Factors affecting the efficacy of vineyard techniques used to delay ripening

Scan for full article

Pietro Previtali[1,2], Filippo Giorgini[3], Nick Dokoozlian[1,4], Randall Mullen[4], Kerry Wilkinson[1,2], Christopher Ford[1,2]

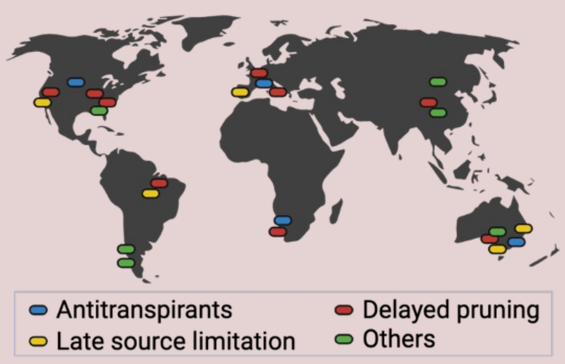
[1]ARC Training Centre for Innovative Wine Production, [2]University of Adelaide and Waite Research Institute, [3]University of Milan Bicocca, [4]E. & J. Gallo Winery

ARC TRAINING CENTRE FOR INNOVATIVE WINE PRODUCTION

Viticultural practices allow growers to adjust grapevine performance to achieve yield and quality targets. As such, they can form an important part of the viticulturists' armoury against the broader impacts of climate change. Over the past two decades significant effort has been dedicated to the identification of strategies to delay sugar accumulation, which we attempted to summarise using meta-analysis.

Literature search

43 studies
242 effects sizes



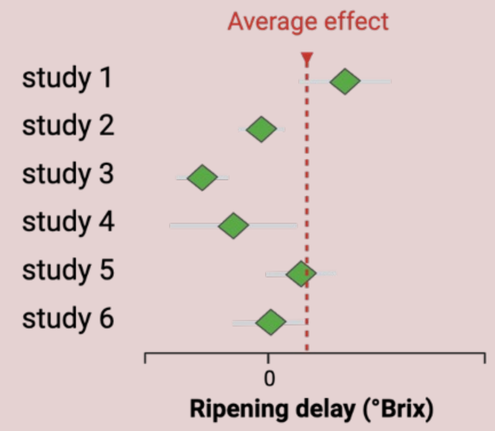
Data curation

Variables of interest
3 treatments

Study ID	Delay (°Brix)	SE	N
1			
2			
3			
4			
5			
N			

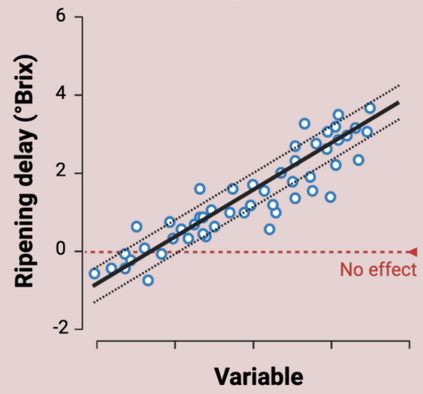
Meta-analysis

Forest plot



Meta-regression

Linear mixed models
Variable significance



Objectives/aims

Novel techniques of meta-analysis, only recently transferred into agronomic research, are a valuable tool to refine experimental trials conducted under variable conditions. Meta-analysis is the analysis of results across studies characterised by the same research question. This statistical procedure is especially capable of determining the size of treatment effects (i.e. effect size) and dissecting factors affecting treatment efficacy and stability.

Our aim was to evaluate the efficacy of vineyard practices applied to delay ripening using meta-analysis. Data were retrieved through a systematic literature search of many research databases. Average treatment effects were calculated and the responses of treatment effects to important growing parameters were explored.

Are treatment effects significant?

The process of data collation returned 43 primary studies that qualified for meta-analysis. From these studies, 242 individual comparisons between total soluble solids (TSS) in control and treated grapes on the same day (harvest) were used to calculate the effect size (ES) values. Positive ES values indicated that ripening was delayed, negative ES values that ripening was advanced and null ES values that the treatment did not affect TSS accumulation.

Table 1: Average delaying effect (ES, in °Brix) and confidence intervals (CI) by treatment.

	AT	DP	LSL
ES (°Brix)	0.74	1.57	1.16
CI	0.54 – 0.95	1.14 – 2.00	0.88 – 1.45

Three treatments were selected based on sample size: antitranspirants (AT, n = 95), delayed pruning (DP, n = 45) and late source limitation (LSL, n = 56), the latter combining late apical defoliation and late trimming. The average treatment effects and confidence intervals (CI) calculated for each treatment were positive, confirming that overall these treatments are effective to delay ripening (**Table 1**).

When are treatments to delay ripening most effective?

Key factors

Antitranspirants. It was found that the delaying power of antitranspirant sprays is lower by 1 °Brix when kaolin formulations are used instead of pinolene (or di-1-*p*-menthene). Late sprays (around veraison) are also more effective than pre-flowering applications (+ 0.6 °Brix), with even larger TSS delays (+ 1 °Brix) when early and late sprays are combined.

- Choice of AT compound
- Timing of spraying
- Single *vs* repeated sprays

Delayed pruning. The efficacy of delayed pruning was dependent on how late vines are pruned, with increasingly larger delays observed moving the pruning activities from budburst (0.5 °Brix) to 2-3 leaves unfolded (2 °Brix) to 7-8 leaves unfolded (3 °Brix) in the most apical nodes of the cane. The potential vine yield also had a significant effect on ripening delays. Delayed pruning was effective at delaying ripening when applied to vines yielding less than 2.5 kg/m cordon, the yield threshold above which late pruning became ineffective.

- Pruning stage *(BBCH stage)*
- Targeted vine yield *(kg/m of cordon)*

Late source limitation. Techniques limiting the activity of photosynthetically active leaves (i.e. "sources") were shown to be suitable to delay ripening of varieties picked at TSS levels higher than 24 °Brix. Additionally, their ability to delay ripening was associated with high-yielding conditions (> 3 kg/m cordon and thereafter) or correlated to decreases in yield caused by the treatment, when yield was decreased by 0.5 kg/m cordon or more.

- Targeted TSS for harvest *(°Brix)*
- Targeted vine yield *(kg/m of cordon)*
- Effects on yield *(kg/m of cordon)*

FOR MORE INFORMATION

Pietro Previtali
E: pietro.previtali@adelaide.edu.au
W: www.arcwinecentre.org.au

Christopher Ford
E: christopher.ford@adelaide.edu.au
W: www.arcwinecentre.org.au

ACKNOWLEDGEMENTS

Australian Government
Australian Research Council

The ARC Training Centre for Innovative Wine Production is funded by the Australian Government (IC170100008) with additional support from Wine Australia and industry partners.

THE UNIVERSITY of ADELAIDE

Wine Australia