SIHA®
yeast nutrient navigator

YEAST NUTRIENTS
Microbiological processes, like alcoholic fermentation, are dynamic because they are adapted to the laws of nature and change according to environmental factors. The situation is further complicated by the fact that microorganisms have very complicated metabolisms. This combination forces the wine and sparkling wine industry to face new challenges again and again.

A successful and complete alcoholic fermentation requires that the wine yeasts are still alive at the end of the fermentation process because they are the essential interface between grape must and wine. Nutrients available in adequate and sufficient form ensure their survival. Table 1 shows the main nutrients and their effect on wine yeasts.

<table>
<thead>
<tr>
<th>Nutrient Type</th>
<th>Yeast Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamins</td>
<td>Increases growth rate</td>
</tr>
<tr>
<td>Minerals</td>
<td>Provides enzyme co-factors</td>
</tr>
<tr>
<td>Nitrogenous compounds</td>
<td>“Multiplication motor” and increases amino acid metabolism</td>
</tr>
<tr>
<td>Lipids/sterols</td>
<td>Stabilizes cell membrane transport and increases cell growth</td>
</tr>
</tbody>
</table>

Table 1: Yeast nutrients in grape must and their effect on yeast cells
When it comes to yeast nutrients, grape must ingredients are still somewhat of a mystery. 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). Legislators are trying to compensate this poor knowledge through an approval procedure for yeast nutrient preparations.

### Legal Limits

**Nutrients in must**  
Knowledge of must ingredients available to the yeast  
Maximum legal limit

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Available nutrients available to the yeast</th>
<th>Maximum legal limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>To some extent, ammonium, amino acid spectrum</td>
<td>Wine production: DAHP 100 g/hl*</td>
</tr>
<tr>
<td>Vitamins</td>
<td>No</td>
<td>Sparkling wine production: DAHP 30 g/hl*</td>
</tr>
<tr>
<td>Minerals</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Unsaturated fatty acid</td>
<td>No</td>
<td>The addition of inactive yeasts, yeast autolysates, and yeast cell walls compensates the nutrient deficiency. Max. dosage: 40 g/hl</td>
</tr>
<tr>
<td>Sterols</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

*German law

### Yeast cell wall preparations

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

### Application

<table>
<thead>
<tr>
<th>Product</th>
<th>Available nutrients for the yeast cell</th>
<th>Timing of application for alcoholic fermentation</th>
<th>Effect on the alcoholic fermentation / yeast cells</th>
<th>Max. dosage*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIHA SpeedFerm</td>
<td>Inactive yeasts, Minerals</td>
<td>Timing of application for alcoholic fermentation</td>
<td>Improved rehydration, higher active yeast cell count up to the end of alcoholic fermentation, assured final fermentation</td>
<td>40 g/hl</td>
</tr>
<tr>
<td>SIHA PROFERM® Hs*</td>
<td>Active yeast, DAHP, vitamin B₁</td>
<td>Timing of application for alcoholic fermentation</td>
<td>Yeast nutrient for complete yeast nutrition, increased development of the yeast cell count at the beginning of alcoholic fermentation, reduction of off-flavors, assured final fermentation</td>
<td>40 g/hl</td>
</tr>
<tr>
<td>SIHA PROFERM® Plus</td>
<td>Hefeautolysate, DAHP, vitamin B₁,</td>
<td>Timing of application for alcoholic fermentation</td>
<td>Complete nutrition for the yeast cells, assured final degree of fermentation</td>
<td>40 g/hl</td>
</tr>
<tr>
<td>SIHA PROFERM® Fit</td>
<td>Inactive yeast cells</td>
<td>Timing of application for alcoholic fermentation</td>
<td>For the reductive development of white musts and white wine musts, enriched with tripeptides (glutathione), high antioxidation potential, freshness and longevity of white wines, protection against browning</td>
<td>40 g/hl</td>
</tr>
<tr>
<td>SIHA PROFERM® Red</td>
<td>Yeast autolysate</td>
<td>Timing of application for alcoholic fermentation</td>
<td>Stabilization of red wine color, increased yeast cell count, and assured final degree fermentation over a wide temperature range, the formation of aromas is promoted</td>
<td>40 g/hl</td>
</tr>
<tr>
<td>SIHA PROFERM® Bio</td>
<td>Yeast cell wall</td>
<td>Timing of application for alcoholic fermentation</td>
<td>Certified organic yeast cell wall preparation, high yeast cell count, assured and clean fermentation, selective adsorption of medium-chain fatty acids (fermentation inhibition)</td>
<td>40 g/hl</td>
</tr>
<tr>
<td>SIHA Gärnlux DAP</td>
<td>DAHP</td>
<td>Timing of application for alcoholic fermentation</td>
<td>Fast yeast reproduction at the beginning of alcoholic fermentation</td>
<td>100 g/hl</td>
</tr>
<tr>
<td>SIHA Gärnlux DHP</td>
<td>DAHP, vitamin B₁, cellulase</td>
<td>Timing of application for alcoholic fermentation</td>
<td>Fast yeast reproduction in particular for highly pre-clarified musts (NTU &lt;10)</td>
<td>50 g/hl</td>
</tr>
<tr>
<td>SIHA Gärnlux DNP</td>
<td>DAHP, vitamin B₁, cellulase</td>
<td>Timing of application for alcoholic fermentation</td>
<td>Fast yeast reproduction at the beginning of alcoholic fermentation</td>
<td>100 g/hl</td>
</tr>
<tr>
<td>SIHA Vitamin B₁ (Sticks oder Pulver)</td>
<td>vitamin B₁</td>
<td>Timing of application for alcoholic fermentation</td>
<td>Reduction of the formation of SO₂ bond partners (ascorbaltdehyde, alpha-ketoglutarate and pynucate), particularly for grapes affected by botrytis</td>
<td>60 mg/hl</td>
</tr>
</tbody>
</table>

*German law

### Nutrient Availability

- **Minerals:**
  - Nitrogen: To some extent, ammonium, amino acid spectrum
  - Vitamins: No
  - Minerals: No
  - Unsaturated fatty acid: No
  - Sterols: No

**Nutrient Table:**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Max. dosage*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>100 g/hl</td>
</tr>
<tr>
<td>Vitamins</td>
<td>60 mg/hl</td>
</tr>
<tr>
<td>Minerals</td>
<td>40 g/hl</td>
</tr>
<tr>
<td>Unsaturated fatty acid</td>
<td>40 g/hl</td>
</tr>
<tr>
<td>Sterols</td>
<td>40 g/hl</td>
</tr>
</tbody>
</table>

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**Table 2: Yeast nutrients and maximum legal limits**  
DAHP = diammonium hydrogen phosphate
A measurable indicator for the alcoholic fermentation is free assimilable nitrogen (FAN). It is the sum of ammonia and amino acids (without Proline) in grape musts. Table 3 shows how much additional nitrogen is necessary to guarantee a complete alcoholic fermentation considering FAN and sugar concentration.

Example:
If FAN in grape must is between 121 and 150 mg/l at a sugar concentration of ≤ 95 °Oe, the addition of 40 mg/l free assimilable nutrient is necessary.

Complex yeast nutrients
The opposite of anorganic fermentation salt, such as ammonium (in the form of ammonium salts) complex yeast nutrients helps to fulfill the complete yeast nutritional demand.
Therefore, especially at low nutrient concentration in grape musts, Eaton recommends complex yeast nutrients.

Benefits:
• Better fermentation performance
• Better stress tolerance
• Better aroma liberation (fermentation bouquet, off-flavors)

Individual yeast nutrients
Fermentation salt, like DAHP or ammonium salts in general, reduction in the formation of off-aroma reduces the production of higher alcohols (fruity aroma and fermentation bouquet), but cannot ensure the sufficient nutrition of the yeasts until the end of the alcoholic fermentation.

<table>
<thead>
<tr>
<th>FAN classes in grape musts</th>
<th>Must quality</th>
<th>90 – 120 mg/l</th>
<th>121 – 150 mg/l</th>
<th>151 – 180 mg/l</th>
<th>181 – 210 mg/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional, free assimilable nutrient dosage</td>
<td>≤ 95 °Oe</td>
<td>70 mg/l</td>
<td>40 mg/l</td>
<td>20 mg/l</td>
<td>0 mg/l</td>
</tr>
<tr>
<td></td>
<td>95 – 102 °Oe</td>
<td>100 mg/l</td>
<td>70 mg/l</td>
<td>40 mg/l</td>
<td>20 mg/l</td>
</tr>
<tr>
<td></td>
<td>13 – 14% alcohol by volume</td>
<td>130 mg/l</td>
<td>100 mg/l</td>
<td>70 mg/l</td>
<td>40 mg/l</td>
</tr>
<tr>
<td></td>
<td>≥ 102 °Oe</td>
<td>130 mg/l</td>
<td>100 mg/l</td>
<td>70 mg/l</td>
<td>40 mg/l</td>
</tr>
</tbody>
</table>

Table 3: Guideline for free assimilable nutrient dosage with respect to FAN and sugar concentration