

The use of selected wine yeast in dry form dates to the mid-1960's (Kraus et al, 1983). Gradually, this practice has been one of the most important innovation in winemaking as it allowed winemakers reliability and security during alcoholic fermentation (AF), as well as tremendous choice of different yeasts, without the concern related to managing a often delicate and difficult spontaneous AF, with all the risk related. Yeast production is a true expertise, one that relies on a strong understanding of yeast metabolism, microbiology and process.

The selected wine yeast used by winemakers must be in optimal shape, and in order to obtain that state, specific feeding regime during its growth and development, tailored to each specific wine yeast, as they are all different, is learned and optimized by true science and years of experience and research. This Under Investigation will showcase how selected wine yeast production is conducted and why it benefits winemakers.

### THE ART OF GROWING YEAST

As a yeast producer, we grow selected wine yeast which must guarantee optimal performances in winemaking conditions.

Simply described, yeast production starts from a pure yeast culture (Lallemand has one of the most extensive private yeast culture collection), to a batch fermentation (Figure 1 - left).

During this phase, where the yeast is in *Crabtree effect* mode (or fermentative metabolism), the goal is to build up some biomass for the next step. The yeast is not yet optimal and healthy (it is a similar step found for yeast propagator in wineries). Yeast biomass increases, as well as ethanol production (since it is in *Crabtree effect* mode), stressful for the yeast cells. That is one of the reason why propagated yeast are often fragile and less performant.

Transferred from batch step, the fed-batch (Figure 1 - right) is initiated in big fermenters. The increasing aeration combined with sugars, nitrogen sources, vitamins and minerals incrementally added, allow the yeast growth without ethanol production. The yeast is maintained in respiratory mode (*Pasteur effect*) thanks to the close monitoring and management and the fermentative activity of the yeast. This is where the magic happens and the yeast grows and multiplies in a timely manner.

The expertise and knowledge to monitor precisely each parameter (oxygen, ethanol and biomass (quality and quantity) are crucial to quality selected wine yeast (Table 1). Aeration management is key at this stage: oxygen will help with increase trehalose (to increase the stability of the final wine active dry yeast) and oxygen is involved as precursor of several yeast membrane compounds like lipids or sugar to help survive the difficult conditions of wine fermentation. Selected dry wine yeasts (active dry yeast) are in optimal health when they are ready to be used by the winemaker.

Parameters monitored during Lallemand wine active dry yeast production	Benefits on quality of final wine active dry yeast for alcoholic fermentation performance
Optimal nutrient addition - carbon, nitrogen, phosphorus	High vitality & viability during AF with proteins & lipids at optimum ratio.
Optimum minerals and vitamins addition	Better cell membrane resistance to ethanol. Decrease the risk of stuck fAF & VA production, Low H <sub>2</sub> S production. Better volatile aromas release, esters synthesis.
Optimum dissolved oxygen	High viability in spite of high ethanol level in AF = No stuck fermentation. High shelf life of ADY: strong cell stability.
Optimum specific growth rate to avoid ethanol production and favor biomass by modulating the carbon source flow.	Yeast cells after rehydration, ready to enter in the lag-phase and start active growth phase, better nitrogen uptake, aromas precursors & maximum of enzymatic activity ( $\beta$ -lyase, $\beta$ -glucosidase...).
Optimum temperature & pH, osmotic pressure control depending on strain or specie	High initial viability with even difficult yeasts.
Optimum filtration and gentle drying. Packaging under vacuum	Stronger adaptation to grape must: resisting low pH, osmotic pressure, SO <sub>2</sub> tolerance... better implantation capacity, shorter lag-phase.

Table 1. Essential steps during yeast production and impact during AF

### DRY SELECTED WINE YEAST: NATURAL, SAFE AND FLEXIBLE

From the selection, collection build up, multiplication in fermenters, all the way to the drying process, the resulting active dry yeast have revolutionized wine fermentation for 50 years. The advantages of using selected wine yeast that have been properly and expertly grown and dried are many for winemakers:

- Regular and safe fermentation speed
- Osmotic and alcohol tolerance
- Resisting low pH, organic acids, and indigenous bacterial contamination
- Optimized lag phase, stable and consistent performance
- Convenient storage and handling

In terms of quality, selected wine yeast are under strict quality control and the winemaker does not have to rely on chance to carry out AF, or let rogue microorganisms take over and risk aromatic deviations. All our selected wine yeasts are produced under OIV specifications and as an expert in wine fermentation, we submit our yeast through a rigorous QC process, including genetic fingerprinting, pesticides and heavy metal residues and allergen monitoring. Additional internal and specific to Lallemand quality control methods include those related to wine fermentation performance as we know what is necessary to have a successful wine fermentation.

### SUMMARY

Expertise in wine yeast production is not something that can be improvised. It must be carefully controlled, optimized and the quality of the dry selected wine yeast fermentation has to be impeccable. This is why at Lallemand we are expert in optimizing production to constantly improve the quality of our wine active dry yeast and to propose winemakers the best fermentation solutions for their wines.

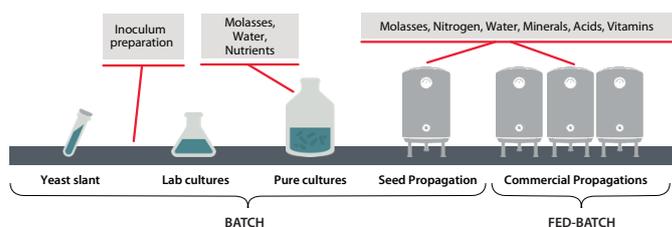


Figure 1. Yeast production steps

### HEALTHY WINE YEAST, HEALTHY WINE FERMENTATION

The proper addition and timing of nutrients (i.e. nitrogen containing molecules, carbon (sugars), vitamins and trace minerals, etc) during growth in fermenters, are necessary for reliable and healthy yeasts able to carry out AF. The drying process, a gentle and carefully monitor step, retains all the characteristic of the selected yeast.

Each nutrient, fed to the yeast during the fed-batch process and each parameter has an impact on yeast composition, yeast vitality and viability during wine fermentation, as well as the number of generations for the yeast cell to retain its genetic stability (Table 1).

Through extensive research, those feeding regimes have been optimized and let to the development of selected wine yeast grown under the YSEO™ process, where the optimization of micronutrients, drying programs, maturation times were adapted for the yeast strains that can benefit the most in terms of their subsequent fermentation performance and their quality.