VALEA CALUGAREASCA RED WINES PRODUCED WITHIN AN INTEGRATED SYSTEM

PRODUCEREA VINURILOR ROŞII DE VALEA CALUGAREASCĂ ÎN SISTEM INTEGRAT

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Abstract. *The International Organization of Biological Control established a new systemic concept. This concept regards Integrated Production as an "agricultural system of high quality production which utilizes natural regulation resources and mechanisms, enabling a viable production for a longer period of time". Integrated Production implies reduced interventions on vine and wine making process, being favorable for the environmental protection and human health. At the Research and Development Institute for Viticulture and Enology, Valea Calugareasca, the effects of integrated production system have been studied on an experimental plot of Cabernet Sauvignon in comparison with a classical control plot and other three modules where different techniques were applied (soil maintenance and fertilization, vegetation structure, phytosanitary protection) representing intermediary steps for accomplishing the integrated production system. Determinations and observations have been made concerning the chemical composition of the soil, production per vine, attack level for the main grapevine diseases and pests, grape evolution during their maturation stage, chemical and mechanical composition of grapes at the harvesting moment and the physical and chemical composition of the wines obtained within the five experimental modules. Following the determinations and observations we could conclude that the current management shift toward that of integrated production was quite a success.*

Rezumat. *Organizatia Internationala a Luptei Biologice si Integrate defineste un nou concept sistemic, acela al productiei integrate ca fiind "sistemul agricol de productie de inalta calitate, care utilizeaza resurse si mecanisme de reglare naturala si care asigura pe o perioada lunga de timp o productie viabila ». Productia integrata înseamna interventii reduse la minim in vie si in crama, având in vedere protectia mediului si sanatatea consumatorului. La ICDVV Valea Calugareasca au fost studiate efectele introducerii sistemului de productie integrata pe o parcela de Cabernet Sauvignon, comparandu-se cu martorul clasic, precum si cu module in care s-au aplicat tehnici de: intretinerea solului si fertilizare, structura vegetatiei, protectie fitosanitara, care constituie etape intermediare pentru realizarea productiei integrate. S-au facut observatii si determinari referitoare la compozitia chimica a solului, productia pe butuc, gradul de atac pentru principalele boli şi daunatori, evolutia strugurilor la maturare, compozitia fizico-chimica si mecanica a strugurilor la recoltare, compozitia fizico-chimica a vinului obtinut din cele cinci module experimentale. In urma observatiilor si determinarilor a rezultat ca reconversia managementului actual la cel al productiei integrate a fost un succes.*

Consumers' expectations regarding the quality of the wines registered quite an evolution during the latest years. The demands concerning the organoleptical qualities

were added with the requirements concerning food security and environmental protection. The International Organization of Biological Control defines the Integrated Production as a new systemic concept consisting in an "agricultural system of high quality production which utilizes natural regulation resources and mechanisms, enabling a viable production for a longer period of time". The implementation of such a concept both in the vinegrowing plots and the wineries represents some kind of requirement for the present, but quite a necessity for the future. It is equally imposed by the legislation of the European Union, as well as by the restructuring of the enterprises according to the principles concerning the competing capacity of the products and the possibility of rendering natural and human resources more efficient, all these being the reason for which the present study has been accomplished.

MATERIAL AND METHOD

An experimental layout was conceived within the system of Integrated Production for Cabernet Sauvignon variety used for obtaining red wines of high quality, specific for Dealu Mare vineyard. The aspects studied at the level of demonstrative experimental module (MED) are s it follows:

MED 1 "Soil maintenance and fertilization" – diminution of the multitude of mechanized works, restrictioning of the integral application of herbicides, organic matter ratio by applying alterntive herbage on the intervals between the grapevine rows, mulching on the row, fertilization with grape marc compost.

MED 2 "Structure of the vegetation" – potential crop adapted for the specific requirements of the variety and for the natural conditions of the grapevine plantation, enabling the air flow which is necessary for the grapevine canopy;

MED 3 "Phytosanitary protection" – structural prophylactic and treatment programs based on the concept of "Integrated Protection", compliance with EU legislation concerning the security of the methods applied in the utilization of the phytosanitary products;

MED 4 "Integrated Production" represents a combination of MED 1~3 effects when put together;

MED 5 "Witness control" – technological works are applied in conformity with the conventional system.

Assessments were made for: soil humidity, vegetative development of the grapevines established to be checked for each module, quality and quantity of grape production, degree of attack in case of the main diseases, composition of the grapes and wines produced, including also analyses concerning the chromatic specific features and the phenolic composition.

RESULTS AND DISCUSSIONS

1. Effects of the actual management shift toward the Integrated Production inside the vinegrowing plots

Modern intensive viticulture of high productivity implies significant challenges concerning the structural and other physical characteristics of the soil. The soil humidity which is the best for the grapevine ranges in between 50-80% of IUA (absolute humidity index), the smallest values being favorable for the berry maturation, and the greatest values for the shoot growth. Comparing the results obtained, we noticed that inside MED 4 (Integrated Production), the water retention into the soil ranges within the

optimal interval during the whole period, even if the values registered are inferior to the witness control (Fig. 1.).

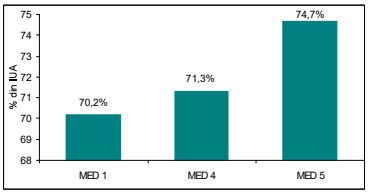

Fig. 1. Variation of the viticultural soil humidity

The chemical composition ratio reveals that total N, P and K supply is optimal for MED 1 and MED 4. As for MED 5 (Witness Control), it was noticeable that P_2O_5 level exceeds the optimal domain, whereas that of K_2O is lower (Table 1). The optimal values: 0,11-0,20 % total N, 10-20 mg P_2O_5 /100 g soil and 25-45 mg K_2O /100 g soil.

Table 1

Chemical composition of the viticultural soils

Module	Total N (%)	P_2O_5 (mg/100g soil)	K_2O (mg/100g soil)
MED 1	0,17	16,0	30,0
MED 4	0,16	16,0	30,0
MED 5	0,20	24,6	22,2

The potential fertility of the checked grapevines is different according to each MED (Fig. 2). In case of MED 1, the fertility of the winter buds increased by a higher percentage than in case of MED 4. In MED 2, the potential crop (buds retained at pruning) was attentively adjusted by considering both the requirements of the variety and the adequate airing of the canopy. With MED 4, the number of inflorescences was an average one, considered however as being optimal for obtaining appropriate grape productions in respect of their quality and quantity.

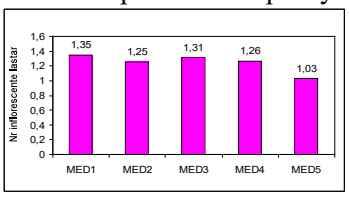

Fig. 2. Variation of potential fertility

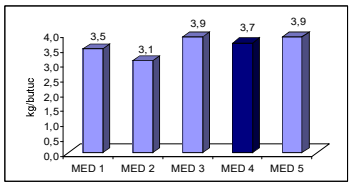

Fig. 3. Grape production for each MED

The grape production (kg/grapevine) was greater in case of MED 3 and MED 5; the difference between the Integrated Production and the Witness Control was of 0,200 kg/grapevine (Fig. 3). The integrated production has as a main objective to protect the vinegrowing plantations by rationally combining chemical, biological, physico-chemical and control methods, having as background specific grapevine technologies aiming at preventing and diminishing the strength of attacks. For MED 3 and MED 4, a phytosanitary "Control Program" was conceived by scheduling the treatments according to the growth and development stage of the grapevine and the strength of the already appeared infection. The active ingredients were those admitted by the Integrated Production, being therefore less toxic and less risky for the human health and for the

environment. For the other experimental modules, the "Control Program" was that practiced by the conventional system. When analyzing the influence of the experimented technological factors on the degree of attack in case of the main cryptogamic diseases, it was noticed that the treatments applied in the modules MED 3 and Med 4 enhanced good efficacy in controlling downy mildew (*Plasmopara viticola*), powdery mildew (*Uncinula necator*) and grey rot (*Botrytis cinerea*) on leaves and grapes. The results are quite significant in case of MED 3 and MED 4 in all the cases, in comparison with MED 5 (Witness Control), proving thus the right choice of the treatments and of the application moment. Quite relevant for the quality of the grapes is the diminution of grey rot attack from 47% in case of MED 5 (Witness Control), to 4,3% in case of MED 3 and MED 4, the results at veraison being mirrored also at harvesting Table 2.

Table 2

Degree of attack (GA%) for the pathogens of the grapevine during "Grape Veraison" (beginning of berry ripening)

Disease and pathogen	GA %		
	MED 3	MED 4	MED 5
Downy mildew (*Plasmopara viticola*)			
- leaves attacked	21,2	22,0	67
- grapes attacked	2,82	3,3	10
Powdery mildew (*Uncinula necator*)			
- leaves attacked	0	0	1,36
- grapes attacked	0,18	0,18	8,10
Grey rot (*Botrytis cinerea*)			
- grapes attacked	4,3	4,3	47

2. Characteristics of the raw material

The study of the grape composition evolution during their maturation process gives the possibility of establishing the optimal moment for harvesting. No significant differences were noticed regarding sugar accumulation, the accumulation of anthocyanins being however influenced by the treatments applied (Fig. 4).

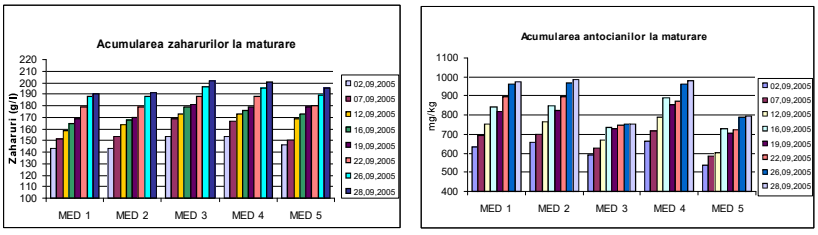

Fig. 4. Accumulation of sugars and anthocyanins in grapes at their maturation

The highest levels of anthocyanins were reached with MED 1, MED 2 and MED 4, outlining therefore the importance of soil maintenance and fertilization procedures and of the vegetation structure. All the experimental variants showed that Cabernet Sauvignon grapes reach their highest polyphenolic potential in about 10 days since their full maturation. Grape composition at harvesting is rendered in Table 3.

Table 3.

Physico-chemical and mechanical composition of grapes at harvesting

Component of quality	Parameters	MED 1	MED 2	MED 3	MED 4	MED 5
Basic composition	G 100 berries (g)	108	118	112	118	107
	Sugars (g/l)	199	199	207	202	196
	Acidity (g/l H_2SO_4)	6,29	6,38	6,20	6,24	6,41
Mechanical structure	Healthy berries (%)	89	89	91	90	81
	Damaged berries (%)	11	11	9	10	19
	G strugure (g)	193	177	175	167	115
	% skin	8,25	5,07	5,42	4,62	9,64
	% seeds	3,88	4,26	4,24	3,26	4,06
	% pulp	87,86	90,67	90,34	92,12	86,29
Polyphenolic composition	Anthocyanins (mg/kg grapes)	974,7	985,9	753,4	980,4	797,8

Differences are noticed in case of all the assessed parameters, but we outline a more reduced percentage of damaged berries in case of the experimental variants in comparison with the Witness Control, and a higher content in anthocyanins for MED 1, Med 2 and MED 4.

3. Physico-chemical composition of wines

The physico-chemical composition of the wines produced presents several differences depending on MED. We mention the higher content in alcohol for the wines produced within MED 3 and MED 4, the correlation with the higher level of the extract within MED 2 and MED 4 revealing the influence of the vegetation structure (Table 4).

Table 4

Basical composition of the wines

Physico-chemical parameters	MED 1	MED 2	MED 3	MED 4	MED 5
Acquired alcoholic strength (%vol)	11,6	11,6	11,9	11,8	11,4
pH	3,30	3,50	3,32	3,48	3,12
Total acidity (g/l H_2SO_4)	5,21	5,38	5,21	5,14	5,16
Volatile acidity (g/l acid acetic)	0,48	0,49	0,33	0,33	0,60
Non-reducing extract (g/l)	25,02	26,76	25,02	26,41	22,50

The phenolic composition is very important for the quality of the red wines. Cabernet Sauvignon wines are corpulent, rich in phenolic compounds and well balanced. High values of the color intensity are noticed in case of MED 2, where the structure of the grapevine vegetation gave the possibility of having an optimal exposure for the grapevine canopy (Table 5).

Table 5

Color and polyphenolic structure of the wines under experiment

Physico-chemical parameters	MED 1	MED 2	MED 3	MED 4	MED 5
Color intensity (1 cm)	0,66	0,74	0,72	0,68	0,58
Hue	0,784	0,786	0,736	0,615	0,639
Total polyphenols (IF)	28,7	27,1	24,1	25,3	23,5
Tannins (g/l)	2,96	2,56	2,19	2,43	2,03
Anthocyanins (mg/l)	421	391	445	455	546

The wines have an intense color, the red color being so intense due to the utmost presence of flavilium cation and of the blue color. The phenolic composition specific to the wines at MED level was estimated by considering the analytical parameters: Folin index, tannins and anthocyanins. Following the analyses, differences of the values between the modules are observed. In MED 4, Folin index and the content in tannins register a higher value comparatively with the Witness Control. The anthocyanin content of the wines is slightly lower in case of MED 4 when compared to the Witness Control to which the size of the berries is smaller, but higher when compared to the intermediary modules.

CONCLUSIONS

1. The agrotechnical management and the phytosanitary protection treatments applied in the demonstrative experimental modules influenced upon the composition of the soil, the vegetative development, the quality and quantity of the grape production.

2. N, K, P supply ranged in between the optimal domains in case of the Integrated Production, the variant taken as a Witness Control registering values not belonging to those intervals for P and K.

3. The potential fertility was higher in case of all the experimental variants when compared with the Witness Control. By reducing the potential crop (MED 2 and MED 4), in order to comply with the requirements of the variety, the grape production was lower in case of these modules comparatively with the Witness Control and MED 3. The modification of the potential crop without adequate phytosanitary protection (MED 2) engendered a more important decrease of the production by 0,8 kg/grapevine, but only 0,2 kg/grapevine in case of the Integrated Production.

4. The phytosanitary protection treatments (MED 3 and MED 4) significantly diminished the attacks of the main diseases (downy mildew, powdery mildew, grey rot), comparatively with the Witness Control, the effects being noticeable both at grape veraison and at harvesting. The treatment application schedule according to the grapevine development stages and the infection strength gave the best results.

5. The potential crop diminution had positive effects on the accumulation of anthocyanins (MED 2 and MED 4).

6. The wines produced within the experimental variants registered higher levels for their alcohol content, non-reducing extract and phenolic compounds than in case of the Witness Control, which consequently emphasized the positive influence of introducing the new concept.

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