectare of 15966.24 m^2/ha at 25 buds/vine, of 24078.12 m^2/ha at 35 buds/vine and of 27522.45 m^2/ha at a load of 45 buds/vine. The results of leaf area/hectare had expressed a high vigor at varieties Astra, Blasius and Selena, and a significant increase of this indicator with the increase of buds number per vine, thing that it was illustrated also by the correlation coefficient values (r = 1) (fig 1).

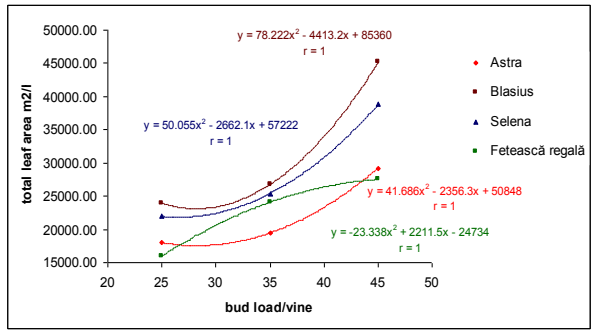

Fig. 1 - Correlation between bud load and leaf area per hectare

Exposed leaf area (ELA, m^2/ha) differs from one training system to another, but also to one grapevine variety to another, depending on growth vigor. For properly express of leaf area, actually this area can be limited to leaves surface exposed to sun light. The photosynthetic activity of leaves exposed to sun light influencing the accumulation of sugar in the grapes berries. Reception of the 90% of sunlight is on the first layer of leaves exposed to light.

Table 2

Exposed leaf area (m^2/ha)

Nr. crt.	Variety	Exponed leaf area m^2/ha	±d m^2/ha	Difference significance
1	Astra	15148.00	-240.24	ns
2	Blasius	16753.67	1365.43	**
3	Selena	15689.30	301.06	ns
4	Fetească regală	13962.00	-1426.24	oo
Average (Control)		15388.24	-	-

LDS 5 % = 866.27 ; LDS 1% = 1297.31 ;LDS 0,1%= 2043.24

The excess leaf area is the factor with direct influence in sunlight capture. By knowing the exposed leaf area, it can be calculated the surplus of leaves per vine. The experience results shows that excess leaf area increased with the bud load level and the excess leaf area increase was significant to all varieties, according to correlation coefficient, r = 1. The excess leaf area varies between limits 0.7 to 2 m^2/vine to a load of

25 buds/vine and between 4 to 8.5 m^2/vine to a load of 45 buds/vine (fig. 2). A part of this surplus of leaves was removed by a partial defoliation made in august, in veraison period.

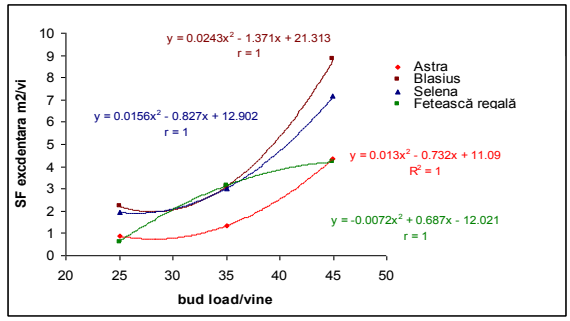

Fig. 2 - Correlation between bud load and excess leaf area (m^2/vine)

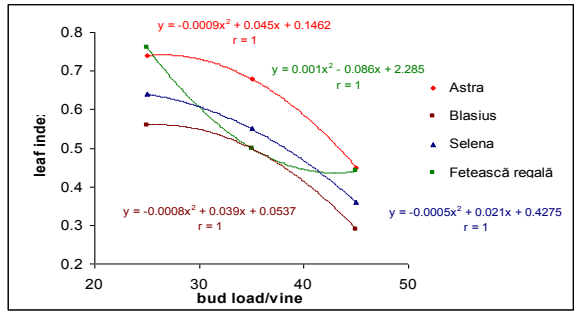

Fig. 3 - Correlation between buds load and foliar index (IF)

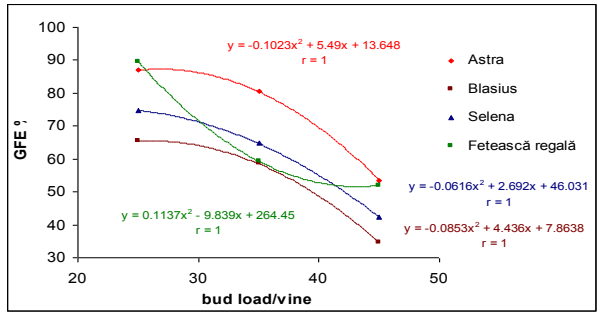

Fig. 4 - Correlation between bud load and degree of exposed vine canopy (DELA, %)

The foliar index (FI) was calculated as ratio between external leaf area (ExLA) and total leaf area (TLA). Regarding the foliar index, the results near to the optimal values (0.75 to 1,00) were registered to the lowest bud load (25 buds/ vine) to Astra (0.74) and to Feteasca regală (0.76). At the same bud load, the foliar index calculated for variety Selena (0.56) and Blasius (0.64) was below the optimum. Increasing the buds number to pruned had led to a significant decrease of the foliar index (r = 1), so to a bud load of 45 buds/vine, the foliar index was lower of 0.50 to all studied varieties. This shows that these varieties have very large leaves with high density (fig. 3).

To all varieties, the degree of exposed leaf area had the biggest percentage at the lower bud load of 25 buds/vine. At this bud load, values of direct sun exposure of vine canopy varied in a wide range, from 65% (Blasius) to 89 % (Feteasc㠠regală). At the maximum bud load (45 buds/vine), the degree of exposure of vine canopy was below 55%. Just as with the foliar index, direct sun exposure has decreased significantly (r = 1) with a increasing of bud load (fig. 4).

CONCLUSIONS

1. The largest leaf area (14.17 m^2/vine) was obtained at Blasius variety to 45 buds/vine, the lowest values of leaf area was at Feteasc㠠regală (4.96 m^2/vine) to 25 buds/vine and between all the experiences variants have registered significant differences.

2. The leaf area per hectare increases with the bud load, but the increase of leaf area was not proportional with the increase of fruit load to all four varieties.

3. Training system, Guyot with periodic replacement cordons, favored a better exposure to sunlight of vine canopy, the highest value (16753.67 m^2/ha), has been registered at Blasius variety, value above experience average at distinct significant difference.

4. Increasing to pruning of the buds number per vines led to an excessive density of the vine canopy to all studied varieties. The bud load significantly influenced foliar index and exposable leaf area to direct sunlight, negative correlations being established between those variables in all varieties.

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