IMPACT OF A SPECIFIC YEAST DERIVED FOLIAR SPRAY ON GENE EXPRESSION AND ACCUMULATION OF ANTHOCYANIN IN SANGIOVESE

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INTRODUCTION

Biotic and abiotic elicitor applications constitute an interesting field of research in viticulture since it has been proved their involvement in the activation of secondary metabolites biosynthetic pathways, increasing the accumulation of phenolic compounds and in particular of anthocyanins. In the last decade, different commercial products became available for viticulturists who desire to ameliorate phenolic maturity and lately also derivatives of yeast were proposed for this aim. The ability of inactivated yeast to elicit the accumulation of phenolic compounds could be linked with the inactive yeast composition. Inactive yeast is characterized by the presence of mannoproteins, β-1,3- and β-1,6-glucans, lipids, sterols and proteins in the cell wall and in the cell membranes of yeast (Kapteyn et al., 1999).

The aim of this research is to verify the effects of the application of a commercial foliar spray obtained from specific inactivated yeast (LalVigne™ MATURE) on the berry skin anthocyanin accumulation in cv. Sangiovese. In order to elucidate the mechanisms underlying the action of this product at molecular level, the impact of the treatment on the expression of the main genes involved in the biosynthetic pathway of anthocyanins was evaluated.

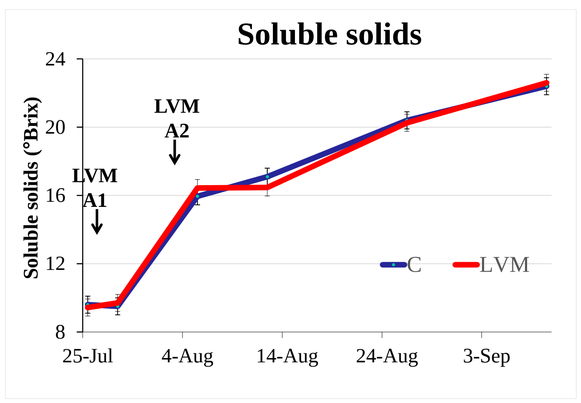
MATERIALS AND METHODS

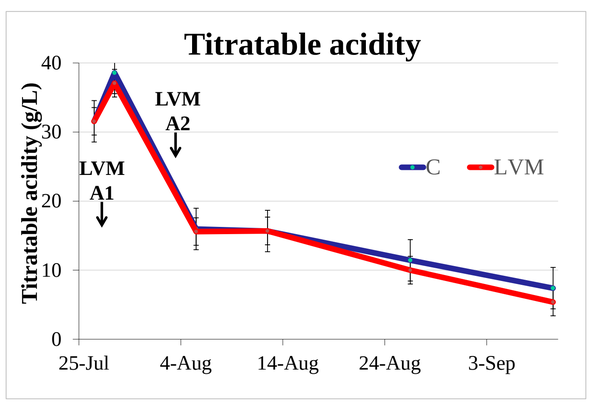
The trial was conducted in 2016 season on seven-years-old uniform potted vines of cv. Sangiovese (clone 12T grafted onto SO4) and 6 vines were randomly assigned to the following treatments: **C** (untreated control) and **LVM** (treatment with LalVigne™ MATURE). This product is a formulation of 100% natural, specific inactivated yeast (*Saccharomyces cerevisiae*) with the patent pending application technology of Lallemand Inc. (Canada). Yeast derivative at the equivalent dosage of 1 kg/ha was sprayed twice to canopy and bunches, at the beginning of veraison (A1 - July, 26th) and when veraison was over 70% (A2 - August, 3th).

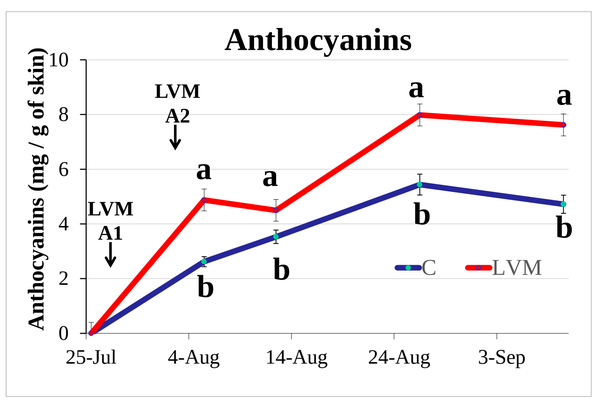
Berries were sampled from pre-veraison to harvest for the following determinations: a) must biochemical parameters (soluble solids, pH and titratable acidity); b) anthocyanin concentration (Mattivi et al., 2006). RNA extractions from the skins and analysis via real Time PCR of the genes involved in the synthesis of the anthocyanins (Movahed et al., 2016), were performed on berries sampled as previously described along five weeks.

RESULTS AND DISCUSSION

The evolution of sugar concentration and titratable acidity showed similar trends for C and LVM berries during all the ripening period. However, anthocyanin accumulation was significantly increased in LVM berries, which showed higher levels of these compounds from the second sampling date to harvest, when no change in the composition of the different anthocyanins were registered.



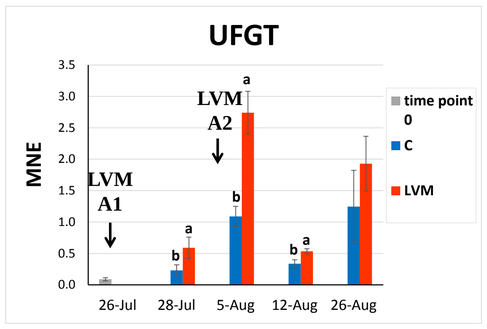


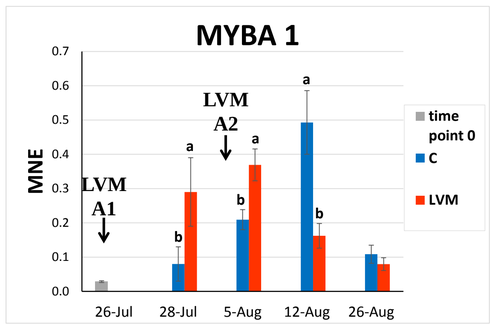


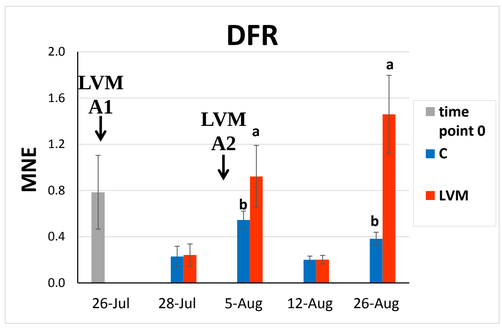
Composition of anthocyanins at harvest.

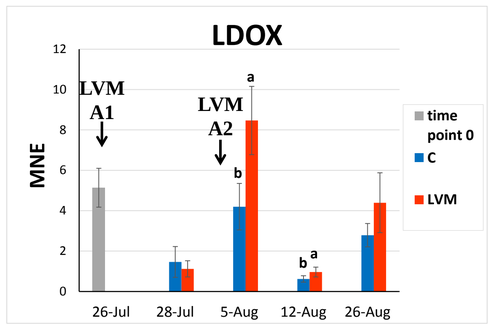
	Delf-3-G (%)	Cian-3-G (%)	Pet-3-G (%)	Peo-3-G (%)	Malv-3-G (%)
C	**14,88**	**28,02**	**14,58**	**13,48**	**29,04**
LVM	**12,98**	**31,53**	**12,29**	**17,22**	**25,97**
Significance (P < 0.05)	ns	ns	ns	ns	ns

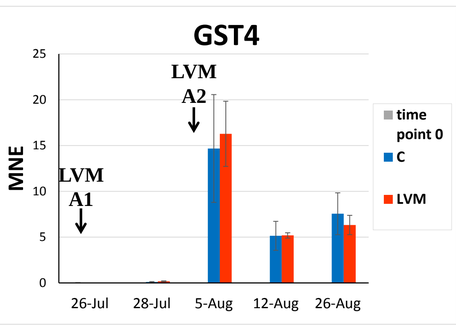
UFGT (UDP-glucose:flavonoid 3-O-glucosyl transferase) and MYBA1, genes strictly involved in the synthesis of anthocyanins, showed higher levels of expression compared to C just 48 hours after the first application that were maintained also after the second application. The expression of the genes DFR (dihydroflavonl reductase) and LDOX (leucoanthocyanidin dioxigenase), responsible of the synthesis of the substrates for UFGT, was higher in LVM berries, but only after the second application. On the contrary no difference was found considering the expression of GST4 (glutathione S-transferase 4), which is involved in the transport of anthocyanins in the vacuole.











CONCLUSIONS

In conclusion, the present work showed that LalVigne™ MATURE could be a potent application for increasing the synthesis of anthocyanin accumulation, without affecting sugar concentration. Such effects can be explained by the robust modification in the expression of key genes involved in anthocyanin synthesis. If these preliminary findings will be confirmed by further researches, the application of LalVigne™ MATURE could become an interesting tool for improving wine quality, especially under the current global warming scenario.

LITERATURE CITED

Kapteyn, J. C., Van Den Ende, H., & Klis, F. M. (1999). The contribution of cell wall proteins to the organization of the yeast cell wall. Biochimica et Biophysica Acta – General Subjects, 1426, 373–383.

Mattivi, F., Guzzon, R., Vrhovsek, U., Stefanini, M., & Velasco, R. (2006). Metabolite profiling of grape: flavonols and anthocyanins. Journal of Agriculture and Food Chemistry, 54, 7692–7702.

Movahed N., Pastore C., Cellini A., Allegro G., Valentini G., Zenoni., Cavallini E., D'Incà E., Tornielli G.B., Filippetti I. (2016) The grapevine VviPrx31 peroxidase as a candidate gene involved in anthocyanin degradation in ripening berries under high temperature. Journal of Plant Research, 129, 513–526.