Cercetări Agronomice în Moldova
Anul XXXX , Vol. 2 (130) / 2007

CORRELATIONS BETWEEN LEAF AREA AND YIELD QUALITY IN VARIETIES FETEASCĂ ALBĂ AND FETEASCĂ REGALĂ

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Received March 1, 2007

ABSTRACT. *The investigation conducted in the Avereşti vine-growing centre of the Huşi vineyard had as purpose the increase of yield quality in Fetească albă and Fetească regală varieties, through the optimization of the canopy parameters. The bud-load, which determined the optimal valorization of the biological potential in the two varieties (20.8 buds/vine), has developed 3.64 m^2/vine foliar excess, in the Fetească albă variety, and 3.48 m^2/vine foliar excess, in the Fetească regală variety. The regression coefficient showed that 1 m^2 foliar excess determined the diminution in the sugar content from the grape-must with 4.5 – 21.5 g/l at the Fetească albă variety, and 5.6 – 65.2 g/l at the Fetească regală variety. The maximum sugar content of the grape-must was realized with 3.86 m^2 total foliar surface/vine at the Fetească albă variety and 4.5 m^2 total foliar surface, at the Fetească regală variety. The increase of the foliar excess with 1 m^2 determined the growth of the acidity with 0.1 – 0.6 g/l H_2SO_4 at the Fetească albă variety, and 0.2 – 2.3 g/l H_2SO_4 at the Fetească regală variety. At Fetească regală variety, the increase in the canopy thickness with 8.07% has determined the growth of the grape-must acidity with 10.7%.*

Key Words: leaf area, foliar excess, leaf area index, vegetal canopy

REZUMAT – Corelațiile dintre suprafața foliară şi calitatea producției la soiurile Fetească albă şi Fetească regală. *Cercetările efectuate în centrul viticol Avereşti-podgoria Huşi, au avut ca scop ameliorarea calității producției la soiurile Fetească albă şi Fetească regală, prin optimizarea parametrilor covorului vegetal. S-a constatat că încărcătura de muguri prin care valorifică potențialul biologic de producție al soiurilor (20.8 ochi/m^2), determină formarea unui excedent foliar de 3.64 m^2/butuc la Feteasca albă şi 3.48 m^2/butuc la Feteasca regală. Din analiza valorii coeficienților de regresie, rezultă că fiecare 1 m^2 suprafață foliară excedentară determină scăderea concentrației mustului în zaharuri cu 4.5 - 21.5 g/l la Feteasca albă şi 5.6 - 65.2 g/l la Feteasca regală. Acumulările maxime de zaharuri se obțin cu*

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o suprafață foliară de 3.86 m^2/butuc la Fetească albă şi 4.5 m^2/butuc la Fetească regală. 1 m^2 suprafață foliară excedentară determină creşterea acidității cu 0.1 – 0.6 g/l H_2SO_4 la Fetească albă şi cu 0.2 – 2.3 g/l H_2SO_4 la Fetească regală. La soiul Fetească regală, creşterea compactității covorului vegetal cu 8.07% determină creşterea acidității mustului cu 10.7%.

Cuvinte cheie: suprafață foliară, excedent foliar, indice foliar, covor vegetal

INTRODUCTION

The biological potential of vinestocks is reflected by the size of leaf apparatus. Theoretically, the larger the vinestock area is, the highest is the amount of organic substances, which resulted after photosynthesis.

The results obtained from many investigations show that this correlation is positive only if the leaf apparatus is totally exposed to direct solar radiation. When the leaf area is greater than the vegetation exposure space, ensured by the guiding system, canopy thickening and shading are produced.

Shadowing has important physiological and phytopathological consequences, such as the diminution in bud fertility and intensification of the attack of pathogenic agents (*Botrytis cinerea, Uncinula necator*). As concerns the yield quality, we found out that shadowing determined the diminution in sugar concentration and increase in must total acidity (Champagnol, 1986).

The investigations on the interdependence between leaf area, sugar concentration and must acidity point out the negative influence of canopy thickening on yield quality in varieties Fetească albă and Fetească regală, under conditions of the Avereşti Vine-Growing Centre from Huşi Vineyard (Țârdea, Dejeu, 1995).

MATERIALS AND METHODS

The biological material was represented by varieties Fetească albă and Fetească regală, grafted on Kober 5BB stock. The plantations, set up in 1987, are situated on an interfluves plateau with the average size of 280 m and have the following characteristics: planting distance of 2.2 m/1.2 m, denseness of 3490 stocks/ha, guiding shape of high trunk-bilateral cordon (1.0 m) and pruning with short fruit-bearing links (shoots of 4-5 buds + knots of 2-3 buds). The guiding system, defined as "*high stem system with vertical monoplane nailing up",* ensures an external area of foliage exposure of 2.58 m^2/vinestock. The vinestock leaf area was studied on four experimental variants with graded bud-load :

- variant V_1 with load of 10.4 buds/m^2 (27 buds/vinestock);
- control variant (C), with load of 17.0 buds/m^2 (45 buds/vinestock);
- variant V_2 with load of 20.8 buds/m^2 (55 buds/vinestock);
- variant V_3 with load of 24.6 buds/m^2 (65 buds/vinestock).

Determinations were carried out on total leaf area, excess leaf area, leaf index, sugar concentration and must total acidity, and correlations between parameters characterizing leaf area and yield quality.

RESULTS AND DISCUSSION

1. Total leaf area. The maximum leaf area was of 6.22 m^2/vinestock in variety Fetească albă and of 6.06 m^2/ vinestock in Fetească regală. The lowest total leaf area was registered at variant V_1 (10.4 buds/m^2): 3.86 m^2/vinestock in Fetească albă and 4.5 m^2/vinestock in Fetească regală (*Table 1*). Previous investigations (Irimia, Ţârdea, 2004) established that vinestocks with optimum vegetative biological balance developed a total leaf area of 5.37 m^2/vinestock in Fetească albă and 6.06 m^2/ vinestock in Fetească regală .

Table 1

Exposed and excess total leaf area, according to bud-load, in varieties Feteasca albă and Fetească regală

Specification	FETEASCĂ ALBĂ				FETEASCĂ REGALĂ			
	V_1	C	V_2	V_3	V_1	C	V_2	V_3
Total leaf area (m^2/vinestock)	3.86	4.96	6.22	5.37	4.50	5.20	6.06	5.0
Exposed leaf area (m^2/ vinestock)	2.58							
Leaf area excess (m^2/ vinestock)	1.28	2.38	3.64	2.79	1.92	2.62	3.48	2.9
Area of the second leaf layer (m^2)	1.28	2.38	2.58	2.58	1.92	2.58	2.58	2.5
Area of the third leaf layer (m^2)	-	-	1.06	0.21	-	0.04	0.90	0.3

2. Leaf area excess. Because the guiding system on high trunk has allowed the exposure to direct solar radiation of only 2.58 m^2/vinestock, a significant part of the leaf area developed on vinestocks was shadowed and, therefore, had a low photosynthetic activity (Smart et al., 1985). It was considered a leaf excess, which has negatively influenced physiological processes and phytosanitary condition of the canopy.

The lowest leaf excess was registered at variant V_1 (1.28 m^2/vinestock in Fetească albă and 1.92 m^2/vinestock in Fetească regală), and the highest one at variant V_2: 3.64 m^2/vinestock in Fetească albă and 3.48 m^2/vinestock in Fetească regală (*Table 1*).

The leaf excess was spread in more shadowed layers inside the canopy. At variant V_1 the leaf excess has formed one layer, and at variants C, V_2 and V_3, two layers of shaded leaves (*Table 1*).

3. Leaf index. Because of the great number of leaves developed on vinestock, the canopy was thickened. The canopy thickening was greater once with the amplification of bud-load. The values of leaf index were of 0.41 - 0.66 in Fetească albă and 0.42 - 0.57 in Fetească regală, having maximum in V_1 and minimum in V_2 (*Table 2*).

Table 2

Canopy thickening and degree of exposure at direct solar radiation, according to bud-load/ vinestock at cutting

Specification	FETEASCA ALBĂ				FETEASCA REGALĂ			
	V_1	C	V_2	V_3	V_1	C	V_2	V_3
Leaf index (LI)	0.66	0.52	0.41	0.48	0.57	0.49	0.42	0.46

4. Corelation between total leaf area and must concentration in sugars. Between total leaf area and must concentration in sugars, there were negative correlations, resulting that once with the increase in total leaf area, must concentration in sugars diminished. The values of correlation coefficient were: r = - 0.8372 in Fetească albă and r = - 0.5774 in Fetească regală.

The values of regression coefficient have shown that each 1 m^2 of leaf area more than in the control variant diminished the must concentration in sugars with 4.5 – 21.5 g/l in Fetească albă and with 5.6 – 65.2 g/l in Fetească regală. Each 1 m^2 of leaf area less than at the control has increased must concentration in sugars with 4.5 g/l in Feteasca albă and with 9.1 g/l in Fetească regală (*Table 3*).

Table 3

Values of regression coefficient between total leaf area and sugar must concentration in varieties Fetească albă and Fetească regală

Specification	FETEASCĂ ALBĂ				FETEASCĂ REGALĂ			
	V_1	C	V_2	V_3	V_1	C	V_2	V_3
Total leaf area (m^2/vinestock)	3.86	4.96	6.22	5.37	4.50	5.20	6.06	5.0
Sugar must concentration (g/l)	188.6	183.3	177.6	174.4	182.0	175.6	170	156.0
Regression coefficient (y/x)	+ 4.5	0	-4.5	-21.5	+9.1	0	-5.6	-65.2

5. Correlation between total leaf area and must total acidity. The growth of total leaf area resulted in increasing must total acidity: r = + 0.6909 in Feteasca albă and r = + 0.8296 in Fetească regală.

In Fetească albă, total leaf area has not influenced significantly must acidity. In Fetească regală, the growth of leaf area by 1 m^2 resulted in increasing must total acidity until 2.31 g/l H_2SO_4 (*Table 4*).

Table 4

Values of regression coefficient between leaf area and must total acidity in varieties Fetească albă and Fetească regală

Specification	FETEASCĂ ALBĂ				FETEASCĂ REGALĂ			
	V_1	C	V_2	V_3	V_1	C	V_2	V_3
Total leaf area (m^2/vinestock)	3.86	4.96	6.22	5.37	4.50	5.20	6.06	5.0
Total must acidity (g/l H_2SO_4)	5.39	5.44	5.57	5.69	6.87	6.97	7.23	7.61
Regression coefficient (y/x)	- 0.04	0	+ 0.1	+ 0.6	- 0.14	0	+ 0.2	+ 2.3

6. Correlation between leaf index and must concentration in sugars. The leaf index was positively correlated to must concentration in sugars: r = +0.8604 in Fetească albă and r = +0.6400 in Feteasca regală. The highest sugar concentration of 182.6 g/l in Fetească albă and 182.03 g/l in Fetească regală was obtained at variant V_1, at which LI had the highest values. Must concentration in sugars diminished at superior graduations C, V_2 and V_3, because of canopy thickening and shading (*Figure 1*).

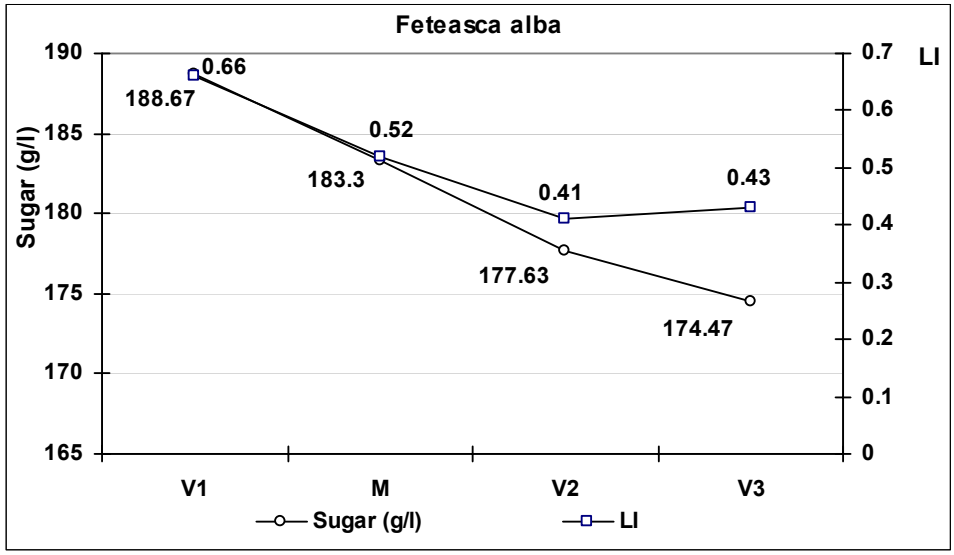
7. Correlation between leaf index and must total acidity. The correlation coefficient between leaf index and must acidity has shown negative values; they showed that once with the growth of shadowing, must total acidity has increased: r = - 0.7144 in Fetească albă and r = - 0.6579 in Fetească regală.

In Fetească albă, the growth of canopy thickness did not influence significantly must acidity: the diminution by 27.27% of the values of leaf index resulted in the increase in must acidity with only 5.56%. In Fetească regală, the influence was higher: the growth of canopy thickness by 8.7% has determined the increase in must acidity by 10.7% (*Table 5*).

Table 5

Interdependence between leaf index and must total acidity in varieties Fetească albă and Fetească regală

Specification	FETEASCA ALBĂ				FETEASCA REGALĂ			
	V_1	M	V_2	V_3	V_1	M	V_2	V_3
Leaf index (LI)	0.66	0.52	0.41	0.48	0.57	0.49	0.42	0.46
Variation size of leaf index (%)	27.27				8.07			
Must total acidity (g/l H_2SO_4)	5.39	5.44	5.57	5.69	6.87	6.97	7.23	7.61
Variation size of must acidity (%)	5.56				10.7			



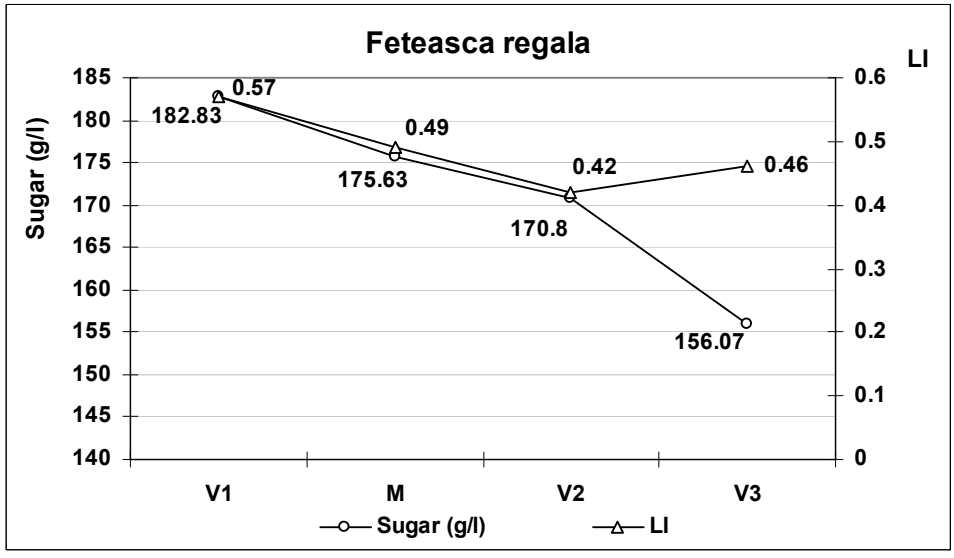


Fig. 1. - Correlations between leaf index and must concentration in sugars in varieties Fetească albă and Fetească regală

CONCLUSIONS

The bud-load of 10.4 – 24.6 buds/m^2 determines the development of great leaf areas of 3.86 – 6.22 m^2/vinestock in Fetească albă and 4.5 - 6.06 m^2/ vinestock in Fetească regală.

The excess of shadowed leaf area grows once with bud-load increasing and is comprised between 1.28 – 3.64 m^2/vinestock in Fetească albă and 1.92 – 3.48 m^2/ vinestock in Fetească regală. The leaf excess forms a shadowed leaf layer inside the canopy at the variant with bud-load of 10.4 buds/m^2 and two shadowed layers at variants with 17.0 – 24.6 buds/m^2.

LI values at variant V_1 (0.66 in Fetească albă and 0.57 in Fetească regală) point out the moderate canopy thickening. At variant V_2, at which the maximum leaf area is developed, canopy is highly thickened: LI = 0.41 in Fetească albă and LI = 0.42 in Fetească regală.

The total leaf area is negatively correlated to must concentration in sugars: r = - 0.8372 in Fetească albă and r = - 0.5774 in Fetească regală. Each 1 m^2 of leaf area more than in the case of the control results in diminishing must concentration in sugars by 4.5 – 21.5 g/l in Fetească albă and 5.6 – 65.2 g/l in Fetească regală.

Total leaf area is positively correlated to must total acidity. In Fetească albă, acidity is not significantly influenced by canopy thickening. In Fetească regală, each 1 m^2 of leaf area determines the increase in must total acidity until 2.31 g/l H_2SO_4.

The leaf area excess is negatively correlated to must concentration in sugars. The maximum concentration in sugars is achieved at variant V_1, with minimum leaf excess: 188.67 g/l in Fetească albă and 182.83 g/l in Fetească regală.

The leaf index is positively correlated to must concentration in sugars and negatively correlated to total acidity. In Fetească regală, the growth of canopy thickness by 8.7% results in increasing must total acidity by10.7 %.

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