LEES ALTERNATIVES

Maturation, Refining, Finishing

IOC

Révélons votre différence

MATURING ON FINE LEES, THE LEGACY OF YEAST

Maturing wine on its fermentation lees is an oenological practice with numerous recognised benefits:

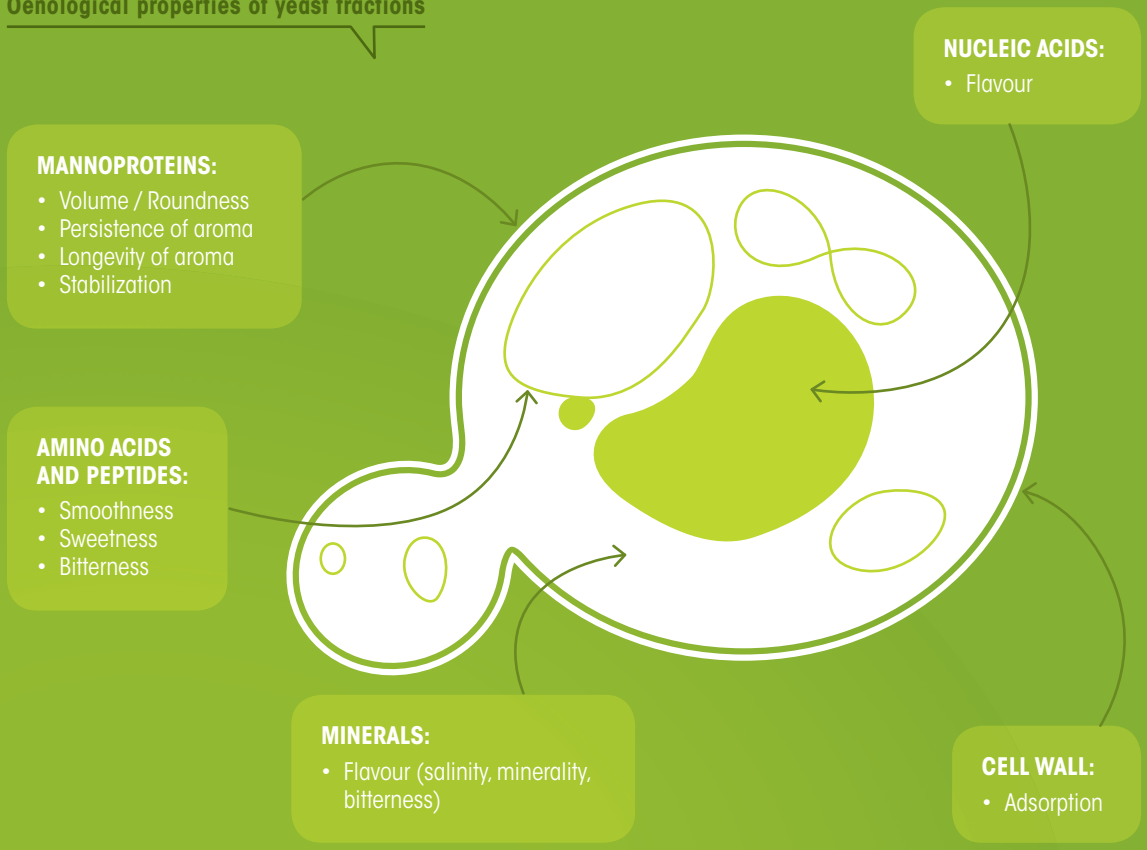
- Contribution to the balance of flavour, with reduced sensations of dryness, bitterness or astringency, and a role in the positive dimensions such as body, roundness, sweetness and length on the palate
- Development of complexity of aroma
- Stabilisation of the active compounds in the wine and improvement of the colloidal balance
- Attenuation of unwanted sulphurous odours
- Influence on the reduction and preservation of oxygen.

However, this method of maturation is not without risks, in that the quality of the lees is extremely variable:

- Depending on the strain of yeast: some are particularly useful in fermentation but distinctly less so in terms of maturation (weak autolytic capacity, few free active compounds such as mannoproteins…)
- Depending on the conditions of fermentation, the yeast's past: most yeasts retain residual sulphite reductase activity likely to form unwanted sulphurous odours. They may also overwhelm some fruity odours and restrict the freshness of wines, according to their composition
- Depending on the microbial contamination of the must, then the wine: the lees sometimes contain the transforming microorganisms such as *Brettanomyces bruxellensis*.

This is why the R & D department at IOC (Institut Œnologique de Champagne) has developed formulations derived from yeast as alternatives to fermentation lees: inactivated yeasts and yeast mannoproteins. Each alternative has been selected to optimise one or several of the oenological properties of lees, while eliminating the uncertainty associated with them. Through the choice of yeast and the conditions of growth and inactivation, there are multiple possibilities that allow for a wide variety of « lees alternatives » adapted for different production objectives.

Oenological properties of yeast fractions

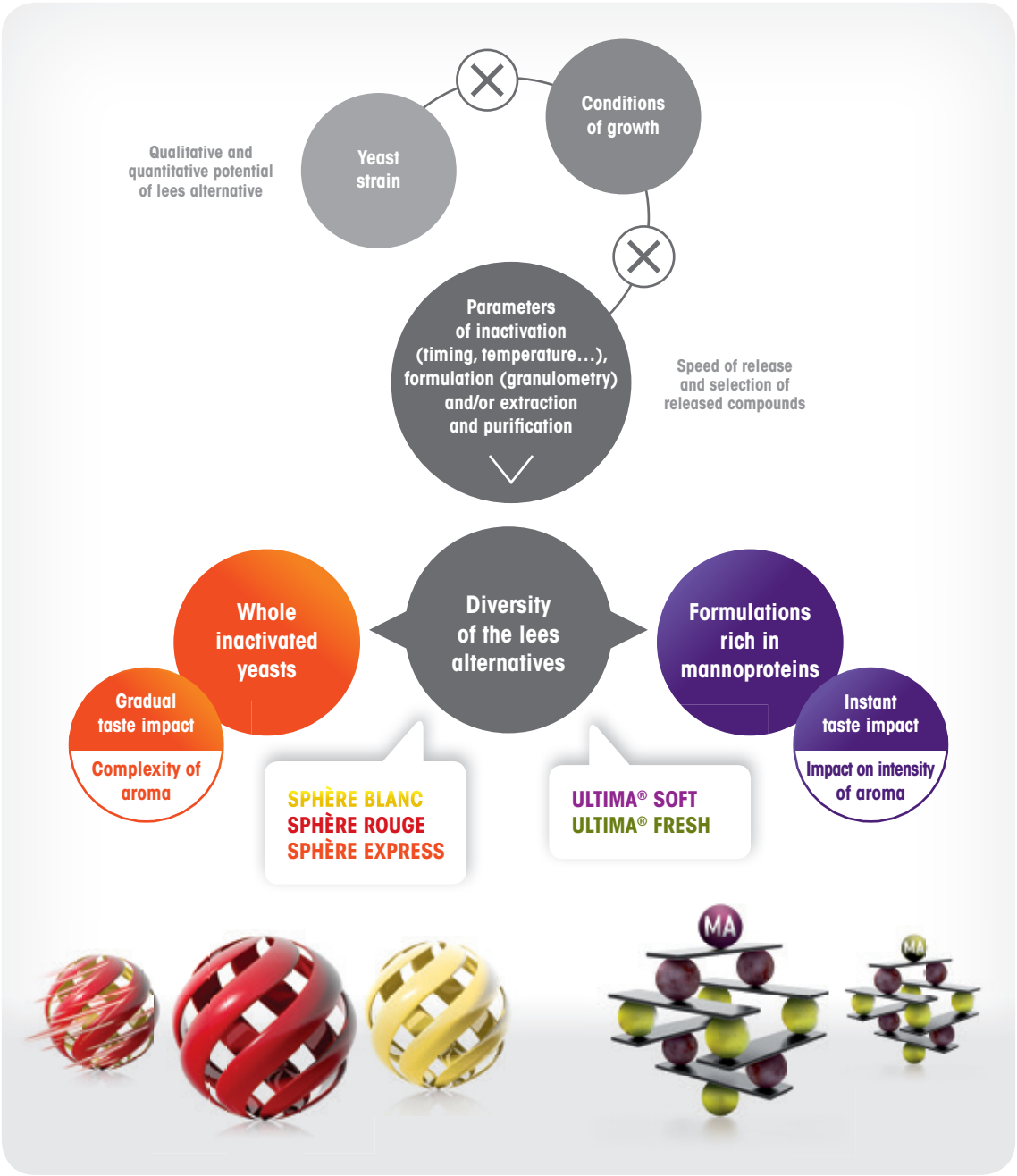


LEES AND THEIR CONTRIBUTION TO WINE QUALITY

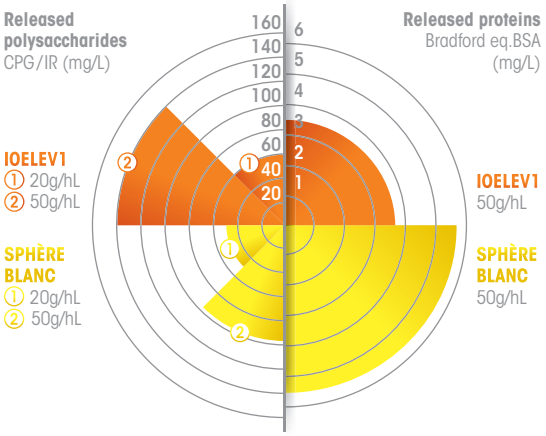
FROM PRECISION MATURATION TO TARGETED FINISHING: STRONGLY DIFFERENTIATED ALTERNATIVES

The sensory impact and the speed of action of each lees alternative depend on its past and the choices that determined its selection.

The strain of yeast determines its potential for greater or lesser release of certain compounds, a capacity that is modulated to an equal extent by the yeast's conditions of growth. The timing and the method of inactivation of the yeast then control the speed and selectivity of the release of the different yeast compounds into the wine (alternatives of the SPHERE type). Extraction and purification also allow for more precise targeting of specific classes of molecules, such as mannoproteins (alternatives of the ultiMA® type), making them instantly active and soluble in the wine, for finishing rather than maturation.



A RECOGNISED IMPACT ON WINE TEXTURE



Active compounds released in the wine by different lees alternatives (IOELEV1 and SPHÈRE BLANC) in hydro-alcoholic solution at 12%, pH 3.5, 25°C, 15 days' contact with light stirring

The lees enrich the wine with the essential compounds of their cell wall: polysaccharides and especially mannoproteins. These compounds reinforce the sensations of volume in the mouth, body and roundness, and research has attributed to some of them the property of reducing the wines' astringency. This is thought to be due to the interactions between certain yeast polysaccharides and the most reactive tannins. Certain large yeast proteins (>15 KDa) are also found to be excellent fining agents for astringent polyphenols.

In order to select the most convincing lees alternatives to contribute to the quality and texture of the wines, IOC has first of all sought to define the sensory dimensions of « volume » and « body ». In collaboration with the Centre des Sciences du Goût et de l'Alimentation (Centre for Sciences of Taste and Food), a research unit in Dijon well-known for its work on sensory analysis, we have been able to establish how these two variables can be conceptualised by tasters.

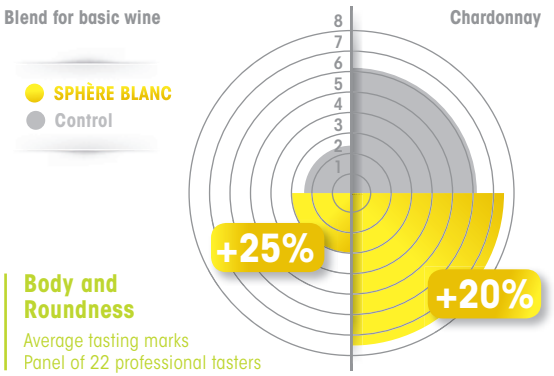
Using descriptors validated in sample tests on wines matured in the presence of lees alternatives, IOC has been able to sift different inactivated yeasts to retain those that correspond best, according to the panel of tasters, with improvement in the sensations of body and roundness of white wine or volume in the mouth of red wine.

↘ SELECTION OF A LEES ALTERNATIVE THAT REINFORCES SENSATIONS OF BODY AND ROUNDNESS

Compared to the other inactivated yeasts evaluated, SPHÈRE BLANC offers a higher aptitude for releasing proteins and, although slightly weaker, for releasing total polysaccharides.

However, the sample marks given by the tasting panel show a stronger capacity of SPHÈRE BLANC to improve the perceived body and roundness, while increasing the level of appreciation of the wine.

Besides the quantity, it is therefore also the quality of the compounds released which reflects the interest of an alternative to lees in relation to a determined sensory objective.



Body and Roundness
Average tasting marks
Panel of 22 professional tasters

↘ WORKING ON VOLUME AND STRUCTURE: EVALUATION OF A LEES ALTERNATIVE SPECIFICALLY FOR RED WINES

The particular interest of the SPHÈRE ROUGE inactivated yeast is its capacity to release small polysaccharides. Soon after the beginning of maturation (4 weeks) and up to 10 months of contact, red wines matured with this alternative offer more volume in the mouth, but also more structure and balance, thanks to the interactions between these polysaccharides and the wine tannins.

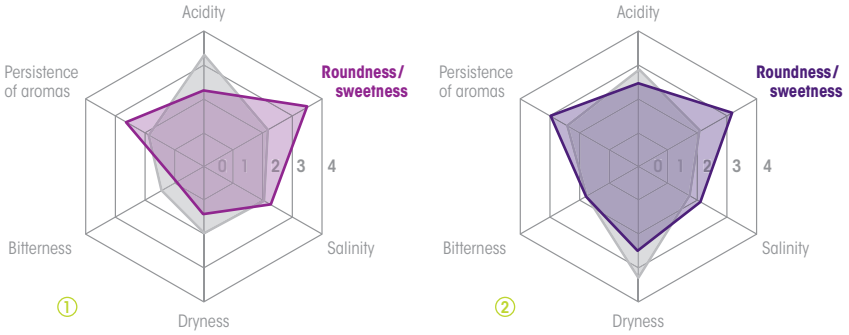
SPHÈRE ROUGE : Volume and structural balance
Trial at 20 g/hL on cabernet sauvignon, médoc (10 months' contact) - 9 tasters

A DECISIVE EFFECT ON TASTE

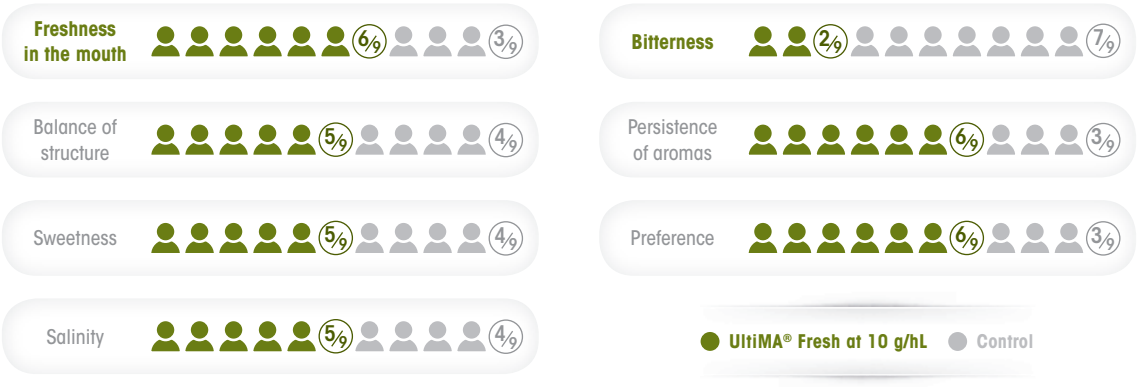
Certain constituants released by the lees are described as having an impact on the fundamental flavours such as sweetness, bitterness, acidity, or on the salinity of the wines. According to the characteristics and the stages of acquisition of the lees alternatives, it is possible to mature the wines in the direction of one or other of these dimensions.

Results of sensory analysis on trial wines
① White wine - Gros plant
② Red wine - Côtes du Rhône

- UltiMA® Soft at 10 g/hL
- UltiMA® Soft at 15 g/hL
- Control



Sensory analysis - Impact on red crop of high maturity
(Significance threshold 90%) Merlot - Gironde – 14.5% vol.



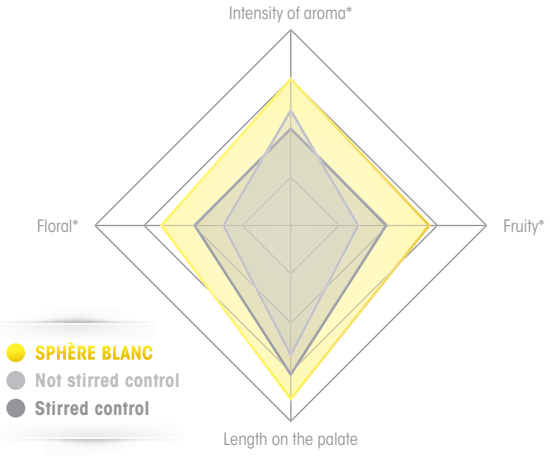
UNDER-ESTIMATED EFFECTS ON AROMATIC PERCEPTION

Yeasts, long after they have stopped fermenting, continue to exercise a significant influence on the aroma of wines during maturation on lees.

The yeast mannoproteins are likely to interact with the aroma compounds through both hydrogen and hydrophobic bonds. These interactions can increase the volatility of certain aromas, enhancing, or conversely diminishing, their olfactory perception, thus improving the length on the palate and the durability of the aromas during the storage time of the wine.

Certain esters, amino acids and nucleic acids from the lees are also described as flavour agents, contributing to the aromatic expression and complexity of the wines.

According to their charactistics, these effects can be found in certain lees alternatives. During selection, care will be taken to avoid the masking of fruity aromas sometimes attributed to lees, and in fact to optimise their perception.



Effects of lees alternatives (SPHÈRE BLANC) on aroma development
Chardonnay – matured 10 months.
Average marks given by the 7 panelists.
Différences significant at 5% are indicated by a *.

LEES AND CONTRIBUTION TO QUALITY OF WINE

CHOOSING THE MOST SUITABLE ALTERNATIVE

END OF ALCOHOLIC FERMENTATION

MATURATION

REFINING

PRE-IMPLEMENTATION OR PRE-FILTRATION FINISHING

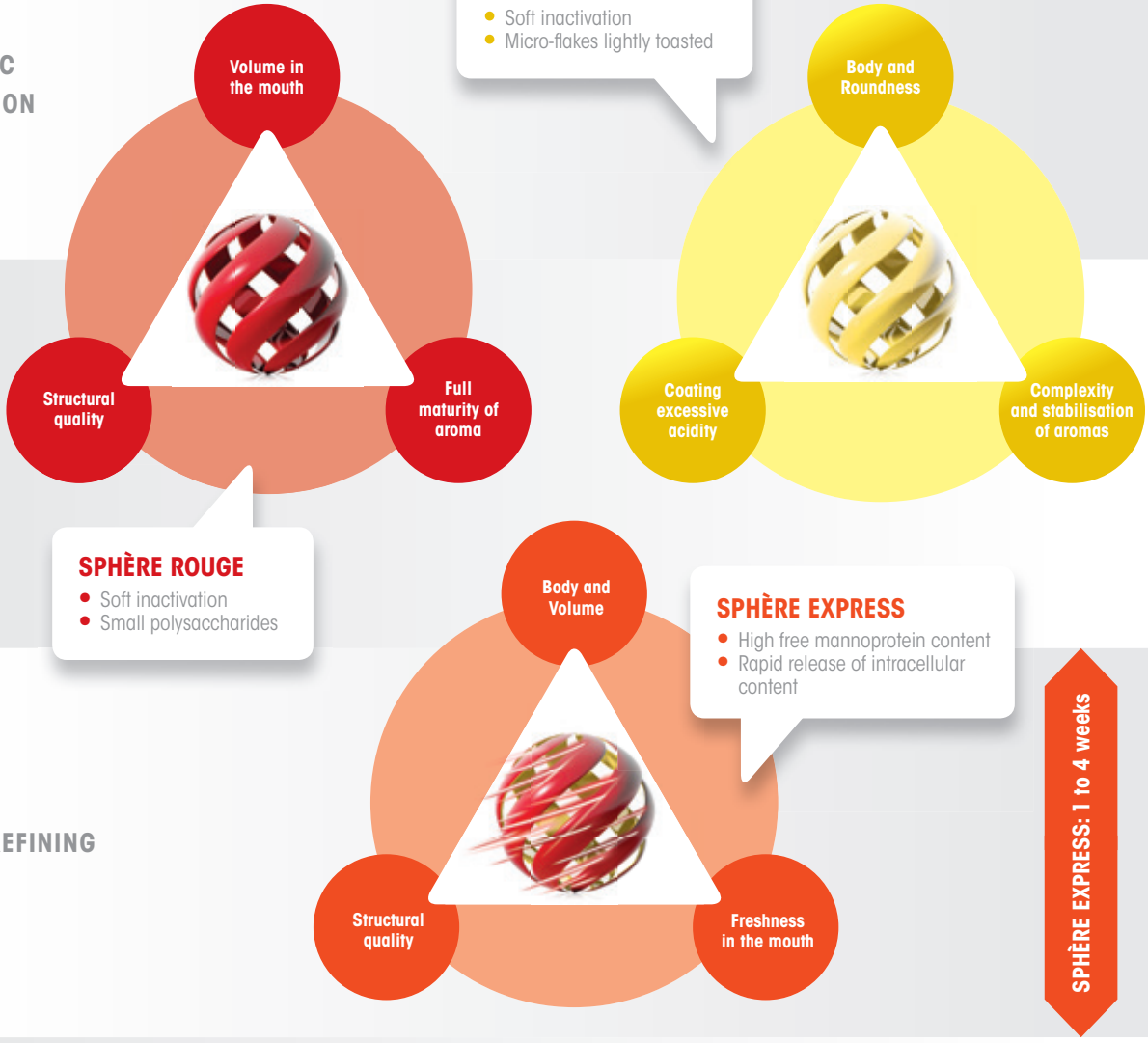
SPHÈRE BLANC
- Soft inactivation
- Micro-flakes lightly toasted

SPHÈRE ROUGE
- Soft inactivation
- Small polysaccharides

SPHÈRE EXPRESS
- High free mannoprotein content
- Rapid release of intracellular content

ULTIMA® SOFT
- Very high free mannoprotein content

ULTIMA® FRESH
- Very high free mannoprotein content



CHOOSING THE MOST SUITABLE ALTERNATIVE

GLUTAROM
- Protection during pre-fermentation phase and start of AF
- Contribution to aroma development (esters and thiols)

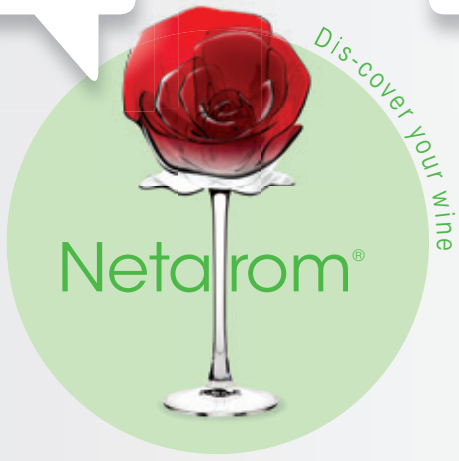
GLUTAROM EXTRA
- Very high reduced glutathione content
- Specially designed for vinifications with low sulphite content
- Optimal stimulation of wines' richness in glutathione
- Better protection over time

START OF FERMENTATION

NETAROM®
- Fixing and use of wines' residual copper
- For light reductions and respect of fruity thiols

NETAROM® EXTRA
- Rich in fixed copper
- For more robust reductions

END OF FERMENTATION MATURATION



LEES AND PROTECTION OF WINE QUALITY

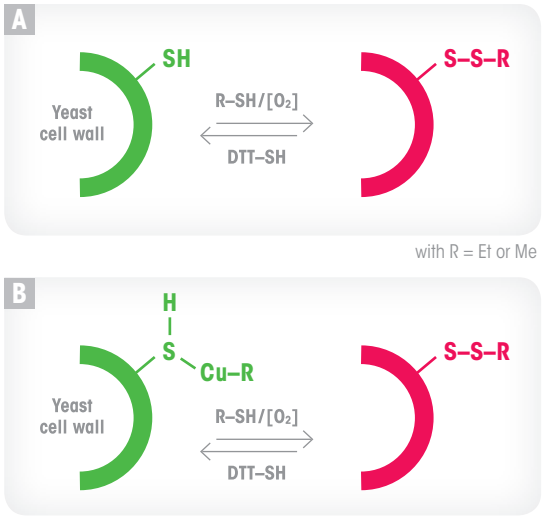
LEES TO ELIMINATE SULPHURUS ODOURS

From an oenological point of view, the cell walls of the yeast offer particularly interesting absorption properties. The capacity to absorb different molecules such as polyphenols, toxic fatty acids or even residues of phytopharmaceutical products has been ascribed to them. This potential action is very variable, according to the strain of yeast and its past.

More recently, studies have revealed yeast lees' property of fixing unwanted sulphurous compounds, responsible for so-called reduction odour and tastes. This phenomenon is all the more interesting for the practitioner if it is not accompanied by dryness or the oxidation risks associated with copper treatment.

The hypothetical method of action involves 2 phenomena:

- The mercaptans attach themselves directly to the sulphur groups present on the surface of the yeast cell wall.
- The copper in the wine is trapped by the sulphur groups, then the mercaptans attach themselves.

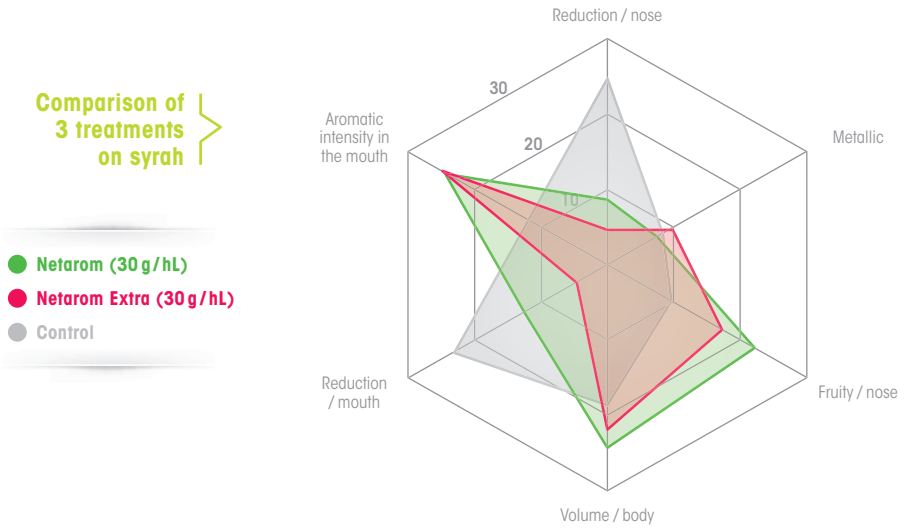


Hypotheses of mechanisms of elimination of mercaptans by lees (after Vasserot et al, 2010)

IOC has selected a lees alternative, NETAROM®, whose capacity to absorb unwanted sulphur groups is particularly developed, due especially to a high potential for fixing the copper present in the wine.

IOC has also confirmed the interest of implementing an inactivated yeast particularly rich in immobilised copper, NETAROM® EXTRA. This lees alternative offers the interest of not being dependent on the presence of copper in the wine to demonstrate efficacy.

Comparison of 3 treatments on syrah



LEES, PROTECTIVE AGENTS AGAINST OXYGEN

The lees' aptitude to protect wines from oxidation is empirically known by wine practitioners.

However, in recent years scientific knowledge has enabled us to explain this protective capacity of yeast lees, expecially as regards their content of antioxidant compounds.

They can in fact be particularly rich in glutathione, a tripeptide with a strongly antioxidant action, which they release into the wine.

However, yeast lees are equally likely to have residual sulphite reductase activity which can result in the formation of unwanted sulphurous odours.

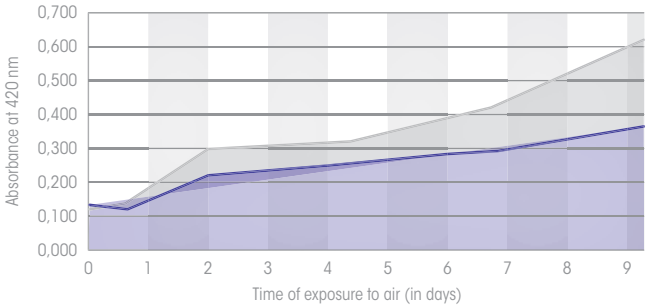
The interest in working with lees alternatives, offering the protective advantages of lees without their disadvantages, is therefore obvious.

In addition to the direct provision of glutathione released by the lees alternatives, we now know that there are positive interactions between the alternatives and the active yeasts in the fermenting must. We therefore usually recommend adding inactivated yeasts at the start of fermentation – coupled with complementary organic nutrition – so as to benefit from these interactions which yield distinctly higher levels of glutathione in the wines than later additions.

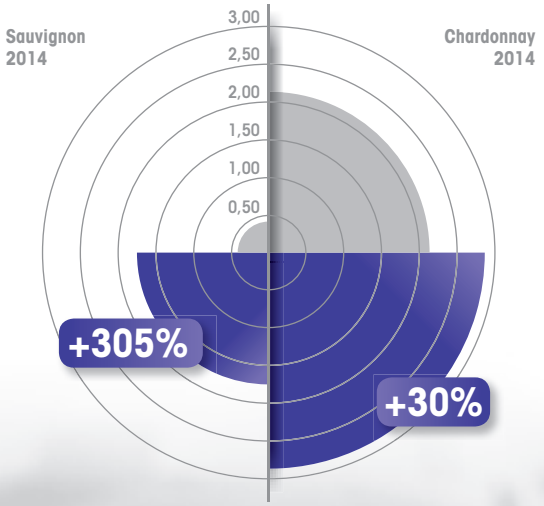
IOC has therefore developed lees alternatives rich in glutathione, the GLUTAROM range, to be integrated into the early stages of the vinification process, so as to contribute to the wine's stability as regards oxygen.

Dynamics of storage in air in low sulphite conditions

Absorbances of 450 nm - Chardonnay 2014
Measure post AF after addition of sulphite
Sulphite levels: on must: 0 g / hL – wine after AF+ before bottling: 0.4 g / hL



Impact of addition of GLUTAROM EXTRA at the start of alcoholic fermentation on the reduced glutathione content of wine



Is it necessary to rack after use? What is the impact of filtration?

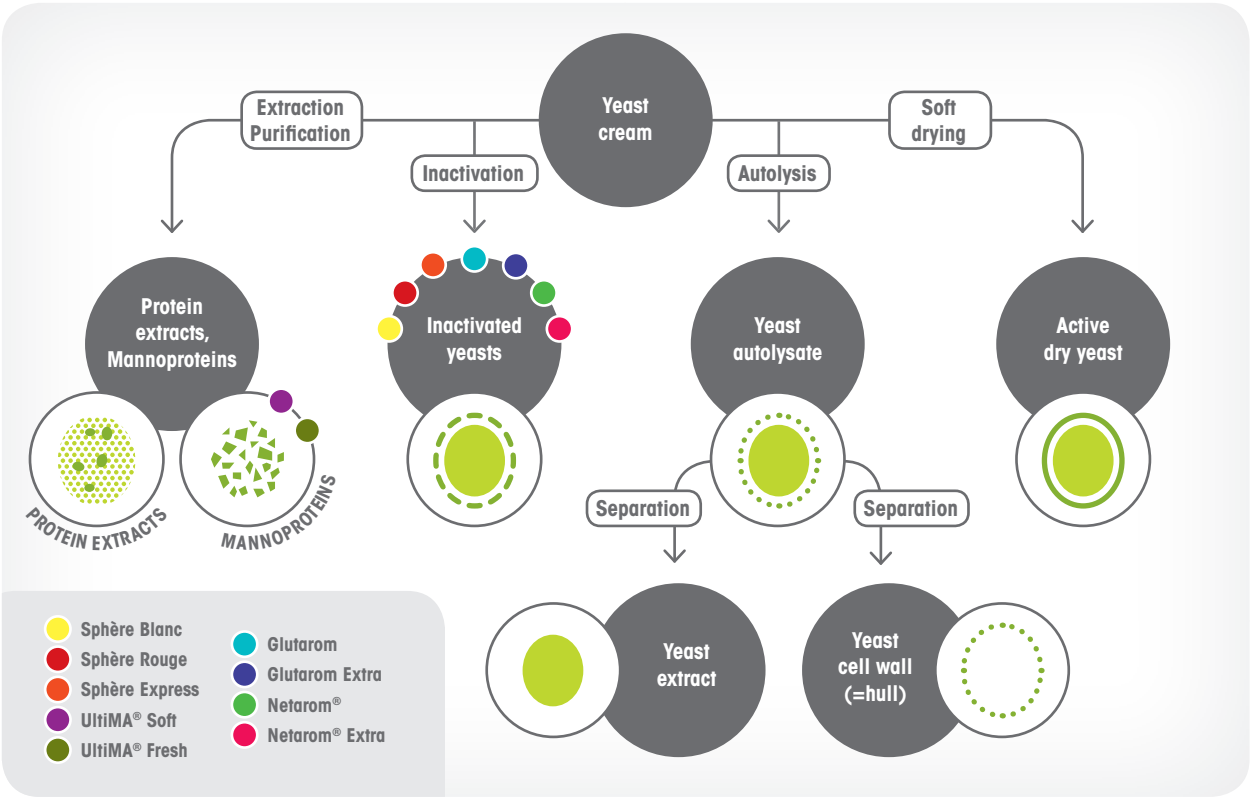
The inactivated yeasts (SPHERE, NETAROM®, GLUTAROM) are insoluble compounds and the wine must therefore be racked and/or filtered to eliminate insoluble fractions. Conversely, ultiMA® formulations are 100% soluble in oenological conditions of use and can be used just before implementation without the need to rack. In all cases, the effects produced by the inactivated yeasts, as by ultiMA®, will not be lost through filtration.

What is an inactivated yeast? How does it differ from yeast hull or mannoprotein?

Starting from living oenological yeast cream, widely differing yeast fractions can be obtained:

- Through simply soft drying, dry active oenological yeast can be obtained, which can bring about alcoholic fermentation.
- Through treatment, such as thermal, inactivated yeasts can be obtained whose composition remains rich in macromolecules of sensory interest (mannoproteins and other polysaccharides) but varies according to the conditions of acquisition (strain, growth conditions, softness of inactivation…), giving a wide diversity of lees alternatives.
- Use of enzymatic autolysis gives a yeast autolysate. This is much more fragmented than inactivated yeast, and a large proportion of the macromolecules has become segmented into smaller molecules. These autolysates are excellent nutrients (rich in amino acids, for example).
- Separation of the soluble and insoluble fractions of the yeast autolysate distinguishes the yeast extract, which is the internal content of the yeast (not authorised in oenology), and the yeast cell wall (or hull). This purified cellular envelope, which offers interesting absorption properties, is totally different from inactivated yeast, which contains both the cell wall and the intra-cellular environment.
- Mannoprotein formulations are obtained by extraction and purification starting from the yeast cream; they do not contain the other constituants of either the yeast cell wall or the intracellular content.

Lees alternatives among other yeast fractions



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Are the sensory effects stable over time?

Sensory analyses carried out at different intervals show that the organoleptic benefits of the SPHERE range of inactivated yeasts and of the mannoproteins contributed by ultiMA® last over time.

What is the optimal maturation time with the SPHERE range?

It is considered that 90% of the desired benefits are obtained with SPHÈRE ROUGE or SPHÈRE BLANC after 4 to 8 weeks. For SPHÈRE EXPRESS, this is reduced to 1 to 2 weeks. There is no contra-indication in keeping the lees alternative in contact with the wine for longer.

What is the impact of lees alternatives on colour?

This will depend on the lees alternative used. UltiMA® has no impact on colour, for example. GLUTAROM, while conveying protection against oxidation, could tend to favour colour preservation. If some fresh lees absorb pigments and reduce colour intensity, in this area the impact of lees alternatives in oenological doses seems distinctly more anecdotal.

Should ultiMA® be used alone or can it be used in conjunction with other products?

The use of ultiMA® products in association with certain tannins regularly gives excellent results, thanks to the complementarity of their sensory actions, but they can perfectly well be used alone, according to the desired aim.

Since ultiMA® is mannoprotein-based, do I therefore not need to stabilise my wines in relation to tartaric precipitation?

Although some mannoproteins do in fact have a positive action on tartaric stability, the use of ultiMA® alone does not remove the necessity of using other stabilisation methods in regard to these precipitations.

Won't the use of GLUTAROM reduce the complexity of the wine?

The glutathione released by GLUTAROM is a powerful antioxidant, but does not in itself produce the unwanted sulphurous odour known as reduction odour. Moreover, unlike some fresh lees, GLUTAROM does not produce residual enzymatic activity that reduces H2S into sulphites. Although it is true that the glutathione retains its potential to protect some sulphurous compounds in relation to oxidation, as it protects varietal thiols, we have not observed « reduction off-flavours » increased by the use of GLUTAROM.

Why should wine not be left in contact with NETAROM® for more than 5 days?

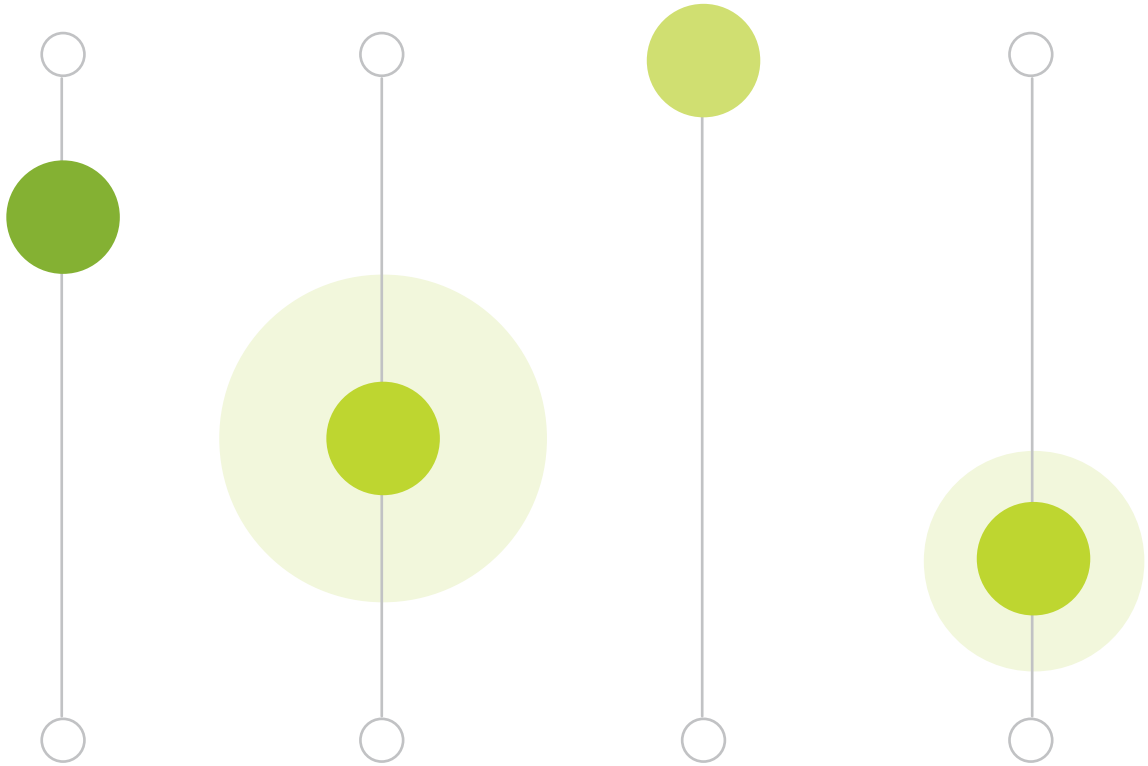
Our trials have shown that a desorption phenomenon sometimes occurred after several days, meaning that the cell walls of NETAROM® may end up releasing the adsorbed compounds. Although this risk is not systematic, it is still preferable to rack the wine sooner than with fining. However, it is also possible to manage the duration of contact through tasting.

Can NETAROM® et NETAROM® EXTRA be used together?

Certainly! In some cases, the complementary actions of these two lees alternatives eliminates sulphurous compounds more efficiently.

Why should sulphite not be added to wine during treatment with NETAROM®?

There is not necessarily any contraindication for sulphiting and contact with NETAROM®. However, it is true that in general we are trying to limit sulphites in wines with sulphurous odours.



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