INFLUENCE OF DIFFERENT ENVIRONMENTS ON GRAPE PHENOLIC AND AROMATIC COMPOSITION OF THREE CLONES OF 'NEBBIOLO' (*Vitis Vinifera* L.)•

Deborah SANTINI [1], Patrizia CASCIO[2], Giacomo MAZZA[2], Franco MANNINI[1]
[1] Istituto di Virologia Vegetale – CNR, UOS Grugliasco, Via L. Da Vinci 44, 10095 Grugliasco, TO, I.
[2] Enosis Meraviglia srl, Via per Cuccaro 19, Fubine, AL, I.
E-mail: d.santini@ivv.cnr.it

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1. INTRODUCTION

The interaction between cultivar and the environment of cultivation is the base of wine quality and typicality. This is particularly true for red bodied wines which need ageing to fully reach final evolution before bottling, such the ones made with 'Nebbiolo' grapes in north-west Italy (Barolo, Barbaresco, Gattinara, etc.). In these wines the quality is strictly related to quantity and quality of berry phenolic and aromatic compounds. The role of phenols in wine colour and structure is well known, whereas the contribution of aromatic substances to the complexity of aged wine bouquet is still under investigation. In recent time the performances of different clones within the same cultivar became another fundamental factor influencing the enological result. This study is focused to clarify the influence of the cultivar/clone/environment relations on grape phenolic and aromatic composition.

2. MATERIAL AND METHODS

In 2008 the performances of three clones of 'Nebbiolo' grown in different environments were studied. Two vineyards in La Morra and in Neive (south-east Piedmont) hosted the clone CVT 63, and the clones CVT 308 and CVT 415 respectively. Both sites are hilly and characterized by a loamy and alkaline soil. A third vineyard hosting all the three clones was located in Lessona (north-east Piedmont), a plain area characterized by a sandy and acidic soil. Pruning wood weight in winter time and yield at harvest were assessed on twenty vines each clone in each site. At harvest three samples of around 300 berries each were also collected from a three vines parcel replicated three times along the rows to determine juice chemical parameters and grape phenolic and aromatic composition. The analysis of anthocyanins was performed by HPLC-DAD (Di Stefano, Cravero, 1991; Pomar *et al*., 2005; Rolle, Guidoni, 2007). The aromatic compounds were analyzed by gas chromatography-mass spectrometry (GC-MS) (Mazza *et al*., 2006). Data were elaborated by ANOVA followed by Tukey's test.

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3. RESULTS AND DISCUSSION

The environment heavily influenced yield, which for all the clones was much lower in Lessona than in the southern locations, determining an increase of grape soluble solids concetration (tab. 1). The advanced ripeness reached in Lessona also determined an higher accumulation of total flavonoids and total anthocyanins in the grapes. Although grape phenolic potential was quantitatively richer in this location compared to southern sites, the anthocyanin profile was however in favour of the less stable di-substituted peonidin-2-glucoside. On the contrary, the grapes produced in southern Piedmont showed an higher % of tri-substituted malvidin-3-glucoside (fig. 1). These aspects are of particular relevance in winemaking because tri-substituted anthocyanins are more determinant for the intensity and the stability of future wine than di-substituted anthocyanins (peonidin and cyanidin) which rapidly undergo enzymatic degradation at the end of fermentation.

Tab. 1. Juice composition, grape phenolic composition and extractability indexes of three 'Nebbiolo' clones (63, 308, 415) in different environments (La Morra, Neive, Lessona).

Parameters	**CVT 63 La Morra**	**CVT 63 Lessona**	**CVT 308 Neive**	**CVT 308 Lessona**	**CVT 415 Neive**	**CVT 415 Lessona**
Yield (kg vine^{-1})	2.41 ± 0.74	0.63 ± 0.3	3.06 ± 1	1.12 ± 0.6	3.09 ± 0.9	0.57 ± 0.3
Pruning wood (g vine^{-1})	798 ± 161	1017 ± 181	1423 ± 374	813 ± 156	1488 ± 274	945 ± 153
Soluble solids (g L^{-1})	230 ± 0.6	259 ± 0.02	225 ± 1.5	255 ± 2	231 ± 5	259 ± 6
Titrable acidity (g L^{-1})	7.1 ± 0.3	8.7 ± 0.8	8.6 ± 0.1	8.5 ± 0.2	8.3 ± 0.5	8.6 ± 0.3
pH	3.02 ± 0.03	3.06 ± 0.02	3.05 ± 0.02	3.09 ± 0.02	3.05 ± 0.03	3.09 ± 0.03
Berry skin total flavonoids (mg kg^{-1})	3970 ± 151	4521 ± 54	2687 ± 275	3471 ± 219	2816 ± 265	3877 ± 145
Berry skin total anthocyanins (mg kg^{-1})	688 ± 27	1164 ± 93	556 ± 73	851 ± 92	604 ± 65	978 ± 75
Seed total flavonoids (mg kg^{-1})	2656 ± 130	3184 ± 287	2224 ±184	2452 ± 132	2246 ± 77	2936 ± 128
EA %	57.5 ± 17	57.5 ± 1.5	33 ± 8.5	48 ± 3	39.5 ± 10	58.6 ± 4.2
Mp %	41.5 ± 6	34 ± 6	46 ± 2	33 ± 10	41 ± 6	42 ± 7
Resveratrol (mg kg^{-1})	-	0.30 ± 0.14	0.25 ± 0.1	0.30 ± 0.9	0.33 ± 0.0	0.34 ± 0.6

In addition the values of Glories indices (Glories, Augustin, 1990) indicate, for the same clone, an easier extractability of the anthocyanins in the grapes from Neive than in the ones from Lessona. Not so for clone 63 whose grapes reached a similar phenolic maturity degree in both the locations. Among clones, 63 produced the grapes with the higher amount of phenolic compounds in all the sites (tab. 1). Environment did not much influence the amount of grape resveratrol. Regarding the aromatic composition, the varietal profiles did not vary despite the different genotypes and environments. However the bound aromatic

compounds differed quantitatively according to the factors involved. Clone 415 resulted the most influenced by environment producing grapes in Lessona with richer aromatic potential compared to the ones of Neive. In general the aromatic composition of clone 415 was also richer than the one of the other clones when grown in the same location. The environment of southern Piedmont (La Morra) enhanced the amount of terpenes and norisoprenoids in the grape of clone 63 (fig. 2). These compounds are very important for the complexity of bouquet in aged wines.

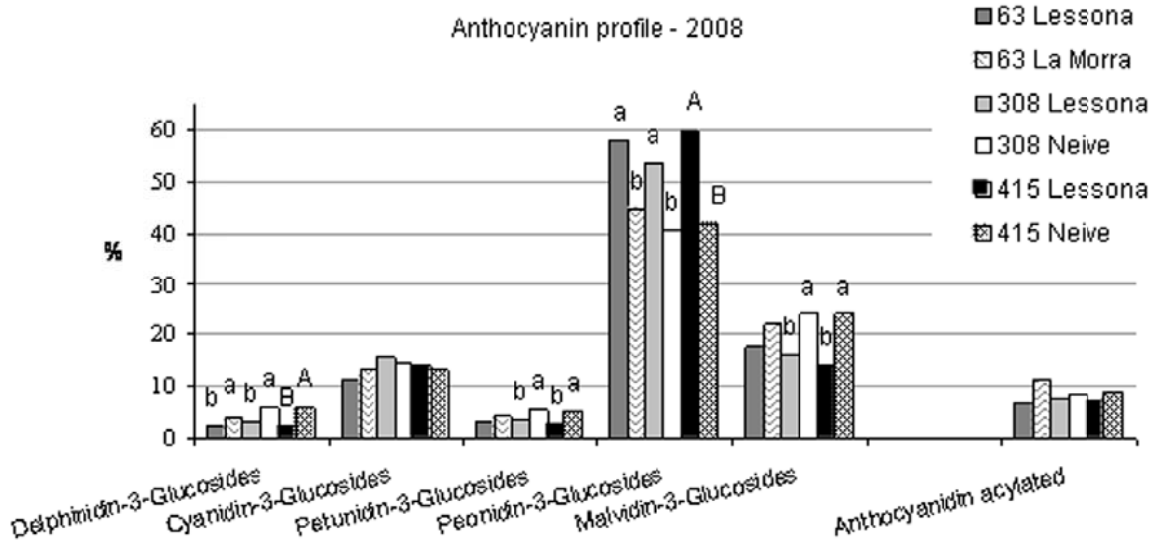

Fig. 1 - Grape anthocyanin profile of three 'Nebbiolo' clones grown in different environments. Different small or capital letters on histograms mean statistical significance at $p \leq 0,05$ and $p \leq 0,01$ respectively.

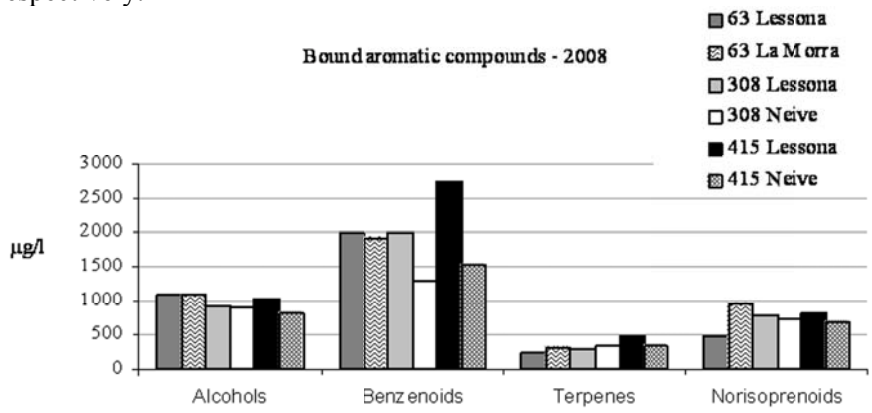

Fig. 2 - Grape aromatic composition of three 'Nebbiolo' clones in different environments.

CONCLUSIONS

The results, although preliminary, indicate the different environment of cultivation influenced quantitative and qualitative response of the three clones of Nebbiolo under investigation, although within the clones specific behaviours are maintained despite the locations. Of particular interest the differences in phenolic composition which resulted quantitatively higher in the location of northern Piedmont (Lessona) compared to the southern sites (La Morra and Neive), although qualitatively weaker as the anthocyanic profile was poorer in malvidin-3-glucoside and richer in peonidin-3-glucoside. These aspects may have relevant implication for the colour of future wine. The varietal aromatic profile, on the contrary, resulted stable between the environments, but quantitatively varied according to the clones and sites involved. Yet to fully understand the role of different factors affecting the aromatic quantitative differences further investigations are needed.

Abstract

The interaction between cultivar and growing environment is the base of wine quality and typicality. In recent time the behaviour of different clones within the same cultivar became another fundamental factor influencing the enological result. In order to clarify cultivar/clone/environment relations, a trial was carried out in 2008 studying the performances of three clones of 'Nebbiolo', grown in different environments: south-east Piedmont (hilly and characterized by a loamy and alkaline soil) and north-east Piedmont (a plain area characterized by a sandy and acidic soil). The results, although preliminary, indicated the different environments of cultivation have influenced quantitative and qualitative response of the same clone. Of particular interest the differences in phenolic composition which resulted quantitatively higher in the location of northern Piedmont compared to the southern sites, although qualitatively weaker as the anthocyanic profile was poorer in malvidin-3-glucoside and richer in peonidin-3-glucoside. These aspects may have relevant implication for the colour of future wine. The varietal aromatic profile, on the contrary, resulted stable between the environments, yet to fully understand the role of different factors affecting the aromatic quantitative differences further investigations are needed.

Literature cited

Di Stefano R., Cravero M. C. - 1991 - Metodi per lo studio dei polifenoli dell'uva. *Riv. Vitic. Enol.,* 44, 2, 37- 45.

Glories Y., Augustin M. - 1990 - *Actualités Oenologiques*. Ed. Dunod, Paris , F, pp 419 .

Mazza G., Raifer W., Lanati D. – 2006 - Il quadro aromatico della cultivar Cabernet Sauvignon coltivata in Alto Adige. *L'Enologo*, 42, 4, 111-117.

Pomar F., Novo M., Masa A. - 2005 - Varietal differences among the anthocyanin profiles of 50 red table grape cultivars studied by high performance liquid chromatography. *J. Chromatogr. A,* 1094, 1-2, 34-41.

Rolle L., Guidoni S. - 2007 - Color and anthocyanin evaluation of red winegrapes by CIE L*, a*, b* parameters. *J. Int. Sci. Vigne Vin*, 41, 4, 193-201.