

Influence of the viruses GLRaV-1 and GFkV on the grape and wine production of cv. Gamay

Jean-Laurent Spring, Jean-Sébastien Reynard*, Paul Gugerli
Agroscope Changins-Wädenswil ACW, Route de Duillier, 1260 Nyon
* Corresponding author: jean-sebastien.reynard@acw.admin.ch

Introduction

Viral diseases are reported to cause several detrimental effects on grapevine. However, few scientific reports have been published on the effect of mixed viral infections on grape and wine production. Therefore, the aim of the present work was to evaluate the effects of GFkV co-infection with GLRaV-1 on physiological, agronomic and oenological characteristics of Gamay.

Materials and Methods

Gamay Rouge de la Loire was grafted on healthy 3309C. Virus inoculation was done by triple grafting according to the following variants:

- A: Healthy control (triple grafting with two healthy interscions)
- B: GLRaV-1 (triple grafting with one healthy interscion and one GLRaV-1 infected interscion)
- C: GFkV (triple grafting with one healthy interscion and one GFkV infected interscion)
- D: GLRaV-1 + GFkV (triple grafting with one GLRaV-1 infected interscion and one GFkV infected interscion)

Plots were planted in 1998 at the Agroscope research station in Nyon (Switzerland) in four randomized blocks with 10 vines per replicate. The study was conducted over 10 years (2001-2010). From 2001 to 2004 grapes from the four variants were collected for identical winemaking procedures.

Results

Yield components. In Figure 1, two groups can be distinguished: the healthy control together with the variant with only GFkV which showed a significantly higher yield compare to the two variants infected by GLRaV-1 with or without GFkV. Significant differences were also observed between those two groups concerning bud fertility, cluster weight and berry weight.

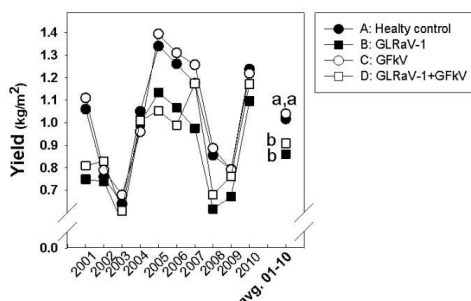


Figure 1. Effects of GLRaV-1 and GFkV infection on Gamay. Yield at harvest, 2001-2010. Means with different letters are significantly different at $P \leq 0.05$.

Vegetative growth. Vine growth, indicated by pruning weight and trimming weight, was significantly reduced by GLRaV-1 infection (average reduction for pruning weight: -20% and -50% for trimming weight). The negative impact on vegetative growth of a mixed infection by GLRaV-1 and GFkV did not differ compare to an infection by GLRaV-1 alone.

Mineral nutrition. The effects of GLRaV-1 with or without GFkV co-infection were the following on vine mineral status: significantly decrease of the leaf nitrogen, calcium and magnesium content and a significant increase of the leaf potassium content. Chlorophyll index is a measure of the density of the green color in the leaves. The infection by GLRaV-1 had a clear effect on leaf colour (Fig. 2). The mixed infection by GLRaV-1 and GFkV tend to aggravate symptoms compared to infection by GLRaV-1 alone.

Must and wine composition. The infection by GLRaV-1 in combination or not with GFkV was associated with modifications of must composition (Table 1).

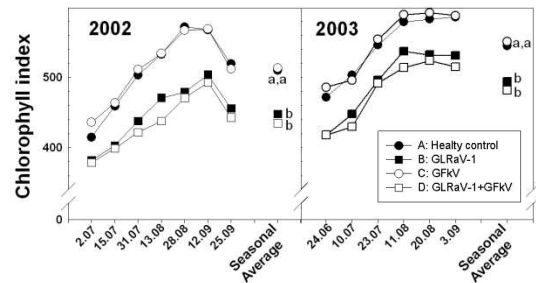


Figure 2. Effects of GLRaV-1 and GFkV infection on Gamay. Chlorophyll index evolution during 2002 and 2003. Means with different letters are significantly different at $P \leq 0.05$.

Variant	Soluble solids content (°Oe)	pH	Yeast assimilable nitrogen (g/l)
Healthy control	90,6 b	3,09 a	171 b
GLRaV-1	92,9 a	3,10 a	174 b
GFkV	89,5 c	3,07 b	176 a
GLRaV-1 + GFkV	88,6 c	3,08 a	150 c

Table 1. Effects of GLRaV-1 and GFkV infection on Gamay. Must composition, average over years 2001-2010. Means with different letters are significantly different at $P \leq 0.05$.

The variant infected by GLRaV-1 alone presented a higher soluble solids content, due probably to lower yield (-20%). On the other hand, the variant co-infected by GLRaV-1 and GFkV had the lowest value for fruit sugar content. The presence of GFkV in mixed infection with GLRaV-1 contributed to increase the negative effects associated with GLRaV-1 infection. Similar results were observed for must nitrogen content: mixed infection by GLRaV-1 and GFkV had a negative impact on must nitrogen content, but infection by GLRaV-1 alone did not have any impact.

The results of the sensory analysis of wines showed a significant decrease of tannin intensity for the variant with co-infection by GLRaV-1 and GFkV. The overall quality of wine tannin was evaluated generally lower in the co-infected variant compared to the others variants.

Summary

An agronomical trial was conducted at the research station Agroscope Changins-Wädenswil in Nyon (Switzerland) in order to evaluate the effects of mixed infections by GLRaV-1 and GFkV on the grape and wine production. In a ten-year study (2001 to 2010), the effects of virus infection on the main parameters of vines, musts and wine were measured. The effects of GLRaV-1 with or without GFkV co-infection were the following: reduction of vine vigour and production potential of the vine, decrease of the leaf mineral content (nitrogen, calcium and magnesium) but increase of the leaf potassium content. No difference was observed between vines infected by GFkV alone and healthy ones. On the other hand, the presence of GFkV in mixed infections with GLRaV-1 contributed to increase the negative effects associated with GLRaV-1: reduction of the sugar and nitrogen contents in musts and reduction of the wine quality measured by sensory analysis.