Yeast nutrition & organic supplementation

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Yeast demand for nitrogen

The nitrogen sources that can be used by *Saccharomyces cerevisiae* are ammonium (NH4+) and amino acids (organic nitrogen). They both represent assimilable nitrogen and are present in must at varying concentrations, sometimes not in sufficient quantities to meet the requirements of the yeast. The three following factors must be taken into consideration:

- Below 150 mg N/L, must is deficient. It is therefore important to supplement it with nitrogen elements.
- Yeast nitrogen requirements depend on sugar concentration. The higher this concentration, the greater the amount of yeast biomass needed to successfully achieve a thorough breakdown of the sugars during alcoholic fermentation. Although, the yeast biomass must not be too excessive to avoid an induced nitrogen deficiency.
- The nitrogen initially present in must is rapidly assimilated during the first third of the alcoholic fermentation (d-30), at the point when the biomass is at its highest density. Consequently, irrespective of the initial nitrogen content, its addition during alcoholic fermentation (d-30) allows to preserve the biomass formed, which is dependent on the yeast strain and proportional to the initial nitrogen concentration.

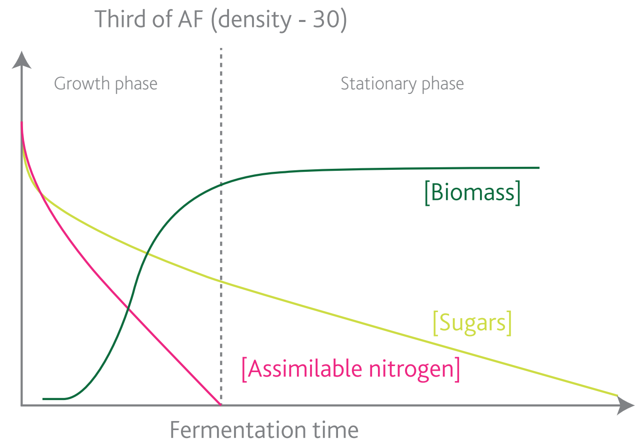


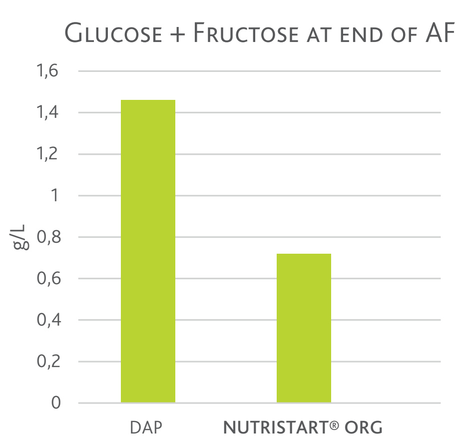
Figure 1: Assimilation of nitrogen and production of biomass during alcoholic fermentation.

Why organic nutrition?

Organic nitrogen is supplied by adding yeast derivatives (usually autolysed yeast). In addition to amino acids, these yeast derivatives include lipids, vitamins and minerals which also contribute to the efficient performance of the yeast.

Yeast has the ability to simultaneously assimilate organic nitrogen and mineral nitrogen from the beginning of the alcoholic fermentation. Organic nitrogen must be present in order to:

- Limit the production of SO_2 and sulphur compounds (H_2S and mercaptans).
- Produce healthy, but not excessive, biomass.
- Limit the risk of stuck or sluggish fermentation.



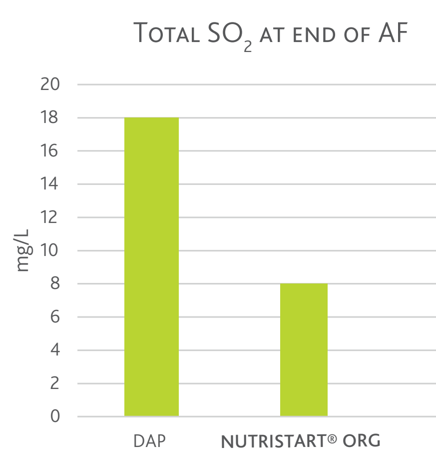


Figure 2: Concentrations of Glucose + Fructose and total SO_2 at the end of alcoholic fermentation. Must derived from sauvignon blanc (TAP vol. 13.9%, initial Nass: 125 mg N/L), 2016. At the one-third point of alcoholic fermentation, 35 mg N/L were added with DAP or **NUTRISTART® ORG**, deliberately making yeast conditions difficult.

By carrying out an extensive study on **NUTRISTART® ORG**, we were able to learn about this product's subtle composition after developing specific assay methods (Figure 3).

LIPIDS	Palmitic acid (C16:0), Stearic acid (C18:0), Palmitoleic acid (C16:1), Oleic acid (C18:1), Squalene, Zymosterol, Lanosterol, Ergosterol
AMINO ACIDS	ASP, GLU, CYS, ASP, SER, GLN, GLY, THR, ARG, ALA, GABA, TYR, ETN, VAL, MET, TRP, PHR, ILE, LEU, ORN, LYS
VITAMINS	Para aminobenzoic acid, Pyridoxine, Riboflavin, Biotin, Pantothenic acid
MINERALS*	Mg, Ca

Figure 3: Elements detected in NUTRISTART® ORG.
* Other minerals are in the process of being assayed.

An experiment design setting up models for 58 trials and omitting various compounds was then carried out to discover the impact of these various nutrients on alcoholic fermentation.

COMPOUNDS INCREASING THE MAXIMUM YEAST POPULATION DURING AF*	COMPOUNDS REDUCING THE LAG PHASE LENGTH OF AF	COMPOUNDS INCREASING THE MAXIMUM RATE OF AF
ASP	CYS	ABA
ARG	GABA	ARG
C18	GLN	ASN
C18:1	GLY	ORN
Calcium	Pyridoxine	Lanosterol
GLU	TRP	
Lanosterol	VAL	
Riboflavin		

Table 1: Effect of the various constituents of NUTRISTART® ORG on alcoholic fermentation parameters (Results obtained following a statistical analysis based on a multiple linear regression and a Kruskal-Wallis test – methods performed according to a Hadamard experiment design).
**Nutrition must enable an optimum, but not excessive, population to be attained.*

Our latest research shows that not all of the constituents have the same effect on yeast and alcoholic fermentation. We will continue with this study in order to have a detailed understanding of the role of each constituent.

ORGANOLEPTIC EFFECTS OF ORGANIC NUTRITION

Numerous experiments show that improved outcomes of alcoholic fermentation can be achieved with the use of organic nitrogen. Even in the case of wines considered dry (glucose + fructose < 2 g/L), small amounts of fermentable sugars can be used by degrading microorganisms and can have an adverse effect on the quality of the wines (Figure 2).

Besides its effects on fermentation kinetics, the addition of oragnic nitrogen can increase the fruitiness of wines and limit the aromatic mask linked to the production of sulphur compounds during the alcoholic fermentation.

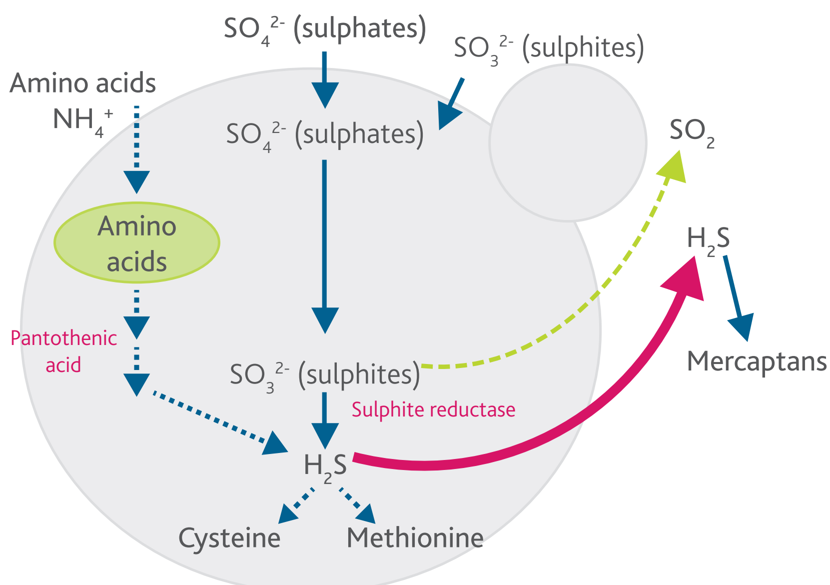
Except for the source of the nitrogen added, a comparison of wines produced under the same conditions reveals significant preferences for wines derived from musts supplemented with **NUTRISTART® ORG** (table 2). The wines are considered fruitier, fresher, less vegetal and subject to less reduction than those supplemented with mineral nitrogen alone.

	Mineral / Organic Comparison
Number of tasters	20
Number of correctly detected differences	13
Results	99% significant difference
Preference	Organic: 13/13

Table 2: Triangular tasting tests (ISO 4120-2004) of red wines. Comparison of two vinified Merlot wines with 65 mg N/L nitrogen added in the form of THIAZOTE® or NUTRISTART® ORG.

Did you know?

The key enzyme in the production of H_2S is sulfate reductase. When the H_2S and amino acids pathways meet the sulphur amino acids (cysteine and methionine) are produced. Where there is an imbalance between these two pathways and a nitrogen deficiency, the precursors of these sulphur amino acids are limiting, leading to an accumulation of H_2S.



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1460 Cader Lane, Suite C - Petaluma, CA 94954 - P: (707) 775-4530

laffortusa@laffort.com - www.laffortusa.com