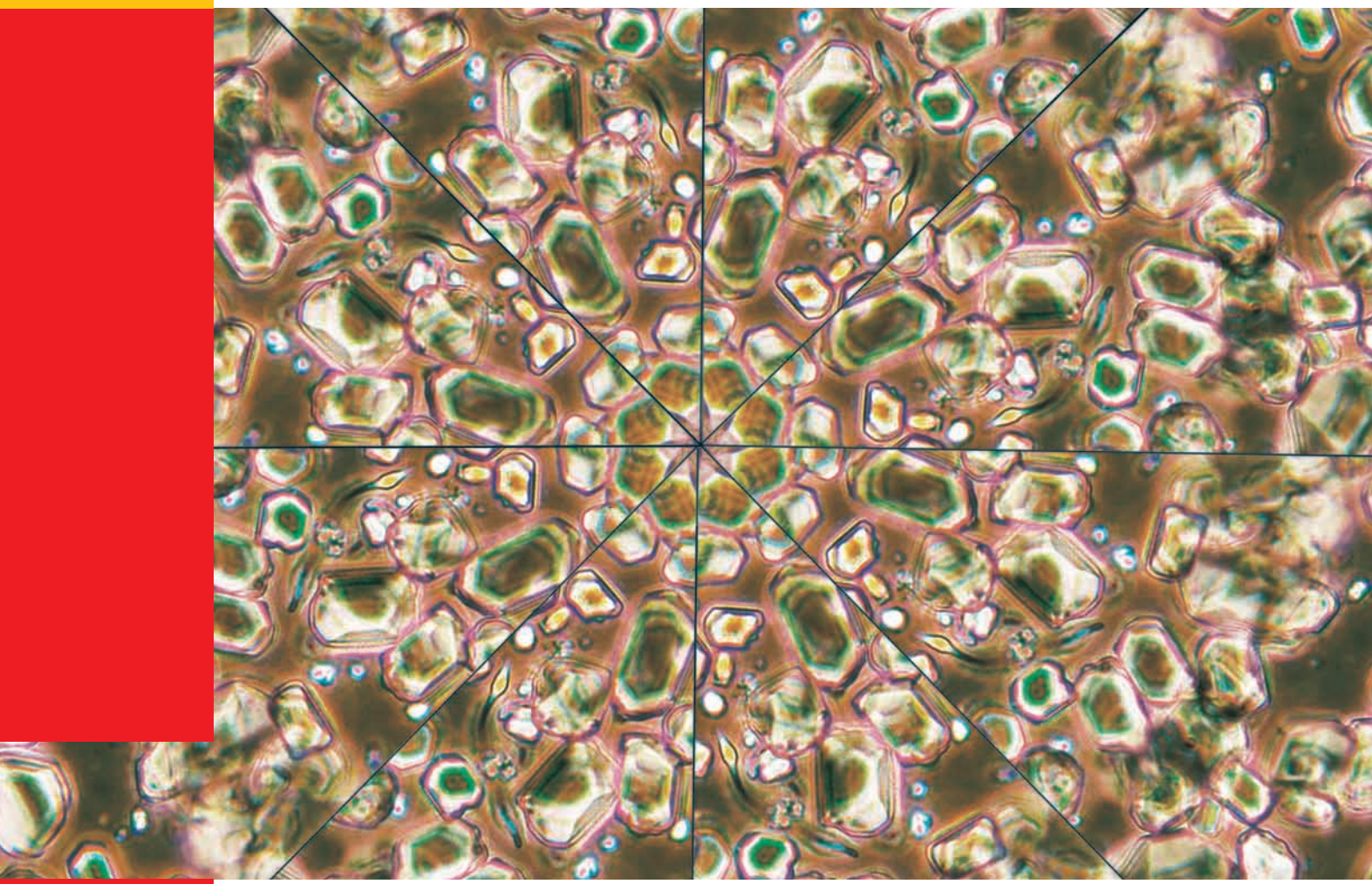
Yeast Nutrient Management



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Function

If microbiological processes were simple and easy to understand, the wine and sparkling wine industry would have solved a significant quality management issue.

However, microbiological processes adapt to the laws of nature and change according to environmental factors. The situation is further complicated by the fact that micro-organisms are very small and have a very complicated metabolism.

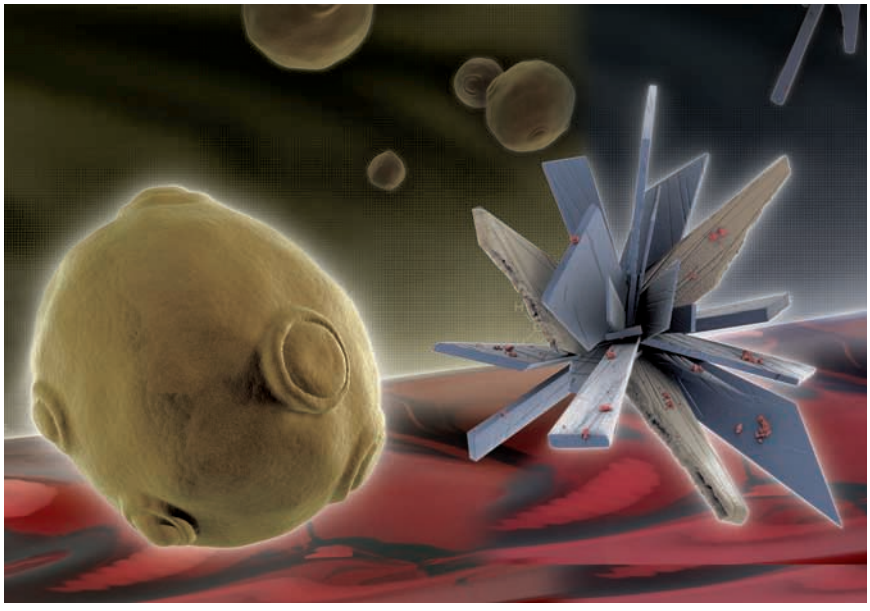
It is therefore all the more surprising that the process of alcoholic fermentation largely remains uncontrolled.

Wine yeasts represent an essential interface between must and wine. It is therefore important to be aware of the fact that optimum fermentation requires that these yeasts be still alive at the end of the fermentation process. This means that yeast is only able to complete the alcoholic fermentation process if the must contains sufficient nutrients to ensure its survival.

This may seem obvious, because we all know that without nutrition, there is no life – and yeast is no exception. The main nutrients and their effect on wine yeast are listed in Table 1.

Yeast cell requirements	Yeast function
Vitamins	Growth rate
Minerals	Enzyme cofactors
Nitrogenous compounds	“Multiplication motor“ Amino acid metabolism
Lipids/sterols	Cell membrane transport Cell growth

Table 1: Yeast nutrients in grape must and their effect on yeast cells



Legal limits

The prevailing problem in large companies is that routine measurements of the sugar concentration and pH value and analysis of organic acids are useless for the purpose of yeast development. There is no correlation between the sugar concentration of a must and the nitrogen concentration (amino acid concentration), nor are essential yeast nutrients such as minerals, vitamins, fatty acids, and sterols analyzed (Table 2). Today, when it comes to yeast nutrients, grape must ingredients are still somewhat of a mystery. Legislators are now trying to compensate this poor knowledge through an approval procedure for yeast nutrient preparations.

Nutrients in must	Knowledge of must ingredients available to the yeast	Maximum legal limit
N_2	To some extent, e.g. FAN value Amino acid spectrum	For wine production: DAHP 100 g/hl* For sparkling wine production: DAHP 30 g/hl*
Vitamins	No	Vitamin B_1 (thiamin): 60 mg/hl* Partially through yeast cell wall preparations
Minerals	No	Partially through addition of yeast cell wall preparations max. dosage: 40 g/hl*
Unsaturated fatty acid	No	
Sterols	No	

Table 2: Yeast nutrients and maximum legal limits

** German law*

***FAN** = free, assimilable nitrogen*

***DAHP** = diammonium hydrogen phosphate*

The most effective yeast nutrients are yeast cell wall preparations. These products contain inactive yeasts that are able to compensate to some extent the lack of essential yeast nutrients (minerals, vitamins, etc.) in the grape must.

Application

		Available nutrients for the yeast cell					Timing of application for alcoholic fermentation						End of fermentation	Effect on the yeast cell	Max. dosage*
Product	**Product components**	**Vitamins**	**Minerals**	**Nitrogen**	**Amino acids**	**Lipids/ sterols**	**Substances for increasing the internal surface**	**Rehydro-genation of dry active yeasts**	**Start**	**After 1/3**	**After 1/2**	**Abating fermentation**			
SIHA SpeedFerm	Inactive yeast cell	x	x		x	x		x					x For rehydro-genation of the new yeast batch	Higher content of living cells over the whole fermentation process, reliable final fermentation	30 g/hl
SIHA fermentation salt	DAHP			x					x	x				Fast yeast reproduction	100 g/hl
SIHA fermentation salt plus	DAHP + vitamin B_1 + cellulose	x (Vitamin B_1)		x			x		x	x				Faster yeast reproduction, particularly for sharply pre-clarified musts	50 g/hl
SIHA Vitamin B_1 (tablets or powder)	Vitamin B_1	x (Vitamin B_1)							x					For grapes affected by botrytis and must bentonite fining	0.6 mg/l
SIHA PROFERM Plus	Yeast cell wall preparation	x	x	x	x	x			x	x	x	x	x	Complete nutrition for yeast cells, higher content of living yeast cells, reliable final degree of fermentation	40 g/hl
SIHA PROFERM H+[2]	Yeast cell wall preparation + DAHP	x	x	x	x	x			x	x	x			Promotes the formation and the growth rate of yeast, improves fermentation conditions, reduces undesirable fermentation-related aromas, ensures reliable final fermentation	40 g/hl

** German law*

Correct application

The question now is: When is the right time for adding the nutrients in order to ensure complete alcoholic fermentation?

Fig. 1 shows the timing of adding yeast nutrients.

In order to ensure optimum nutrition of the yeast cells, rehydrogenation of the yeast cells with inactive yeast products (e.g. SIHA SpeedFerm) is advisable. Yeast cells in the form of a dry active yeast product are in a physiologically dormant stage. This status can be reversed through addition of water and nutrients.

Addition of pure nitrogen components, such as DAHP, during the rehydrogenation phase would damage the yeast cell, whereas addition of inactive yeasts promotes intracellular concentration of essential yeast nutrients (minerals, vitamins, etc.) in the yeast cell. This intracellular nutrient pool can be metabolized step-by-step for subsequent yeast/enzyme reactions.

In addition, the number of living cells was shown to be higher throughout the entire alcoholic fermentation process than for yeasts that were not rehydrogenated with inactive yeasts.

Pure nitrogen components such as DAHP (SIHA fermentation salt) or combination preparations (SIHA PROFERM Plus) should be added in stages, i.e. at the start, after one third, and after half (at the latest) of the alcoholic fermentation, up to the maximum legal limit (see Table 2). Adding 100 grams of DAHP per hectoliter once in one work step is not recommended, because this could significantly inhibit the fermentation performance of the yeast cells.

Optimum rehydrogenation and staggered addition of yeast nutrients are important, but not the only factors for optimum alcoholic fermentation.

Factors such as must/mash treatment, spontaneous flora (spontaneous yeasts, spontaneous bacteria), oxygen gassing and fermentation temperature also play a role in optimum yeast development.

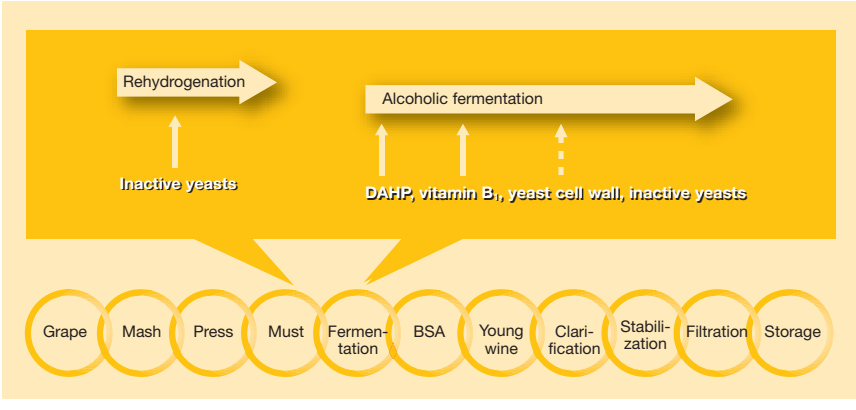


Fig. 1: Optimum timing (detail) for adding yeast nutrients

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