In vitro selection for tolerance to magnesium deficiency in grapevine rootstocks

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Summary: Some grapevine rootstocks (44-53 Malègue, Fercal) are known as very susceptible to magnesium deficiency, whether it is induced by low level of magnesium in the soil, particularly in acidic soils or, more generally, by high levels of potassium fertilization in soils normally provided with magnesium. So, their cultivation is strongly hindered in many vineyards, despite their other interesting cultural characteristics: very high chlorosis resistance for Fercal, drought tolerance, low vigor and beneficial effects on wine quality for 44-53 Malègue. *In vitro* tissue culture offers new prospects to solve this problem. In order to select somaclonal variants of these rootstocks exhibiting a lower level of susceptibility to magnesium deficiency, we compared the results of *in vitro* tests made on different varieties known as tolerant or susceptible to magnesium deficiency with the behavior of these varieties in the vineyard.

The varieties chosen were 44-53 Malègue and Fercal (susceptible), 41 B and 140 Ruggeri (tolerant). Plants were grown for 2 months on culture media with different concentrations of magnesium and potassium. Tissues of samples constituted of the foliar system (leaf blades, petioles and stems) of 6-15 plants (100-300 mg of dry matter) were extracted by HCl 0.1 N (10 ml for 100 mg of dry matter) and ions K^+, Mg^{++} and Ca^{++} were assayed by flame spectrophotometry.

An initial experiment was performed using one-node microcuttings and micrografting (scion: *Vitis vinifera* cv. Syrah) grown on a half-strength Murashige and Skoog medium with three levels of potassium and magnesium fertilization. It shows that the uptake of magnesium by vitroplants grown on this medium is not suitable to characterize the differences in susceptibility of rootstock varieties to magnesium deficiency. Fercal was more susceptible than 41 B (difference slightly significant, $P = 0.05$), 44-53 Malègue appeared curiously more tolerant than 140 Ruggeri, but the difference was not significant. The effect of grafting was not significant and there was no interaction between variety and grafting.

A second experiment was performed using one-node microcuttings grown on a Galzy medium (modified Knoop $^1/_2$), with a low content in magnesium and increasing levels of potassium fertilization (0, 500, 750 and 1000 mg/l of KNO_3). It showed that the uptake of magnesium was significantly ($P < 0.01$) higher in 140 Ruggeri and 41 B than in Fercal and 44-53 Malègue. The inhibitory effect of increasing levels of K^+ on the absorption of Mg^{++} was clearly demonstrated.

Somatic embryos of 44-53 Malègue were obtained by anther culture and selected in conditions of magnesium deficiency: After four sub-cultures in liquid medium, 37 embryos were retained from which 4 germinated and developed into plants. Attempts to obtain somatic embryos by anther culture were unsuccessful with the variety Fercal.

3 selected somaplants of 44-53 Malègue (S_1, S_3 and S_4) were compared to an unselected somaplant (T_0) and the original clone (Cl. 120). After micropropagation of the somaclones, one-node microcuttings and micrografting (scion: *Vitis vinifera* cv. Cot) were grown on Galzy medium with reduced level of magnesium and two levels of potassium fertilization (0 and 1000 mg/l KNO_3). There were no significant differences in the uptake of potassium and calcium between clone and somaclones. With low potassium fertilization, the uptake of magnesium by somaclone S_2 was significantly lower ($P < 0.01$). With high potassium fertilization, somaclone S_2 and clone 120 were significantly lower than the other somaclones S_1, S_4 and T_0. So, there is evidence of somaclonal variation, but it is possible that the occurrence of this variation is not linked to the selection pressure applied *in vitro*. The amplitude of this variation is small and its stability and expression need to be confirmed in the vineyard. So far, the somaplants have been acclimated in the greenhouse and will be planted next year in the field for further investigations.

Key words: magnesium, potassium, calcium, deficiency, tolerance, rootstock, tissue culture, somaclonal variation, test, selection.

The detailed results will be published elsewhere.