CHANGES IN AGRONOMICAL AND OENOLOGICAL PERFORMANCES OF CLONES OF THE GRAPEVINE CV GEWÜRZTRAMINER AFTER *GRAPEVINE FANLEAF VIRUS* ELIMINATION BY HEAT THERAPY

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Grapevine fanleaf virus (GFLV) is the most widespread nepovirus involved in the grapevine degeneration. It is generally reported that GLFV elimination induces a strong modification of vine behaviour, an increase of cane length and leaf surface, a dramatic increase of vigour and yield. In a warm climate the increase of vigour and yield of GFLV-free materials did not penalize the berry juice composition: more doubtful are the results obtained in a cool climate area (4). The genetic variability within a cultivar is the basis of clonal distinction, but the virus infections may have great practical implication on the studied phenotypical variability. The clonal selection carried out at IASMA confirmed interesting differences, as for agronomical performances and analytical and sensorial profiles of wines, among Gewürztraminer's clones (3). Only a few clones (both healthy and affected by virus) showed always varietal typicality. It was confirmed that the profile of bound forms of certain aroma compounds (e.g. geraniol and linalool) well discriminated the *aromatic* and *neutral* genotypes (3). In this preliminary work was investigate the influence of GFLV on the characteristics of two infected clones of grapevine cv Gewürztraminer in comparison to the same clones after sanitation.

The present study deals with the differences in agronomical and oenological performances between GFLV-infected (MP) and heat-treated healthy (HT) progenies of two Gewürztraminer's clones. In 1997, the originally GFLV-infected clones 920 and 921 (respectively as *aromatic* and *neutral* Gewürztraminer's genotypes) were heat-treated according to in vitro thermo-therapy (1). Established daughter vines of both original (MP) and heat treated (HT) clones were tested by ELISA for GFLV, ArMV, GLRaV-1, GLRaV-3 and GVA using commercial kits (Agritest, Valenzano-Bari, Italy). ELISA tests were carried out on leaves and woody samples from each original (MP) and heat-treated (HT) vines in five years (1998-2002). HT progeny of 920 and 921 clones resulted GLFV-free. MP and HT both *ex-vitro* material was green-grafted on virus-certified rootstocks (Kober 5BB). An experimental vineyard in sandy soil was established in the year 2000 at plane (210 m a.s.l., San Michele a/A - Italy). More of 10 plants for each trial are Guyot-system trained. In June 2001 (only for 920 clone), sample of 10 leaves with 4 different ages (node position on shoot) from both MP and HT vine were collected. The length of shoots, blades (main vein) and leaf-petioles were measured. Amounts of total chlorophyll (Chl) were spectrophotometrically (2) and by chlorophyll-meter Minolta SPAD-502 (5) determined. All measurements of Chl and fluorescence were performed, on detached leaves, with portable PAM-2000 fluorimeter (Walz, Effeltrich, Germany). In 2002 instead, were repeated the measures of SPAD index on collected leaves during the veraison (31 July) and at harvest (9 Sept.) from MP and HT plants of both clones (920 and 921). Additionally, the fresh weight of blades and petioles were measured and chemical analysis of these were carried out (5). At the harvest (2002) grape yield and must composition (Brix degrees, total acidity and pH) after grape crushing, short skin-contact, pectolitic enzyme addition and overnight cool-settling of the juice were recorded for each plot. Free and bound (as aglycons) monoterpene aroma compounds have been quantified in the juice after frozen storage according to Versini et al. (7) by HRGC-MS. Some 2002 data were processed by ANOVA with statistical software (6).

In 2001 vintage, only for clone 920 the sanitation showed an increase of shoots (Fig.1) and veins length (Fig. 2), but a decrease of total chlorophyll contents (Fig. 3) and SPAD values (Fig. 4). Moreover in 2002 all the considered sources of variation have a statistical significance on the leaves data (Table 1). Data of MP and HT leaves of the two clones 920 and 921 confirmed the increase of blade and petiole size (as for weight and length) in healthy vines. Lower content of nitrogen, phosphorus and potassium and a significantly greater level of calcium, magnesium and manganese have been found in HT leaves (Tab. 2). As for aroma compounds (Tables 4a,4b), 920 clone is confirmed as aroma-rich one for both forms (under them, geraniol and rose oxide are the most aroma variety contributors), while the 921 as a middle-low aroma clone. The HT-plants are in the first case richer than the MP vines, on the contrary for the 921 clone. This fact usually could be attributed to a different ripening stage of the grape, but in this case both HT-plants showed the higher sugar and a lower acidity level.

Regardless to the sanitary level, some genotypic important clonal aspects linked to oenological goals as aroma profile, pH and total acidity are maintained. Virus elimination surely improves the plant status and some agronomical characters.

References

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Fig.1: shoot's lenght of Gewürztraminer's grapevine (clone 920 - the 25th June 2001)

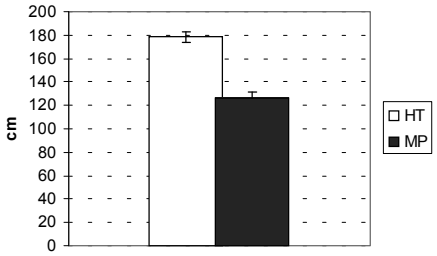

Fig.2: lenght of main vein on detached leaves by different age (clone 920 - the 25th June 2001)
[node position 1= basal]

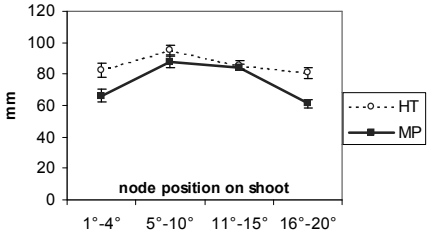

Fig. 3: total chlorophyll of detached leaves by different age (clone 920 - the 25th June 2001)
[node position 1= basal]

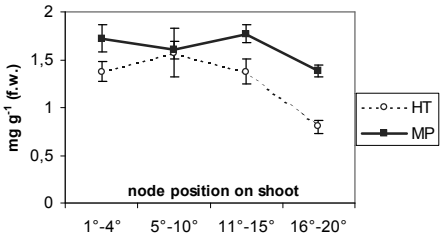

Fig. 4: SPAD values of detached leaves by different age (clone 920 - the 25th June 2001)
[node position 1= basal]

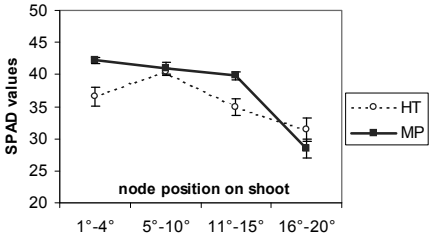

Table 1. Values of F and their statistic significance from ANOVA relatively to leaves (blades and petioles) of two GFLV-infected Gewurztraminer's clones, in relief in healty condition and date [year 2002].

Characteristics - / - Source of variation	Sanitation	Clone	Date
d.f.	1	1	1
leaf's weight (g)	9,1 *	0,1 ns	25,2 **
petiol's weight (g)	13,2 *	0,2 ns	7,4 *
blade's weight (g)	7,8 *	0,1 ns	31,1 **
vein's length (mm)	20,9 **	6,6 ns	9,9 *
petiol's length (mm)	61,1 **	16,9 **	24,0 **
SPAD index	2,0 ns	248,0 **	27,6 **
N blade (% s.s.)	17,2 *	4,5 ns	128,9 **
P blade (% s.s.)	7,2 ns	3,2 ns	7,2 ns
K blade (% s.s.)	149,4 **	10,8 *	17,4 *
Ca blade (% s.s.)	26,3 **	4,5 ns	4,5 ns
Mg blade (% s.s.)	30,2 **	0,6 ns	7,5 *
Mn blade (% s.s.)	93,7 **	11,9 *	5,8 ns
Bo blade (% s.s.)	9,0 *	289,0 **	25,0 **
N petiol (% s.s.)	3,0 ns	0,6 ns	5,5 ns
P petiol (% s.s.)	51,6 **	37,3 **	62,5 **
K petiol (% s.s.)	34,3 **	1,2 ns	45,2 **
Ca petiol (% s.s.)	12,8 *	22,0 **	11,1 *
Mg petiol (% s.s.)	12,9 *	6,1 ns	19,0 *
Mn petiol (% s.s.)	34,0 *	12,1 *	11,2 *

Note: (n.s.) not significance (*) significance between 95 and 99% (**) significance of 99% or superior

Table 2: Means of any characteristics of MP and HT leaves (blade and petioles) from two Gewürztraminer's clones, in relief of 2 date (see Tab. 1).

	MP	HT
leaf's weight (g)	2,41 b	3,10 a
petiol's weight (g)	0,61 b	0,80 a
blade's weight (g)	1,80 b	2,31 a
vein's length (mm)	81,8 b	89,8 a
petiol's length (mm)	69,5 b	84,3 a
SPAD index	41,1	41,4
N blade (% s.s.)	2,39 a	2,08 b
P blade (% s.s.)	0,26	0,25
K blade (% s.s.)	1,20 a	0,99 b
Ca blade (% s.s.)	3,15 b	3,48 a
Mg blade (% s.s.)	0,28 b	0,35 a
Mn blade (% s.s.)	101,8 b	139,0 a
Bo blade (% s.s.)	31,8 b	32,5 a
N petiol (% s.s.)	0,56	0,54
P petiol (% s.s.)	0,55 a	0,45 b
K petiol (% s.s.)	2,77 a	2,02 b
Ca petiol (% s.s.)	2,19 b	2,41 a
Mg petiol (% s.s.)	0,80 b	0,94 a
Mn petiol (% s.s.)	25,8 b	48,0 a

Note: different letters of the same variable given significantly differ (p 0.05) by Tukey's test

Table 3: Means of any characteristics of grape of two Gewürztraminer's clones (MP vs HT). Vintage 2002

	MP	HT
grape yield (kg)	0,184	0,550
weight cluster (g)	34,7 b	59,6 a
Brix degrees	20,15	21,00
total acidity (g/L)	5,70	6,34
pH	3,45	3,36
% stem / cluster (% g/g)	16,3 a	8,1 b

Note: different letters of the same variable given significantly differ (p 0.05) by Tukey's test

Tab. 4a. Aroma compounds of juice (vintage 2002) of Gewurztraminer's clones in free form (ug/L n-heptanol).

	920 HT	920 MP	921 HT	921 MP
MONOTERPENES				
trans furan linalool oxide	0,4	0,2	<0.1	0,2
cis furan linalool oxide	0,5	0,6	0,2	0,2
trans pyran linalool oxide	9,3	6,6	0,6	1,3
cis pyran linalool oxide	2,1	1,3	0,3	0,4
linalool	1,1	0,9	0,2	0,3
α–terpineol	0,9	0,7	0,6	0,4
citronellol	7,4	3,6	0,2	0,3
nerol	90,0	42,5	1,0	4,3
geraniol	260,0	137,5	3,3	16,5
trans geranic acid	31,0	13,0	0,6	1,8
Ho-diendiol (I)	35,0	17,0	4,0	3,5
cis 2,6-dimethyl-2,7-octadiene-1,6-diol	38,5	21,5	1,4	5,0
trans rose oxide	0,60	0,20	<0.01	0,04
cis rose oxide	0,20	0,07	<0.01	<0.01

Tab. 4b. Aroma compounds of juice (vintage 2002) of Gewurztraminer's clones in bound form (ug/L n-heptanol).

	920 HT	920 MP	921 HT	921 MP
MONOTERPENES				
trans furan linalool oxide	27,0	17,0	2,0	4,6
cis furan linalool oxide	24,0	12,0	2,9	3,7
trans pyran linalool oxide	12,0	6,6	1,0	1,5
cis pyran linalool oxide	7,5	2,8	0,9	1,2
linalool	13,5	5,2	0,4	1,2
α–terpineol	22,0	12,5	5,8	5,4
citronellol	3,5	18,0	0,6	2,1
nerol	297,0	130,0	3,9	19,5
geraniol	782,5	525,0	27,0	73,5
trans geranic acid	125,0	55,0	1,4	8,4
Ho-diendiol (I)	56,0	27,0	3,1	6,7
cis 2,6-dimethyl-2,7-octadiene-1,6-diol	121,0	91,5	13,5	31,0
trans rose oxide (*)	2,50	1,30	<0.01	0,04
cis rose oxide (*)	0,90	0,15	<0.01	0,02

(*) from an aglycon precursor