Decompressing your vintage

Using antitranspirants on Shiraz in the 2018–19 vintage

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Increased temperatures and heatwave conditions are causing compressed vintages, creating challenges for winery logistics. Anecdotal evidence suggests that coating the berries with an antitranspirant could help manipulate berry ripening while maintaining yield.

Antitranspirants are a group of compounds that when applied to plants help reduce water loss from tissues, thus avoiding water stress and enabling normal metabolic and growth processes to continue. Film-forming antitranspirants can be synthetic (polyacrylamide, silicone oils or low viscosity waxes), inorganic compounds (kaolin clay and other silicates) or natural biopolymers (chitosan).

To assess the effects of applying a naturally derived film-forming polymer to berries, seven trial sites were established across different NSW wine regions during 2018 and 2019. Di-1-p menthene (Stress-Ex™) was applied to each treatment area at a 1% solution rate at pre-flowering (PF) in 2018 vintage only, with 2019 vintage applications at EL 29 (berries 3–5 mm), pre-veraison (PF) and at both pre-flowering and pre-veraison (PFPV). These were compared against a control (no antitranspirant) using a fully randomised and replicated complete block trial design.

Just before the commercial harvest date at each site, 20 randomly selected bunches were hand harvested with two 100-berry samples collected for weight measurements and berry quality analysis. Yield was calculated using bunch weight × bunches/vine × vines/ha. Return on investment was calculated using yield/ha less application costs, including extra harvest costs if weight exceeded the control.

Results

Berry weight

Berry weight was significantly increased by di-1-p menthene at four of the seven sites in 2018 and at three of the seven sites in 2019 with the PV and PFPV treatments.

Bunch weight

Applying the antitranspirant increased bunch weight at six of the seven sites in 2018. In 2019, bunch weight significantly increased at five of the seven sites, with the PFPV treatment being the most effective. Grape yield increased likewise (Figure 26 and Table 6).

Figure 26. Passing the bucket test: increased Shiraz yield at Orange with the combined replicates of the control on the left displaying 2.5 buckets of berries, followed by the PF, then PV and on the far right the dual treatment of PFPV with 3 full buckets.

Return on investment

The cost of applying di-1-p menthene per hectare was calculated to reach a net profit figure after all costs. Inclusions were the cost of product, tractor, fuel and labour ($400/ha/treatment) along with the extra cost of harvesting fruit (@ $50/t) above the control.

Grape price for Shiraz ranged from $500/t in warm–hot climates to $2,100/t in cool–warm climates (Table 7). This assessment only includes differences between the control and the PV and PFPV treatments at each site in both vintages. Only one site returned a loss and this occurred in the PFPV treatment in Mudgee in 2019 where little yield difference resulted between the control and the dual application treatment.

Grape quality

Grape quality for the 2018 vintage was tested at the NWGIC (Figure 27). Berry quality parameters such as pH and titratable acidity (TA) were unaffected by the antitranspirant application. °Brix decreased at sites 3, 4 and 6 (Table 8) along with anthocyanin readings at sites 1, 3 and 4 (Table 9) with the PV and PFPV treatments.

At the time of writing, the 2019 berry quality results are still being tested and will be published in next year's guide.

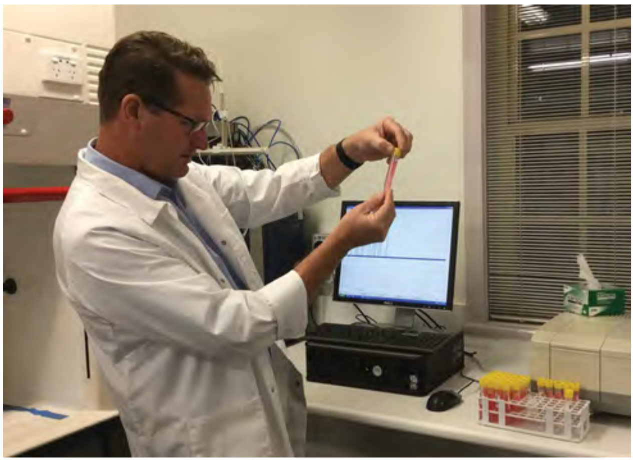

Figure 27. Grape quality testing at the NWGIC.

Wine quality

Experimental wines were made at the NWGIC from one site in 2018 (Figure 28). Shiraz wine pH increased and alcohol concentration decreased with antitranspirant use (Table 10). Total red pigments were significantly reduced with all treatments. The acetic acid concentration was decreased by the PV treatment, increased by the PFPV but not affected by the PF treatment. Applying the antitranspirant did not affect Shiraz TA or free, bound or total sulfur and phenolics.

Pivot profiling

Bottled experimental Shiraz wines (Figure 29) were assessed by a team of NWGIC staff. Pivot profiling was not able to separate the respective treatments of the Shiraz trial wines in a distinct and logical manner. However, the Shiraz control and the PF treatment wines were perceived as darker with more red and dark fruit, and were associated with higher alcohol. Wines from the PV and PFPV treatments were characterised by less ripe attributes, with PV in particular associated with herbaceous attributes and higher acidity (Figure 30).

Figure 28. Replicate experimental Shiraz wines being tested at the NWGIC.

Figure 29. Sensory testing of bottled experimental Shiraz wines was conducted at the NWGIC. Control wine on the left followed by the PF, then PV and on the far right the dual treatment PFPV wine.

Table 6. Yield (t/ha) differences in field grown Shiraz vines treated with antitranspirant at pre-flowering (PF), pre-veraison (PV), at both pre-flowering and pre-veraison (PFPV) or left untreated (Control) during 2018-19.

Site	Location	Yield (t/ha)							
		2018				2019			
		Control	PF	PV	PFPV	Control	PF	PV	PFPV
1	Hunter Valley	9.7 c	11.4 b	11.3 b	12.3 a	11.7 c	11.7 c	13.2 b	15.0 a
2	Mudgee	13.2 c	14.6 b	16.4 a	14.3 b	14.3 ns	13.4 ns	15.0 ns	14.7 ns
3	Orange	7.6 d	8.8 c	9.8 b	11.0 a	11.4 ns	11.5 ns	12.7 ns	13.6 ns
4	Hilltops	11.3 c	11.4 c	12.7 b	14.5 a	8.7 b	9.2 b	10.0 a	10.6 a
5	Canberra	17.1 b	16.7 b	19.7 a	20.4 a	8.2 d	10.2 c	12.1 b	13.6 a
6	Griffith	16.6 b	17.7 b	19.7 a	19.1 a	16.8 c	18.6 b	20.5 a	21.3 a
7	Griffith	13.5 ns	13.5 ns	14.9 ns	15.9 ns	12.3 bc	13.0 b	13.6 b	15.6 a

Values with different letters in the same row are significantly different ($p<0.05$), ns = non-significant.

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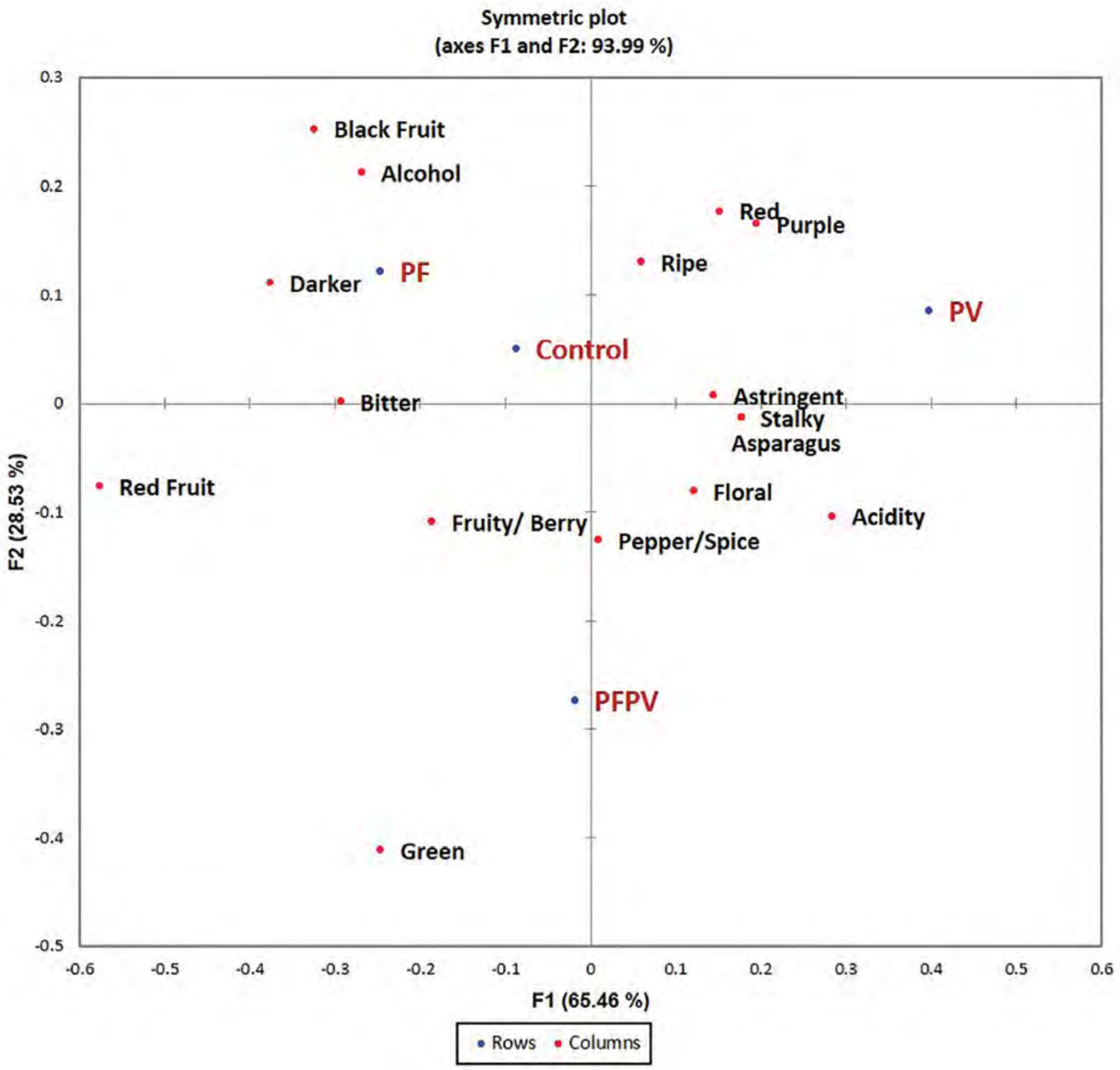

Figure 30. Shiraz wine pivot profile assessment, all treatment replicates combined.

Discussion

Applying a film-forming antitranspirant at a 1% solution rate can effectively manipulate berry ripening. Perhaps the most notable effect was on grape yield, with increases in berry size and bunch weight across both vintages at multiple sites. The lower rainfall and higher temperatures that occurred during both vintages would have caused stress to the berries during cell division and expansion, subsequently affecting berry growth and final size (Keller 2010). If the antitranspirant had not been applied, it is likely that the yield increases would not have occurred.

Increased berry size occurred more with the PV and PFPV treatments than with the PF treatment. This is in contrast to Palliotti et al. (2013), who indicated that PV antitranspirant applications had little chance of affecting berry size. The antitranspirant application covered bunch structures where bunches were exposed within the canopy. The bunch weight increases might have eventuated from less desiccation of the rachis (Poni et al. 2001; Fahey and Rogiers 2018) or from greater turgor pressure (Matthews et al. 2009; Castelarrin et al. 2016), as berries treated with antitranspirants demonstrated less berry shrivel compared to untreated berries.

The effect of the antitranspirant on grape quality was less pronounced than grape yield. Overall, many sites had pH readings above 4.0, highlighting the effect of increased temperatures on winegrape growing (Sadras et al. 2013). This also affected TA readings (Escudier et al. 2014), which would be considered low overall, regardless of treatment.

Table 7. Net profit after using antitranspirant.

Site	Location and year	Treatment	Yield (t/ha)	Difference (t/ha)	Net profit ($/ha)
1	Hunter Valley 2018	Control	9.7	–	–
		PV	11.3	1.7	2,857
		PFPV	12.3	2.6	4,290
1	Hunter Valley 2019	Control	11.7	–	–
		PV	13.2	1.5	2,525
		PFPV	15.0	3.3	5,655
2	Mudgee 2018	Control	13.2	–	–
		PV	16.4	3.2	2,960
		PFPV	14.3	1.1	355
2	Mudgee 2019	Control	14.3	–	–
		PV	15.0	0.7	623
		PFPV	14.8	0.4	-149
3	Orange 2018	Control	7.6	–	–
		PV	9.9	2.2	3,026
		PFPV	11.0	3.4	4,455
3	Orange 2019	Control	10.4	–	–
		PV	12.0	1.6	2,096
		PFPV	13.2	2.8	3,587
4	Hilltops 2018	Control	11.3	–	–
		PV	12.7	1.4	552
		PFPV	14.6	3.3	1,514
4	Hilltops 2019	Control	8.7	–	–
		PV	10.0	1.3	1,471
		PFPV	10.6	1.9	1,959
5	Canberra 2018	Control	17.1	–	–
		PV	19.7	2.6	5,012
		PFPV	20.4	3.3	5,986
5	Canberra 2019	Control	8.2	–	–
		PV	12.1	3.9	7,595
		PFPV	13.9	5.7	10,865
6	Griffith 2018	Control	16.6	–	–
		PV	19.7	3.1	1,037
		PFPV	19.1	2.5	369
6	Griffith 2019	Control	16.8	–	–
		PV	20.5	3.7	1,613
		PFPV	21.3	4.5	1,653
7	Griffith 2018	Control	13.5	–	–
		PV	14.9	1.4	240
		PFPV	15.9	2.4	316
7	Griffith 2019	Control	12.3	–	–
		PV	13.6	1.3	332
		PFPV	15.6	3.3	1,015

°Brix readings were significantly reduced in the PV and PFPV treatments. Similar reductions were reported on cv. Sangiovese (Palliotti et al. 2013), cv. Cabernet Sauvignon (Brillante et al. 2016) and cv. Barbera (Gatti et al. 2016). It is interesting to note that the reductions in this trial resulted from a lower antitranspirant application rate compared with the other studies mentioned.

The decrease in anthocyanin content in PV and PFPV treatments (at three sites) is similar to results reported by Palliotti et al. (2013). Moreover, all sites recorded significant increases in berry and bunch weight. Two separate variables may have elicited this result. Increased absolute berry temperature across the warmer drier vintage may have reduced anthocyanins (Spayd et al. 2002) as would a water deficit (Bucchetti et al. 2011), and this is known to inhibit berry growth (McCarthy 1997, 1999). Given that antitranspirants reduce transpiration (Palliotti et al. 2010), the enhanced berry size resulted in a lower skin to pulp ratio and therefore lower anthocyanin content.

Shiraz wine made from berries treated with the antitranspirant had lower alcohol concentration as the lower °Brix levels in the fruit led to less alcohol in the finished wines, a result that may fit well with a growing consumer trend based on health and societal issues (Saliba et al. 2013). The lower alcohol percentage was also perceived in the pivot profile assessment with PV and PFPV treatments plotted further away from alcohol compared to the control and PF treatments. However, perception of green, herbaceous and high acidity attributes in both PV and PFPV wines supports the notion that these treatments were made with under-ripe fruit, especially given the aforementioned sugar levels, and not derived from the treatment itself.

All fruit for winemaking was picked based on commercial harvest dates and not against a determined sugar level. While the wine from this trial might be undesirable for some wineries, it demonstrates the potential of antitranspirants to mitigate vintage compression (Jarvis et al. 2018) in the vineyard. If treated fruit were allowed further hang time, enhanced flavour and aroma development could result. Furthermore, it provides an alternative to adding water to high sugar fruit in the winery (Schelezki and Jeffery 2018).

Despite the reduction in total red pigments which occurred in the Shiraz PV and PFPV treated wines, only the PFPV treatment was perceived to be less red/purple in the pivot profile assessment.

Table 8. Mean °Brix differences in field grown Shiraz vines treated with an antitranspirant at pre-flowering (PF), pre-veraision (PV), at both times of pre-flowering and pre-veraision (PFPV) or left untreated (C).

Site	Location	°Brix			
		C	PF	PV	PFPV
1	Hunter Valley	20.59 ns	20.74 ns	19.66 ns	19.19 ns
2	Mudgee	23.83 ns	23.65 ns	23.09 ns	23.62 ns
3	Orange	24.80 a	24.73 a	23.11 b	22.14 c
4	Hilltops	25.02 a	25.02 a	24.12 b	24.12 b
5	Canberra	21.78 ns	22.14 ns	21.96 ns	21.96 ns
6	Griffith	22.93 a	22.97 a	22.25 b	21.85 c
7	Griffith	25.45 ns	25.31 ns	25.34 ns	25.20 ns

Values with different letters in the same row are significantly different ($p<0.05$), ns = non-significant.

Table 9. Mean anthocyanins per gram of berry weight (mg/g) in field grown Shiraz vines treated with antitranspirant at pre-flowering (PF), pre-veraision (PV), at both times of pre-flowering and pre-veraision (PFPV) or left untreated (C).

Site	Location	Anthocyanins per gram berry weight (mg/g)			
		C	PF	PV	PFPV
1	Hunter Valley	1.15 a	1.12 a	0.96 b	0.94 b
2	Mudgee	1.42 ns	1.45 ns	1.32 ns	1.31 ns
3	Orange	1.70 a	1.69 a	1.40 b	1.43 b
4	Hilltops	1.55 a	1.56 a	1.45 b	1.39 b
5	Canberra	1.33 ns	1.42 ns	1.32 ns	1.33 ns
6	Griffith	0.80 ns	0.78 ns	0.76 ns	0.61 ns
7	Griffith	1.07 ns	1.01 ns	0.97 ns	0.98 ns

Values with different letters in the same row are significantly different ($p<0.05$), ns = non-significant.

Table 10. Mean wine composition parameters recorded from Shiraz (Site 6) treated with an antitranspirant at pre-flowering (PF), pre-veraison (PV), at both times of pre-flowering and pre-veraison (PFPV) or left untreated (C).

Location and variety	Treatment	pH	Titratable acidity (g/L)	Alcohol % (w/v)	Total red pigments (a.u.)	Acetic acid (g/L)
Site 6	C	3.54 c	5.53 ns	12.2 a	11.35 a	0.34 b
Shiraz	PF	3.56 b	5.37 ns	12.0 b	10.50 b	0.34 b
	PV	3.56 b	5.37 ns	11.8 c	8.92 c	0.33 c
	PFPV	3.57 a	5.33 ns	11.8 c	8.92 c	0.38 a

Values with different letters in the same column are significantly different ($p<0.05$), ns = non-significant.

Conclusions

All antitranspirant treatments significantly increased wine pH and reduced TA in Shiraz, and all results were well within winery specifications. Therefore, using an antitranspirant will enhance yield, decompress vintage and still result in acceptable wine. The treatment effect of the PF application on its own was negligible and, on reflection, even when applied at the later EL stage of peppercorn or pea size berries in 2019, still elicited minimal effects. Therefore, if you are considering applying an antitranspirant to your grapes, perhaps consider not using it at PF stage.

Using a film-forming antitranspirant (di-1-p menthene) at a 1% application rate can manipulate winegrape production in field conditions across different viticultural climatic zones of NSW. Applying the antitranspirant:

- increased yield at 6 of the 7 sites in 2018 and 5 of the 7 sites in 2019.
- reduced °Brix at 4 of the 9 sites in 2018 (2019 results yet to be analysed)
- reduced anthocyanins at 3 of the 9 sites in 2018 (2019 results yet to be analysed)
- produced lower alcohol wine
- provided a tool to mitigate vintage compression.

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