

ENARTIS NEWS

FAQ ON YEAST NUTRITION

Yeast nutrition is an essential factor in managing the overall health and success of fermentations. Without proper nutrition introduced at the right stage of its growth cycle, yeast can face stress and produce undesirable characteristics. Stuck or sluggish fermentations are also hazards of poor yeast nutrition.

WHAT ARE YEAST NUTRITIONAL NEEDS?

Yeast requires Assimilable Nitrogen (YAN), vitamins, mineral salts, sterols and long-chain, unsaturated fatty acids to succeed at fermentation (Table 1). The quantity and quality of these compounds play an essential role in yeast metabolism, fermentation kinetics and the organoleptic profile of wine.

- YAN is necessary for yeast growth, protein, cell wall components, enzyme synthesis and sugar transport.
- Vitamins (thiamine, biotin, pantothenic

acid, niacin etc.) have a role in cell growth, fermentation activity and nitrogen metabolism. Deficiencies may result in slow yeast growth and stuck fermentations.

- Minerals impact yeast fermentative metabolism. Magnesium and zinc, for example, are involved in sugar catabolism, have a key role in ATP synthesis and improve yeast's ability to withstand stress conditions.
- Sterols and unsaturated fatty acids are essential for maintaining cell membrane integrity and yeast's capability to regulate exchanges with the external environment. Low levels of sterols and unsaturated fatty acids can stop yeast sugar consumption, cause stuck fermentations and increase off-flavour production.
- Oxygen is necessary for sterols and unsaturated fatty acid synthesis by the yeast. In anaerobiosis, yeast is unable to synthesize these compounds. That is why oxygen is considered a nutrient in all respects.

Table 1: yeast nutrient requirement

| Nutrient | Biochemical function | Timing of addition |
|-------------------------|--|---------------------|
| Thiamine | Stimulate yeast multiplication Reduce production of SO ₂ binding compounds | Yeast inoculation |
| Mg, Zn | Cofactors for glycolytic enzymes Reduce yeast stress | Yeast inoculation |
| Amino acids | Stimulate yeast multiplication Maintain active yeast metabolism Enhance aroma production | Yeast inoculation |
| Ammonium | Stimulate yeast multiplication Maintain active yeast metabolism Enhance aroma production | 1/3 sugar depletion |
| Sterols and fatty acids | Increase membrane permeability and tolerance to alcohol | 1/3 sugar depletion |
| Oxygen | Increase production of lipids and sterols Stimulate yeast multiplication | 1/3 sugar depletion |

WHAT IS YEAST ASSIMILABLE NITROGEN (YAN)?

Yeast Assimilable Nitrogen (YAN) is composed of ammonium ions and alpha amino acids. It is used by yeast for the synthesis of proteins, cell wall components and enzymes.

- Ammonium ions are fast and preferentially assimilated by yeast; throughout fermentation ammonium is the primary form of nitrogen used by yeast.

- Amino acids are a more efficient form of nitrogen for cell metabolism and aromatic production than ammonia. Yeast uses them as a source of nitrogen and to synthesize esters and acetates. Their transport into yeast cells is inhibited by ethanol and/or ammonium.

A balanced diet of organic nitrogen, inorganic nitrogen, vitamins and minerals produce healthier fermentations with better aromatics and fewer off-flavors.

HOW MUCH YAN IS NEEDED?

The range of YAN in grapes can vary depending on the vintage conditions, vineyard practices and grape variety. Generally, to build up a sufficient yeast biomass for fermentation, a minimum YAN of 150 mg/L is required.

The initial sugar content and initial YAN of juice are essential to determine the proper nutrition supplementation. The higher the initial sugar concentration, the more YAN is required to complete the fermentation.

BETTER TO PROVIDE NITROGEN FRACTIONED OR IN ONE SOLUTION?

Supplying a big quantity of nitrogen at the time of inoculation can stimulate an excessive multiplication of the yeast and consequently cause both an overall increase in nitrogen requirements and an increase in temperature that, if not adequately controlled, can cause stuck fermentation.

WHAT NITROGEN FORM TO PROVIDE AND WHEN?

Yeast benefits from a mix of different nutrient sources; the use of both organic and inorganic nitrogen is the best guarantee for healthy growth and

performance. Organic nitrogen intake is inhibited by inorganic nitrogen and it is for this reason that amino acids must be provided separately from inorganic nutrients. Additionally, organic nitrogen intake is very difficult when alcohol content is above 4% – this is the reason why we advise on adding amino acids at the beginning of alcoholic fermentation. For optimum results, nutrients high in amino acids should be added at the time of yeast inoculation and nutrients high in inorganic nitrogen, only after a 3 Brix drop or 24-48 hours. Similarly, inorganic nutrients are the most accessible source of nitrogen when alcohol levels are above 4%.

WHY ADD ORGANIC NITROGEN?

Organic nitrogen is more nutritional for yeast than ammonium because amino acids can be used as they are without requiring energy consumption for their synthesis. When feeding yeast with amino acids, the resulting wine has a lower content of volatile acidity, H₂S and acetaldehyde while it is richer in esters and higher alcohols (Graph 1). In particular, the so-called branched-chain amino acids – valine, leucine, isoleucine, phenylalanine, threonine – stimulate the synthesis of the correspondent higher alcohols and esters (Table 2) via the catabolic pathway proposed a century ago by Ehrlich. As a result, the wine has a more intense fruity and floral aroma.

Graph1: Impact of organic nitrogen on the production of aromatic compounds

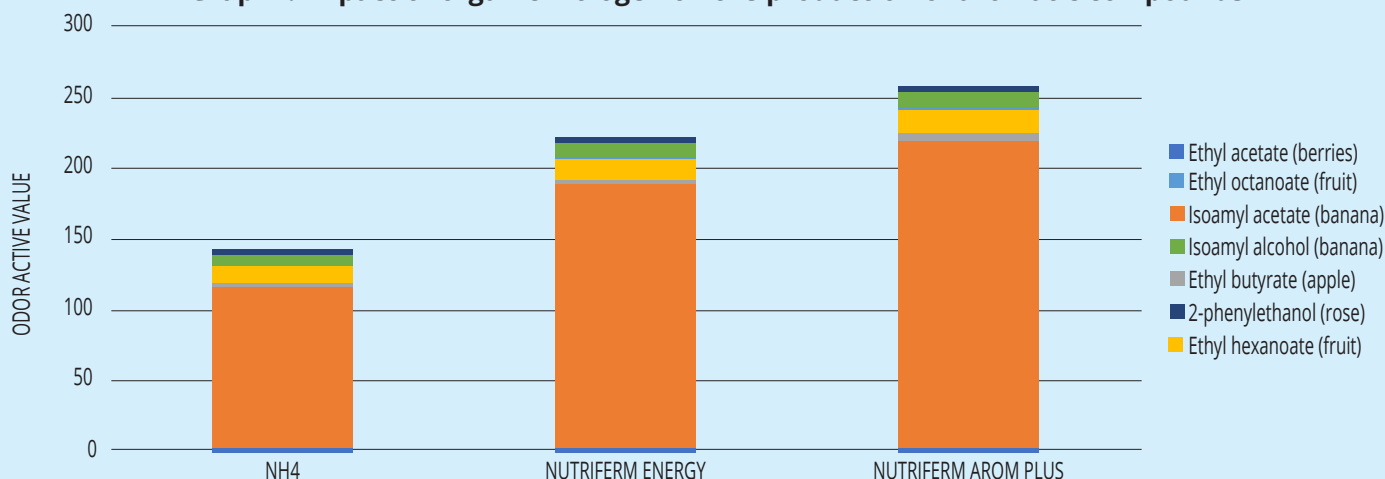


Table 2: Branched-chain amino acids influence on higher alcohol and ester production

| BRANCHED-CHAIN AMINO ACID | RESULTING HIGHER ALCOHOL | AROMA | RESULTING ESTER | AROMA |
|---------------------------|--------------------------|-----------------------|-----------------------|--------------|
| Leucine/isoleucine | Isoamyl alcohol | Marzipan | Isoamyl acetate | Banana, pear |
| Phenylalanine | 2-phenylethyl alcohol | Floral | 2-phenylethyl acetate | Rose, floral |
| Threonine | Propanol | Fruit, sweet, pungent | | |
| Valine | Isobutyl alcohol | Alcoholic | Isobutyl acetate | Banana |

WHEN IS THE BEST TIME FOR ADDING NUTRIENTS?

- **Growth phase:** yeast requires vitamins, minerals and nitrogen to build 'healthy' cells resistant to stress. Due to the inhibiting effect of alcohol and/or ammonium ions, amino acids should be added at inoculation.
- In case of severe nitrogen deficiencies, juice must to be corrected by an addition of ammonium ions **24-48 hours after inoculation.**
- **At 1/3 of fermentation,** yeast becomes stressed and its capacity to use nitrogen is reduced. To complete fermentation and increase its alcohol resistance, it needs fast and easy-to-adsorb sources of nitrogen like ammonium ions, and survival factors (sterols and unsaturated fatty acids) with oxygen.

WHICH OTHER FACTORS SHOULD BE CONSIDERED REGARDING YEAST NUTRITION?

- **Fermentation temperature:** high temperature stimulates yeast growth and fermentation rate, thereby requiring increased levels of nitrogen, sterols and fatty acids. Low temperature decreases yeast's ability to synthesize unsaturated fatty acids that must be provided through yeast derivatives addition.
- **Turbidity:** in whites and rosés, juice clarification eliminates some nutrients, sterols and fatty acids essential for yeast survival. If the turbidity after clarification is below 80 NTU, the addition of a nutrient based on yeast derivative is recommended.
- **Health status of the grapes:** fruit affected by mold requires more amino acids and vitamins than healthy fruit.
- **Yeast strains:** each yeast strain has specific nutritional requirements. To calculate the actual needs of a chosen strain, you can use the following guidelines and table:
 - Low nitrogen requiring strains: $\text{sugar (g/L)} \times 0.75$
 - Medium nitrogen requiring strains: $\text{sugar (g/L)} \times 0.9$
 - High nitrogen requiring strains: $\text{sugar (g/L)} \times 1.25$

ENARTIS NUTRIENTS

Enartis has a wide range of nutrients which provide solutions for various conditions and purposes.

Nutrifer Energy provides **quickly-absorbed amino acids, vitamins** and **minerals** necessary for proper yeast development. It makes yeast stronger and more resistant to difficult conditions, prevents

off-flavors forming and stimulates the production of compounds such as glycerol and polysaccharides.

Nutrifer Arom Plus contains a high content of **moderately-absorbed amino acids**, selected for their aromatic precursors potential, **vitamins** and **minerals**. It stimulates yeast multiplication, enhances fermentation aroma production and increases aromatic intensity.

Nutrifer Bianco is more than a nutrient. It is a complex containing **DAP, thiamine, mannoproteins** and **gallic tannin**. One product simultaneously ensures a steady fermentation and better wine stability.

Nutrifer WM is dedicated to the wineries that struggle in managing the addition of multiple products during red and rosé vinification. Its composition based on **DAP, inactivated yeast** and **thiamine** offers all the essential elements for yeast metabolism while **condensed tannin** and **mannoproteins** improve wine color stability and overall quality.

Nutrifer Vit is a nutrient containing **ammonium sulfate, DAP** and **thiamine**. It ensures a healthy fermentation and good cell growth. For the yeast to assimilate amino acids from the must and organic-based rehydration/inoculation nutrients, it is advised to use Nutrifer Vit at least 24h after inoculation.

Nutrifer Special is a complex nutrient containing **inactivated yeast, ammonium phosphates** and **thiamine**. It provides the necessary vitamins, ammonium, sterols and fatty acids creating a healthy environment for the yeast population to grow, produce aromas and no off-flavors.

Green Nutriente nutritional supplement made of organic certified inactivated yeast. It provides physical support to the fermenting cells, helping CO₂ liberation and absorbing toxic compounds present in the juice or produced during the fermentation.

Nutrifer No Stop is a fermentation aid made of inactivated yeast rich in **sterols** and **long-chain fatty acids**. It has a detoxifying action, helps maintain yeast membrane integrity, and prevents and corrects fermentation irregularities.

NUTRIFERM GRADUAL RELEASE - NEW

This blend of DAP and tannin is contained in a special bag that gradually releases its content during fermentation. Nutriferm Gradual Release is to be added before the filling of the fermentation tank but it will start to release its content only at the end of the exponential growth phase of the yeast. By using Nutriferm Gradual Release, the second addition of nutrient is not necessary and its formulation guarantees a complete fermentation

and the prevention of the reductive character. Nutriferm Gradual Release can also be used in the production of sparkling wine with the Charmat method, where it avoids the need for the addition of nutrient after the closure of the pressure tank.

Application: yeast nutrition; second fermentation in pressure tank.

Packaging: 5 kg bag for 250-500 hL

Table 3: Enartis nutrients guide table

| | NUTRIFERM AROM PLUS | NUTRIFERM ENERGY | NUTRIFERM SPECIAL | NUTRIFERM BIANCO | NUTRIFERM WM | NUTRIFERM VIT | NUTRIFERM GRADUAL RELEASE | GREEN NUTRIENTE | NUTRIFERM NO STOP |
|--|---|--|---------------------------------|--|--|---|--|--|---|
| APPLICATION | Supply of precursors for the synthesis of fermentation aromas | Reinforce fermentation capacity of yeast | Balanced and complete nutrition | Complete yeast nutrition, juice protection and stabilization | Complete yeast nutrition, juice protection and red color stabilization | Basic nitrogen nutrition | Help for a complete and clean fermentation | Detoxification of must | Prevention and treatment of stuck fermentation |
| NITROGEN FROM AMINO ACIDS | ★★★★★★ | ★★★★ | ★★ | ★ | ★ | | | | |
| INORGANIC NITROGEN | | | ★★★ | ★★ | ★ | ★★★★★★ | ★★★★ | | |
| AROMATIC PRECURSORS | ★★★★★★ | ★★★ | ★ | ★ | ★ | | | | ★ |
| STEROLS & FATTY ACIDS | ★★★ | ★★★★ | ★★ | ★★ | ★ | | | ★★★ | ★★★★★★ |
| MINERALS | ★★★ | ★★★ | ★★ | ★ | ★ | | | | ★★ |
| VITAMINS | ★★★ | ★★★★ | ★★ | ★★ | ★ | ★ | | | ★★★ |
| TANNINS | | | | ★ | ★★ | | ★ | | |
| SULFATE | No | No | No | No | No | Yes | No | No | No |
| ADSORPTIVE EFFECT | ★★★★ | ★★★★ | ★★★ | ★★ | ★ | | | ★★★★ | ★★★★ |
| TIMING OF ADDITION | Yeast inoculation | Yeast inoculation | Yeast inoculation | Yeast inoculation | Yeast inoculation | Yeast inoculation or starting from 24 hrs after organic nitrogen addition | Before filling the fermentation tank | Any time during fermentation and in case of sluggish or stuck fermentation | Second half of fermentation and in case of sluggish or stuck fermentation |
| RECOMMENDED DOSAGE | 15-30 g/hL | 10-30 g/hL | 30-50 g/hL | 30-50 g/hL | 30-50 g/hL | 10-30 g/hL | 20 g/hL | 10-40 g/hL | 20-40 g/hL |
| MAXIMUM LEGAL DOSAGE (EU REGULATION) | 40 g/hL | 40 g/hL | 60 g/hL | 60 g/hL | 60 g/hL | 40 g/hL | 110 g/hL | 40 g/hL | q.s. |
| SUITABILITY FOR ORGANIC WINE (EU REGULATION) | Yes | Yes | Yes | Yes | Yes | No | Yes | Organic certified | Yes |