

Summary of technical documents
from the RADOUX Cooperage
Research & Development departement



Factors which have an impact on **barrel quality** at RADOUX

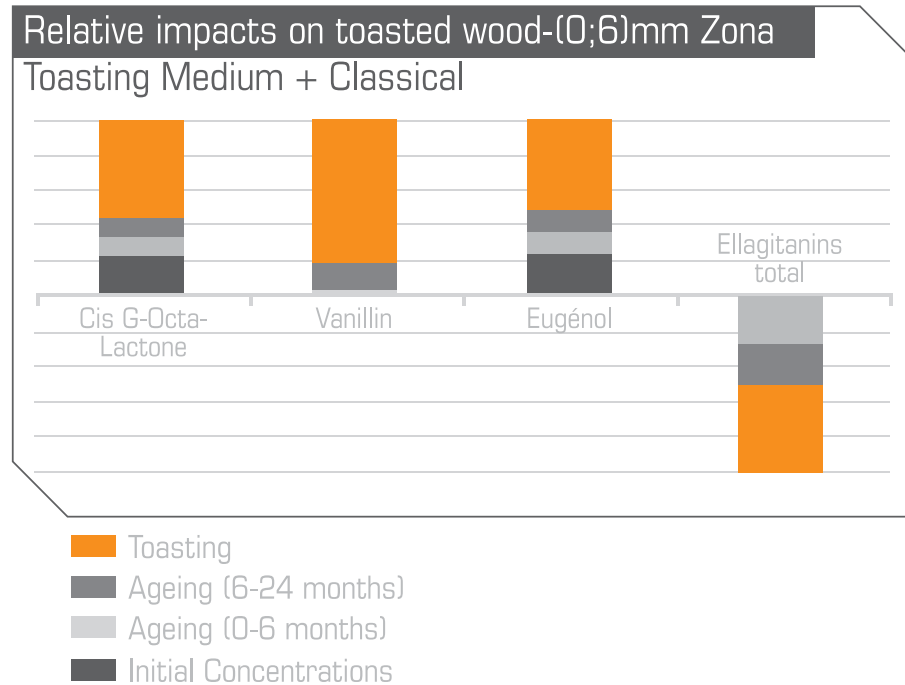
The aim here is to evaluate the impact of three basic factors :

- Raw material evaluated through the analysis of components on non toasted wood.
- Ageing phase in woodyard, over 2 periods of 0 to 6 months and 12 to 24 months.
- Toasting.

The molecules we analysed are responsible for contributing aromas and structure :

- Cis G-Octa Lactone gives the aroma of coconut, and is the dominant aroma present in rough timber.
- Vanillin expresses the vanilla aroma.
- Eugenol gives the aroma of cloves and is the second aroma most present in fresh wood.
- Ellagitanins are the tannins brought by the wood.

Relative impact of various stages of process expressed in %



According to the components examined, the quantitative impact of each phase (wood selection, ageing, toasting) varies.

Regarding the aromatic components, the importance of the toasting on the results is clear, varying from 50% to more than 80%. The initial richness of the wood and the ageing in the woodyard each have an impact of 0 to 25% on the final result.

Regarding Ellagitanins, the ageing of the wood and the toasting each have an impact of around 50%, this being explained by the wearing away of the initial potential of the wood (washing away and destruction through temperature).

Firstly, the selection of the raw material is crucial.

Secondly, the ageing of the wood has an effect on the organoleptic qualities of the wine which means that this stage of the process can be considered as a real «refining» stage. During the first months of ageing, the water-soluble components, above all the polyphenols (tannins) are washed away. Our cooperage has set up a watering system during this particular phase which allows us to keep a close control on the wood, without being dependent on the variations in climate.

During ageing, certain aromas are reinforced (eg coconut aroma, coming from the lactones (transformation of Trans-isomer into cis-isomer which has more aroma).

Our studies have revealed that it is better to reason in terms of «preparation of the wood» including selection, palletization, watering and ageing of the wood rather than reasoning only in terms of drying.

Finally, the toasting stage is another key factor in quality barrel making, both through its effect on releasing various aromas which can be passed on to the wine, and through its effect on the quality and the accessibility of the polyphenolic substance of the wood.

Understanding and mastering **selection** **of the wood on basis** **of grain** at RADOUX

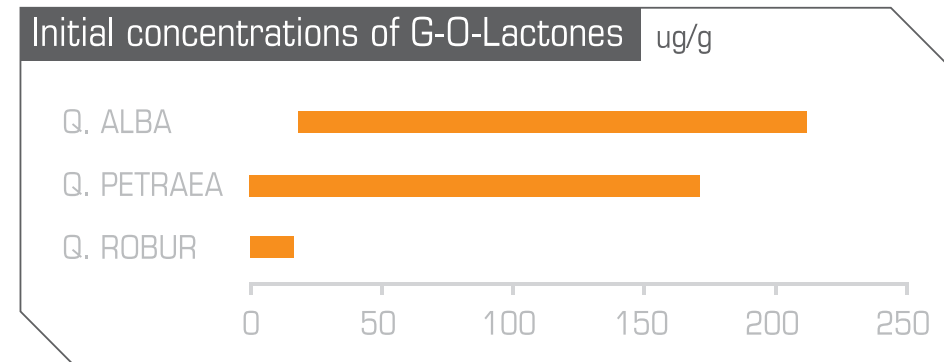
In this section, we concentrate on determining which criteria are the most important when selecting and qualifying our wood. We analyze the aromatic potential by measuring the G-O Lactones (coconut) and the structural potential through the concentration of Ellagitanins.

1 Species

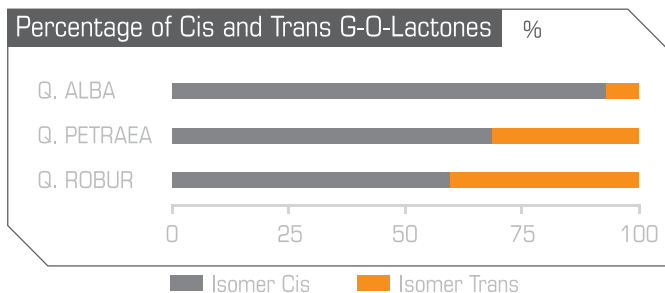
There are more than 250 different types of oak throughout the world. Only 3 types are used in barrel making :

- Quercus Alba (white oak = American oak)
- Q. Petrae (sessile oak)
- Q.Robur (peduncle oak)

*Analysis of initial concentrations of G-O-Lactones in different oak species
(Q.Alba : white oak; Q.Petraea : sessile oak; Q.Robur : peduncle oak)*

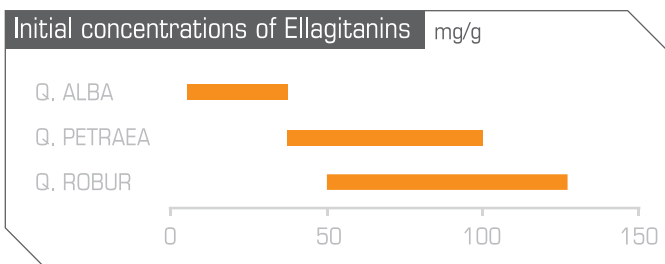


Contribution of Cis/Trans isomers of G-O-Lactones (Cis is 5 times more aromatic than trans)



Q.Robur, the peduncle oak, shows a weaker aromatic potential because of its initial content - and the proportion of Cis and Trans isomers of G-O-Lactones.

Initial concentration of Ellagitanins according to species

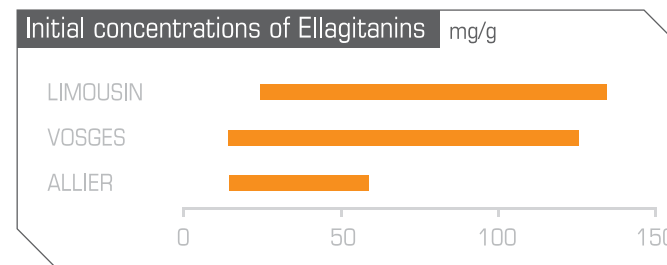
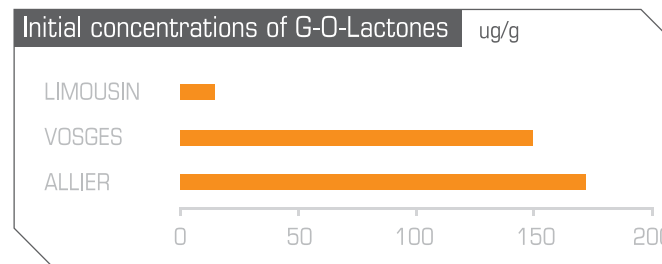


The selection of species allows us to propose two very different types : Q. Alba, «American oak» type, and «French oak» type, (Q.Petrae and Robur). The characteristic of the American oak is a higher average concentration of G-O-Lactones than in French oak and a much lower tannin content. The Q. Petrae or sessile oak is interesting in oenology because of its aromatic richness and its moderate capacity to bring structure to the wine. Q.Robur, the peduncle oak, is of lesser interest for wine than sessile oak because of its weak aromatic contribution and stronger concentration of tannins.

2 Geographical origins

We took as an example three well know origins : «Allier», «Limousin», «Vosges».

As above, we carried out analyses of G-O-Lactones and Ellagitanins on a batch of samples coming from various origins.



With the exception of «Limousin», which can be used for barrels holding spirits, there is only a slight difference between the «Vosges» and «Allier» origins, which shows that the criteria «geographical origin» is not sufficiently reliable for selecting our wood.

3 Grain

Grain is measured by the distance between each annual ring. The notion of grain expresses the speed of growth of the tree, which depends on the «terroir» (climate, type of soil) and methods of cultivation (timber trees, brushwood...).

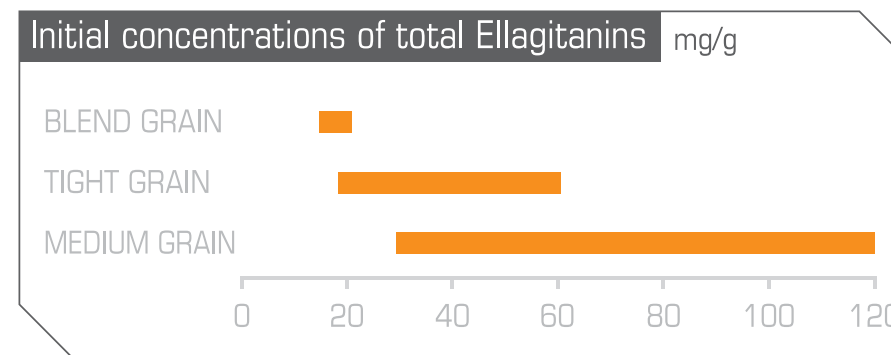
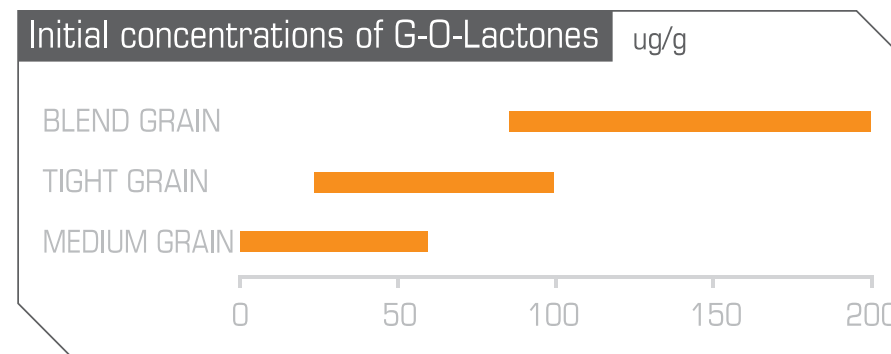
We measured G-O-Lactones and Ellagitanins in 3 series of samples classified by age ring width :

- **Lc** ≤ 1.7 mm slow growth
- **Lc** = 2.9 mm medium growth
- **Lc** = 4.5 mm rapid growth

At RADOUX, we select wood based on 3 selections of grain :

- **Blend (or extra-tight grain)** Lc (width of age ring) below 1,5 mm
- **Tight grain** 1,5 mm < Lc < 2,5 mm
- **Medium grain** 2,5 mm < Lc < 3,5 mm

The concentration of G-O-Lactones and Ellagitanins in relation to our selection classification was analysed :



The conclusion of our studies shows that our selection of French wood RADOUX tight grain (1,5 mm to 2,5 mm) and RADOUX Blend (less than 1.5 mm) allows us to control (with a confidence level of 92%) the potential of polyphenolic components (tannins) and 80% the potential of aromatic components. This type of selection therefore allows us to obtain a very satisfactory reproducibility of our barrels.

Oenological characteristic of our selection of French wood

Blend

Extra fine grain, below 1,5 mm
Complex aromatic contribution, in synergy with the aromas of the fruit.

Moderate structural contribution favoring roundness, fattiness, fullness on the palate.

Very gradual extraction = gentle wood intake.

Optimal maturation time beyond 14 months to exploit all the potential of the barrel.

Interesting remaining aromatic potential even after 3 wines.

Fine grain

Width of age ring between 1,5 mm and 2,5 mm.

Discreet to present aromatic contribution according to toasting techniques and intensity Moderate to high structural contribution according to toasting techniques and intensity.

Possibility of longer maturation periods depending on «Bousinage» techniques and intensity of toasting. Generally speaking, optimal maturation over 12 months.

Medium Grain

Grain between 2.5 and 3.5 mm.

Particularly adapted to vinification and maturation of white wines.

Moderate aromatic contribution to respect the fruit on the nose.

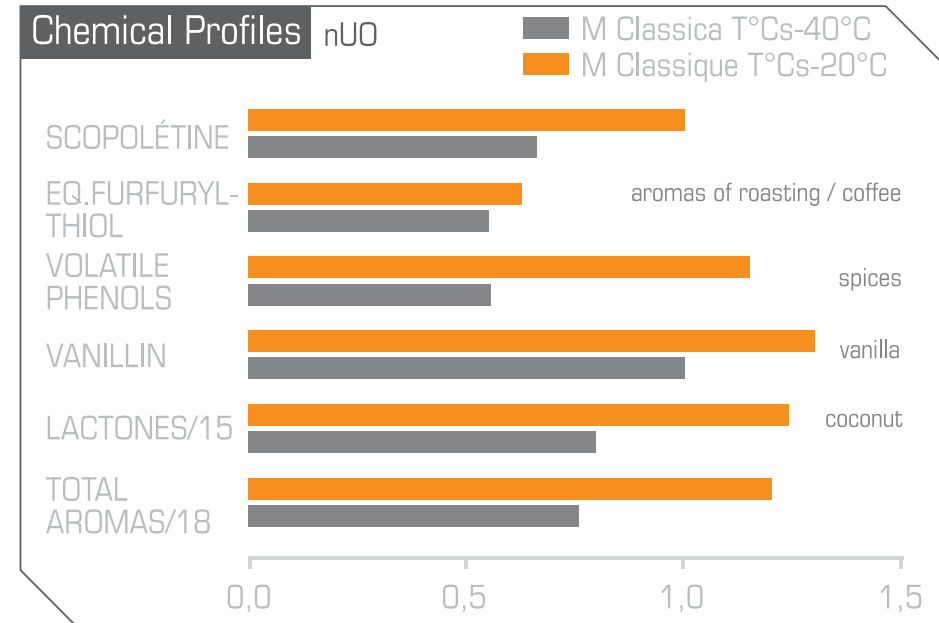
Quite a high structural contribution optimising the fatty compromise and intensity on the palate.

Optimal length of maturation 10 to 12 months maximum.

Understanding and mastering the RADOUX toasting process : The «Evolution» range

1 Impact of temperature

The graph below represents the analytical profiles of the same «Bousinage» technique with the same level of toasting but carried out at levels of maximum temperature (T°C) differing by 20°C.

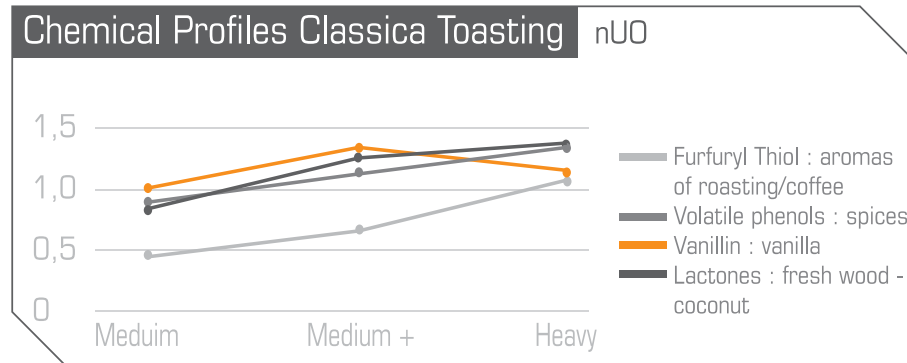
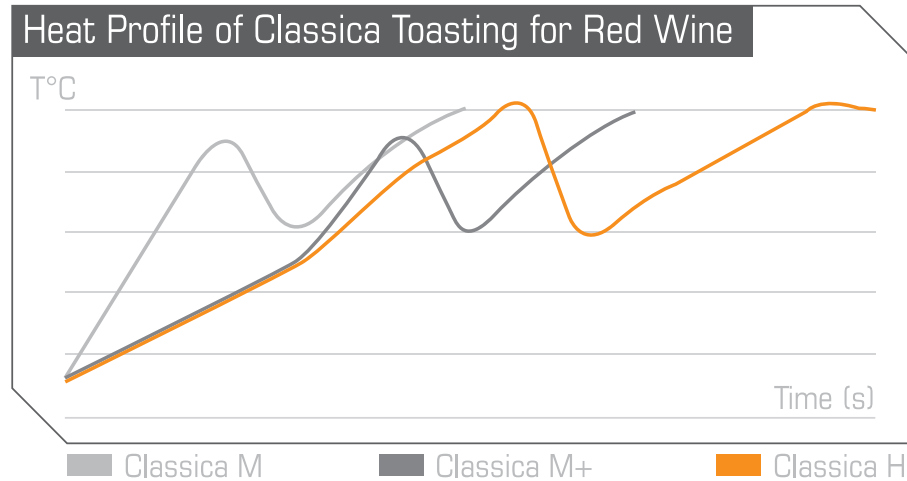


We noted differences of up to 50% for the more sensitive aromas (range of volatile phenols).

This example therefore illustrates the importance of a close control of the temperature on the aromatic profile of a barrel.

2 Impact of the length of «Bousinage»

The following graph represents the trace of temperatures registered on the barrel during «Bousinage».



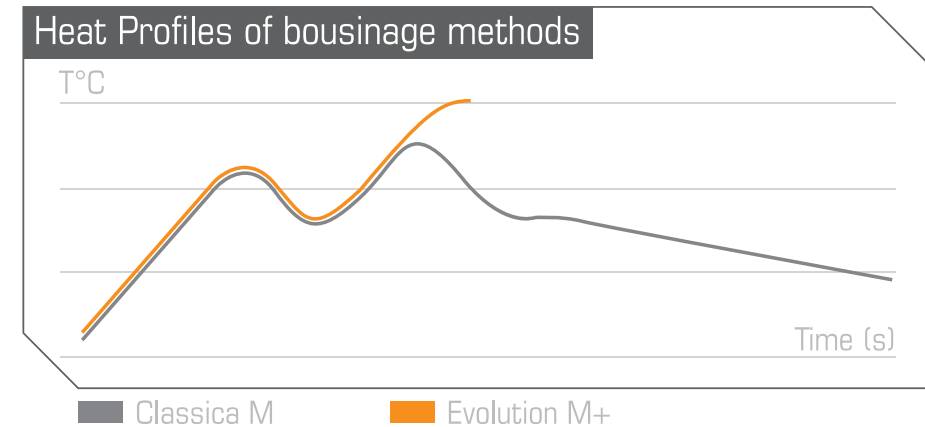
The length of this operation allows 3 levels of toasting : Medium, Medium+ and Heavy, the aromatic characteristics of which are illustrated in the second graph.

3 Impact of «Bousinage» technique

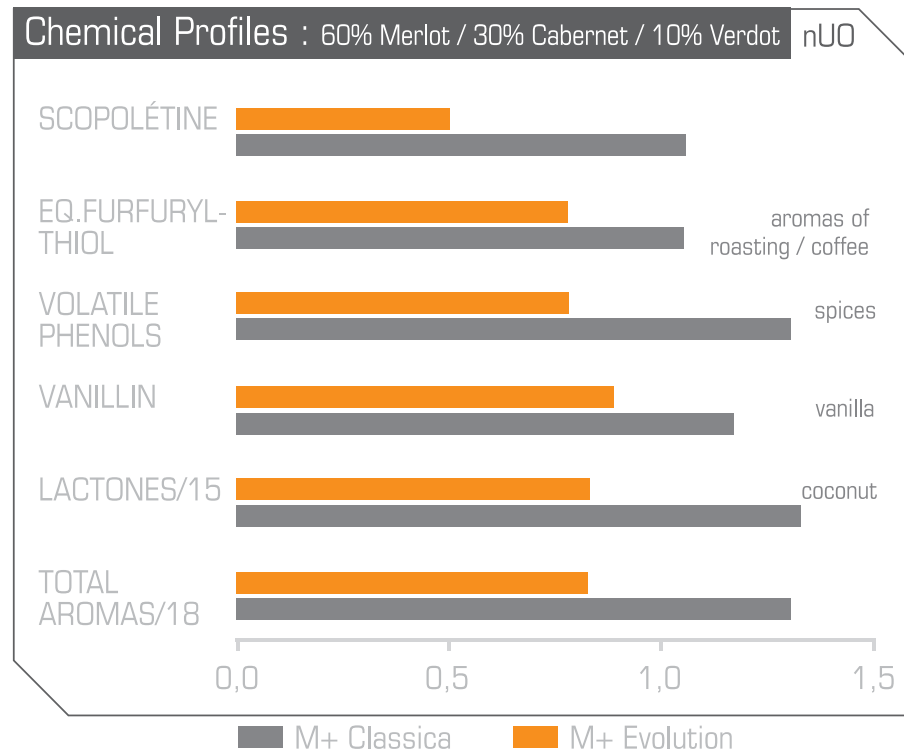
«Evolution» toasting process

In order to be able to propose new styles of barrels, Tonnellerie RADOUX has developed a new toasting technique called «Evolution».

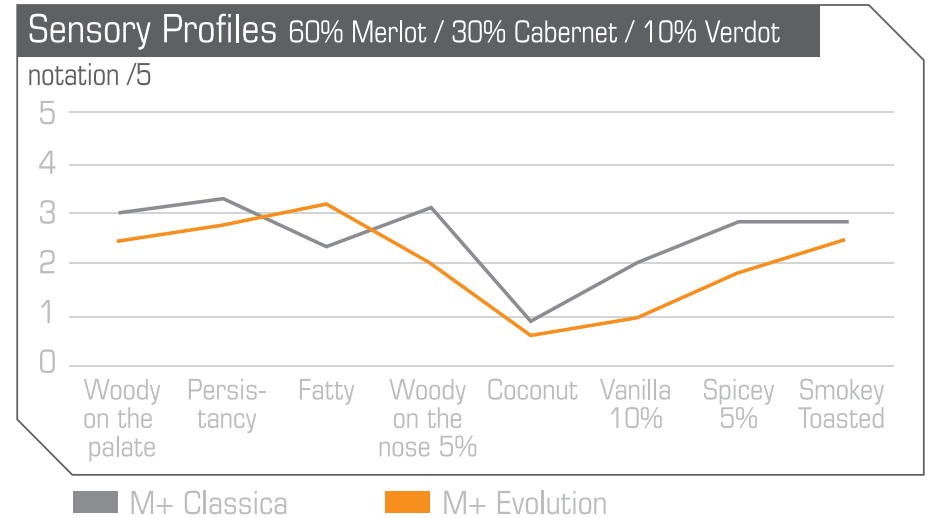
As seen in the graph below, the maximum temperature has been lowered and the length of the «Bousinage» operation extended through a «re-cooking» phase.



As seen on this second graph, which represents comparative analyses of components carried out at the end of the maturation period on a blend of Merlot / Cabernet / Petit Verdot, the aromatic contribution of the «Evolution» toasting process is more discreet and balanced, allowing for a better expression of the fruit.



This is confirmed by sensorial analyses on the following graph where the aromatic proportions differ significantly at a risk threshold of 10%.



A wide range
of barrel «**styles**»
and as many solutions
for **varied oenological**
requirements

The choice of technique and the intensity of the toasting allows us, with the equivalent selection of wood, a wide range of barrel «styles» and as many solutions for varied oenological requirements.

To quickly sum up, we can identify 2 main types of toasting process at RADOUX :

1 «Classic range of toasting»

Aromatic strength and structure

Available in two alternatives : white and red wine, and in three levels of toasting Medium, Medium + and Heavy.

Aromatic contribution : moderate to intense.

Reinforce structure and persistence.

2 «Evolution range of toasting»

Respect of the fruit and sweetness

Available in Medium and Medium + intensity.

Aromatic contribution which highlights the fruit.

Bring roundness and sweetness.

Wood is integrated more rapidly into the wine.



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