Strategies for reducing alcohol concentration in wine

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Alcohol in Australian wine

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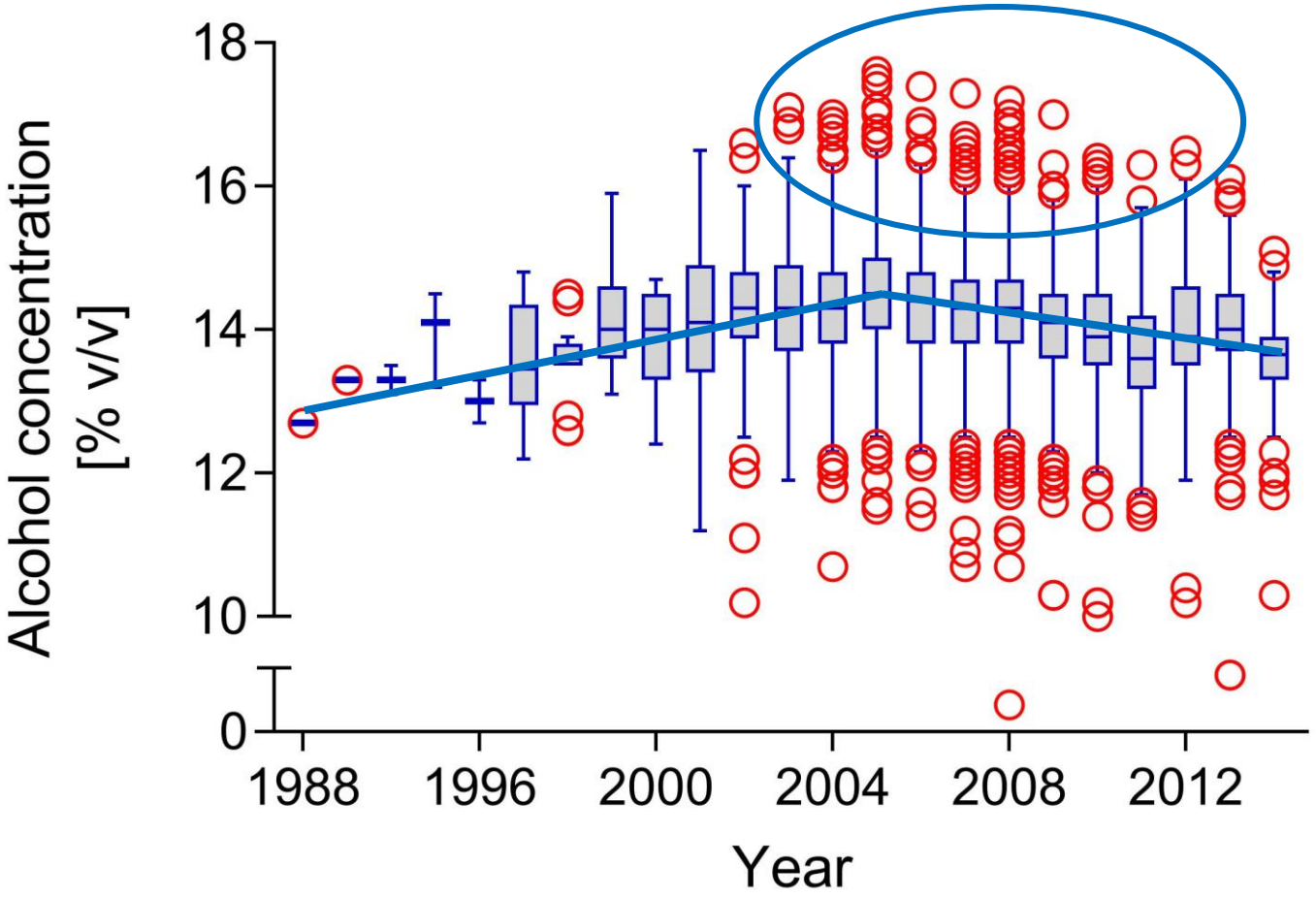

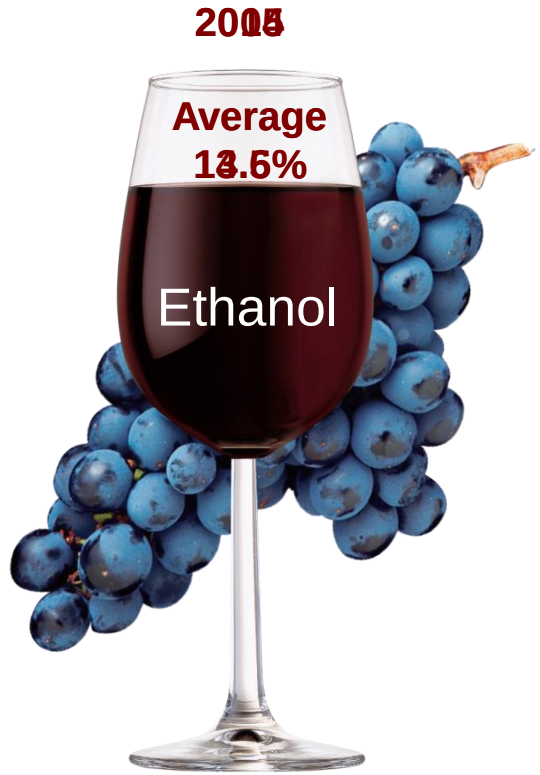

Godden *et al.* 2015

Why is alcohol increasing?

The Australian Wine Research Institute

Grape maturity enhances rich, ripe fruit flavour, and colour intensity.

Decreases the unripe green and vegetal flavours.

Greater maturity leads to higher sugar content.

Higher sugar equals higher alcohol levels.

Why reduce alcohol?

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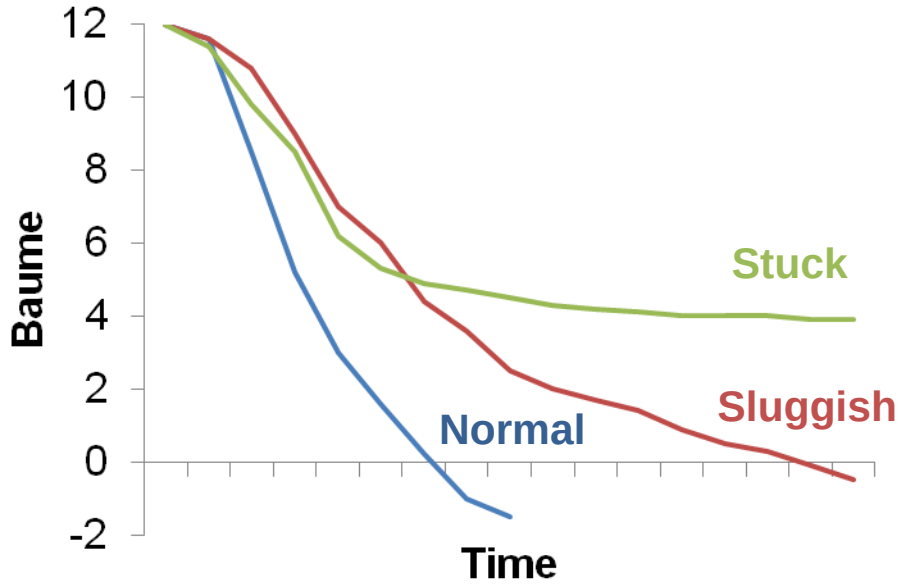
15% 14% 13% 12%

Ethanol content

Wine & society

Alcohol abuse



How to reduce alcohol in wine?

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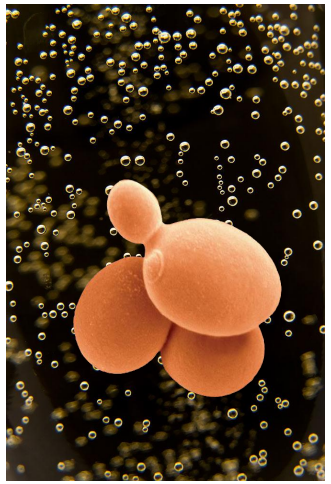
Varela *et al.* 2015

Viticultural practices

Winemaking practices



Fermentation practices

Post-fermentation technologies

Viticultural practices

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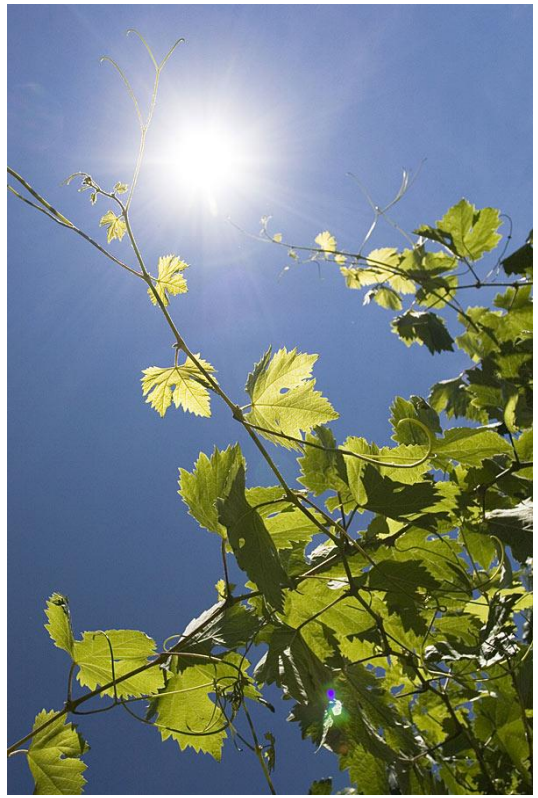
Reducing leaf area



Harvesting earlier

Decreasi les sugar accumulation from othe

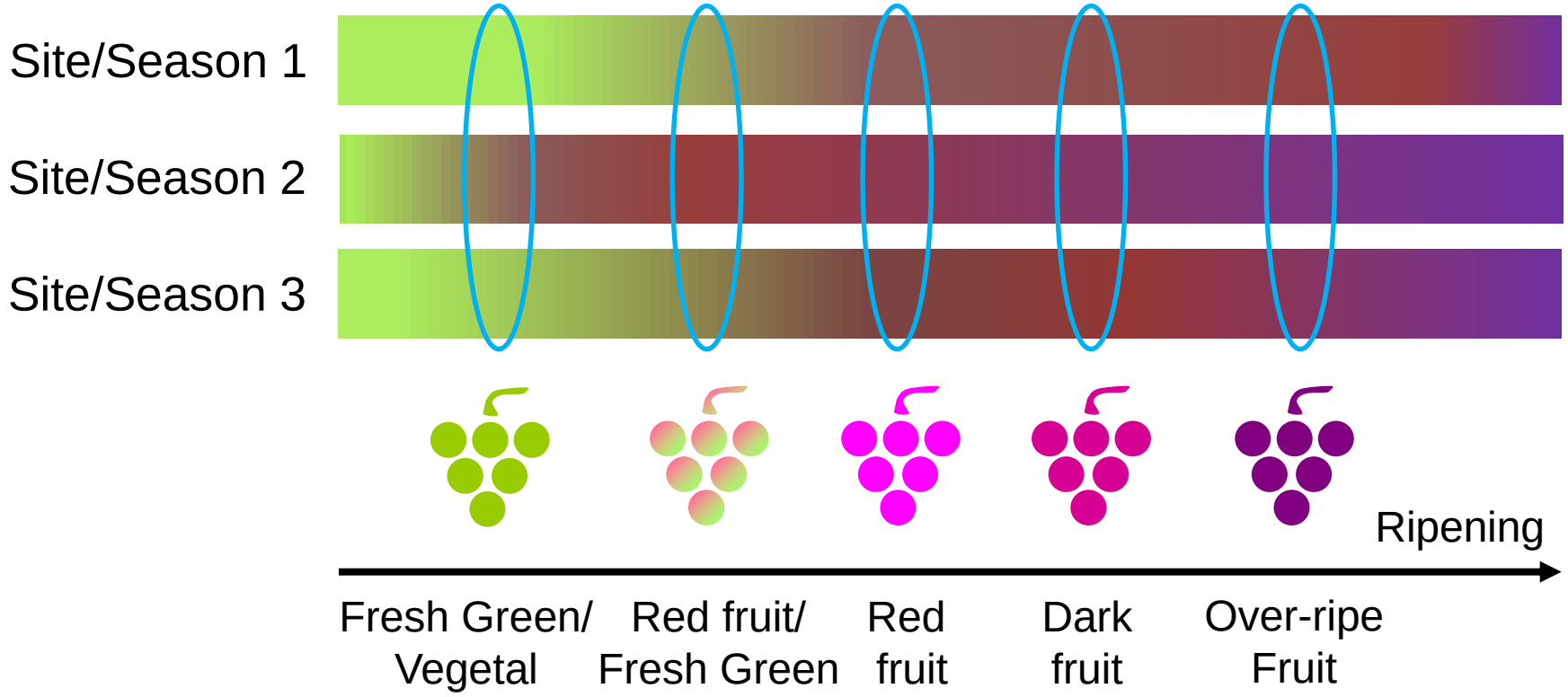
Several r ethanol, leaf removal Temprani TSS, theoretically 2% v/v le Sangiove SS

Some hav e in anthocyanin concentra

Harvesting earlier: does alcohol matter?

The Australian Wine Research Institute

Observed changes in sensory profile during ripening Cabernet Sauvignon

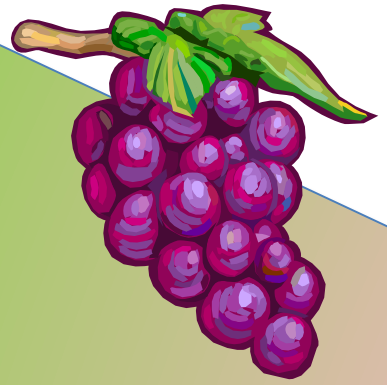


Alcohol concentration from: 11.8 % v/v to 15.5 % v/v

Wines harvested earlier

The Australian Wine Research Institute

Bindon *et al.* 2013



Green

Red berry

Low astringency

Low viscosity

Low esters

Low anthocyanin

Low glycerol and alcohol

High methoxypyrazine and C6 compounds

Low extractable tannin, seed tannin > skin

Low tannin polymerisation

High grape-derived polysaccharides

Wines harvested later

The Australian Wine Research Institute

Bindon *et al.* 2013

Dark Berry

Hot/Pungent

High astringency

High viscosity

High esters

High anthocyanin

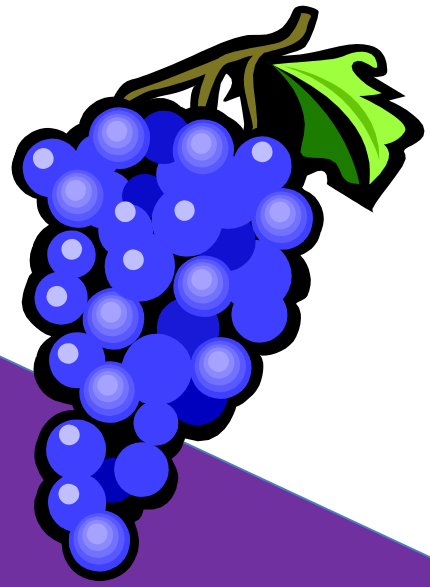
High glycerol and alcohol

Low methoxypyrazine and C6 compounds

High extractable tannin, higher mDP, skin > seed

Low grape-derived polysaccharides

High mannoproteins



Some sensory data – palate attributes

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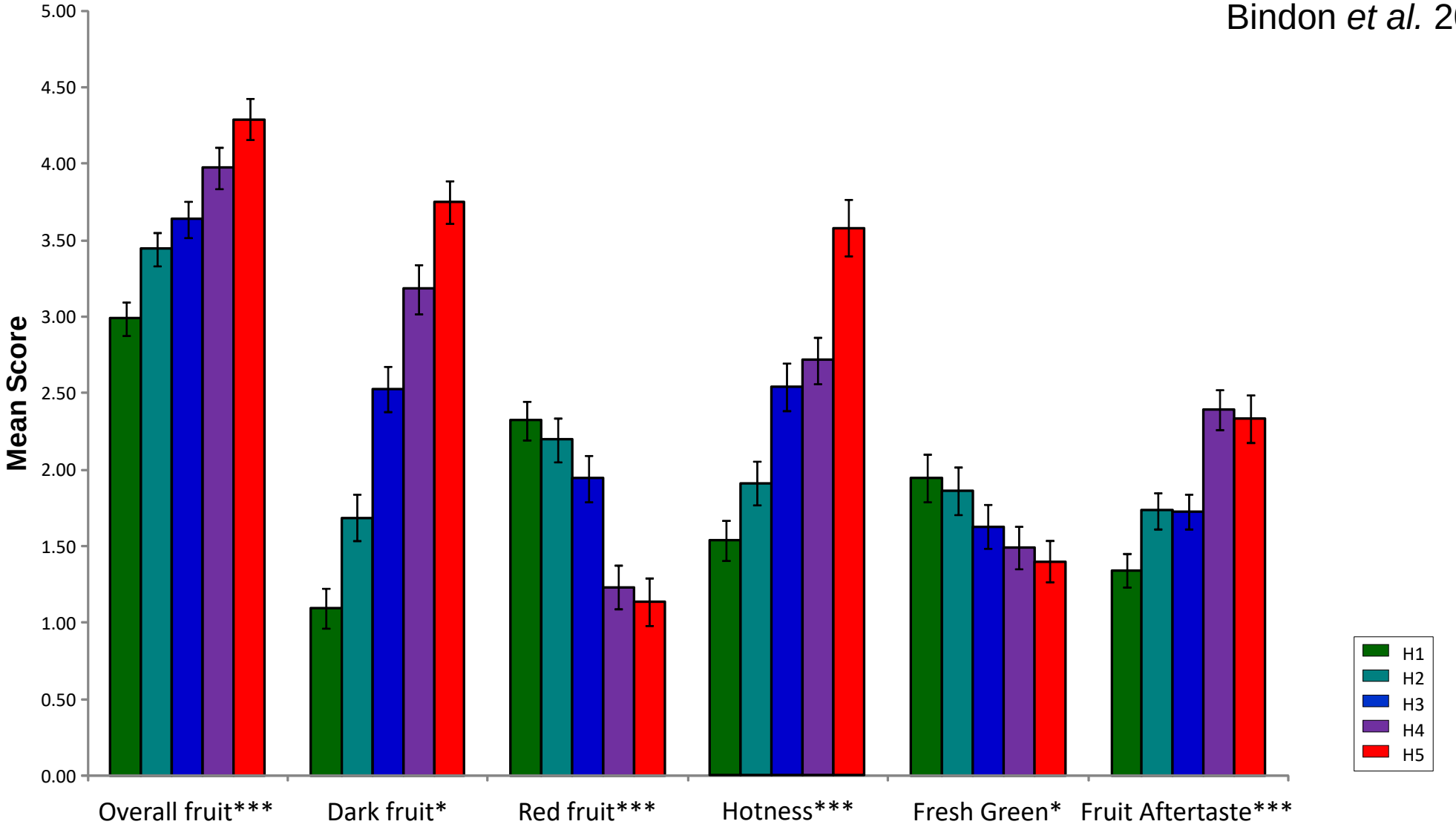
Bindon *et al.* 2014



Consumer liking

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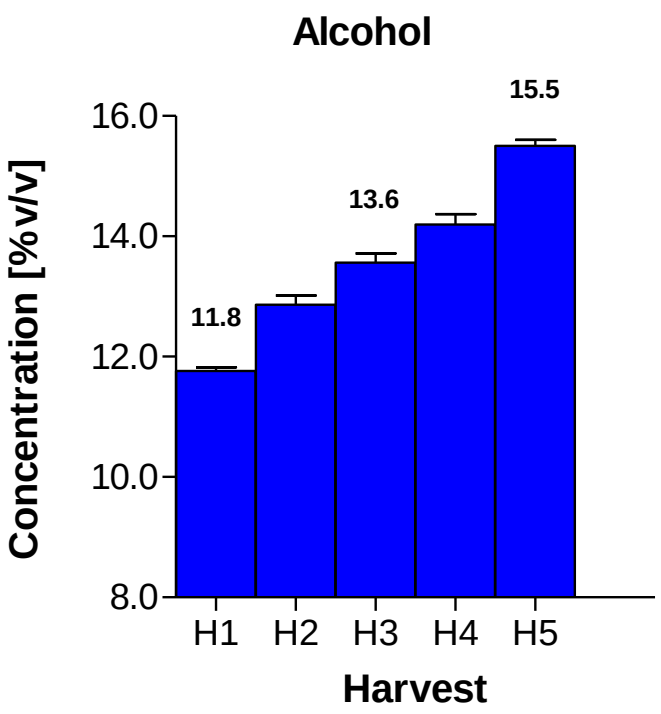
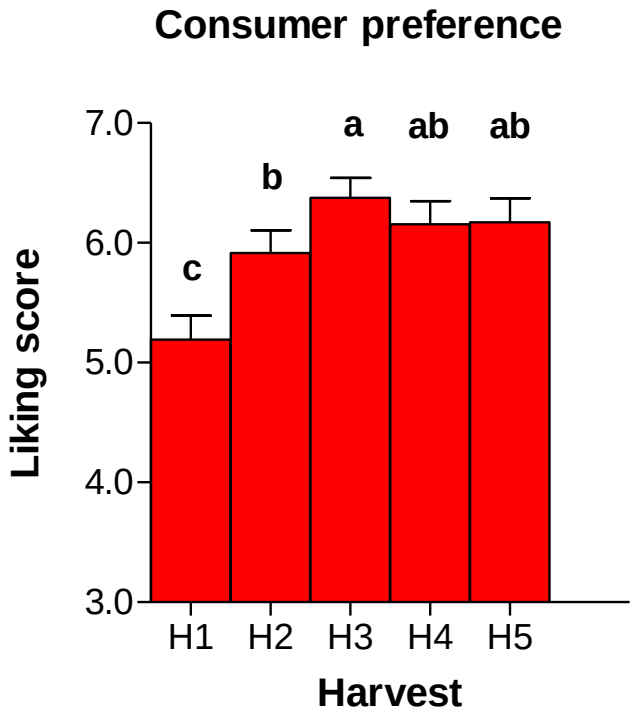
Bindon *et al.* 2014





Harvesting earlier could deliver a wine that consumers prefer or like just as much and contains up to 2 %(v/v) less alcohol

Caution: One trial – one variety – one vintage

Winemaking practices

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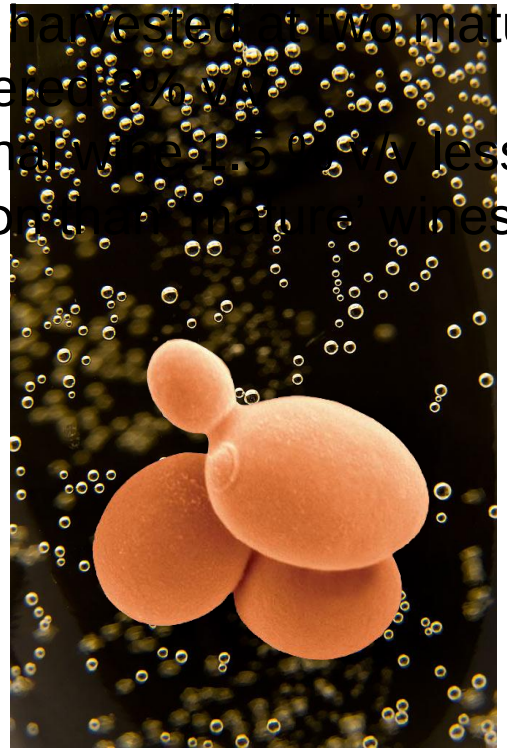
Blending

Fermentation design

Verdelho and Petit Verdot harvested at two maturities for each variety wines differed by ~2% v/v mixed in equal volumes finished ~1.5% v/v less alcohol similar sensory composition to the mature wines

Longo *et al.* 2017a

Choice of yeast strain



Choice of wine yeast

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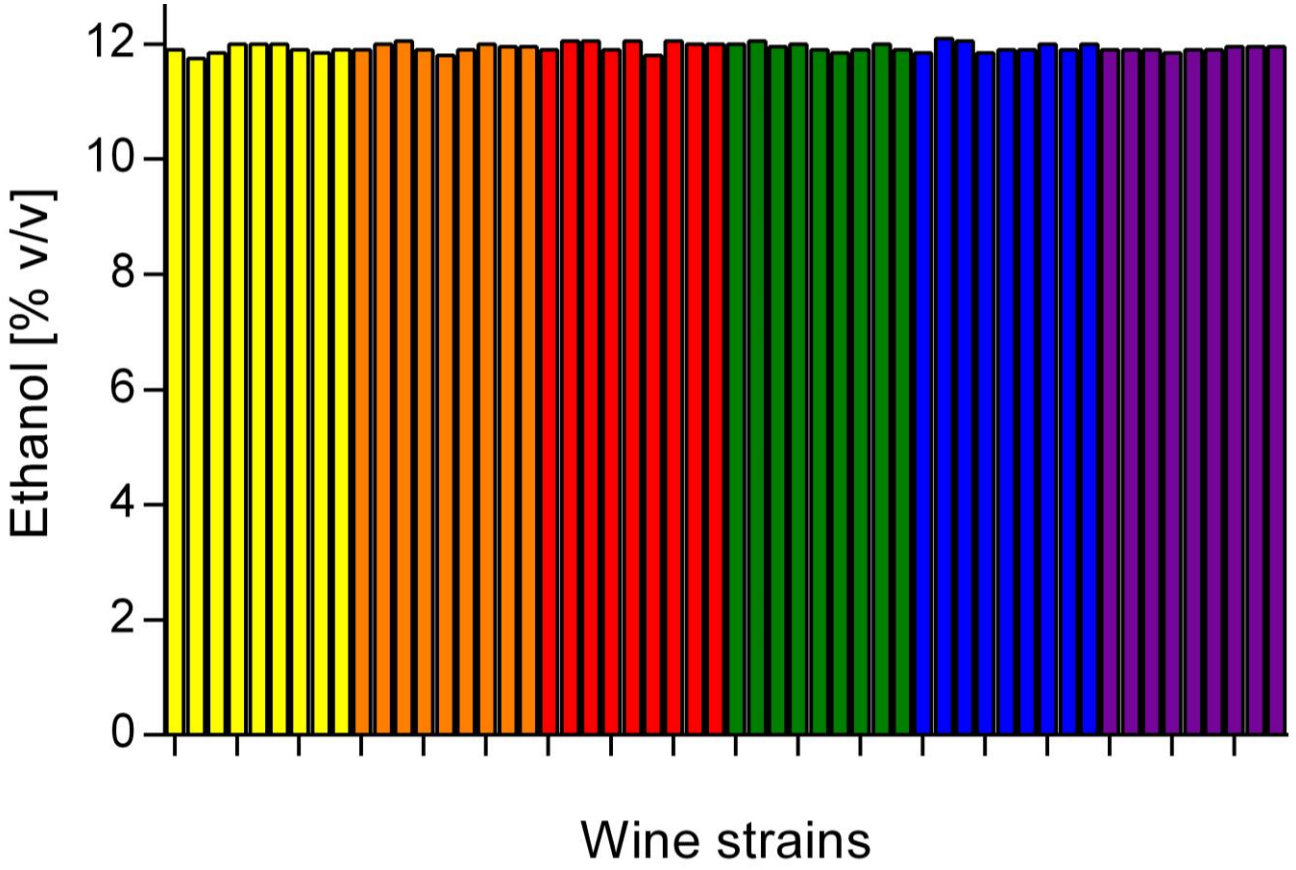
Palacios *et al.* 2007



Not much variation in ethanol yields for commercial wine yeast strains

Low-ethanol wine yeasts

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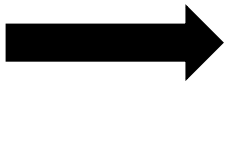
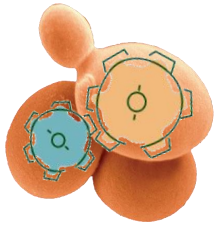
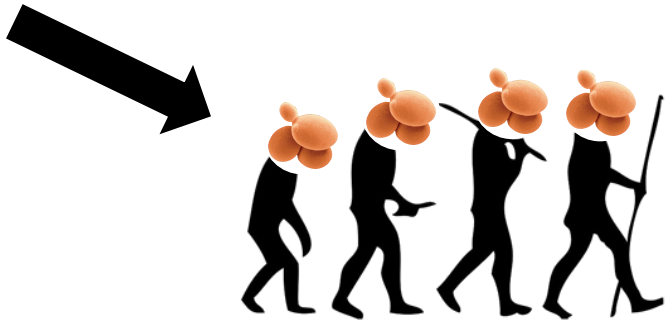
S. cerevisiae



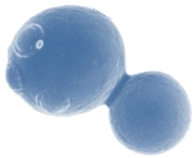


Genetically modified (GM) strains



Generation of new strains (nonGM)
mutagenesis, adaptive evolution

Non-*Saccharomyces*



Isolation and characterisation of strains

Non-GM techniques

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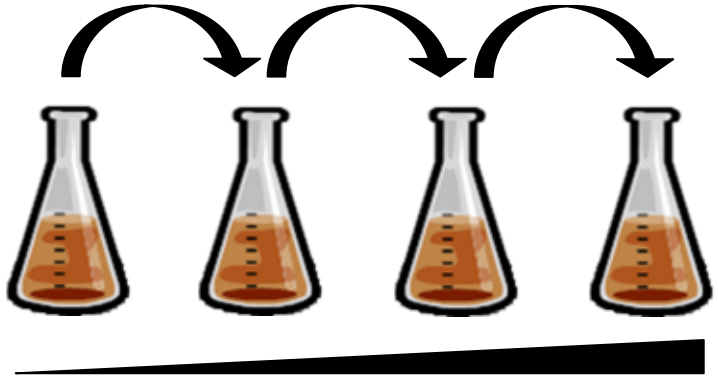
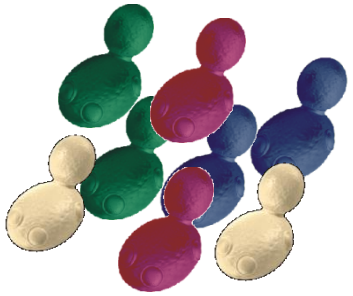
Mutagenesis

Adaptive evolution



Selective pressure that drives alcohol down



Screening of low alcohol phenotype

Mutant yeast

Low alcohol yeast

Wine yeast

Novel *S. cerevisiae* yeast strain

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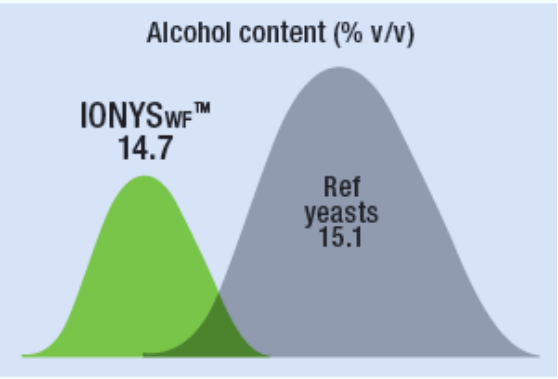
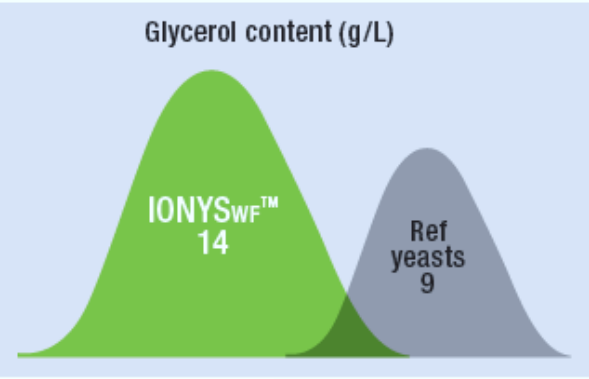
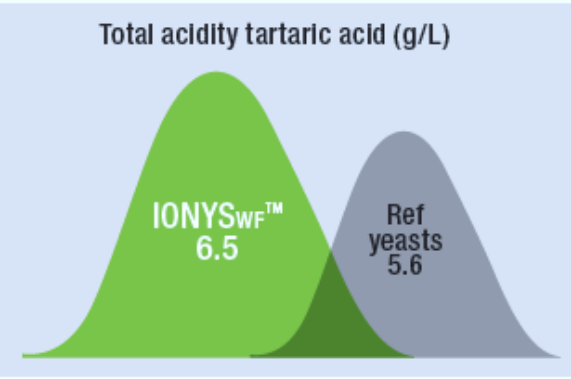
Tilloy *et al.* 2014

IONYS$_{WF}$™ obtained by adaptive evolution in Montpellier, France
Commercialised by Lallemand
Decreases ethanol and increases glycerol and acidity







Difference observed:
0.4 % v/v to 0.8 % v/v

* average results from over 30 wineries, figures and data from Lallemand technical datasheet

Mutagenesis and selection

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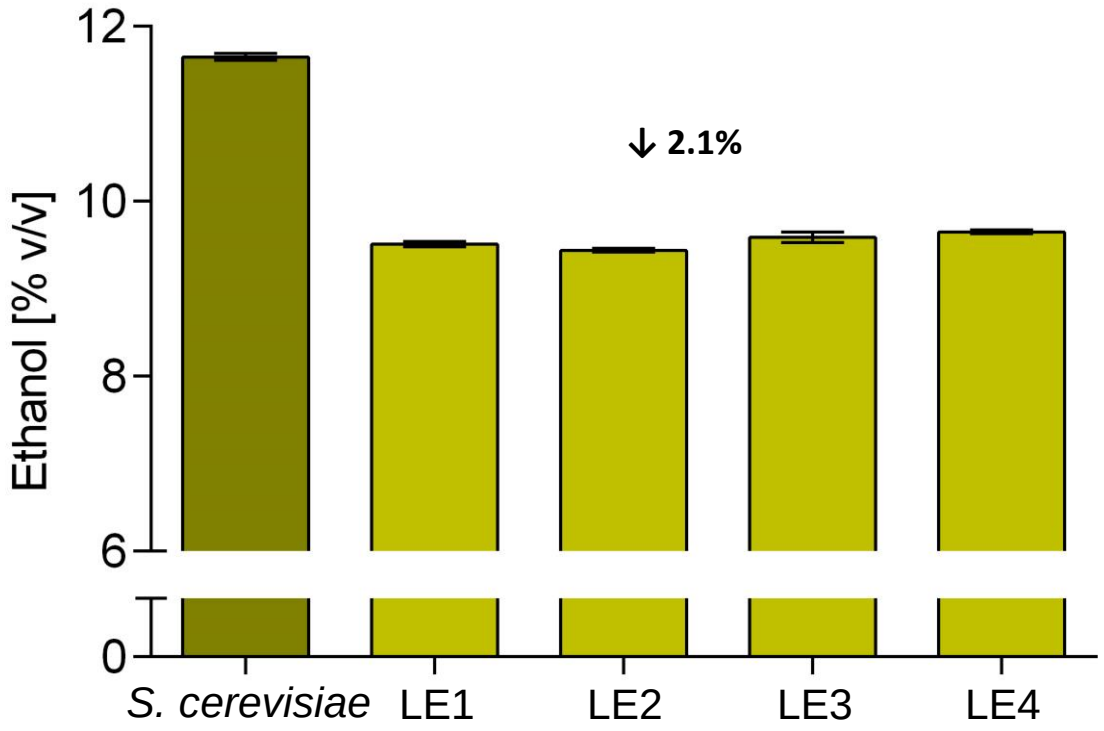

Lab-scale
Chardonnay
Anaerobic conditions
22°C

Non-*Saccharomyces* strains

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- 50 Non-*Saccharomyces* strains
- Sequential inoculation
- Aerobic and anaerobic conditions

Sequential inoculation

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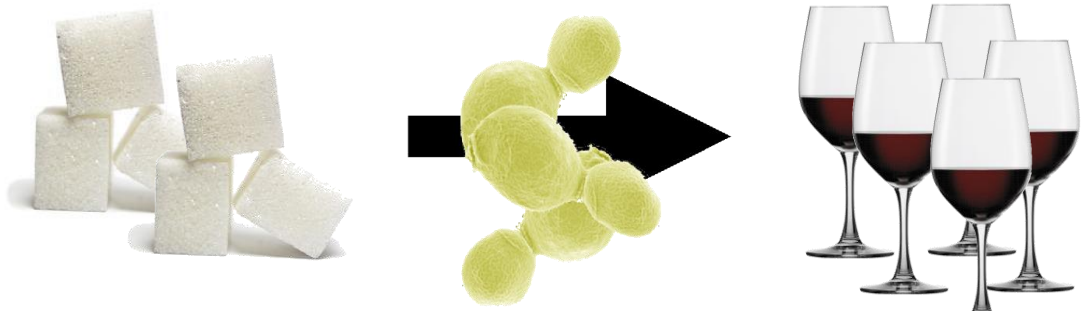

S. cerevisiae

Non-*Saccharomyces*

S. cerevisiae

Lab-scale trial - aeration

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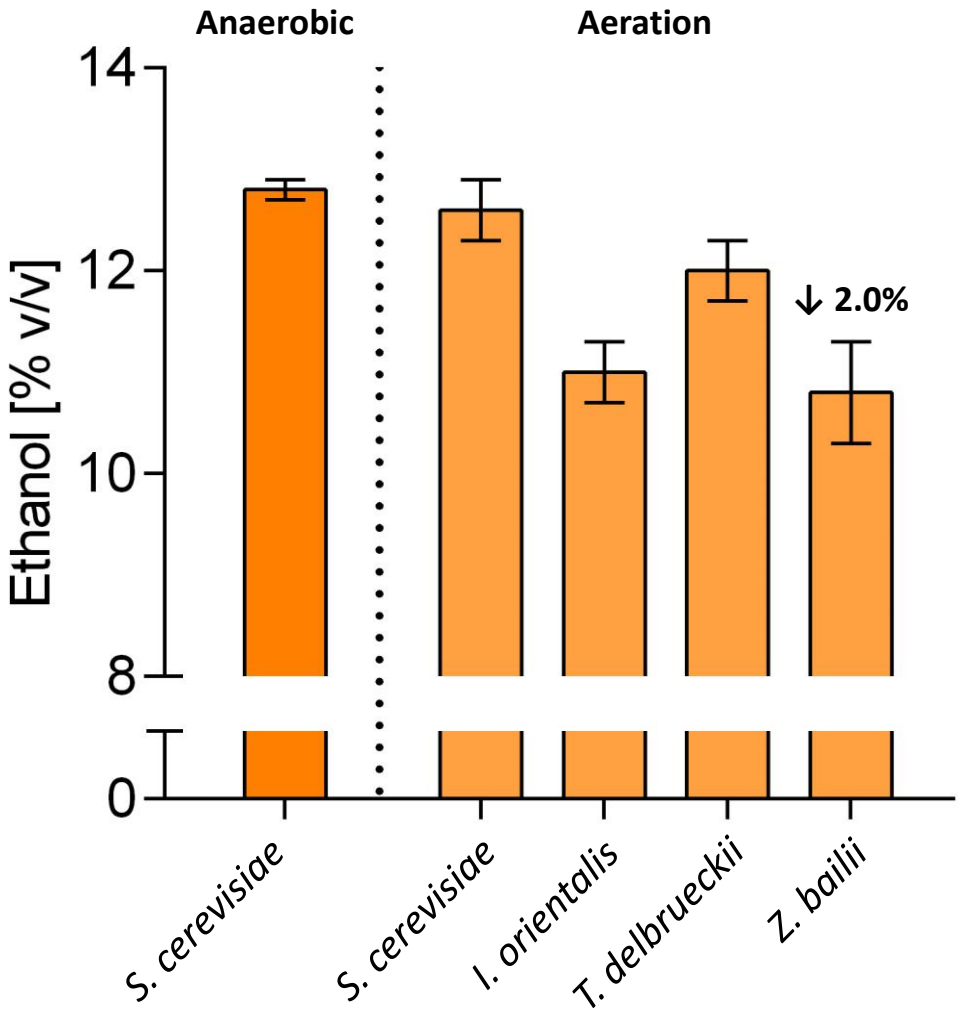
Contreras *et al.* 2015a



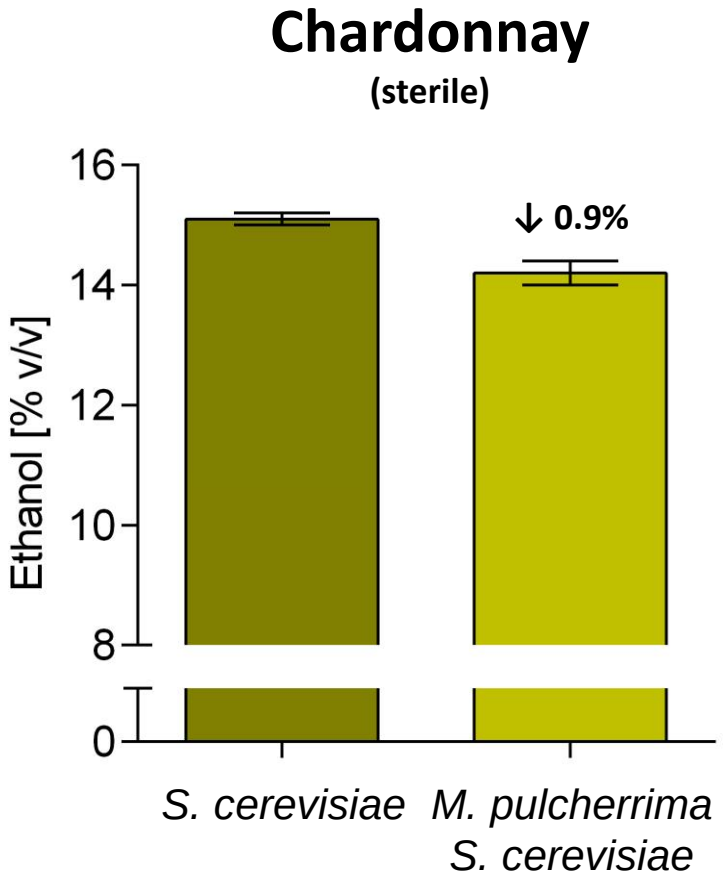
Sterile CDGJ
22°C
Aeration 5mL/min

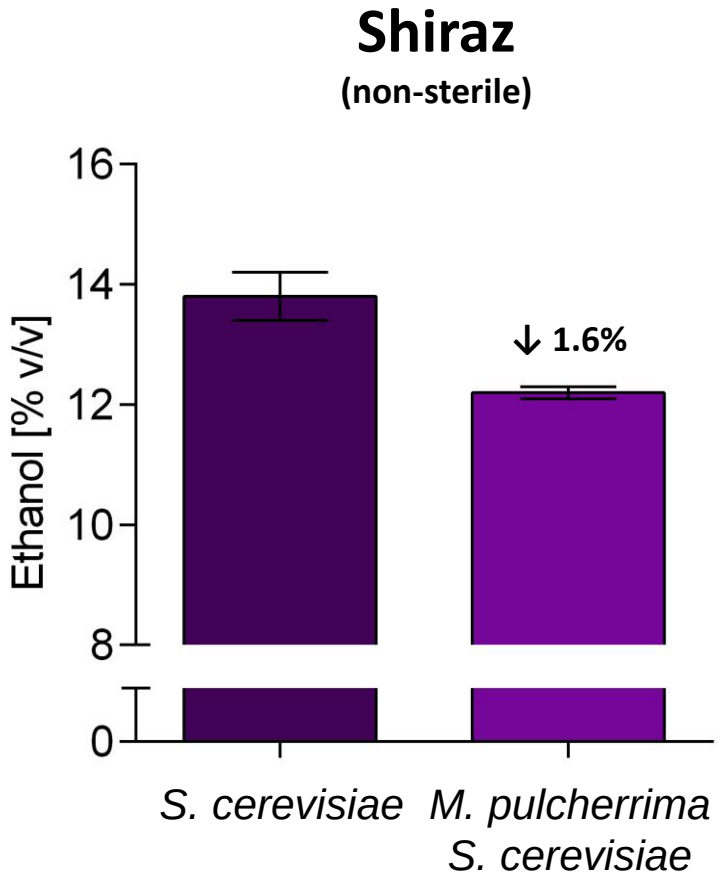
Pilot-scale trials in Shiraz performed last vintage

Lab scale trial - anaerobic

The Australian Wine Research Institute

Contreras *et al.* 2014
Contreras *et al.* 2015b





Lab-scale trial - Shiraz

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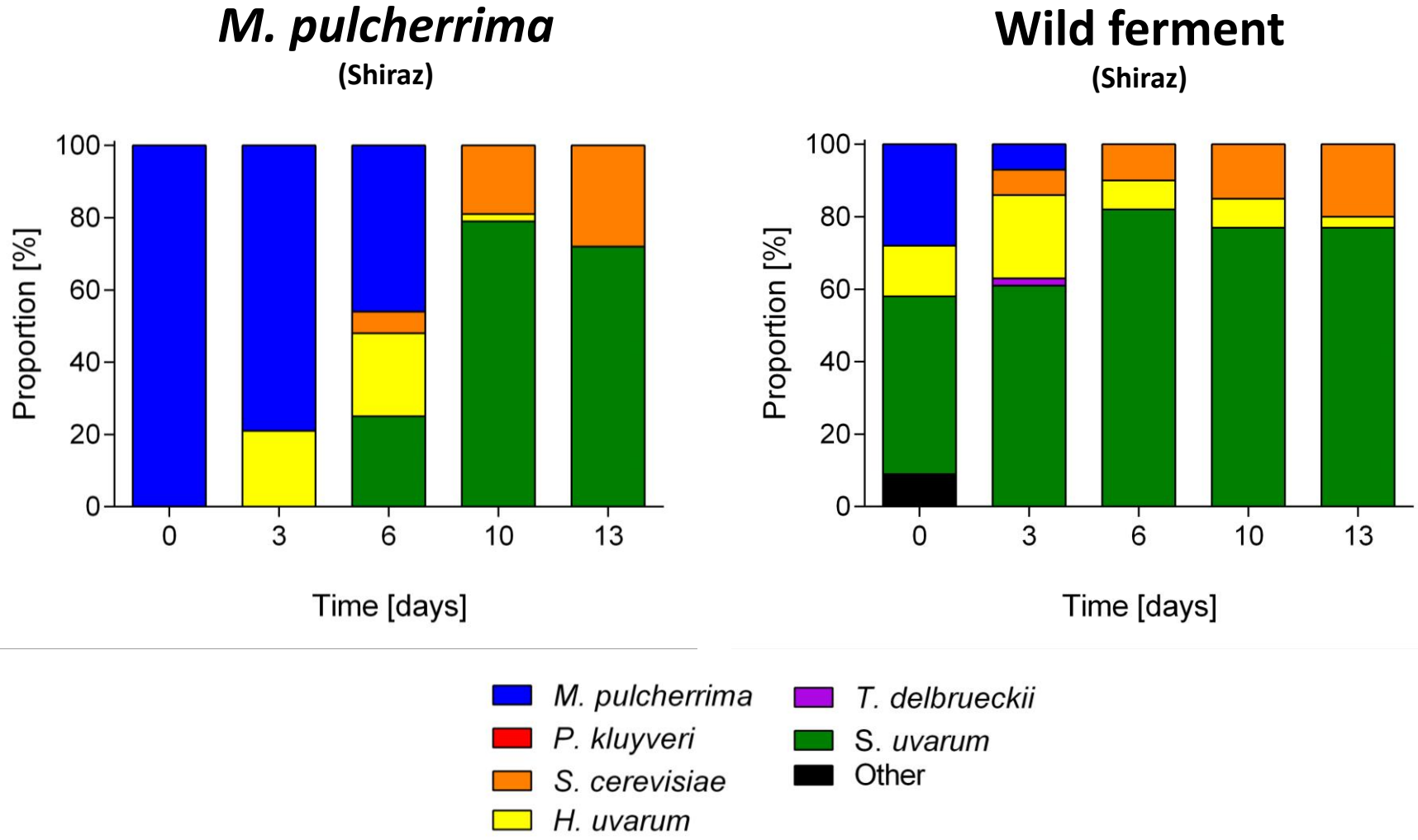
Contreras *et al.* 2015b



Shiraz trial - coinoculation

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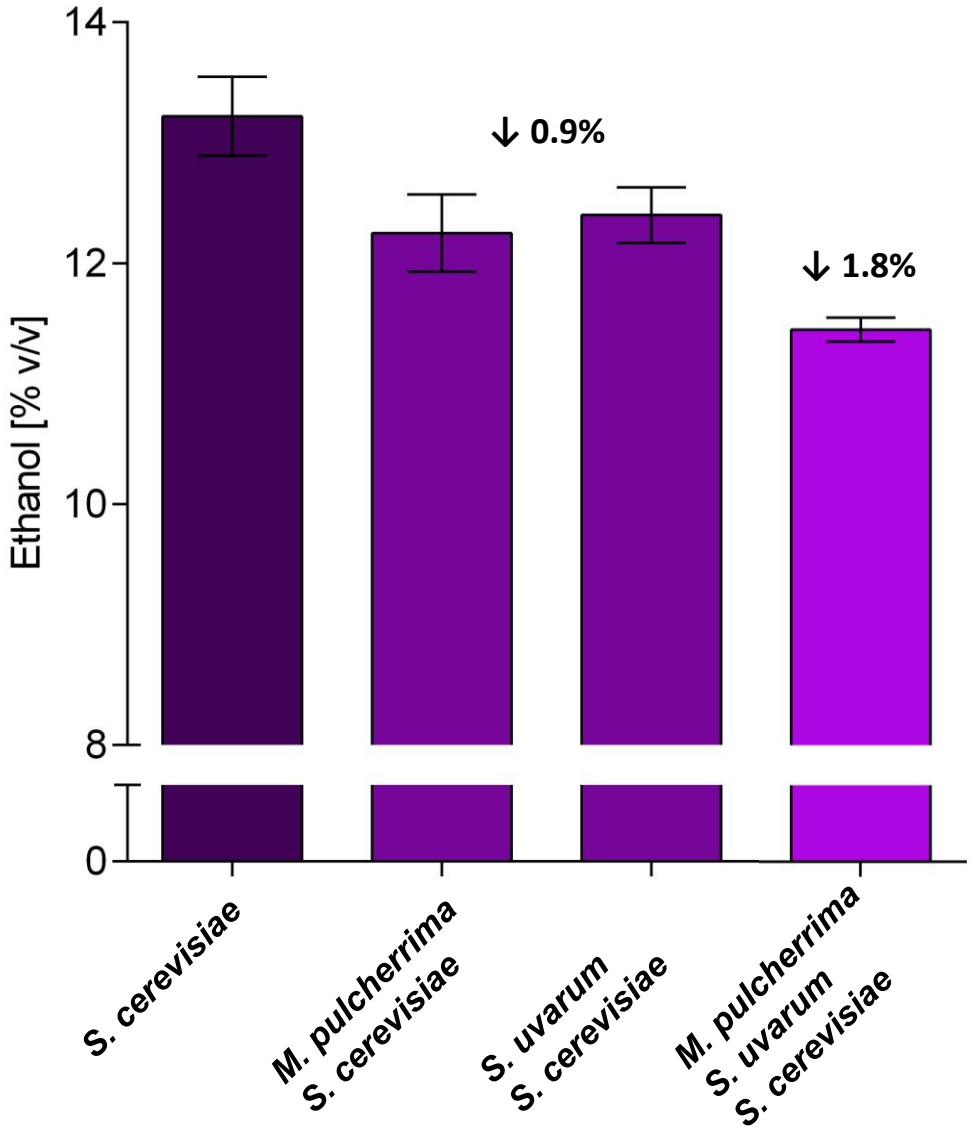
Varela *et al.* 2016

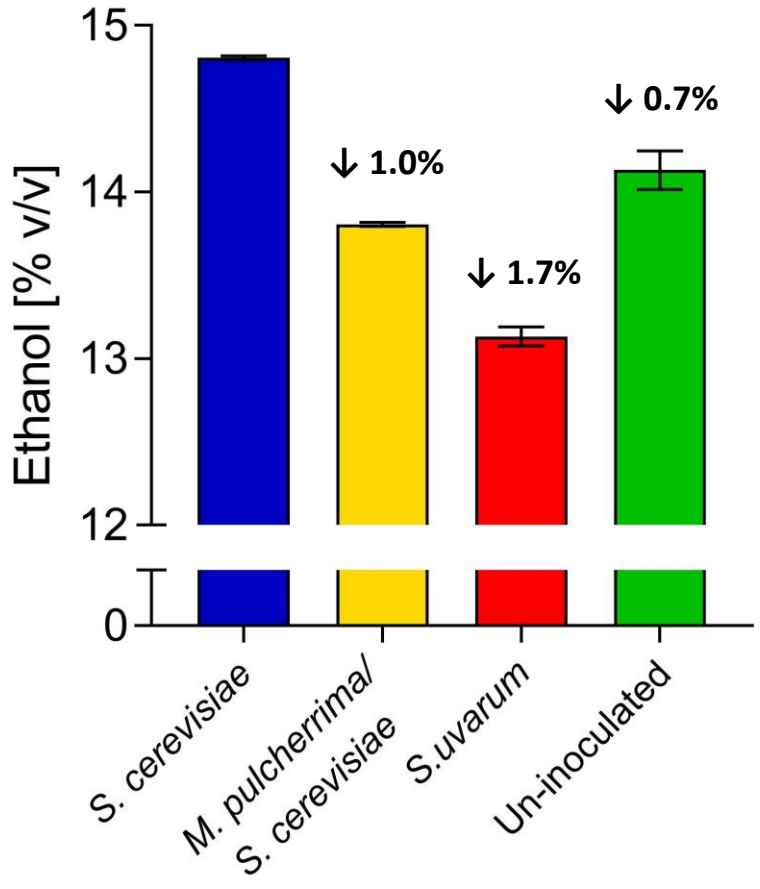


Lab-scale
Sterile Shiraz
Anaerobic conditions
22°C

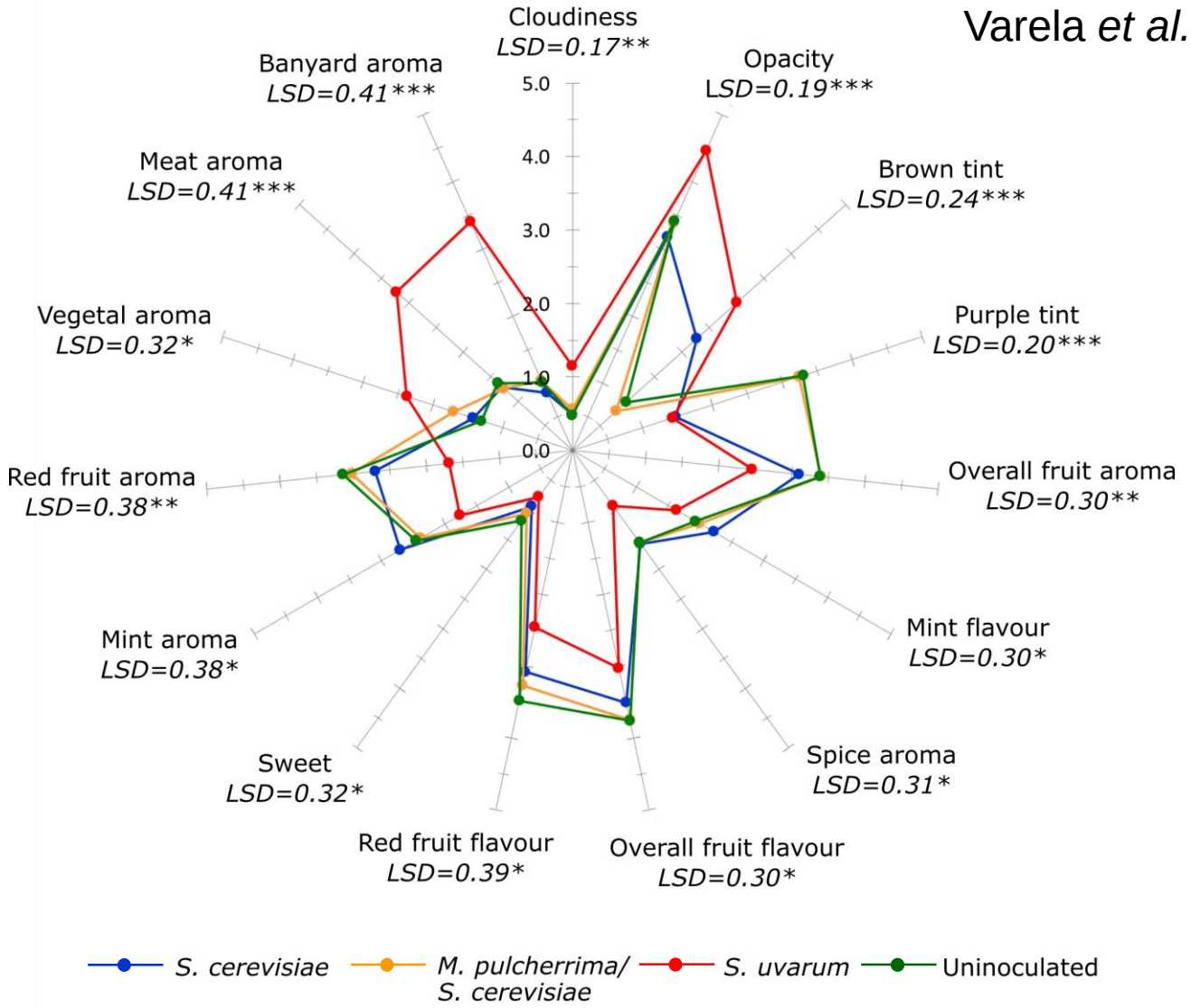
Pilot-scale trials – sensory profile

The Australian Wine Research Institute

Velcorin®-treated Merlot
30L 22 °C



Varela *et al.* 2017



Post-fermentation technologies

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Physical removal of alcohol

- Membrane-based systems
  - reverse osmosis
  - evaporative perstraction
- Vacuum distillation
- Spinning cone column

These provide effective and precise control of alcohol reduction

All affect volatile composition and depending on ethanol removal they also affect sensory profile and potentially wine style

Sensory effects - summary

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Longo *et al.* 2017b

Variety	Method	Ethanol removed	Sensory impact
Aglianico	EP	2% - 5%	Decrease fruity and flowery notes, increase astringency and acid
Chardonnay	SCC	2%	Decrease overall aroma intensity and hot mouthfeel
Merlot	RO	2% - 3%	Decrease heat and texture, increase astringency and acid
Shiraz	RO	2% - 5%	Decrease balance, persistency and heat
Sauvignon blanc	RO	1% - 3%	Decrease overall aroma, heat, balance and persistency

Summary

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- Several strategies available for managing alcohol concentration in wine.
- Different strategies may impact on wine aroma, flavour and/or style.
- Fundamental to understand alcohol preferences by consumers.
- Combination of strategies will most likely affect wine attributes significantly.

Acknowledgements

The Australian Wine Research Institute

Australian Government
Australian Grape and Wine Authority

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The Australian Wine Research Institute

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