EFFECTS OF GLRaV 1 ELIMINATION ON PHYSIOLOGICAL, AGRONOMIC AND OENOLOGICAL CHARACTERISTICS OF TWO CV. MARZEMINO CLONES

Umberto MALOSSINI [1] *, Luca ZULINI [1], Giorgio NICOLINI [1], Antonella VECCHIONE [1], Elisa DECARLI [1], Pierluigi BIANCHEDI [1], Renzo MOSCON [1]

[1] IASMA Fondazione Edmund Mach, I-38010, SAN MICHELE ALL'ADIGE, Italy
*Corresp. author: Umberto Malossini, +39 0461615384, +39 0461650956, Email: umberto.malossini@iasma.it

Summary

In this work we compared, during two years in two vineyards (Trentino, North-East Italy), some physiological, agronomic and oenological characteristics of two *V. vinifera* cv. Marzemino clones, before and after GLRaV 1 elimination. The leafroll sanitation confirms the data previously obtained, resulting in an increased leaf dimension and efficiency (SPAD index, pigment content) at veraison and, especially, at harvest. On the other hand, the positive effects of leafroll sanitation on agronomic characteristics resulted only in a significant increase of bunch and stem cluster weight, while the fertility of buds, yield and vigour of vine seem to be not influenced. Leafroll sanitation of the two clones did not significantly change most of the oenological parameters analysed and the results of wine tasting.

INTRODUCTION

The present work continues and specifies the evaluations reported in previous trials (Malossini *et al.*, 2003; 2006), performed with only one clone (SMA 9) affected by double virus infection (GVA and GLRaV 1). In this paper a single virus sanitation (GLRaV 1) on two Marzemino clones (SMA 18 and SMA 9) was evaluated. Clone SMA 18 is confirmed to be affected only by GLRaV 1. Eradication of virus was carried out by means of thermotherapy *in vitro* and meristem culture (Gribaudo *et al.*, 2003). Controls by ELISA test were carried out from 1998 till today, on different lines.

MATERIAL AND METHODS

GLRaV 1 infected (=LR1) and sanitated (=LR1-free) cv. Marzemino clones (SMA 9 and SMA 18) vines were compared in two vineyards during two years (2007 and 2008). Single vines samples of the control (infected vines = LR1) and of the healthy *ex-vitro* material (LR1-free) were tested from 2000 to 2008 by ELISA for ArMV, GFLV, GFkV, GLRaV-1, 2, 3 and GVA using commercial kit (Agritest, Valenzano-Bari, Italy). LR1 and LR1-free self rooted vines of two clones were stored in greenhouse and in field located at San Michele all'Adige (year 2001, Guyot trained). A second vineyard (year 2005, simple pergola trained) was planted in Rovereto, in the same cool climate conditions as the first one, with vines of both materials propagated onto GLRaV-1 and GVA-free rootstock (Kober 5BB). In both experimental vineyards two blocks with 4-20 vine for each treatment and clone were planted. During 2 years (2007 and 2008), 20 to 30 leaves from LR1 and LR1-free plants were sampled at veraison and at harvest. Physical and chemical analyses of blades and petioles were carried out, i.e. nitrogen (by Kjeldahl) and mineral elements' content (by ICP-OES), SPAD-index (by SPAD 502 Chlorophyll Meter, Minolta; Porro *et al.*, 2000) and chlorophyll fluorescence (PAM-2000 fluorometer; Walz, Effeltrich, Germany). Amount of chlorophyll (Chl), carotenoids (Car) and total soluble proteins were spectrophotometrically determined (Lichtenthaler, 1987). Fertility of buds, yield (grape and wood production) and characteristics of grape (weight of bunch, berry, and stem cluster, soluble solids, total acidity, pH, anthocyanins and polyphenols) measured on 15 bunch for each treatment were evaluated. The grapes (120 kg/sample) from one vineyard (at Rovereto) were processed according to the following main steps: crushing-destemming, 50 mg/L SO2, inoculum with selected dry yeast (30 g/hL), punching the cup twice a day, 7-day skin-contact, soft pressing of pomace with total blending of free run and press wine, malolactic fermentation using selected lactic bacteria, sulfiting, sterile bottling. Paired-preference test of the wines (control *vs* LR1-free) were carried out with 64 judges. For the comparison of treatments, Student's t test has been used. All statistical analyses were performed with Statistica software (StatSoft, Tulsa, USA)

RESULTS AND DISCUSSION

Sanitary conditions. Results of ELISA test confirm the GLRaV 1 elimination (Table 1); the materials of LR1-free SMA 9 clone confirm, with 72.6 % of samples, GVA originary infection.

Table 1. Results of ELISA test on samples from single vine of two clones of Marzemino.

Original labelled clone	Conventional label	N of tested samples	% of positive or doubt samples	
			GLRaV 1	GVA
SMA 9	LR1	123	96.6	98.0
	LR1-free	134	0.0	72.6
SMA 18	LR1	110	96.6	0.0
	LR1-free	209	0.2	0.0

Samples (leaf or wood) were gathered (from 2000 to 2008) in field or in greenhouse.

Leaf parameters. Pigment content (Chl a, Chl b, Carotenoids) and SPAD index of leaves (Table 2) were highly affected by GLRaV 1 sanitation both at veraison and harvest: LR1-free samples showed higher values. Fv/Fm ratio (chlorophyll fluorescence) revealed the same values on treatments both at veraison and harvest. Leaves of LR1-free samples showed only at harvest a significant increasing in weight of petioles and blades as well as in leaf area.

Some mineral elements resulted significantly different between treatments (data not show). At veraison in LR1-free blades S, Ca and Mg resulted higher than in LR1 blades; on the contrary, K was higher in LR1 blades. In LR1-free petioles both Zn and Ca resulted higher. At harvest only S in blades resulted affected by sanitation with higher values on LR1-free samples.

Table 2. Effect of GLRaV-1 sanitation (LR1 *vs* LR1-free) on some parameters in leaves of two cv. Marzemino clones, collected at veraison and harvest in two vineyards in years 2007 and 2008 (means ± std. error).

Parameter	Treatment		sig.
	LR1	LR1-free	
VERAISON			
Blade weight (g)	5.06 ± 0.145	5.12 ± 0.149	n.s.
Petiole weight (g)	1.55 ± 0.066	1.62 ± 0.061	n.s.
Leaf area (cm^2)	261.3 ± 8.65	263.6 ± 8.25	n.s.
SPAD Index	33.6 ± 0.202	37.3 ± 0.210	***
Fv/Fm	0.767 ± 0.008	0.758 ± 0.011	n.s.
Chl a	0.960 ± 0.038	1.100 ± 0.033	**
Chl b	0.357 ± 0.015	0.404 ± 0.011	*
Car	0.318 ± 0.009	0.376 ± 0.088	***
HARVEST			
Blade weight (g)	4.79 ± 0.133	5.40 ± 0.176	**
Petiole weight (g)	1.48 ± 0.056	1.87 ± 0.086	***
Leaf area (cm^2)	236.4 ± 7.71	276.2 ± 12.4	**
SPAD Index	35.4 ± 0.280	38.4 ± 0.226	***
Fv/Fm	0.733 ± 0.005	0.721 ± 0.005	n.s.
Chl a	0.832 ± 0.033	1.044 ± 0.046	***
Chl b	0.315 ± 0.014	0.416 ± 0.022	***
Car	0.315 ± 0.009	0.377 ± 0.012	***

*** = significant ($p < 0.001$), ** = significant ($p < 0.01$), * = significant ($p < 0.05$), n.s. = not significant

Agronomic and oenological parameters. The virus elimination effects in yield resulted significant only in bunch and stem cluster weight, wich showed higher values in LR1-free samples (Table 3). Vigour of vines (Kg wood/vine) resulted in the same range. Fertility of buds was not significantly different among treatments, but LR1 revealed higher values of total and break buds per vine. Must analyses revealed slight differences only in pH and K content, with higher values in LR1. No significant differences between treatments emerged by means of wine tasting.

In conclusion, the effects of GLRaV 1 sanitation confirms the previous information, resulting in an increased leaf dimension and efficiency (SPAD index, pigment content) at veraison and, especially, at harvest. On the other hand, the positive effects of leafroll sanitation on agronomic characteristics resulted only in a significant increase of bunch and stem cluster weight, while the fertility of buds, yield and vigour of vine seem to be not influenced. Moreover, leafroll sanitation of the two clones did not change significantly most of the oenological parameters analysed and the results of wine tasting.

Similar studies will be continued also in other conditions, for a better knowledge of the interactions between virus and grapevine clones.

Table 3. Effect of GLRaV-1 sanitation (LR1 *vs* LR1-free) on some agronomic and analytical parameters of two clones cv. Marzemino, in two vineyards in years 2007 and 2008 (means ± std. error).

Parameter	Treatment		sig.
	LR1	LR1-free	
Number of buds/vine	19.6 ± 0.862	15.9 ± 0.591	***
Budbreak (%)	70.8 ± 0.015	69.9 ± 0.011	n.s.
Real fertility	0.81 ± 0.034	0.78 ± 0.028	n.s.
Potential fertility	1.13 ± 0.361	1.10 ± 0.032	n.s.
Vigour (Kg wood/vine)	1.13 ± 0.077	1.18 ± 0.097	n.s.
Number of bunches/vine	11.1 ± 1.132	11.3 ± 0.692	n.s.
Yield (kg)	2.81 ± 0.283	3.38 ± 0.297	n.s.
Bunch weigth (g)	259 ± 14.4	303 ± 13.9	*
Berry weight (g)	2.28 ± 0.089	2.34 ± 0.059	n.s.
Stem cluster weight (g)	14.7 ± 1.34	19.31 ± 1.61	**
Soluble solids (°Brix)	19.8 ± 0.342	19.6 ± 0.284	n.s.
Total acidity (g/L)	6.27 ± 0.302	6.26 ± 0.258	n.s.
pH	3.32 ± 0.025	3.29 ± 0.020	*
Anthocyanins (mg/Kg berries)	952.3 ± 36.8	977.2 ± 47.7	n.s.
Polyphenols (mg/Kg berries)	1029.5 ± 31.0	1039.8 ± 48.3	n.s.

*** = significant ($p < 0.001$), ** = significant ($p < 0.01$), * = significant ($p < 0.05$), n.s. = not significant

LITERATURE

GRIBAUDO, I., MANNINI, F., CUOZZO, D., GOBETTO, M., LENZI, R. & CREDI, R. 2003. Eradication of viral and virus-like diseases from grapevine clones (*Vitis vinifera* L). *Quad. Vitic. Enol. Univ. Torino*, 25, 39-50.

LICHTENTHALER, H.K. 1987. Chlorophylls and carotenoids, the pigments of photosynthetic biomembranes. *Methods in Enzymology* 148, 350-382.

MALOSSINI, U., RONCADOR, I., CICCOTTI, A.M., BERTAMINI, M. & NEDUNCHEZHIAN, N. 2003. Grapevine virus (GLRaV-1+GVA) inhibits pigments, RUBPC and photosynthetic activities in field grown grapevine (*Vitis vinifera* L. cv. Marzemino) leaves. *Extended abstracts 14th Meeting of ICVG,* Locorotondo, Italy, 254-255.

MALOSSINI, U., NICOLINI, G., CICCOTTI, A.M., ZULINI, L., MATTIVI, F., RAMPONI, M. & BIANCHEDI, P.L. 2006. Agronomical and enological performances of a "Marzemino" clone before and after virus (GLRaV-1 and GVA) elimination. *Extended abstracts 15th Meeting of ICVG*, Stellenbosch, Southe Africa, 132.

PORRO, D., CESCHINI, A., DORIGATTI, C. & STEFANINI, M. 2000.. Use of SPAD meter in diagnosis of nutritional status in apple and grapevine. *Acta Horticulturae (ISHS,* 564, 243-252.

ACKNOWLEDGEMENTS

Mauro Ferrazza, Paola Bragagna, Mario Ramponi, Erica Corradini and Tomas Roman are acknowledged for the technical support.