Developing an integrated viticulture in the upper part of the hill Somló

Le développement de la viticulture intégrée dans le haut coteau de Somló

Laszlo KOCSIS[1*], Péter VARGA[2], Péter PODMANICZKY[1], Zoltán VARGA[1], Gizella GYORFFYNE[2] JAHNKE, Sándor BARAT[3], Attila CSASZAR[3], János MAJER[2],

[1]University of Pannonia, Georgikon Faculty of Agriculture; 8360 Keszthely, Deák F. u. 16
[2]University of Pannonia, Agriculture Center, Research Institute for Viticulture and Enology, Badacsony; 8261 Badacsonytomaj, Római út 165
[3]Kreinbacher Estate Wine, Trading and Hospitality Limited, 8481 Somlóvásárhely P.O.Box 3.

***Corresponding author:** kocsis-l@georgikon.hu

Summary

The hill Somló looks like a huge island wich jumps out of the see, a few kilometers away from the slope of Bakony highland and on the edge of the Hungarian small plane. Viticulture has started on the slopes of the hill few thousand years ago, but because of the latest technological development and economical circumstances the copartners have developed a synchronized research program. In the frame of this program we have 8 very distinctive sub-projects. The projects are including the effect of rootstock on grapevine quality, the canopy management, the order of the steps and the quality cultivation, the evaluation of site effect and row direction of the plantation, the plant protection system and the fertilization of the vineyards. Differences were obtained in sugar content related alcohol content in the crop load management experiment, in the soil cultivation and fertilization experiment. The titratable acid content also varied by treatments, we have got the lowest value (5.44 g/l) in the higher N fertilization treatment in the *V. vinifera* cv 'Italian Riesling' vineyard, while the highest value (7.93 g/l) was in the mechanically cultivated experiment among other two kind of cultivation methods in the *V. vinifera* cv 'Furmint' plantation. It was measured the pH, the residual sugar content, the sugar free dry matter content and phenol compounds in a few experiments. Row direction, rootstocks crop load management, soil cultivation methods, and fertilization are very influential in the quality production as our results shows.

Keywords: viticulture, integrated vineyard management, quality, site effect

Introduction

Sustainable viticulture and winemaking practices are an integral part of the European grape and wine industry nowadays. Switzerland was the first European country to establish integrated production organizations (Boller 1993). The integrated viticultural production system considers many factors that interact to influence yield and fruit quality and composition. For example, soil factors, like fertility and soil type affect choice of rootstock and vine vigor, which impact choice of trellis system and pruning level. Other factors, like environmental, crop level, impact canopy density and hence potential disease risk, finally influence the yield, the fruit quality and composition. All cultural management practices become potential tools for integrated viticultural production. The key elements of the integrated production systems is based on interdisciplinary studies conducted in Switzerland, summarized in the "Wadenswil Model' (Boller et al. 1990). It is ecologically and environmentally based, flexible, sustainable, provide direction towards reduced artificial inputs (Basler and Boller 1991).
One of the first element of the integrated production is integrated pest management (IPM) was introduced in 1959 by Stern et al. (Zalom 2000). In the 1970s IPM become more complex by considering the interactions of pests, natural enemies, the crop and the environment in a matrix (Prokopy 1994). Integrated crop management (ICM) represents a shift from a view of the pest management. Vineyard is a part of a larger biological system. We must learn to take advantage what we know about the biological system to help us produce sustainable yields of high quality fruit. Jordan

(1996) introduced a Sustainable Viticulture Scheme which has been developed in New Zealand. The key elements of the scheme are based on the Wadenswil Integrated Production Scorecard. An integrated viticultural production system relies on vineyard scouting, weather monitoring, and the use of economic thresholds. Vineyard nutrition, vineyard floor management, vine vigor management, and crop control are all aimed at producing adequately ripen good yields of quality fruit located in good exposure situations while maintaining good wine size. Management decisions are site specific. Fertility can be modified, however cultivar characteristics should be considered prior to planting when vineyards spacing and trellis decisions are made (Edson et al. 1996). Choice of cultivar is an important component of the integrated production system. Mikóczy (2007) has examined six V. vinifera cultivars (cv 'Chardonnay Cl 75', cv 'Sauvignon blanc Cl 297' cv 'Királyleánka 21', cv 'Cabernet sauvignon E 153', cv 'Pinot noir M2', cv 'Kékfrankos Kt 1') fitting into the integrated vine production in the wine region of Ászár-Neszmély in Hungary. The experiment concluded all the six varieties are suitable for the integrated vine production; however there are differences in the aspects of productivity and quality among the cultivars. Series of factors are influencing a successful operation. Its knowledge and objective description is an advantage of field work rationalization, resource use optimization and quality improvement. It will lead to us to precision viticulture. Romani et al. (2005) introduced VIVES (Vineyard Variability Evaluation System) what uses a vine growing model and a series of geo-morphological layers, technical information and High Resolution images for the evaluation of existing differences and a detailed description of local variability.
In our study we use conventional methods to examine the effect of rootstock on grapevine quality, the canopy management, the order of the steps and the quality cultivation, the evaluation of site effect and row direction of the plantation, the plant protection system and the fertilization of the vineyards. A matrix system with the combination of the information will lead us to build an integrated production model of the upper part of the hill side.

Material and methods

Our experiment is located in Somló hills which is one of the unique region for viticulture in the world. Its a volcanic origin hill with the highest point 416 meters. The hill Somló looks like a huge island wich jumps out of the see, a few kilometers away from the slope of Bakony highland and on the edge of the Hungarian small plane. Viticulture has started on the slopes of the hill few thousand years ago, but because of the latest technological development and economical circumstances the copartners have developed a synchronized research program. In the frame of this program we have 8 very distinctive sub-projects. The soil conditions are equal. The underwater level is more than 2 meters, the fertile soil layer is more than 1 m, rich in humus. The pH of the soil is little above 7.00, low level of active calc characterized, salt is present in trace. The soil is rich in Phosphor , Potassium and Magnesium, while poor in mineral Nitrogen. The projects are including the effect of rootstock on grapevine quality, the canopy management, the order of the steps and the quality cultivation, the evaluation of site effect and row direction of the plantation, the plant protection system, comparing soil cultivation systems, cultivar evaluations and the fertilization of the vineyards.Date of harvest was determined according to the winery capacity and requirements in each experiment. Yield (kg/m2), must degree (Kl^o), titratable acid content (g/l), pH were measured at the time of harvest, and percentage of Botrytis rotting was recorded in both years. Wine was made with standardized methods in microvinification level (10 liters per treatment). Basic wine analyses were run on the experimental wines and the wines were evaluated organoleptically as well.

Results and Discussion

Crop load management was measured on V. vinifera cv 'Hárslevelű'. We have three treatments as cluster thinning, cluster cutting in half and the control treatment. The bud load was the same in all treatment (4 buds/m^2) as well all the cultivation year around. The yield was significantly less of course in the treatment where the cluster number or cluster form was modified. The most balanced grapes were obtained when the cluster was cut in a half, but all the cluster remained on the stock (Figure 1).

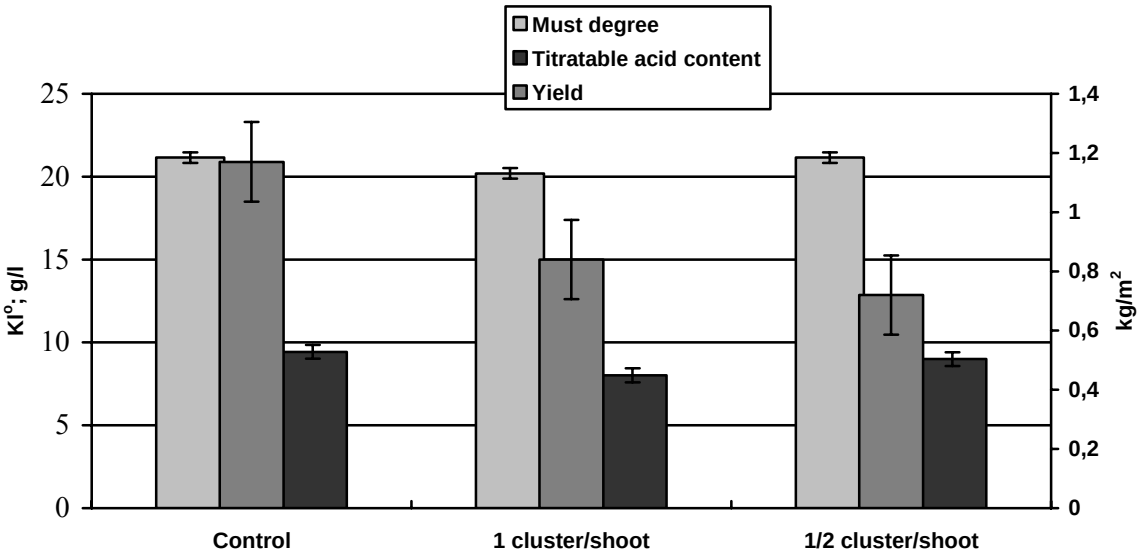

Figure 1 Two years average of the yield, of the soluble sugar content (Klo) and of the titratable acid content in the crop load management experiment in Somló, the cultivar is 'Hárslevelű'.

We have established a comparison experiment of two rootstocks to determine the effect on quality. The soil conditions and the bud load and all the cultivation steps were same. We have got no differences in yield production, in number of cluster per vines and pH, however the soluble sugar content differed and there was difference between the titratable acid content. So far the Teleki 5C produce more balanced grapes, but the percentage of the rotted berries was higher than on the Fercal rootstock.

	Rootstock effect		**Fertilization experiment**		
	Fercal	**T 5C**	**Non fertilized**	**Nitrogen 50 kg/ha per year**	**Manure 34 t/ha in a first year**
Date of harvest	09.10./03.10.	09.10./03.10.	16.10./03.10.	16.10./03.10.	16.10./03.10.
Yield (kg/m^2)	0,37	0,34	0,88	1,03	1,03
Number of cluster/vinestock	3,79	3,79	4,16	4,79	4,75
Must degree (Kl^o)	18,65	19,00	18,2	17,7	17,4
Titratable acid content (g/l)	6,45	7,11	5,92	6,14	6,74
pH	3,36	3,40	3,24	3,32	3,29
Percentage of Botrytis rotting	20,00	26,25	6,87	5,00	4,00

Table 1 Two years average of quantitative and qualitative parameters of the yield form the vineyard of Somló on cv'Furmint'at rootstock effect and on cv 'Olasz rizling' at fertilization experiment.

The soil on the Somló hill is extremely fertile. Even the fertile soil conditions the different Nitrogen supply cause differences in yield production, in soluble sugars, in acid content and in the percentage of Botrytis rotting. Two years a short time period to evaluate the usefulness of the manure on the vineyard, but the trend is clear as the soluble solid was 16,7 Klo in 2006 and 18,1 Klo in 2007 with 20

% increase on yield production. As the weather conditions were very dry in the summer of 2007 the results of fertilization shows the positive effect on yield and its quality (Table 1).

Wine was made from the harvested grape with standardized white wine technology. All the applications were same during the crushing, fermentation and ageing. Differences were obtained in the parameters, and during the organoleptic evaluation as well.

	Rootstock effect		**Fertilization experiment**		
	Fercal	**T 5C**	**Non fertilized**	**Nitrogen 50 kg/ha per year**	**Manure 34 t/ha in a first year**
Alcohol content v/v %	12,16	13,39	11,91	11,56	11,39
pH	3,35	3,84	3,58	3,15	3,59
Specific gravity weight	0,9944	0,9957	1,0150	0,9990	1,0001
Sugar free extract content g/l	20,88	19,16	25,84	20,30	22,43
Sugar content g/l	5,79	4,04	54,66	17,70	17,87
Volatile acid mg/l	0,72	0,60	0,82	0,82	0,63

Table 2 The wine parameters of the rootstock effect and of the fertilization experiment from the Somló hill in 2007.

The results of the soil cultivation treatment shows on the Figure 2. Three treatments were applied as mechanically cultivated, grass covering between the rows and crushed mulch covering between the rows. The mulch resulted less sugar, more yield in a first year. There were no differences in titratable acid content among the treaments.

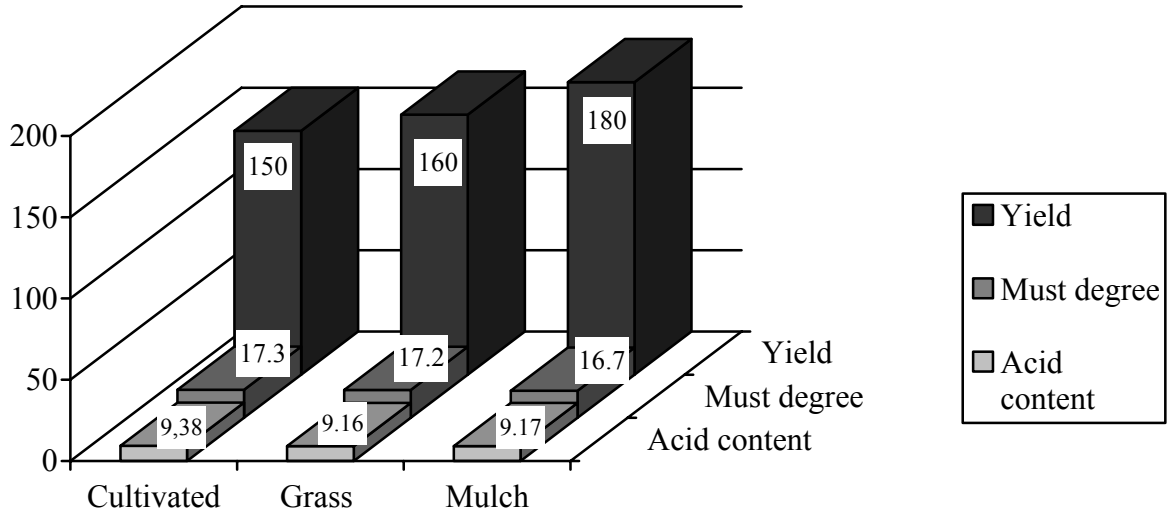

Figure 2 The yield production, the soluble sugars and the titratable acid content of the soil cultivation trial in 2006 on the hill of Somló

Conclusion

We have two years of results to present how cultivation methods, and the rootstocks are influenced the quality of the grapes and wine. Differences were obtained in sugar content related alcohol content in the crop load management experiment, in the soil cultivation and fertilization experiment. The titratable acid content also varied by treatments, we have got the lowest value (4.76 g/l in 2007) in the fertilization treatment in the cv 'Olasz rizling' vineyard, while the highest value (8.18 g/l in 2006) was in the rootstock trial on cv 'Furmint'. It was measured the pH, the residual sugar content, the sugar free dry matter content and phenol compounds in a few experiments. Row direction, rootstocks crop load management, soil cultivation methods, and fertilization are very influential in the quality production as our results shows. We will be able to put together the most effective vineyard management for the hill of Somló. As we determine which rootstock gives better quality, we determine the right row direction, the use of fertilization and applied soil cultivation. After two years we could say that a sustainable vineyard needs medium vigor rootstock to the cultivar 'Furmint' and 'Olasz rizling', fertilization with manure and the soil needs to be covered with mulch. Our results will enhance economy of the viticulture in cost effective part of the premium vine growing areas.

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