Understanding Shiraz berry shrivel and links to berry quality

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The Vineyard of The Future initiative:

www.vineyardofthefuture.wordpress.com

Vineyards of the Future

Pics: James Morgan

www.vineyardofthefuture.wordpress.com
Climate Change

- CO₂
- Temperature
- Rainfall

Viticulture

- Plant water status
- Plant physiology
- Growth

QUALITY
HOMOCLIMES IN AUSTRALIA

Context:

Best match Overseas
- Argentina
- Chile
- New Zealand
- Portugal
- South Africa
- USA
- Other
Maturity Assessment
Berry Cell Death
Berry shrivel

Fluorescein diacetate (FDA)
MATLAB:

Codes developed:

- Berry cell death using fluorescence microscopy (MATLAB)

PCA

Cluster Analysis

Fuentes et al. 2010
MATLAB:

Codes developed:

- Berry cell death using fluorescence microscopy (MATLAB)

\[ ShI = \frac{R - R_{\text{min}}}{R_{\text{max}} - R_{\text{min}}} \]

\[ R = \frac{A}{P} \]

(shrivelled berry) \( 0 > ShI < 1 \) (turgid berry)
ShI = 0.67

Shiraz Sultana Chardonnay Verdelho

ShI = 0.79

Viogner Furmint Traminer Cabernet Sav.

ShI = 0.86

Monukka Merlot Chenin Blanc Red Globe

ShI = 0.71

Pinot Noir Kyoho Chasselas Semillon

ShI = 0.87

Flame Seedless Carignane Grenache Riesling

ShI = 0.63

Colombard Emperor

Fuentes et al. 2010

Tilbrook et al. 2008
Shiraz
Fumint
Riesling
Verdelho
Cab Sav
Carignan
Viognier
Flame S.
Thompson S.
Chennin B.
Red Globe
Monukka
Kyoho
Emperor
Chasselas
Chardonnay
Sémillon
Traminer
Merlot
Pinot Noir
Grenache
Colombard

Linkage Distance
Berry cell death in management - irrigated / drought
Experiments (Shiraz)

Same management, soil differences

Differences in water application
Increased Temperatures Experiment: Nuri (SA)
Onset and rate of cell death

Bonada M., Sadras V. and Fuentes S. 2013; AJGWR

(a) Shiraz
(b) Chardonnay

Living tissue (%)

Days after anthesis (DAA)

Thermal time (°Cd)

- Control
- Heated

(c) (d)

Onset and rate of cell death
Berry Shrivels

\[ Shi = \frac{R - R_{\text{min}}}{R_{\text{max}} - R_{\text{min}}}; \quad R = \frac{A}{P} \]

(shrivelled berry) \( 0 > Shi < 1 \) (turgid berry)

- No temperature effect for Chardonnay
- Shrivelling in Shiraz under warmer conditions

**Shiraz**

- Berry Shrivel

**Chardonnay**

- Berry Shrivel

Bonada M., Sadras V. and Fuentes S. 2013  AJGWR (19): 87-94
Two possible hypotheses:

1. Cell death and shrivel are not functionally linked

2. Cell death is necessary but not sufficient for shrinkage to occur

Source: Fuentes et al. 2010
Smoke taint experiment

(Kerry Wilkinson, Roberta De Bei, Sigfredo Fuentes, Stephen Tyerman):

- Coombe Vineyard (Adelaide)
- 7 grapevine cultivars
Principal component Analysis: Canopy conductance
Smoke taint experiment

**Cabernet Sauvignon**

**Pinot Gris**

**Shiraz**

**Sauvignon Blanc**

**Merlot**

**Chardonnay**

**Pinot Noir**

Days after smoking

Control (unsmoked)  
Smoked

Melbourne School of Land and Environment
PCA 1 (44.5%)
PCA 2 (36.1%)

Brix

Chardonnay
Sauvignon Blanc
Shiraz
Merlot

Control
Smoked

Bp
Ba
Bd
Bsh

LT
Nocturnal transpiration / refill

Nocturnal sap flow output: Shiraz

Benalla VIC

Fuentes et al. 2014 Agricultural Water Management
Plant Based Instrumentation

NIR: Near Infrared

Non-destructive measurement of grapevine water potential using near infrared spectroscopy

R. DE BEI¹, D. COZZOLINO², W. SULLIVAN¹, W. CYNKAR², S. FUENTES¹, R. DAMBERGS³, J. PECH⁴ and S. TYERMAN¹

Cosmic | Gamma | X | Micro | Radio

Ultraviolet | Vis | Infrared

Near | Mid | Far

1 nm | 400 nm | 750 nm | 2500 nm | 10000000 nm
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