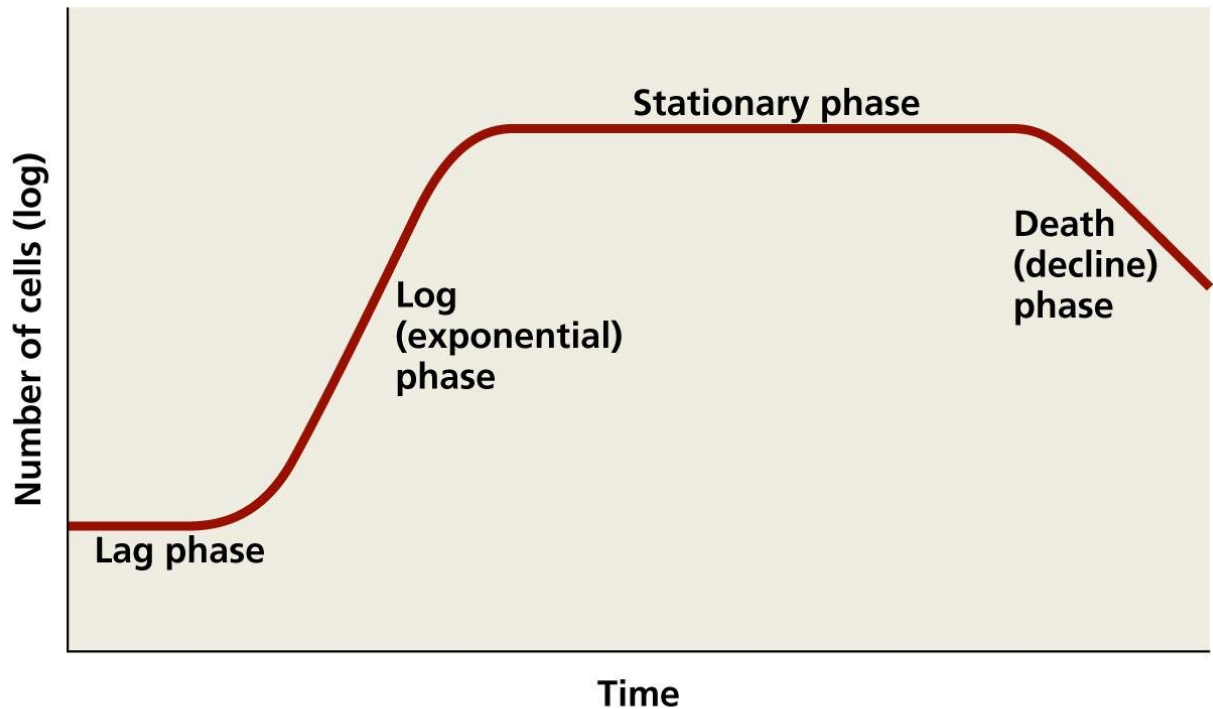


Feed Your Yeast: Managing YAN in Fermentations

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Yeast life cycle:

Phase	Time	Cell Activities	Nutrient Needs
Lag	6-25 hrs.	Acclimation, cell wall formation	Nitrogen, Oxygen, micronutrients
Log	12-48 hrs.	Rapid multiplication; biomass formation; alcohol production begins at end of log phase	Nitrogen, sterols for cell wall repair
Stationary	varies	Cell metabolism, protein repair, kinetic control; yeast will take up sugar, but biomass growth stops	Amino acids to aid in sugar uptake (at less than 10 °Brix)
Death	varies	Cell metabolism, protein repair	(none)

Types of Yeast Assimilable Nitrogen (YAN)

1. **Ammonium (AMM)**, NH_4 , also called ammonia or inorganic nitrogen

2. **Amino Acids**, also called Free Amino Nitrogen (FAN), Primary Amino Nitrogen (PAN), α -amino acids, or organic nitrogen

- 20 Amino acids are found in grape juice and must; all but proline can be used for yeast metabolism

- Arginine and proline make up around 50% of the PAN in grapes

YAN concentration and needs

- YAN concentration in grapes varies by cultivar, site, climate, and year. It is impossible to predict through vineyard measures such as petiole analysis. The only way to accurately predict juice or must YAN is to measure it spectrophotometrically using enzyme test kits for ammonia and NOPA.

- Higher sugar content results in higher YAN needs.

- Different yeast strains have varying nitrogen needs; most are ranked as high, medium, or low in vendor catalogs.

Nitrogen supplementation

1. Diammonium phosphate (DAP) is a source of inorganic nitrogen (AMM). It's cheap, but is consumed rapidly by yeast, creating a rapid population boom, increase in fermentation temperature, and subsequent rapid cell death.

2. Complex nutrients include amino acids, thiamine, micronutrients, and sometimes DAP. The additional ingredients help yeast metabolize YAN more slowly and sustainably. Complex nutrients are more expensive, but they help control yeast kinetics and increase aromatic complexity.

What supplement to use when

When	What	Why
Yeast rehydration	Rehydration nutrient (and ONLY rehydration nutrient)	Allows yeast cells to amplify protection factors that will last throughout fermentation. Especially important with low turbidity juices, high ethanol fermentations, and low temperature fermentations.
End of lag phase	Complex nutrients (if needed)	In addition to nitrogen, provides sterols and micronutrients needed to maintain cell function
1/3 sugar depletion (early stationary phase)	Complex nutrients; DAP if needed to bring YAN to required total concentration	Amino acids and micronutrients allow continued cell maintenance and sugar uptake

In summary:

1. Yeast cannot live on DAP alone.
2. Initial YAN measurements are essential for appropriate additions. Excess additions will leave nutrients in the must following fermentation, providing fertile ground for invading microbial spoilage.
3. Strategically-timed nitrogen additions improve yeast health and wine quality.
4. Consult your yeast vendor with questions about specific products.

References:

Yeast Nutrients and Protection for Reliable Alcohol Fermentation: The State of the Art. Lallemmand.

<http://www.lallemmandwine.com/en/north-america/expertise-innovation/expertise-documents/>

Brix	Nitrogen req.
20°	150 mg/L
21°	200 mg/L
23°	250 mg/L
25°	300 mg/L
27°	350 mg/L