Yeast assimilable nitrogen (YAN) and Nutrition

Nitrogen is the main growth factor present in grapes for yeast growth and fermentation, and can impact the production of aroma compounds. Its deficiency can lead to the production of hydrogen sulphide (H_2S) and stuck or sluggish fermentations (Jiranek et al 1995). Yeast require nitrogen for cell growth and efficient fermentation. In the first third of fermentation the yeast will build in biomass sufficient to metabolise the level of sugar present. Yeast biomass is also impacted by whether the strain has a high or low nitrogen requirement. Yeast assimilable nitrogen (YAN) can be found in two forms; mineral or organic. In grapes, mineral nitrogen makes up one third of the total nitrogen, whilst the organic fraction makes up two third to three quarters of the grape derived of YAN.

Why measure YAN?

Getting an indication of vineyard nutrition deficiencies enables a winemaker to avoid dealing with stuck and sluggish fermentations. It also allows the winemaker to prevent H_2S formation and maximise fruity aromas in the final wines. YAN can be measured enzymatically to give an absolute result. YAN is a measurement of ammonia nitrogen (FAN) and primary amino nitrogen (PAN). A DAP addition represents a mineral nitrogen or an ammonia addition, but not organic or amino nitrogen. Hydrogen sulphide production is linked to a deficiency in amino or organic nutrition, whereby timing of addition is critical.

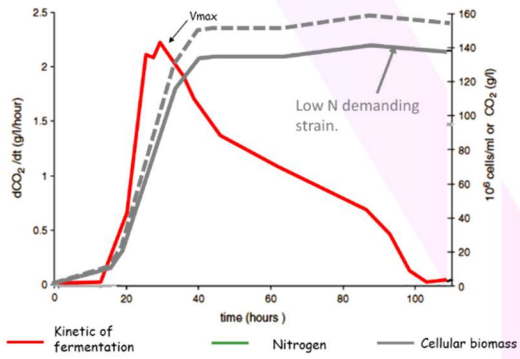

Figure 1. Assimilation of N and production of biomass for a high and a low N demanding strain during alcoholic fermentation. Personal communication Marina Bely, University of Bordeaux

Take home points

Measure YAN in must and supplement nitrogen in both organic and inorganic forms accordingly. Critical points in alcoholic fermentation are:

- Nitrogen supplementation #1 within 24 hours of yeast inoculation.
- Nitrogen supplementation #2 at one third of the way through alcoholic fermentation.
- In most cases, a nitrogen content of below 150 mg N/L is considered deficient.
- The higher the potential alcohol, the more nitrogen is required to achieve the correct biomass
- Strain selection appropriate to must.
- Water additions will minimise the amount of alcohol produced by reducing the concentration of sugars present, but will also dilute key nutrients and lipids important for yeast cell membrane structure.
- Yeast rehydration nutrients high in ergosterol and use of oxygen in the yeast exponential growth phase are especially critical in high alcohol red wines to ensure alcoholic fermentation completes.
- Fructose is the predominant sugar in a stuck fermentation. Must detoxification and dealcoholisation will not change the high proportion of fructose (relative to glucose) remaining in a stuck fermentation.
- Restarting a stuck or sluggish alcoholic fermentation requires a yeast strain which possesses at least one if not two copies of the HXT3 transporter that has a higher affinity for fructose like Actiflore® BO213 from Laffort.
- The best way to avoid stuck and sluggish fermentations from happening is by addressing the must before fermentation has commenced by rehydrating the yeast with rehydration factors and oxygen, providing oxygen in the yeast log phase.

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