INTRODUCTION

One of the primary concerns of the enologist during winemaking is to ensure a steady and complete fermentation so that all of the sugars in the must are converted into alcohol. This should be done in order to avoid any unpleasant surprises that could arise, including a stuck fermentation or problems due to secondary metabolisms detrimental to the aroma and taste of the wine.

NUTRITION AND PROTECTION: TWO DIFFERENT CONCEPTS

Nutrition, in the form of assimilable nitrogen, membrane lipids, vitamins and minerals, is vital for yeast during fermentation, but protection is also important—two concepts that need to be differentiated and treated separately. Before feeding selected yeasts, first ensure they are well protected and in good physiological condition in order to improve viability in a stressful medium not ideal for growth. For proper fermentation, good enological practices include both nutrition and protection.

HOW TO MANAGE AND OPTIMIZE YEAST PROTECTION

Nourished with micronutrients (the vitamins and minerals available in the must), sterols are responsible for maintaining the integrity of the yeast cell membrane and increasing its resistance to ethanol. The protection and nutrition of yeast are consecutive and complementary steps. Their benefits should be combined to ensure good alcoholic fermentation, with no problems with a stuck fermentation or secondary metabolisms compromising the quality of the wine.

In recent years, the use of selected yeasts in winemaking has become widespread, allowing greater control of the alcoholic fermentation and reducing the risk of unwanted sensory effects resulting from the growth and metabolism of contaminating indigenous yeast. However, a lack of nutrients in the fermentation medium, as is the case in very mature harvests (rich in sugars and polyphenols), harvests with Botrytis, highly clarified musts with low turbidity, and in the presence of inhibiting substances, can lead to slow or stuck fermentations.

Numerous enological studies and research projects have focused on defining the best supplements and correct levels of nutrients in the fermentation medium. The main ones used in winemaking are mainly assimilable nitrogen, vitamins, minerals, anaerobic growth factors and oxygen. Contrary to assimilable nitrogen, must deficiencies in terms of sterols, vitamins and minerals are rarely foreseeable when the selected yeasts are inoculated, and therefore in adverse fermentation conditions general enological practices should include protecting the yeast for fermentation.
PROTECTION DURING THE REHYDRATION OF THE YEASTS

During rehydration in an aqueous medium, active dry yeast can be supplemented with protective nutritional elements derived from inactive yeast rich in certain cellular components, to increase fermentation and metabolic capacity in the must. Lallemand, in collaboration with INRA (Montpellier), has discovered that the membrane lipids and the sterols from the inactive yeast form in situ hydrophobic micellar colloids in water during rehydration of selected active yeast. These colloidal particles move through the rehydration water until they reach the membrane of the active yeast, and integrate into its structure, which is particularly effective at stimulating efficient alcoholic fermentation. The spontaneous formation of these sterol-rich micellae occurs through the formation of colloids that stay in suspension in an aqueous medium and are made up of membrane phospholipids, specific polysaccharides of cell walls and sterols, all deriving from the inactive yeast prepared for that purpose. During the rehydration of the active yeast, these micellae are capable of interacting with the cellular membranes, modifying the original structure of the plasmatic membrane and significantly increasing sterol and unsaturated fatty acid content – very useful in maintaining the fluidity of the membrane and also making it more resistant to ethanol (see Figures 1 and 2).

The selected natural yeast strains used to ferment wine contain only 8% moisture in their dry form, thereby guaranteeing ideal conservation until they are used in winemaking. The yeast cell membrane is made up of two flexible and permeable lipid layers, performing a vital function which consists of controlling the entry and exit of cellular metabolites. The yeast protector acts specifically during the rehydration phase, releasing specific micronutrients and micro-protectors that move from the inactive yeast to the active yeast in the warm rehydration water, becoming available to the fermentation yeast and enhancing its effectiveness during alcoholic fermentation.
When rehydration with yeast protectors is complete, the yeast is ready to act efficiently and resist the multiple stress factors present in the alcoholic fermentation of a must with technical difficulties. The protection strategy assists the yeast at the following critical points:

- **During incorporation into the must**, the yeast suffers osmotic shock due to the high sugar concentration in the must. The specific micro-protectors protect the yeast, helping it resist the osmotic shock during incorporation into the must. The specific micronutrients allow the yeast to acclimatize better and develop an ideal metabolism. As a result, the yeast produces less volatile acidity and hydrogen sulphide (H₂S), etc., that affects the final quality of the wine.

- **During the multiplication phase**, the inoculated yeast will transfer part of its own cellular material to the following generations, gradually reducing the thickness of the cell membrane in each successive generation. The yeast protector offers it a supplement of reserves in micronutrients and micro-protectors that can be transferred to the future generations, increasing the resistance and viability of the final population, which would usually be in poor condition and facing worse fermentation conditions, given that nutrients are practically non-existent in this phase, and the degree of alcohol is higher, with the possibility of toxins that could inhibit their activity.
Maintaining a membrane rich in micro-protectors increases the resistance of future generations and enhances the viability of the total yeast population (see Figure 3).

At the end of the fermentation process, the yeast suffers a high degree of stress due to the high alcohol concentration and the difficulties in transporting residual sugars: the alcohol diffuses through the membrane and kills the cell. During the rehydration phase, protected yeast maintains a very high viability rate. Its membrane, rich in sterols and PUFA is able to withstand high concentrations of alcohol and prevent the alcohol from entering the cells. With this protection, the yeast can finish consuming all the sugars in the must. Healthy and stress-free yeast cells do not produce excessive amounts of undesirable compounds or volatile acidity. Protecting the yeast guarantees that the end of the fermentation is faster and safer (see Figure 4).

**CONCLUSION**

In conclusion, we may state that protecting the yeast cells during rehydration guarantees the following principal parameters:

- The reactivation of the internal metabolism thanks to the micronutrients. The yeast cells have more time to reinforce their cell membranes before being incorporated to the must.
- The consolidation of the external membrane, a vital organ for yeast cells, thanks to the micro-protectors.
- Enhanced viability and cellular activity until the alcoholic fermentation process is complete.
- During fermentation, the protected yeast also indirectly assists in:
  - Totally occupying the must with a good implantation, and restricting the activity of contaminating indigenous yeast.
  - Guaranteeing faster and safer fermentation.
  - Reducing the production of undesirable compounds, such as volatile acidity, H₂S, etc.
HOW TO ENSURE & IMPROVE WINE FERMENTATIONS BY PROTECTING THE YEAST

GO-FERM
Go-Ferm® is certified organic by OMRI. It is a natural yeast rehydration nutrient containing a balance of micronutrients. It was developed to enhance kinetics and thereby potentially avoid problem fermentations.
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GO-FERM PROTECT EVOLUTION
Go-Ferm Protect® Evolution is a natural yeast rehydration nutrient developed specifically for problem musts and stuck fermentations. It is certified organic by OMRI. Difficult fermentation conditions may include overripe fruit (>28°B), marginal fruit quality (poorly developed fruit, Botrytis, rot, high bacteria count, insecticide or fungicide residue), low nutrient levels and overclarified juice.
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VIDEO RESOURCES

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