Chemical markers in wine related to low levels of yeast available nitrogen in the grape: Effect of yeast strains.

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Objectivs

Nitrogen contents of grapes has an important effect on wine quality. In a previous report, we proposed four chemical markers to relate wine quality defects to low levels of yeast available nitrogen (YAN) in grapes. The concentrations of these markers (2-phenylethanol (PhEtOH), 2- plus 3-methylbutanol (2,3-MeBuOH), succinic acid and proline) in the wine show good correlations with YAN content in the grape juice. To avoid sluggish fermentations, winemakers can supplement grape must with nitrogen in the cellar and choose adequate yeast strains. The purpose of this work was to study the effect of these oenological practices on the proposed chemical markers in wine.

Figure 1: Fermentation experiences of Chasselas must (YAN = 95 mgN/L) using different yeast strains (*Sacch. cerev.*) without (Control) and with 200 mgN/L $(NH_4)_2HPO_4$ supplementation.

I. Fermentation kinetics of must

Considering fermentation kinetics of must (Control), significant differences between the yeast strains were observed (Fig.2). The addition of $(NH_4)_2HPO_4$ allowed in all cases to activate the fermentation rate, but in varying proportions depending on the yeast strain.

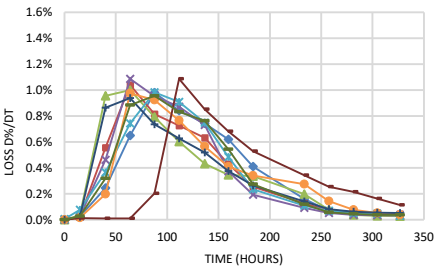

Figure 2: Evolution of CO_2 emission rate during the fermentation of Chasselas must with different yeast strain (**L1**, **L2**, **L3**, **L4**, **L5**, **L6**, **L7**, **L8** and **L9**) without N supplementation.

II. Effect of yeast strain and N supplementation on the chemical markers in the wine

All chemical markers reacted to both yeast strain and nitrogen supplementation. Yeast strains with a low nitrogen requirement produced wines with higher amounts of proline and lower concentrations of PhEtOH, 2,3-MeBuOH and succinic acid. The addition of $(NH_4)_2HPO_4$ to the must resulted the same effect (Fig.3).

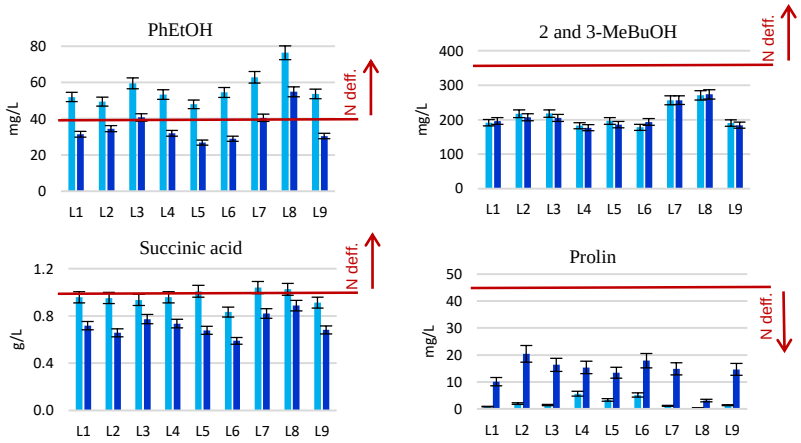

Figure 3: Concentration of markers at the end of the fermentation. **Control** and **$(NH_4)_2HPO_4$ supplementation**. Red lines correspond to the mean value calculated from the correlation marker-YAN for Chasselas variety indicating an important N deficiency (YAN < 140 mgN/L).

III. Chemical markers for the classification of wine according to YAN

The four chemical markers were used earlier successfully for the classification of white wines fermented without nitrogen supplementation in our experimental cave. Using this model in the discriminant analyses (Fig.4), the results of this study was placed in the class with YAN <140. This confirm, that even if the choice of a more suitable strain combined with nitrogen addition in the cellar can improve fermentation rate and wine quality, it cannot completely take away the negative effects of an important nitrogen deficiency on the vineyard.

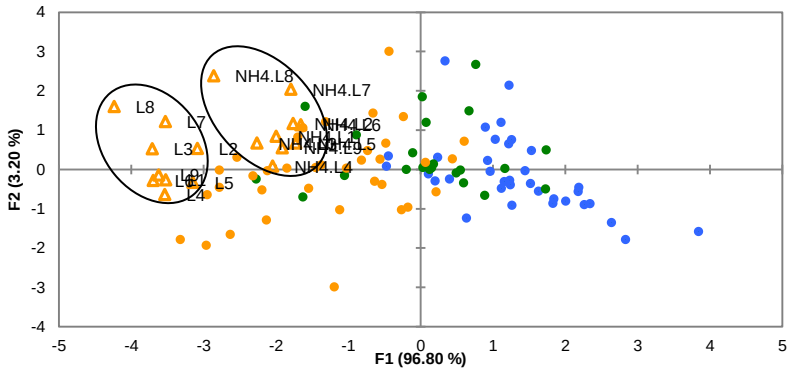

Figure 4: Discriminant analyses of white wines (n=93) using the four chemical markers as variables and three predefined classes: **YAN > 200 mgN/L**, **140 mgN/L >YAN> 200 mgN/L** and **YAN < 140 mgN/L** . Prediction of classification was done for the yeast strain experiences (Λ).

Conclusion

- The addition of $(NH_4)_2HPO_4$ to the must increased the YAN and therefore resulted in an increased concentration of proline and a decreased amount of PhEtOH, 2,3-MeBuOH and succinic acid.
- The proportion of these variations was yeast strain dependent.
- The influence of the studied yeast strains even with addition of usual amounts of $(NH_4)_2HPO_4$, cannot completely mask the effects of an important nitrogen deficiency in the vineyard. Therefore, combined use of the four chemical markers in wine to detect nitrogen deficiency in grapes seems to be robust.

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