Evaluation of *Saccharomyces cerevisiae* wine yeast competitive fitness in oenologically relevant environments by barcode sequencing

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**INTRODUCTION**

Grape juice composition:
- The complex interaction between yeasts and their environment is brought sharply into focus when wine fermentations fail to complete.
- Choice of yeast strain, of which there are many, grape juice composition and winemaker intervention are key elements of fermentation performance.
- The relationship between yeast strain and grape juice composition is the subject of this work.

Yeast strain fitness:
- Through the DNA barcoding of 90 wine yeast strains of commercial or environmental origin, yeast fitness was assessed in a range of wine-relevant conditions.
- Sulfite and copper tolerance are the compositional factors that most strongly differentiate wine yeast.

**METHODOLOGY**

Molecular barcoding of wine yeast strains:
- Each one of 89 different wine yeast strains has had a unique DNA barcode introduced into the HO locus.
- This was achieved using KanMX as a selectable marker with subsequent marker removal by Cre-mediated excision at LoxP sites

Experimental approach to fitness determination:
- Serial batch pooled inoculum fermentation

**RESULTS**

Yeast fitness in a range of wine-relevant conditions:

![Graph showing yeast fitness](image)

**CONCLUSIONS**

- Nearly one-third of all strains evaluated demonstrated the ability to dominate a low-stress defined medium or grape juice (A).
- Many of the less competitive strains improved their performance with 10 mg/L free SO2 in the medium (B).
- A second set of strains showed strongly improved competitiveness with 10 mg/L copper in the medium.
- In conditions of high sugar, temperature extremes, vitamin limitation, nitrogen variation and pH extremes, most strains did not perform differently than in the reference condition.
- Interactions between different combinations of conditions were not observed.