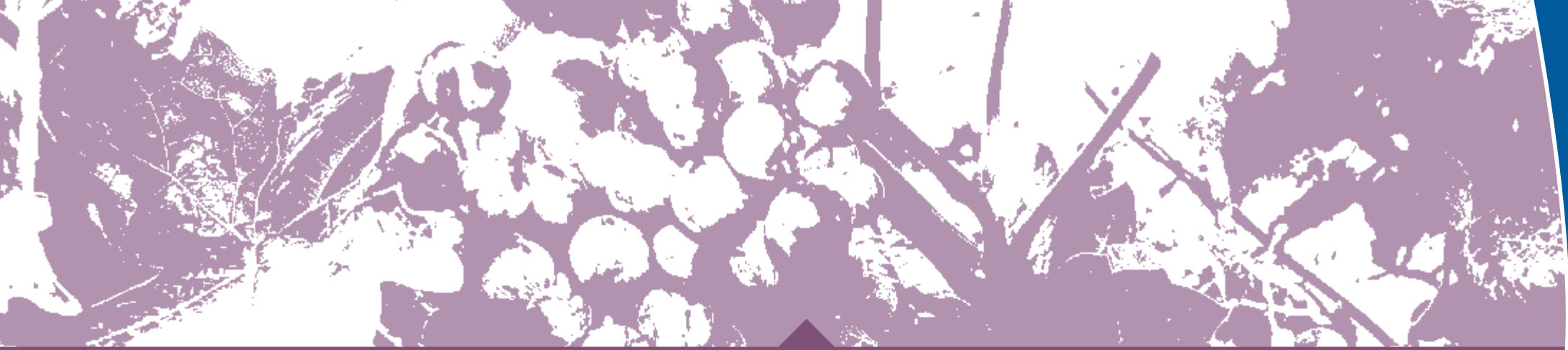

Fungicide Programs for Grapevines

Crop Care

Fungicide Program for Grapevines

Cool/Wet Climates

Margaret River, Coonawarra, Yarra Valley, Mudgee/Orange and Stanthorpe

Phomopsis, Black Spot, Powdery and Downy Mildew, and Botrytis Rot Control

	DORMANT	WOOLY BUD	BUD BURST	SHOOT GROWTH		UP TO 5% CAP FALL	5%-80% CAP FALL	EARLY BUNCH CLOSURE	BUNCH CLOSURE	10 DAYS AFTER BUNCH CLOSURE	VERAISON	PRE-HARVEST	POST-HARVEST
	HIGH DISEASE PRESSURE												
PRODUCT	Emblem	←Delan→ + ←Sulfur→ x2		Captan + Vivando	Barrack + Vivando x2	Supernova	Supernova + Filan	Corvette + DMI	Legend[1] + Captan	Sulfur + Cuprofix or Duplex[2] x3	Captan	Corvette	Sulfur + Cuprofix
TARGET DISEASE	Phomopsis	Phomopsis Mites Black spot		Phomopsis Black spot Powdery mildew		Powdery mildew Downy mildew	Botrytis Downy mildew Powdery mildew	Botrytis Powdery mildew	Botrytis Downy mildew Powdery mildew	Powdery mildew Downy mildew	Downy mildew	Botrytis	Downy mildew Powdery mildew

Resistance:
All uses comply with CropLife recommendations for fungicide resistance management.

Suggested total volumes for dilute spraying:

- Dormant..... 200L/ha
- Wooly bud to early flower..... 500L/ha
- Late flower to pre-bunch closure 750L/ha
- Bunch closure to vintage..... 1,000L/ha

Withholding Periods:
All suggestions comply with AWRI recommendations, provided the last **Captan** spray is at least 30 days before harvest and the last **Corvette** spray is at least 7 days before harvest.

[1] Information on the IPM compatibility of **Legend** is not available.

[2] Use **Duplex** instead of **Cuprofix** if there has been an infection period for downy mildew and/or downy mildew infection is detected in the vineyard. Do not apply more than two consecutive sprays of **Duplex**.

Fungicide Program for Grapevines

Warm/Dry Climates

Barossa, Riverland, Sunraysia, Murrumbidgee Irrigation Area (MIA), Hunter Valley and Inland Queensland

Phomopsis, Black Spot, Powdery and Downy Mildew, and Botrytis Rot Control

	DORMANT	WOOLY BUD	BUD BURST	SHOOT GROWTH	UP TO 5% CAP FALL	5%-80% CAP FALL	EARLY BUNCH CLOSURE	BUNCH CLOSURE	10 DAYS AFTER BUNCH CLOSURE	VERAISON	PRE-HARVEST	POST-HARVEST
	HIGH DISEASE PRESSURE											
PRODUCT	Emblem	← Delan → + ← Sulfur → x2		Captan + Vivando	Captan + Vivando	Supernova + Corvette	Captan + Legend[1]		Sulfur + Cuprofix or Duplex[2] x3	Captan	Corvette	Sulfur + Cuprofix
TARGET DISEASE	Phomopsis	Phomopsis Mites Black spot		Phomopsis Black spot Powdery mildew	Powdery mildew Downy mildew	Botrytis Downy mildew Powdery mildew	Botrytis Downy mildew Powdery mildew		Powdery mildew Downy mildew		Botrytis	Downy mildew Powdery mildew

Resistance:
All uses comply with CropLife recommendations for fungicide resistance management.

Suggested total volumes for dilute spraying:

- Dormant..... 200L/ha
- Wooly bud to early flower..... 500L/ha
- Late flower to pre-bunch closure 750-1,000L/ha
- Bunch closure to vintage..... 1,000-1,500L/ha

Withholding Periods:
All suggestions comply with AWRI recommendations, provided the last **Captan** spray is at least 30 days before harvest and the last **Corvette** spray is at least 7 days before harvest.

[1] Information on the IPM compatibility of **Legend** is not available.

[2] Use **Duplex** instead of **Cuprofix** if there has been an infection period for downy mildew and/or downy mildew infection is detected in the vineyard. Do not apply more than two consecutive sprays of Duplex.

Fungicide Program for Grapevines
Spray Guidelines

The spray program for warm dry climates is designed to give you the best options for disease control throughout the season in districts such as Barossa, Riverland, Sunraysia, Murrumbidgee Irrigation Area (MIA), Hunter Valley and Inland Queensland grape growing regions.
The spray program for cool wet climates is designed to give you the best options for disease control throughout the season in districts such as Margaret River, Coonawarra, Yarra Valley, Mudgee/Orange and Stanthorpe grape growing regions.
In both situations the number of sprays needed will vary with disease pressure and the diseases present.
The programs provided are for conditions of high disease pressure. Important factors considered when preparing these programs are outlined below.

Strategic Coverage: The viticulture industry has become more focused on good phomopsis control, thanks to research over recent years, which has identified different strains with different pathogenicity, the importance of pruning methods and effective fungicides. The importance of early season control of this disease is supported by pre-budburst application of Emblem®. This is followed by applications of Delan® and Captan between budburst and pre-flowering. These two fungicides have been shown to be very effective as protectant fungicides against phomopsis.
Another example is the control of Botrytis with a balance between high value systemic products at critical times of the crop/disease life cycle. In this case the highly effective bunch rot fungicides Filan® and Corvette® are recommended in cool wet climates at the critical stages of 80% capfall, pre-bunch closure and pre harvest.
Where Botrytis pressure is much lower or the stage of the crop/disease life cycle is less critical, the protectants Barrack® and Captan are recommended.

Mode of Action: To reduce the chance of fungicide resistance developing, a range of modes of action are recommended for control of diseases. Fungicides are also recommended at times of the disease life cycle where they will be most effective according to their mode of action.
For example, for powdery mildew control we recommend the protectant fungicide sulphur (Group M2) for early and late sprays. Before, during and after flowering, which are the critical periods for powdery mildew control, we recommend 3 sprays of Vivando® (Group U8), 2 sprays of Supernova® (Group 11), 1 DMI (Group 3) spray and 1 Legend® (Group 13) spray, so that 5 modes of action products are recommended for powdery mildew control.

Fungicide Resistance Management: The maximum number of sprays as recommended by CropLife is always adhered to so as to minimise the risk of the development of fungicide resistance. In some cases the number of sprays of a product in the program may be less than the recommended maximum, but never more.
Relatively cheap and effective fungicide options such as DMI, copper and sulphur are included. However, reduced effectiveness of some DMI's has been reported and we have therefore restricted the number of DMI sprays to one, depending on climate, and introduced products from different modes of action for powdery mildew control. A maximum of 1 or 2 dicarboximides (depending on the total sprays for this disease) are recommended by CropLife for Botrytis control in vines. Therefore two applications of Corvette® are recommended in our programs.

Integrated Pest Management: The effect of fungicides on biological control agents such as predatory mites is carefully considered. Fungicides which are known to have an adverse affect are generally not included in the spray program unless there is no alternative product with a better IPM profile.
Captan and Delan control a wide spectrum of diseases (phomopsis cane and leaf blight, downy mildew and black spot) and at the same time have excellent IPM profiles. Some other protectant fungicides such as those based on mancozeb are known to have a damaging affect on a range of predatory mites which assist in the management of bud mite and rust mite in vines. We **do not** recommend them.

Withholding Period: Withholding requirements for export wines, as recommended by the Australian Wine Research Institute (AWRI) have been strictly adhered to.
Although Barrack has a 7 day withholding period in Australian grapes, MRL's do not exist in some important overseas wine markets and therefore it is not recommended past 80% capfall as recommended by the AWRI.

Cost Effectiveness: Where there are 2 alternative products or product combinations that will fulfil a similar role, the one, which costs less, is recommended.
Several products are registered for protective and post infection control of downy mildew, but these are generally more expensive than straight protectants. We only recommend these products (e.g. Crop Care's new Duplex®) where there has been a downy mildew infection and curative activity is required. Otherwise we recommend the protectant copper product Cuprofix® Disperss®.

Crop Effects: Where a large number of sprays of a product may have an adverse affect on vines or the environment, the total sprays are reduced (or sometimes eliminated) and another product with similar activity is recommended.
For example copper products used throughout the season will cause a bronzing of leaves of many varieties and may result in pollen sterility at flowering. We recommend our copper product Cuprofix Disperss only after flowering and later in the season after earlier sprays of Delan, Barrack and Captan.

For more information, please contact your local Technical Sales Representative.

Customer Service (Australia-wide):
1800 111 454
www.cropcare.com.au

® Delan, Vivando and Filan are registered trademarks of BASF
® Cuprofix and Disperss are registered trademarks of Ceraxagri SA
® Barrack and Supernova are registered trademarks of Crop Care Australasia
® Corvette, Duplex and Emblem are registered trademarks
® Legend is a registered trademark of Dow AgroSciences

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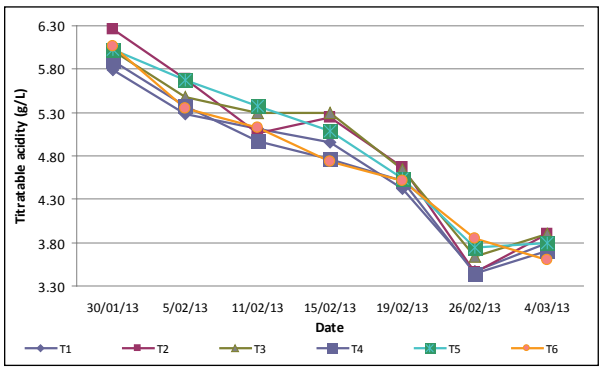

Figure 12. Maturity titratable acidity analysis across treatment plots

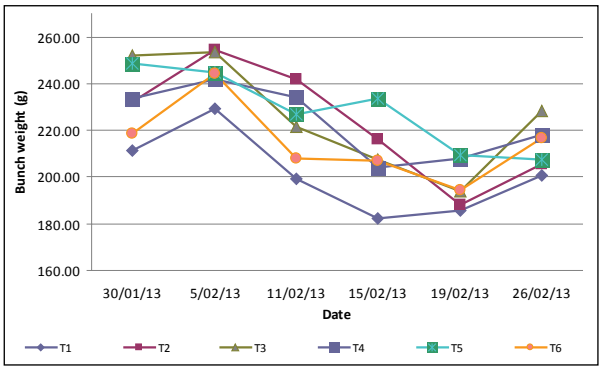

Figure 13. Maturity bunch weights analysis across treatment plots

Berry weight. There were no treatment effects on berry weight, which declined over time (Figure 14). Berry weight measurements were not obtained on 30 January 2013 or 15 February 2013.

Anthocyanin colour (mg/g berry weight). There were significant effects of both treatment and date. Treatment 6 gave the highest colour averaged over all dates (Figure 15). Measurements were not obtained for anthocyanin colour on 30 January 2013 or 15 February 2013.

For the analyses we used the wet chemistry method in the Australian Wine Research Institute 2009 factsheet *Measuring total anthocyanins (colour) in red grape berries* (see www.awri.com.au/wp-content/uploads/anthocyanins_fact_sheet.pdf).

Harvest yield. ANOVA analysis indicated that on the basis of this one year's worth of data we do not have enough evidence to be 95% confident of the treatment differences. Further investigation in future years of the variability of the different treatments is needed to confirm a difference in harvest yield between treatment 6 and treatment 3.

Figure 16 shows the combined yields of the harvested plots for each treatment and the estimated yields per hectare.

Wine analysis and potassium levels. Small-lot wines were made from the grapes from all treatments. This was done at the NWGIC's experimental winery at Wagga Wagga. The wines were made by collecting all the fruit harvested from each replicate plot of the treatment and then crushing them to obtain three replicates of 60-L wine batches.

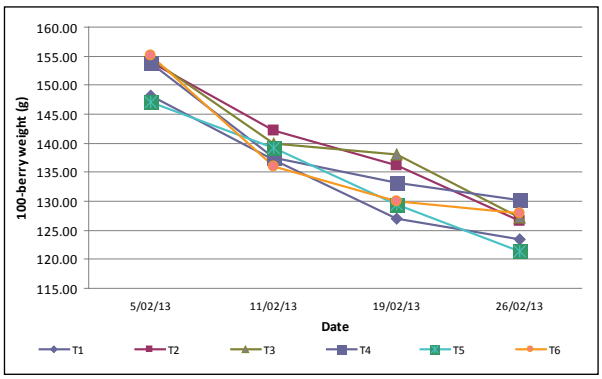

Figure 14. Maturity 100-berry-weight analysis across treatment plots

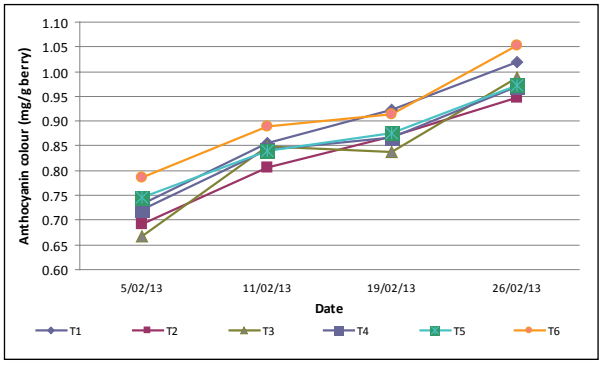

Figure 15. Maturity anthocyanin colour values across treatment plots

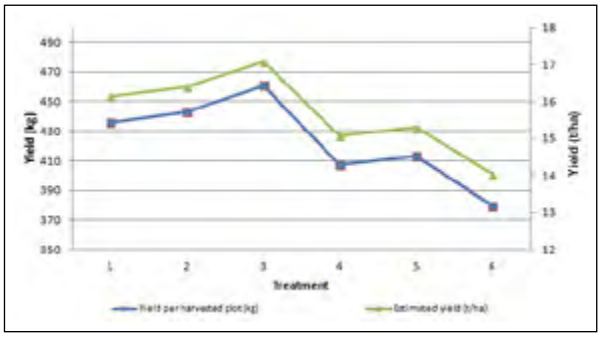

Figure 16. Combined harvested yields across treatment plots

At the time of bottling a final analysis was done to observe any chemical differences between the wines (Table 14). Also a potassium ion concentration analysis was done to determine whether the first year of using the grape marc in the vineyard had caused any elevation in potassium ion concentrations. Potassium ion concentrations did not differ greatly from those of commercial wines.

Table 14. Wine analysis results averaged across replicates at the time of bottling

Treatment no.	Free SO_2 (ppm)	Total SO_2 (ppm)	pH	Titratable acidity (g/L)	Acetic acid (g/L)	Alcohol (% v/v)	Potassium (mg/L)
1	33	71	3.79	5.8	0.19	14.57	1390
2	31	71	3.77	5.9	0.20	14.58	1416
3	34	71	3.78	5.9	0.20	14.33	1484
4	34	68	3.8	5.9	0.23	14.50	1513
5	33	70	3.72	5.6	0.50	14.25	1261
6	34	68	3.76	5.8	0.30	14.86	1356

Sensors installed in the soil to monitor the soil temperature for each treatment. *Photo: Jason Cappello*

Vineyard area slashed and set up in preparation for the trials in the third week of September 2012. *Photo: Jason Cappello*

Attendees interact on 22 November 2012 during a field walk at the trial site. *Photo: James Codemo*

Marc and other mulch materials applied on 25 September 2012. *Photo: Jason Cappello*

Marc on 24 October 2012, one month after application. *Photo: Jason Cappello*

Fine white root hairs evident under grape marc application compared with nil treatment. *Photo: Jason Cappello*

Marc on 26 November 2012, two months after application.
Photo: Jason Cappello

Marc on 21 December 2012, three months after application.
Photo: Jason Cappello

Harvest setup for collecting fruit to make wine, 4 March 2013.
Photo: Jason Cappello

Harvesting the treated plots in March 2013.
Photo: Jason Cappello

Fruit for processing into wine at the National Wine and Grape Industry Centre's experimental winery at Wagga Wagga.
Photo: Jason Cappello

Undervine weed management

Weeds have become established under all treatments of the trial. In those plots where thicker grape marc has been applied, the weed count has been reduced to one or two plants per metre, whereas in plots with exposed soil there are more than 10 plants per metre.

Costing for applications as at September 2012

The delivery and application cost for using the grape march in this project was estimated at $15/tonne (freight was $10/t and spreader/loader hire was $5/tonne), not including labour and tractor-running costs.

Hire rates generally work out at about $300/day for a spreader. Loader fees may be included or additional to the spreader hire.

Freight can cost between $5 and $10 a tonne, depending on the distance and the quantity of material to be moved.

The loading fee charged by Tarac Technologies near Griffith, the supplier of the marc, is about $2 or $3 a tonne to recover operational costs.

Other information of interest

Tarac Technologies at Beelbangera, near Griffith, has the only major distillation processing facility in NSW and presently has a large quantity of aged marc that could be put to use.

Work done in Western Australia by the Grape and Wine Research and Development Corporation's (GWRDC's) regional Grassroots Solutions program has resulted in the development of updated information guides on composts and mulching for industry. To view these documents, visit www.perthregionnrm.com/media/57989/grapevine_nutrition_amended.pdf (*Managing grapevine nutrition and vineyard soil health*) or www.perthregionnrm.com/media/65488/utilising_mulch_and_composts_in_vineyards.pdf (*The use of mulch and compost in vineyards*).

Take-home message and things to think about before using mulches undervine

- Compared with the results in bare earth soil, using grape marc mulch improved soil moisture retention under thick levels of mulch and reduced soil temperature fluctuation within the top 10 cm of the soil.
- Greater amounts of fine vine roots were observed with the use of grape marc mulch than with bare earth soil.
- It is important to have a clean soil free from weeds and prunings before you apply thick layers of organic material: fresh prunings can take root and need to be sprayed out with herbicide.
- Ensure that the source material has been subjected to a recent nutrient analysis test. This allows you to identify whether there are any issues with the material, such as a high pH or carbon to nitrogen (C:N) ratio.
- If the organic material has a high C:N ratio (>25:1), add a nitrogen fertiliser before you apply the organic material to the soil. This will reduce the drawdown of soil nitrogen stocks.
- It may be more economical to use high rates of mulch to target poorer areas of a vineyard (i.e. poorly designed irrigation setups or lighter soil types in a vineyard patch) rather than the whole vineyard.
- Consider using pre-emergent herbicides before marc application to improve weed management, unless you are applying thick mulch layers (between 5 and 7 cm thick).

References and further reading

Compost for Soils 2011. Compost for vineyards. – a case study from Treasury Wine Estates, SA. Treasury Wine Estates - Fleurieu vineyards. Treasury Wine Estates. www.compostforsoils.com.au/uploads/file/pdfs/casestudies/cfs_cs_treasury_web.pdf. Accessed 2 August 2013.

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