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Tuning the pH during the fermentation has a strong effect on the wine protein composition and the stability of the resulting white wines.

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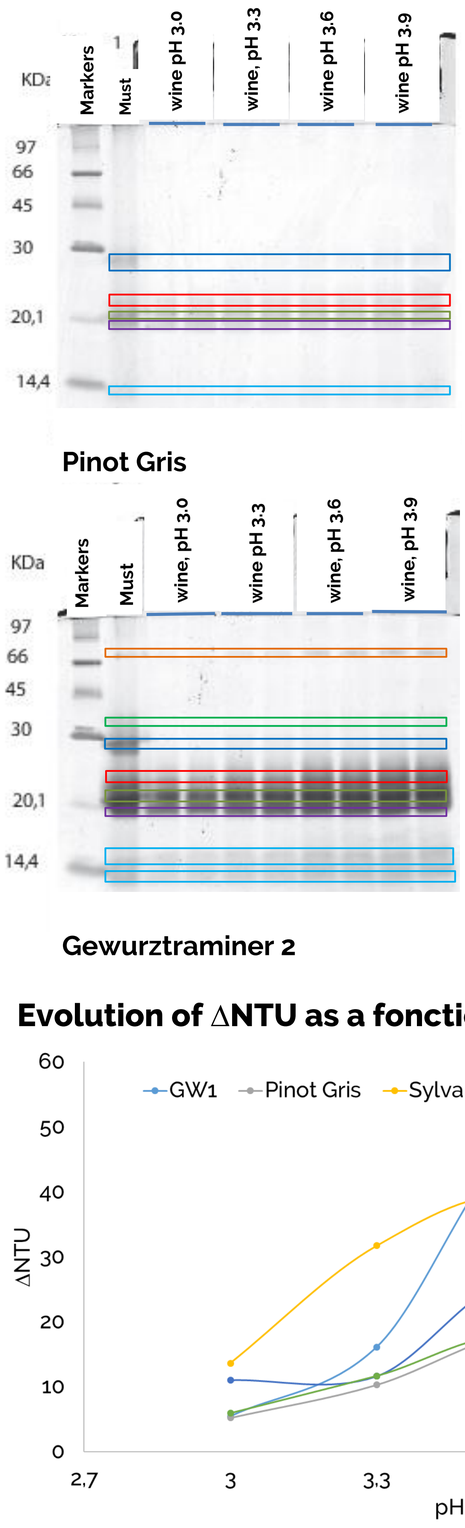
AIM: The context of global warming implies increases of ethanol content and pH in wines. Elsewhere, previous results have shown the impact of pH on the stability of proteins in white wines. Our aim was to asses for different varieties the effect of pH on the protein content of wines at the end of the alcoholic fermentation. Fermentations were performed using the same starting must, to avoid any other difference in terms of matrix composition (polyphenols, polysaccharides, ions…).

METHODS: Fermentations were carried out using musts from different grape varieties (Sauvignon, Sylvaner, Riesling, Gewurztraminer and Pinot Gris), adjusting the pH of the initial musts to 3.0, 3.3, 3.6 and 3.9 either with hydrochloric acid or sodium hydroxide. For each wine thus obtained, the proteins were analyzed and quantified by gel electrophoresis. Heat tests (heating at 40°C during 4 hours) were carried out and the differences between the initial and final turbidities (ΔNTU) were calculated.

RESULTS:

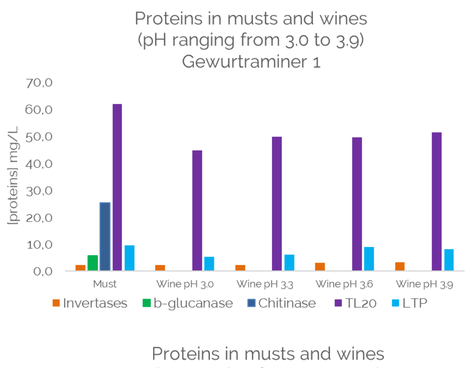
SDS – PAGE analysis of proteins in musts and wines

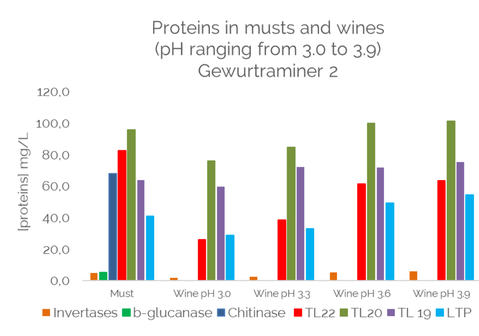
Invertase 70 kDa **β-glucanase ~35 kDa** **Chiti27 : chitinase 27 kDa** **Chiti 24: chitinase 24 kDa** **TL22: Thaumatin like protein 22 kDa**
TL21: Thaumatin like protein 21 kDa **TL19-20: Thaumatin like protein 19-20 kDa** **LTP: Lipid transfer Proteins ~13-15 kDa**

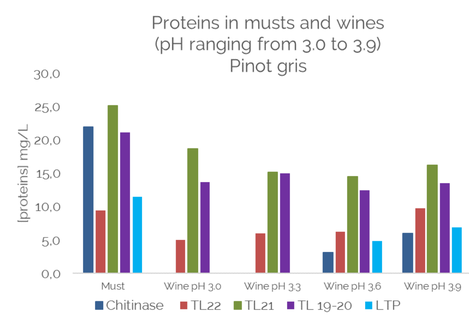


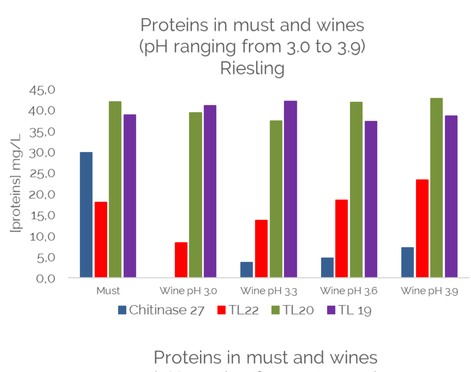
Pinot Gris

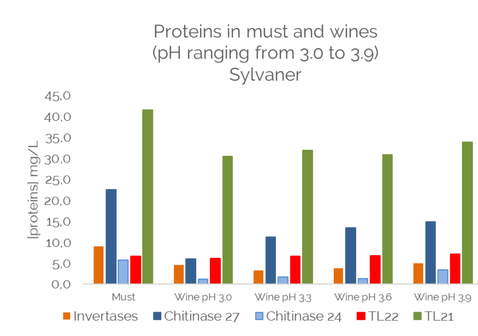
Gewurztraminer 2

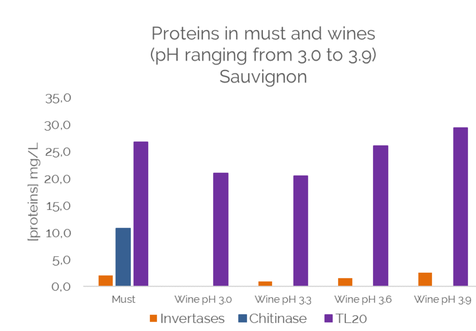












On the whole and in accordance with previous works, protein concentrations in wines decreased during fermentation.

However, this decrease was more marked for the lowest pHs (3.0 and 3.3).

Furthermore, two families of proteins (chitinases and β-glucanases) were particularly fragile, but their behavior also depended on the initial pH of the must and the matrix composition : for instance chitinases were eliminated in Gewurztraminer and Sauvignon, but not in Pinot Gris, nor Riesling and Sylvaner.

On the contrary, invertases and lipid transfer proteins remained stable when they were initially present.

All these behaviors are in agreement with previous results [1, 2, 3].

Evolution of ΔNTU as a fonction of the pH

Even though the concentration of proteins either decreased or remained stable when the pH decreased, the turbidity measured after the heat tests evolved differently: a maximum was observed at pH 3.6.

This is probably due to a balance between different phenomena:

- at higher pHs (>3,6) the temperature of denaturation of most proteins is increased above 50°C and are thus not unfolded at 40°C;
- at lower pH (3.0 and 3.3), proteins unfold at lower temperature, but once unfolded, there are more charged and their aggregation is limited due to electrostatic repulsions, limiting the visual haze formation.

CONCLUSIONS:

This study confirms that pH has a decisive impact on protein composition in white wines, but the latter is not directly related to the risk of haze formation. Other parameters such as the composition in ions, polyphenols, and polysaccharides play a part. They are themselves strongly dependent on the grape variety and cultural practices.

References

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