

THE CONCEPT!

Erbslöh® LA-C and Oenoferm® LA-HOG

for fruitier and more balanced wines with improved
mouthfeel and lower alcohol

NEW



ERBSLÖH

Fortschritt macht Zukunft®

Where winegrowing is concerned, increasingly hot summers cause grapes to develop a higher sugar content and leading to a much higher alcohol content after fermentation. These wines are too heavy and therefore less popular with customers. In recent decades yeasts' alcohol tolerance and strength of fermentation has been increased in order to cope with the changes wrought by climate change. Existing yeasts fully ferment the sugar in the grape juices, resulting in high alcohol contents.

The wines seem very alcoholic and the aromas are increasingly masked. It was necessary for yeast development to adopt a new approach in order to form less alcohol and produce fresh wines. This has been achieved by targeted selection of the innovative Oenoferm® LA-HOG yeast. The name "LA-HOG" stands for "Low Alcohol - High Osmolarity Glycerol". The aroma profile meets the expectations of today's customers and allows modern, light wines to be produced.

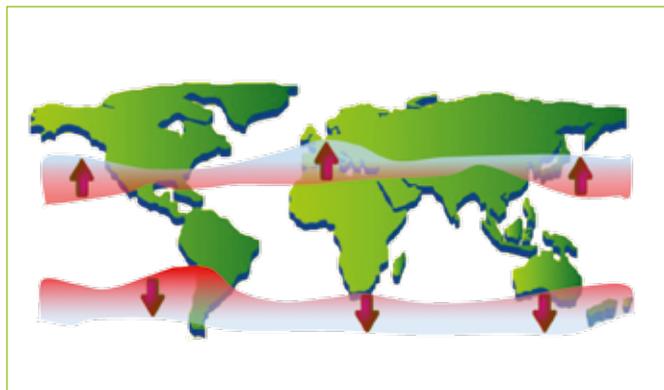


Fig. 1: In addition to extreme weather, such as droughts and floods, the consequences of climate change also include a shift of climatic zones suitable for growing vines towards polar regions.

Erbslöh® LA-C – improved mouthfeel, less alcohol and rich aromas

Oenoferm® LA-HOG is a GMO-free yeast developed for red and white wines. It forms comparatively less alcohol, but above average levels of glycerol compared to other wine yeasts. The addition of obligatory nutrients optimises sugar uptake, metabolism and focussed aroma formation.

VitaDrive® F3 is used for rehydration. The complex nutrient VitaFerm® Ultra F3 provides a base for the must. Different amounts of Vitamon® Liquid are dosed depending on the must (white or red).

Advantages of Erbslöh® LA-C using Oenoferm® LA-HOG

- The above-average glycerol formation improves mouthfeel.
- The alcohol content is reduced by up to 1% ABV.
- Formation of fruity aromas
- Very high fermentation strength

What does glycerol do?

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Production of glycerol rather than ethanol creates benefits for the global balance of the wine. Excessive alcohol is reduced and astringent wines smoothed out. Higher glycerol contents give wines more body and softness on the palate. If there is a bitter taste, higher glycerol content suppresses the "rough" mouthfeel and hardness. It has a positive influence on overall perception of the aromas. The 3-methyl-butylacetate

aromas (aromas of ripe pears and bananas) and ethyl hexanoate (fruity apples and dark berry aromas) are emphasised, especially in the range of 10 to 15 g/L glycerol.

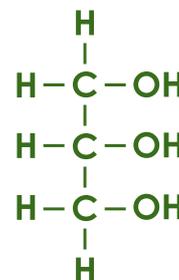


Fig. 2: Structural formula of glycerol

Concept

The Erbslöh® LA-C concept

In addition to strongly fermenting Oenoferm® LA-HOG yeast, the special nutrients in Erbslöh® LA-C, correctly used, are important for successfully reducing alcohol and increasing glycerol. The complex nutrient VitaFerm® Ultra F3 ensures a successful fermentation. It supplements the effect of VitaDrive® F3 and provides the yeast with other nitrogen-containing components during fermentation. The aroma profile meets the expectations of today's customers and allows modern, light wines to be produced. By also adding liquid yeast nutrient Vitamon® Liquid, this promotes fruity, long-lasting aromas. The recommended quantities must be added continuously. Daily addition is made easier by the liquid formulation. The particle-free solution avoids spontaneous release of CO₂ and leads to rapid availability of nitrogen and vitamin B1.

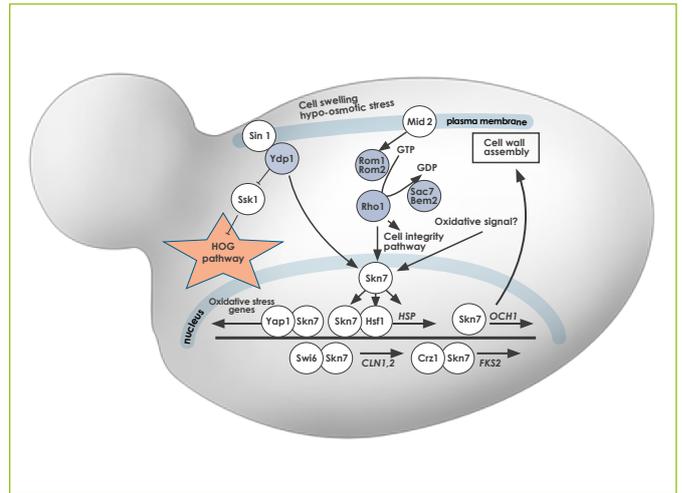


Fig. 6: The HOG metabolic pathway (high osmolarity glycerol) of *Saccharomyces cerevisiae*

| | White wine | Red wine |
|---|---|--|
| Three-part nutrient concept* | VitaDrive® F3: 30 – 40 g/100 L VitaFerm® Ultra F3: 30 g/100 L Vitamon® Liquid: Day 1 – 5: 30 mL/100 L Day 6: 20 mL/100 L Additional days: 15 mL/100 L (depending on fermentation progress) | VitaDrive® F3: 30 – 40 g/100 L VitaFerm® Ultra F3: 20 g/100 L Vitamon® Liquid: Day 1– 4: 20 mL/100 L Additional days: 15 mL/100 L (depending on fermentation progress) |
| Recommended fermentation temperature | 15 – 18 (20) °C | 25 – 33 °C |

* = Under extreme conditions we recommend increasing the VitaFerm® Ultra F3 dosage - see Oenoferm® LA-HOG product data sheet.

Background information

Background information on development of Oenoferm® LA-HOG special yeast

Our research is based on the Neuberger forms of fermentation, which have already successfully attempted to increase yeast's glycerol formation through external influences. We have been able to select a new, special yeast by transferring this concept to wine technology. It offers the customary usage properties of high-performance wine yeasts. The yeast's genetic stability and the formation of special aromas is another research success.

The complexity of the wine's aroma is promoted through moderate formation of succinic acid esters. In nature, mutagenesis and selection are routine evolutionary mechanisms. They ensure that living organisms adapt to changing environmental conditions and that a species consequently survives. By using these techniques it has been possible to accelerate this natural process when developing the yeast.



Fig. 7: Oenoferm® LA-HOG's development path through the various stages of mutagenesis and selection

The mutagenesis and selection stages have been specially developed in a patent-pending process (Patent WO/2016/128296). The selection stages are particularly important. First, the yeasts are selected under osmotic conditions with the help of sodium chloride (NaCl), after mutagenesis (EMS: ethylmethanesulphonate). Glycerol and alcohol formation were subsequently chosen as selection markers. The best strains from this selection were subjected to a second mutagenesis using sodium nitrite. The final selection was carried out using pyrazole, which blocks the alcohol dehydrogenase. Forty clones remain from more than 10,000. These were then tested in other trials (maximum glycerol, minimum alcohol formation, good fermentation

performance and optimum aromas) and finally reduced to five clones. The Oenoferm® LA-HOG yeast once again stood out from these clones, as the strain exhibited the best properties for both white and red wine making.

Further analysis using micro-array technology highlights the differences between Oenoferm® LA-HOG and the original, strongly fermenting strain used (Bayanus). As expected the genes in the HOG metabolic pathway have been affected.

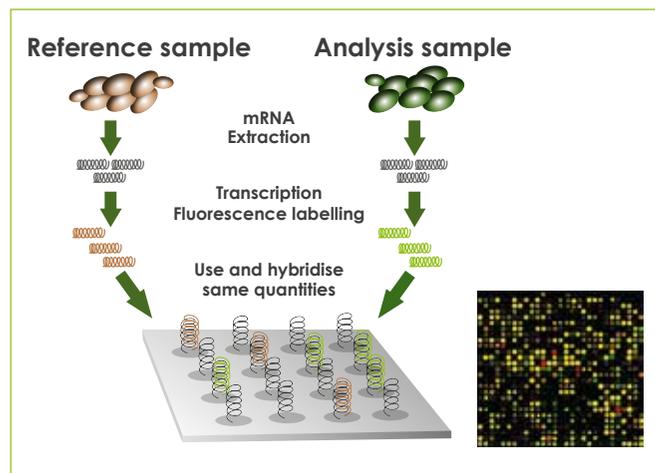


Fig. 8: Micro-array test to investigate the expression pattern of yeasts to be compared

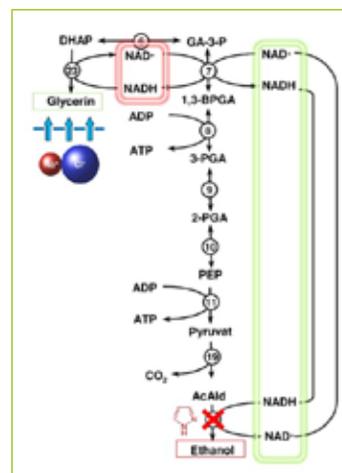


Fig. 9: Influence of evolutionary pressures on glycolysis and ethanol formation

This metabolic path normally uses the yeast only under highly osmotic conditions. In the process more glycerol is formed to equalise the pressure. This situation occurs particularly at the start of fermentation, when there are high sugar contents in the grape juice. In the case of Oenoferm® LA-HOG, glycerol formation is always active compared to other yeasts. It was possible to achieve an alcohol reduction of up

to 1.0% ABV and a glycerol formation of up to 15 g/L in various series of tests; these average values of course depend on the sugar contents present at the start. Depending on grape quality and fermentation progress a slight acetaldehyde note can emerge immediately after fermentation. This is degraded during maturation.

| Yeast | Glucose g/L | Fructose g/L | Alcohol g/L | Glycerol g/L | Acetic acid g/L | Malic acid g/L | Acetaldehyde mg/L | Succinic acid g/L |
|-------------------------|-------------|--------------|--------------|--------------|-----------------|----------------|-------------------|-------------------|
| Oenoferm® LA-HOG | 0.67 | 0.64 | 94.6 | 12.9 | 0.21 | 2.53 | 14 | 1.47 |
| Competitor | 0.84 | 0.86 | 99.7 | 8.7 | 0.25 | 2.48 | 16 | 1.35 |
| Reference | 0.59 | 0.68 | 102.4 | 6.4 | 0.26 | 2.58 | 15 | 0.98 |

Table: Analysis results for wines after alcoholic fermentation. Comparison of different yeasts with regard to alcohol formation. Pinot Noir 2016.

General requirements:

- Healthy grapes
- If the grapes are affected by fungi or molds at the start, use CarboTec GE and increase the quantity of yeast used (50 g/100 L) and VitaFerm® Ultra F3.
- Depending on the grapes' initial condition (variety, vintage, climatic conditions), we recommend must treatment with OenoPur or Erbslöh Mostgelatine - see technical data sheet at www.erbsloeh.com

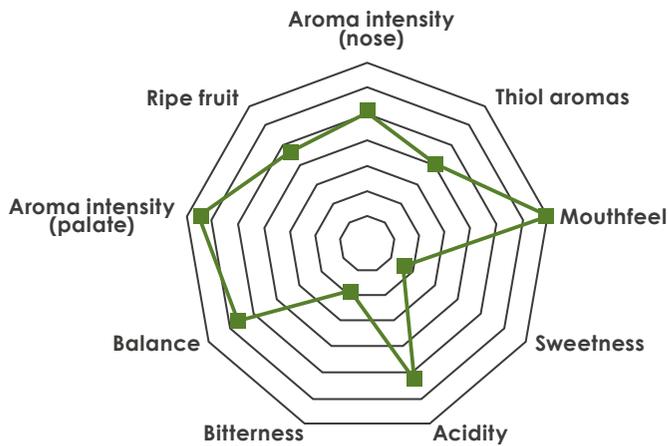


Fig. 3: Attributes of Oenoferm® LA-HOG

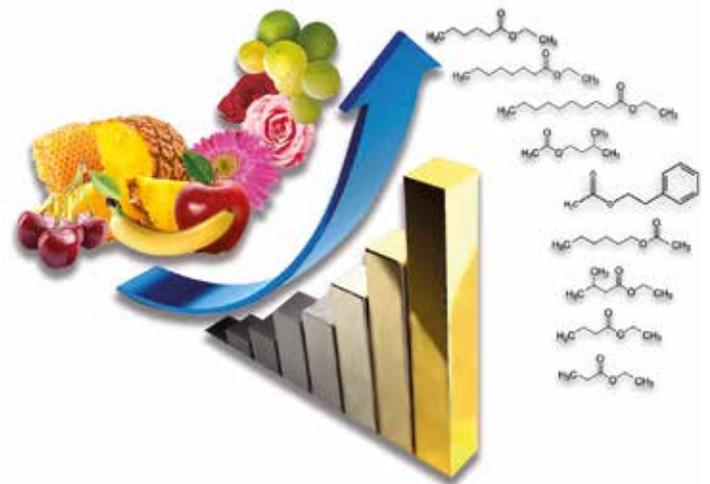


Fig. 4: Increase in fruit aromas through use of Erbslöh® LA-C in red and white wine

The Erbslöh® LA-C concept can be used for all grape varieties. It increases the intensity of the aroma and improves mouthfeel in fermented white and red wines. By reducing the alcohol content and balancing the wine, this complies with the current lifestyle trend towards light, fruity wines, with a moderate alcohol content, intense aromas and full body. These wines are ideal vinification cuvée partners.

The following yeasts are recommended for cuvée partner wines:

- Oenoferm® X-treme
- Oenoferm® X-thiol
- Oenoferm® PinoType
- Oenoferm® Color
- Oenoferm® Be-Red

Oenoferm® LA-HOG

Fermentation is possible even at low temperatures thanks to the yeast's fermentation strength. The grapes used should be healthy. If the grapes are suffering from fungal infestation, they should be treated beforehand with CarboTec GE. We generally recommend a yeast dosage of 30 - 40 g/100 L to achieve the desired results. If conditions are difficult the dosage must be adjusted to 50 g/100 L. Rapid onset of fermentation is very important for successful reduced alcohol and increased glycerol formation. This is shown by Erbslöh® LA-C.

The concept consists of a special yeast, Oenoferm® LA-HOG and a three-part nutrient concept (VitaDrive® F3, VitaFerm® Ultra F3 and Vitamon® Liquid). VitaDrive® F3 helps the yeast to optimally adjust during rehydration to must conditions and the technology. It provides an important supply of vitamins, sterols and unsaturated fatty acids during yeast reproduction. The availability of yeast's preferred amino acids (A group) should be highlighted, in addition to the balanced composition of the ingredients.

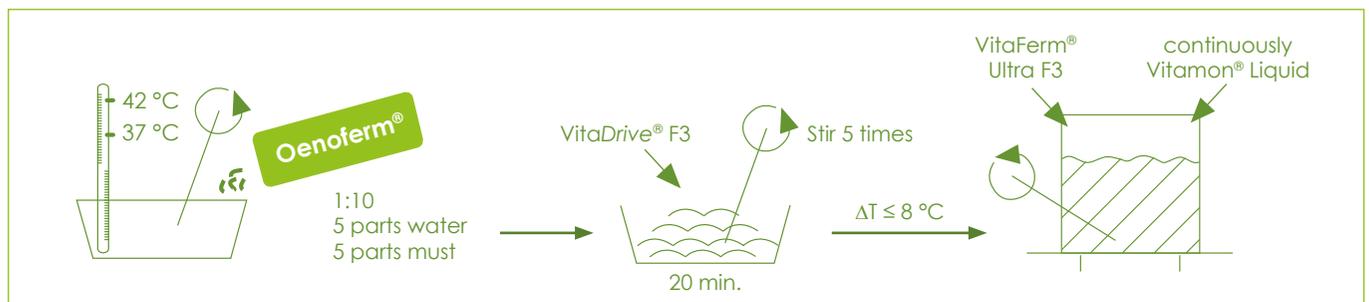
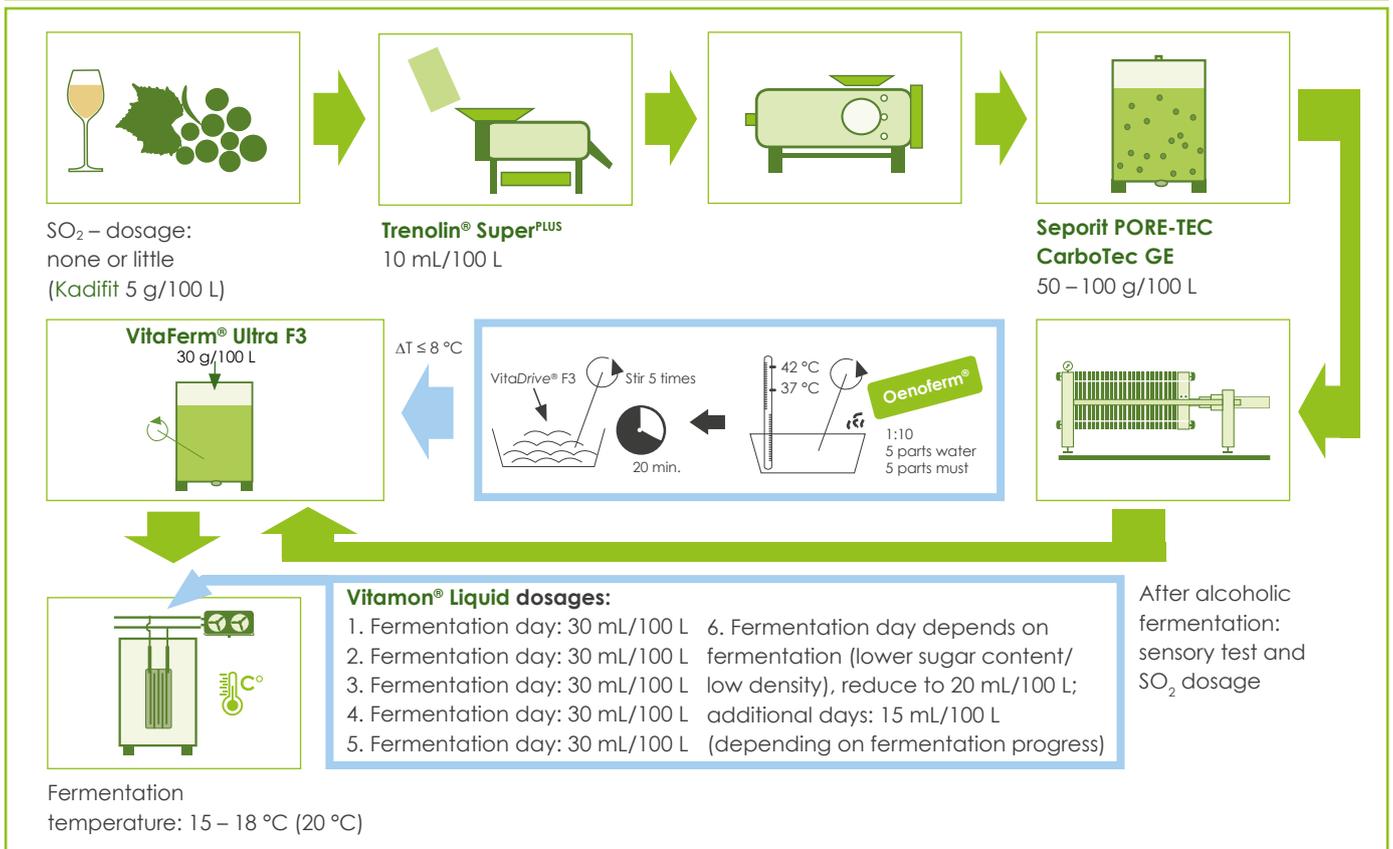


Fig. 5: Use of Oenoferm® LA-HOG, whilst retaining Erbslöh® LA-C

Protocol for using Erbslöh® LA-C with Oenoferm® LA-HOG

For white wine



For red wine

