

Conservation: the best valorisation strategy for wine growing areas

DIEGO TOMASI^{1,*}, Federica GAIOTTI¹, Gianni FILA¹

¹ CRA-VIT, Center for Research in Viticulture, Viale 28 Aprile 26, Conegliano (TV), ITALY

* Corresp. author : Tomasi D., Telephone +39 0438 456733, Fax +39 0438 64779, Email : diego.tomasi@entecra.it

ABSTRACT

Terroir encompasses many elements, including environment, grapes and human inputs that together contribute to the final wine quality of a certain wine growing area.

From the actual market situation, a clear trend has been emerging in the last years: only a small part of the total wine demand is oriented to high quality wines, the consumer being more oriented towards the medium-low cost wines. Thus, on one side there are the ancient and prominent winegrowing areas yielding high quality wines, where any aspect of the *terroir* (soil, climate, autochthonous varieties, tradition, landscape) must be valorised. On the other one, there is a new viticulture model spreading in less renowned areas where the traditions are not so deep-seated and where mechanical vineyard management is prevalent.

Considering the evident difference between these two *terroirs*, it becomes necessary to identify the key elements for each of them and to define their relative significance on wine global quality.

The preservation and valorisation of each single *terroir* component is the first step to best promote both these viticultures and their products.

Keywords: *terroir, climate, soil, landscape.*

1 INTRODUCTION

The term *Terroir* summarizes in a single word many elements that characterize a grapevine growing area and its wines, linking together physic, physiologic and human aspects. The valorisation of a given *terroir* therefore requires to take into account several factors such as mesoclimate, soil properties, geomorphology, landscape, human inputs in terms of vine and wine management, and historical traditions. Looking at the actual world market situation, fig. 1 shows that starting from 2007 the wine consumption is decreasing, especially in Italy, where the decreasing rate is higher than in other Countries (-6%, OIV data). But which kind of wine is the consumer more addressed to? A high- or a medium-quality level one? In other words a costly or a medium/low price wine? From the general market situation, it appears clearly that the former represents only a small part of the total demand, the consumer being more oriented towards the latter wine type. This brings us to one question: which *terroir* do the two different wine qualities come from? And what strategies must the producers adopt to attract the

market attention? Is it possible to distinguish two different types of *terroir*?

Depending on the aforementioned *terroir* components, it is possible to describe many specific realities, but recently, due also to the general economic situation, two directions are becoming more evident. On one side the ancient and prominent winegrowing areas yielding high quality wines, where the manual labour has an important role and any aspect of the *terroir* must be valorised. On the other one, there is a new viticulture model to be found in less renowned areas where the traditions are not so deep-seated and where mechanical vineyard management is prevalent. In these situations fine and cheap wines can be obtained from many international varieties.

It is clear that both of these viticulture models must be preserved and promoted. Considering their evident difference in terms of vine management and wine destination, it becomes necessary to identify the *terroir* elements that must be emphasized respectively to assess their relative importance for wine quality. The site-variety interaction gives the opportunity to obtain different wine styles.

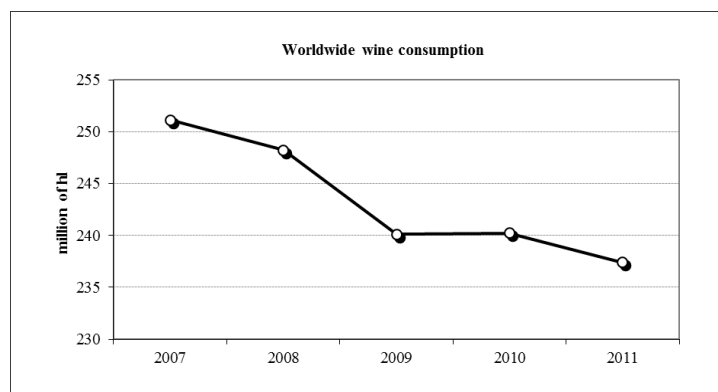


Figure 1. Worldwide wine consumption from 2007 to 2011 (OIV data).

2 WINES FROM HISTORICAL AND WORLDWIDE KNOWN AREAS

In these areas the pedo-climatic conditions play a key role, and their contribute is maximized when well adapted varieties are grown, which typically happens in systems based on autochthonous varieties. A representative example of these latter ones is the cultivation of Garganega in the volcanic soils of the Soave area, which gives wines with particular characteristics which can not be found when cultivation is performed elsewhere in different soils. These wines are characterized by marked floral and fruity notes, accompanied by those of cherry, almond and tropical fruit. Well perceptible are also the mineral and spicy aromas. Another typical aspect of the wines from this area is the olfactory and flavour intensity which is always exalted by a fresh acidity (1).

So, on one side there is the climate, a factor which is difficult to modify (at least in the short term); on the other one there is the soil, which varies from place to place, but with a global physical and chemical composition that are greatly affected by the human activity. As reported by Van Leuween (2) the key factor that guides the relationship between soil and vine is the constant and tight link between vine water demand and available soil water. Variation in soil moisture due to difference in water holding capacity as a consequence of soil movements deeply influence the vine response and induces a different distribution of photosynthetic compounds (3): the more the soil is lacking water in certain periods, the more the plant invests energy for developing its root system, changing the root – to –canopy ratio.

It must be also added that the microbiological activity present in the soil plays a crucial role for the production of high quality grapes, a role which is more important than the mineral composition of the soil.

Every human activity changing soil status modifies its attitude to produce high quality wines. This is particularly evident in hilly sites, where vine growers often change the original soil morphology to obtain wider vineyards with a low and uniform slope.

Also soil compaction and erosion due to a bad soil management can reduce roots activity and the overall plant health. Considering what reported so far, it is clear that the first *terroir* valorisation passes through the soil characteristics conservation.

Moving from the regional to the vineyard and the vine canopy scale, we pass through macro, meso and microclimate situations.

Temperature, water, light and air humidity are the main climatic factors that drive plant growth and that affect its health.

In general, temperature and water availability are considered to have the highest impact on vine phenology and on berry dimension and composition, with optimal daytime temperatures ranging between 27-30 °C and with the highest water request occurring between bloom and veraison.

Nowadays water is becoming a limiting resource and the amount of water used, or the “water footprint”, is going to be one of the key characterizing features of any production process. In this contest, the application of water deficit is an important vineyard management strategy not only to save water, but also to achieve better quality (4). It is well known that light guides the photosynthesis (photos= light and synthesis=building a whole) or, in other words, that plants build organic compounds starting from inorganic ones captured from the environment (5).

The concentration of anthocyanin and aroma compounds varies depending on temperature and light conditions. Since valorisation means to know which wine styles can be obtained in different mesoclimatic areas, a key point to understand is the role of temperature and the effect of the DTR (diurnal thermal range) on grape composition. A recent research carried out in Sardinia on Cannonau variety provided a better understanding of temperature effect on colour and aroma compounds (6).

As shown in tab.1 benzenoids and norisoprenoids are favoured by high temperatures, while monoterpenes are related to cool-warm climatic conditions. In areas with very hot climate Cannonau wines smell of chocolate, raspberry, cherry, plum and jam, while in cooler areas violet, pepper and floral are the prevalent flavours.

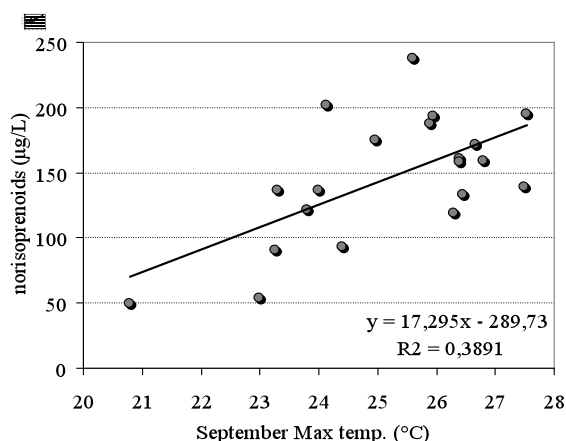
As far as grape colour, the same experience (tab.1) confirmed that in Cannonau, the anthocyanin synthesis potential is higher in cool to warm areas, while DTR and high temperature seems not to be positively related to the synthesis of these compounds (7). In hilly areas the wine style is greatly affected by altitude and exposition and the vine management can only emphasize this environmental effect.

Table 1. Climate effect on colour and aroma compounds (Cannonau variety, Jerzu, 2006-2008) - Within columns, means followed by different letters are significantly different according to the Duncan test (P <=0,05).

Site	Climate				Colour	Aromas		
	Max temp. (°C)	Average temp. (°C)	Min temp. (°C)	Diurnal Thermal Range (°C)	Anthocyanins (mg/Kg)	Monoterpenes (mg/L)	Benzenoids (mg/L)	Norisoprenoids (mg/L)
High hill - 700 m (cool climate)	22,4	19,3	14,8	7,6	263 a	244	513 c	194 b
Medium hill - 430 m (warm climate)	27,4	21,1	16,6	10,8	296 a	235	702 b	279 ab
Low hill 250 m (warm to hot climate)	-	-	-	-	277 a	212	1039a	387 a
Bottom 170 m (hot climate)	28,2	20,9	13,6	14,6	214 b	222	973 a	372 a

Another aspect that must be considered regarding the plant-climate relationship are the cold and heat acclimations process and “sunscreen” protection against sunburn. Due to climate change, it is likely that warm areas will extend and that wine style as well as vine behaviour will change. For example in the

Prosecco wine district the warmer is the site the higher is the berry norisoprenoid content (fig. 2). It is therefore quite possible that in the next future the general wine character will move to more intense tastes and flavours.

**Figure 2. Correlation between September minimum and maximum temperature and norisoprenoids content in the Glera variety (2003-2006) . From Tomasi *et al.* (2011).**

Referring to the modern concept of “terroir”, the landscape plays an important role in defining a territory and its products. The landscape perception, which depends on biological, affective and cognitive factors (8,9), can act in essentially a subconscious manner and can deeply influence memory and overall evaluation of a wine. We know that consumers use certain signals to infer quality on a wine, in an attempt to optimise their choices. As an extrinsic component of the overall wine quality, landscape is capable of influencing the intention to purchase, the perception of wine sensory properties. A recent study evaluated the importance of landscape in wine quality perception (10); based on the results of this study, the effect of the landscape beauty on the perception of the wine’s sensory quality proved to be so significant that it leaved little doubt as to its importance for the development and promotion of wine products. In a previous study, Veale and Quester (2008 - 11), found that information regarding country of origin and price meant even poor quality wines were perceived as having a pleasant taste.

These studies prove that, in the last years, the landscape is gaining consideration because of its capability of rising up emotions and of its strong linkage with the history of the territory and its products. Considering that, the role of a vine grower is not just producing wine, but also preserving the natural characteristic of this important component of the *terroir*, spreading culture, tradition, innovation and promotion related to the territory he is operating in.

In the last twenty years many vine growing areas (like Italy) often imported from other countries new models of viticulture, that did not always fit the pedo-climatic conditions. A clear example of this trend is represented by the adoption of very high plant densities (> 4.000 plants/ha) and of very contained trellising systems like the Guyot, although the pedo-climatic conditions in these regions are very different from the original ones. As a matter of facts, in many Italian regions, water availability during the growing season (April-September) varies between 600-900 mm, promoting a high vegetative growth. Furthermore, the vine has a

lifelong growth, needing space to naturally develop. Vine spacing should therefore be chosen with a long term perspective, otherwise winegrowers will be forced to depress the natural growth potential by means of severe pruning, often on old wood, causing real injury and wood infections to the plant. Heavy cuts may also reduce vascular tissue functionality, leading gradually to an unbalanced wine growth to the detriment of vine longevity.

The valorization of the *terroir* imposes to take care of the vine-environment interactions, enhancing the vine ability to adapt against biotic and abiotic stresses. An adequate plant density, a careful pruning, the adoption of suitable rootstocks, together with an appropriate management can contribute in preserving the vine health and durability, improving both economic and qualitative results.

3 WINES FROM NEW OR NOT-SO-WELL-KNOWN VINE GROWING AREAS

Considering plain areas in particular, which are the elements of the *terroir* that we have to promote? Ongoing experiences at CRA-VIT in Conegliano, are demonstrating that in these sites the first driving force is the strong relation between vine management and wine global quality. Very often in newly established winegrowing areas, the goal is to reduce the manual labour and the production costs adopting an high mechanisation level, taking care to preserve wine quality. The first results from the 2011 experimental campaign, where winter manual and mechanical pruning in Cabernet Sauvignon were compared, showed no difference in grape macro composition, but a double resveratrol content in the mechanical pruning treatment (tab. 2). This means that when the grapevine is less “protected” it is able to produce more stilbene compounds suitable to make a tight linkage between the plant and its environment exalting its genetic resources.

Table 2. Vine response to different pruning treatments (Cabernet S., 2011).

Treatment	Yield (Kg)	cluster weight (g)	n. shoot/vine	Potential fertility	Soluble solids (°Brix)	Tritable acidity (g/L)	pH	Antocyanins (mg/Kg)	Flavonoids (mg/Kg)	T-resveratrol (mg/L)	Cis-resveratrol (mg/L)
No pruning	3,2	58	103	0,5	19,2	7,4	3,38	541	1346	2,88	0,71
Mechanical pruning	3,5	75	59	0,8	18,6	8,1	3,29	520	1380	2,71	0,76
Manual pruning	3	78	42	0,9	18,7	7,4	3,36	600	1425	1,57	0,80

Furthermore, in our experience mechanical pruning resulted in double grape, leaves and shoots number, and the point quadrat measurements showed a canopy structure completely different, with an impact on microclimate. In these growing conditions the human skill and viticulture technique must be stress on the consumer with the advantage to have more healthy wines. The new concept of “soft pruning”, “less aesthetics vineyards”, runs in the direction to have more resistant grapevines.

In these new realities where it is not possible to rely on local tradition or culture, the vine grower can nonetheless take advantage of landscape opportunities and appropriate technical approaches (i.e. training systems, new rootstocks, updated irrigation strategy, mechanical canopy management, ripening control). The new challenge should be an environment-friendly viticulture based on precision agriculture approaches aimed at preserving the agro-ecosystem complexity and biodiversity and on reinforced attention to so far neglected system components (i.e. the valorization of the “third landscape” (12).

4 CONCLUSIONS

Nowadays viticulture is heavily influenced by modern lifestyles, and its conservation is highly desired. Environment preservation is therefore mandatory to maintain at the highest level the reputation of our

historical winegrowing areas, where viticulture technique is already at its best.

There is still room however for new production realities, whose success will depend on their ability to produce quality wine while containing water use, fertilizers, pesticides and costs in general.

European viticulture is certainly living in a crucial historical moment, having to confirm its cultural value, its importance to everyday life as well as the pursuit for the highest quality, a concept that now includes also wine health-preserving properties.

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Pinot noir: an endemic or a flexible variety? *Le Pinot noir : cépage endémique ou plastique ?*

Alain CARBONNEAU¹, Robert BOIDRON²

¹ *Professor of Viticulture of Montpellier SupAgro, IHEV bâtiment 28, 2 place Viala, 34060 Montpellier cedex*

² *Honorary Director of ENTAV, 'La Rochette', 71960 La Roche Vineuse*

* *Corresp. author : CARBONNEAU; Telephone: 0499612360; Fax: 0499613043; Email : carbonne@supagro.inra.fr*

ABSTRACT

Pinot noir has its historical roots in Burgundy and is generally considered as an endemic vine variety which means that its adaptation is very specific to this environment and that its wines are the most expressive in the same particular situations. Now, Pinot noir has become an international variety because growers rely on its exceptional œnological potential and reputation to reproduce something excellent under their own conditions, and also because the general style of the wines is original and dominated by 'finesse' which is a new trend on the international wine market. In that context, it is interesting to evaluate the ability Pinot noir has to adapt, either as a vine variety interacting in a first time with the climate which is the entrance door to the terroir, or as a wine in terms of 'typicity' and specific elements revealed by sensory analysis.

The method which is used is a survey of some sensory analysis of Pinot noir wines around the world done by the authors, which is based, first on the characterization of the degree of maturation on the main trend called 'fruity unfolding' (from non mature, to fresh, then mature, dried, jam or cooked fruit), second on the identification of some very specific elements such as general balance (acidity) or particular fruits (wild cherry) or elements of the 'derived series' (floral, spicy, mineral, balsamic, mushroom characters...).

The main analysis concerns the type of macro/meso-climate in relation to the wine 'typicity'. The interest of the study is that wines are produced under a maximum range of situations. Some Burgundy terroirs under Semi-Continental climate being references and considered as able to produce some exceptional wines, the following climates are chosen: Continental (Cosne s/Loire, Alsace, Franconia, Valais), Continental Semi-Arid (Gansu), Cool – Mountain (Eastern Pyrénées – Hautes vallées), Cool (North Oregon, Australia - Victoria), Temperate – Cool (Loir et Cher, New Zealand – Marlborough), Temperate (Friuli), Mediterranean – Temperate (High Languedoc, Penedes, California – Monterey), Mediterranean – Mountain Kosovo), Mediterranean (Languedoc plain), Mediterranean – Semi-Arid (Mendoza-Tupungato), Subtropical (Carmelo – Uruguay), Subequatorial – High Altitude (Boyaca– Colombia).

The results show that:

- Pinot noir can be cultivated and produce quality wines under many climates within the range of 1700-2300 °C; days of Huglin's Heliothermal Index, which gives some security in front of the climate change.

- The type of adaptation of Pinot noir depends on the elements of the wine 'typicity': it may be considered as 'flexible' because it reproduces very often on a wide range of climates the sensory characteristics of 'fruity-cherry' and 'balance/elegance'; it may be considered as 'endemic' because it expresses a lot of specific sensory characters which depend on the 'viticultural terroir' (perception of acidity, wild cherry, artemisia, violet, mild spices, leather, truffle, chocolate, degree of excellence...).

That study needs to be deepened in the fields of micro-Climatology, sensory analysis, grape berry Biochemistry.

Keywords: *Pinot noir, Burgundy, world climates, adaptation, wine sensory analysis, 'typicity'.*

1 INTRODUCTION

La culture du Pinot noir a ses racines historiques en Bourgogne. Ce cépage est généralement considéré comme une variété endémique, ce qui signifie que son adaptation est très spécifique de cet environnement et que ses vins sont les plus expressifs dans les situations

du même type. Désormais, le pinot noir est devenu un cépage international parce que des producteurs s'appuient sur son potentiel œnologique exceptionnel et sa réputation pour reproduire quelque chose d'excellent dans leurs propres conditions, et aussi parce que le style général de ses vins est original et dominé