IOCFE 2025 Conference

The 1st International Online Conference on Fermentation

12–13 November 2025 | Online

MDPI

Effects of Sequential Inoculation of Non-*Saccharomyces* and *S. cerevisiae* Strains on the Fermentation Process of High-Sugar Chardonnay

Ipek Aktuna[1,2], Jonathan D. Brumley[1], G. Candan Gurakan[3], Charles G. Edwards[1]

[1] School of Food Science, Washington State University, Pullman, WA, USA

[2] Department of Biotechnology, Middle East Technical University, Ankara, Turkey

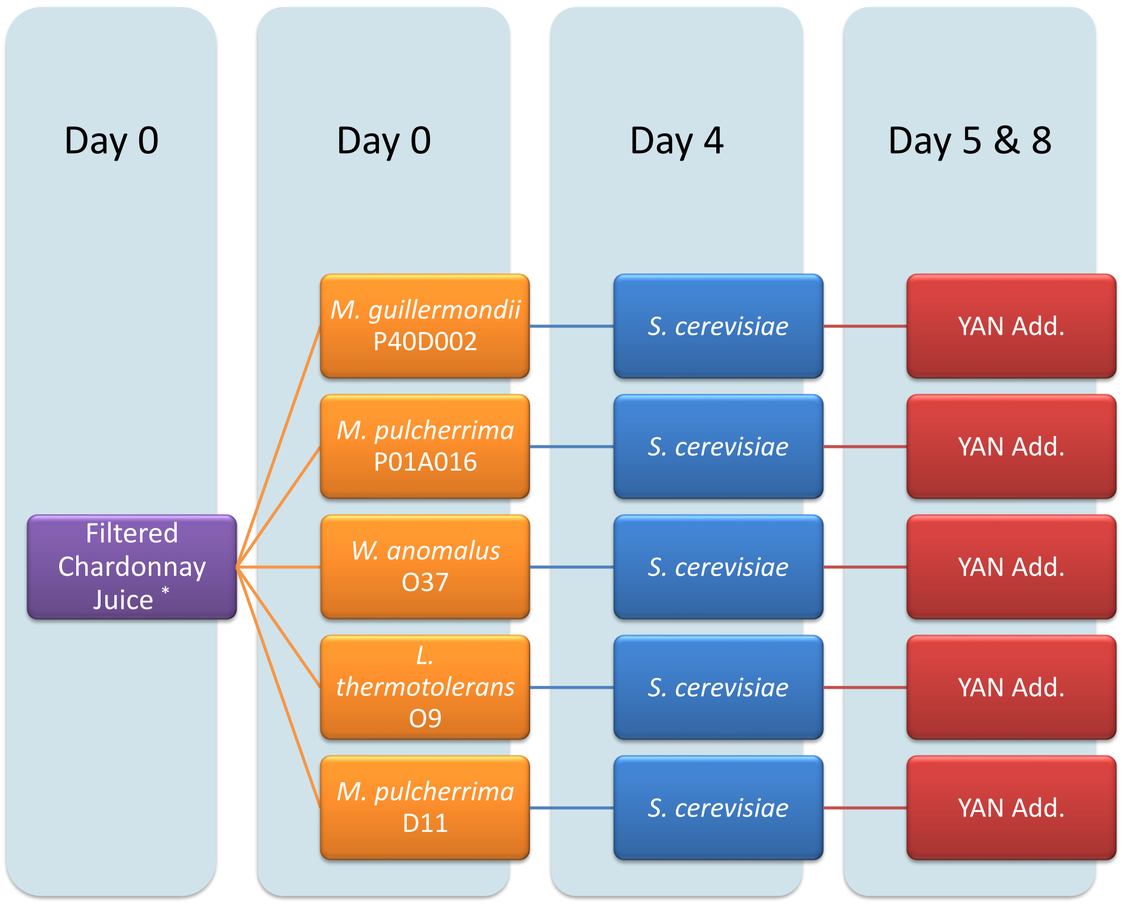
[3] Department of Food Engineering, Middle East Technical University, Ankara, Turkey

ipek_aktuna@hotmail.com

INTRODUCTION & AIM

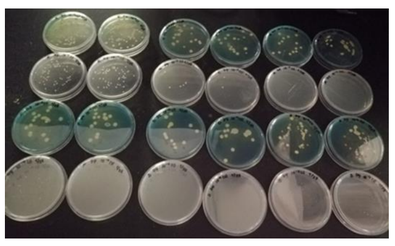
- Increasing grape sugar levels, driven by climate change, impacts the alcohol content of wine. One of the possible solutions to reduce alcohol content is the use of non-*Saccharomyces* yeasts.
- In this study, chaptalized Chardonnay must (28˚Brix) was sequentially inoculated with one of non-*Saccharomyces*
  - *M. pulcherrima* P01A016,
  - *M. guillermondii* P40D002,
  - *W. anomalus* O37,
  - *L. thermotolerans* O9, or
  - *M. pulcherrima* D11 and commercial *S. cerevisiae* Lalvin NBC™ with YAN supplementation (Fermaid K™) to track
    - fermentation kinetics,
    - YAN consumption,
    - ethanol and by-products concentrations.

METHOD

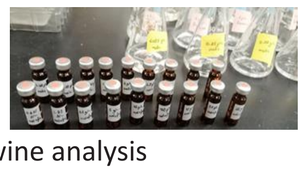


*For the control treatment, the Chardonnay fermentation inoculated only *S. cerevisiae* was started on day 4 and YAN was added on the day the other treatments were added.

Chardonnay must in Wheaton fermenter



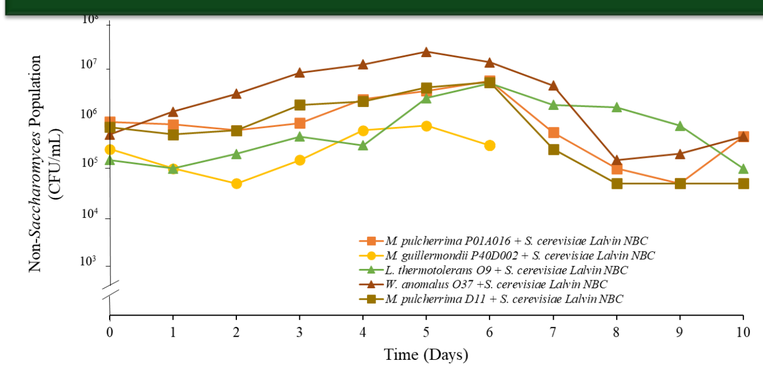
Yeast colonies on WL & Lysine Agars to measure the yeasts' cultivability

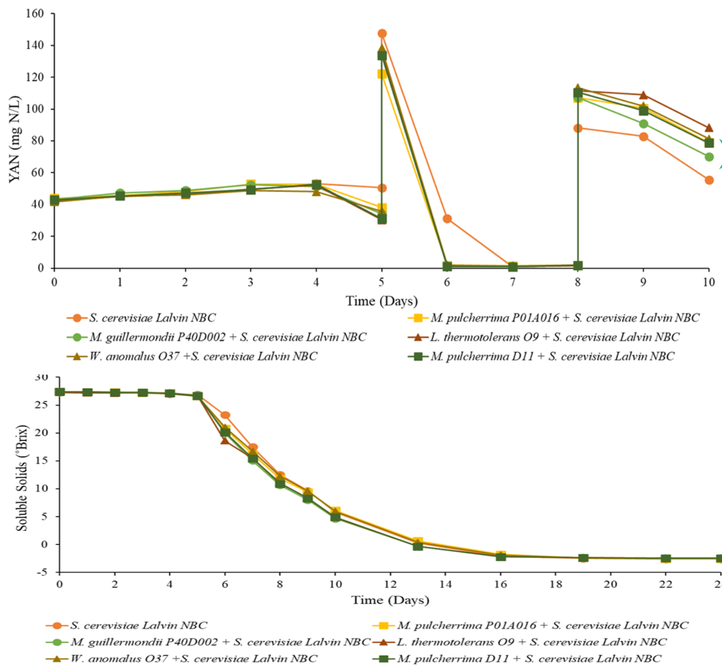


HPLC for wine analysis

ACKNOWLEDGEMENT: This research was made possible by the financial support of the Washington State Grape & Wine Research Program, the Northwest Center for Small Fruits Research, and the PhD scholarship of the Turkish Higher Education Council (YÖK 100/2000). This work was also supported in part by the USDA National Institute of Food and Agriculture Hatch project 1016366.

RESULTS & DISCUSSION





- During the early stages of fermentation, non-*Saccharomyces* strains exhibited **lower growth**, **biomass production**, and **YAN consumption**, likely due to **osmotic stress** and their **inadequate adaptation** to high-sugar must.
- All treatments **reached dryness**.

Chardonnay wines at the end of the fermentation

Treatments	Ethanol (% v/v)	Glycerol (g/L)	Glucose (g/L)	Fructose (g/L)	Acetic Acid (g/L)	Succinic Acid (g/L)
S. cerevisiae Lalvin NBC	16.3^{a,b}	9.11^{a}	1.60^{c}	0.511^{a,b}	0.378^{c}	0.417^{c,d}
M. pulcherrima* P01A016	**16.0^{b}**	8.93^{a}	1.75^{b,c}	0.359^{a,b}	**0.580^{a}**	**0.366^{e}**
M. guilliermondii* P40D002	16.6^{a}	9.18^{a}	1.73^{b,c}	0.349^{a,b}	0.405^{b,c}	0.478^{a,b}
L. thermotolerans* O9	16.7^{a}	8.91^{a}	1.95^{a,b}	0.656^{a}	0.469^{b}	0.433^{b,c}
W. anomalus* O37	16.7^{a}	9.18^{a}	2.00^{a}	0.492^{a,b}	0.611^{a}	0.376^{d,e}
M. pulcherrima* D11	16.5^{a,b}	9.44^{a}	1.85^{a,b}	0.209^{b}	**0.432^{b,c}**	**0.488^{a}**

Means within a column with different superscript letters indicate significantly different at $p \leq 0.05$.

* represents sequential inoculation with *S. cerevisiae* Lalvin NBC.

CONCLUSION

- ***M. pulcherrima* P01A016** exhibited a **0.6–0.7%(v/v) alcohol** reduction.
- Although ***M. pulcherrima* strains** from various regions of the world produced **similar alcohol levels**, their profiles of **acetic and succinic acids differed**, highlighting how strain selection affects wine composition.

FUTURE WORK / REFERENCES

- To **decrease osmotic stress** and **enhance adaptation** to high-sugar environments, future research should concentrate on optimizing fermentation conditions for non-*Saccharomyces* yeasts.

Aplin, J. J., & Edwards, C. G. (2021). Impacts of non-*Saccharomyces* species and aeration on sequential inoculation with *Saccharomyces cerevisiae* to produce lower alcohol Merlot wines from Washington state. *Journal of the Science of Food and Agriculture*, 101(4), 1715–1719. https://doi.org/10.1002/JSFA.10769

Rodrigues, A. J., Raimbourg, T., Gonzalez, R., & Morales, P. (2016). Environmental factors influencing the efficacy of different yeast strains for alcohol level reduction in wine by respiration. *LWT*, 65, 1038-1043. https://doi.org/10.1016/j.lwt.2015.09.046