

Pest & Disease Management

Managing eutypa dieback of grapevines by remedial surgery



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Summary

Remedial surgery is a method used by growers to restore productivity in grapevines severely affected by eutypa dieback. Research is under way to evaluate this strategy in commercial vineyards in different regions and on a range of grapevine cultivars. Short-term success of reworking vines is variable, gauged by watershoots and wood symptoms remaining after surgery. Malbec and Pinot Noir vines produced watershoots more readily than Shiraz and Cabernet Sauvignon. Vines cut at the crown produced more watershoots than vines cut 30-40cm above the ground, however, more infected wood remained below watershoots in vines cut at the crown. Foliar symptoms reappeared at low levels within four years in reworked vines, which was attributed to failure to remove all the infection in the trunk. Long-term success of remedial surgery will be determined by the occurrence of foliar symptoms and in turn by the yield and quality of grapes. Growers planning to rework vines in order to remove eutypa infection are recommended to remove as much infected wood as possible and protect wounds with paint or fungicide.

Introduction

Eutypa dieback, caused by the fungus *Eutypa lata*, is a major disease of grapevines. The disease causes characteristic symptoms including stunted shoots and a wedge of discoloured tissue in wood sections. The disease is a major problem in established vineyards, particularly premium red cultivars such as Shiraz, Cabernet Sauvignon and Grenache, reducing vineyard productivity and longevity, and costing the Australian grapegrowing industry approximately \$20m per year for Shiraz alone (Wicks and Davies, 1999; Creaser, unpublished).

There is no reliable means to eradicate the fungus once it becomes established within a vine. Consequently, many growers "renew" infected vines by removing infected wood and reworking or top-working. When infection is restricted to part of one or both cordons, wood is removed until the cross-sectional wedge of discoloured wood is no longer visible and then a further 10-20cm to ensure that all infected wood is removed. A cane is then trained to replace the section of cordon removed. Where cordons are

infected and the fungus has progressed into the trunk, two methods are used to restore vines.

- The cut and train method involves cutting off the trunk 30-40cm above the ground, inducing and training up a watershoot to replace the lost canopy (see Figure 1). Stumps can also be grafted.
- The train and cut method, where a healthy shoot is selected from the base of the trunk and trained up to form a new canopy (see Figure 2). The infected trunk is not removed until the new shoot begins cropping (Creaser and Wicks, 2002b).

The success of the cut and train method depends on removal of



Fig. 1. Cut and train method of reworking a vine. The trunk is cut 30-40cm above the ground to remove wood infected with *E. lata*. When a watershoot is produced from the stump it is trained up to the wire to become the new trunk. ▶

all of the infected tissue and production of watershoots to replace the lost canopy. Creaser and Wicks (2002b) reported on the short-term success of three trials established in 1999-2000. These trials are being monitored for production of new watershoots and foliar symptoms and in 2002-03 another seven trials were established involving different cultivars and environments using the two methods. Results are presented in this article.

The objective of these trials is to assess the long-term effectiveness of remedial surgery, which is determined by restoration of the vine to productivity (yield and quality), failure of symptoms to reappear and increased longevity of the vines. Monitoring these trials over a long period (5-10 years) will enable us to determine the most-effective methods for extending the productivity of eutypa-infected vines.

Methods

Three trials (trials 1-3) were established in 2000 on Shiraz and Malbec grapevines in Eden Valley and McLaren Vale in South Australia. In winter 2000, cuts were made through the cordons and



Fig. 2. Train and cut method of reworking a vine. The lowest watershoot is chosen to train up as a new trunk, and once established the old trunk will be cut off above the watershoot to remove wood infected with *E. lata*.

trunk (30-40cm above ground) of each vine. At Eden Valley, vines were also assessed for foliar symptoms of eutypa dieback in spring 1999 and wood symptoms were recorded in trunk cross-sections during remedial surgery. At Eden Valley, wounds were treated with either Benlate®, Nustar® or Trichoseal™ and at McLaren Vale wounds were treated with Benlate mixed into acrylic paint. Each spring, vines have been assessed for watershoot production and foliar symptoms of eutypa dieback.

In the Coonawarra, South Australia, cordons were removed at the crown of Shiraz vines in two vineyards in 2002 and 2003 (trials 4 and 5). Benlate was applied to wounds immediately. The position of watershoot production was assessed during

the following spring and foliar symptoms were recorded. Excess wood will be removed once watershoots are established on the wire.

Three trials (trials 6-8) were established in 2002 and 2003 on Cabernet Sauvignon and Shiraz vines in McLaren Vale and Eden Valley. Vines were cut about 30-40cm from the ground and wounds were assessed for presence of wood discoloration typical of eutypa, esca and Petri disease. Samples (2-3cm slices of trunk) were collected for fungal isolation and molecular diagnosis of *E. lata* before wounds were treated with Benlate mixed into acrylic paint or with Garrison® (cyproconazole + iodocarb). In autumn and spring 2003, vines were assessed for watershoot production and foliar symptoms.

In the Barossa Valley, Pinot Noir vines were reworked in winter 2003 (trial 9). Vines were cut 30-40cm above the ground and wounds were treated with one of four pruning wound protectants (Benlate, Garrison, Vinevax™ and acrylic paint) or left untreated (controls). Wounds were inoculated with ascospores of *E. lata*. In spring 2003 vines were assessed for watershoot production and foliar symptoms of eutypa dieback.

A grafting trial was set up in the Barossa Valley, South Australia, to assess Sauvignon Blanc vines which were cut 30-40cm above the ground and grafted with Shiraz (two canes per vine) in spring 2001. Wounds were painted with five pruning wound treatments (Bavistin®, Fungaflor®, Nustar, Scala® and Trichoseal) or left untreated and then all covered with Bitkote® (Davco Construction Materials Pty Ltd). On the following day, wounds were inoculated with ascospores of *E. lata*. Each spring, vines have been assessed for graft success and appearance of foliar symptoms of eutypa dieback.

Results

In trial 1 at Eden Valley, foliar symptoms were visible on only 35% of Shiraz vines, yet all vines contained discoloured wood in the cordons (Creaser and Wicks, 2002b). Furthermore, 71% of vines contained infected wood that could not be removed, ie. that was visible on the stump surface 30-40cm above the ground. The remaining infections did not effect watershoot production, as 63% of vines produced watershoots in the first spring following surgery, and pruning wound treatment had no effect on watershoot production. Three years later, in spring 2003, the incidence of watershoot production had increased to 75% and 1.4% of vines expressed foliar symptoms of eutypa dieback.

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In trials 2 and 3 at McLaren Vale, significantly more Malbec vines (95%) produced watershoots than Shiraz vines (76%) in the 20 rows examined in spring 2001, and none of the vines exhibited foliar symptoms of eutypa dieback (Creaser and Wicks, 2002b). There was a significant difference between the two locations in terms of watershoot production in Shiraz. By spring 2003, incidence of watershoot production remained the same for Malbec, but rose to 82% for Shiraz and foliar symptoms of eutypa dieback were observed on watershoots on 0.1% of Malbec and 0.9% of Shiraz vines.

Figure 3 shows the incidence of watershoots produced after remedial surgery in four cultivars of grapevine. Pinot Noir and Malbec produced watershoots more readily than Shiraz and Cabernet Sauvignon, when cut 30-40cm above the ground. Furthermore, more vines produced watershoots when cut at the crown than when cut closer to the ground. However, when cut at the crown, 32-40% of watershoots grew from above 40cm from the ground, increasing the likelihood that eutypa infection exists beneath the watershoot.

The recurrence of foliar symptoms of eutypa dieback on vines which have been reworked is shown in Table 1. In trials 1-3, foliar symptoms first appeared four years after surgery. Of trials 4 to 9, only in trial 8 did vines express foliar symptoms in the first two years following surgery. In trial 8, watershoots grew from above 40cm from the ground in three of the four vines which expressed foliar symptoms.

Vines in trials 7 and 8 were assessed for discolouration of the cross-sectional trunk surface exposed after surgery. Figure 4 shows a cross-section of a trunk

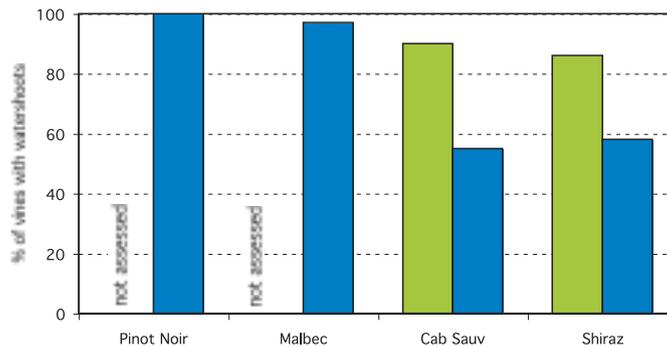


Fig. 3. Incidence of watershoot production during the spring following remedial surgery in four cultivars of grapevine. Vines are either cut at the crown (green) to remove cordons or 30-40cm above the ground through the trunk (blue). Data have been averaged from all trials in this project and include observations from three vineyard blocks in the Wynns Coonawarra Estate Vineyards.

with characteristic wood discolouration and indicates the locations from which the following fungi were isolated in this study; *Eutypa lata*, which causes eutypa dieback, *Phaeomoniella chlamydospora* and *Phaeoacremonium aleophilum*, which have been associated with both Petri disease and esca (Edwards and Pascoe, 2004). A number of basidiomycete fungi, which are associated with esca, are commonly isolated from the whiteheartrot-affected wood in the centre of the trunk (J.

Edwards, pers comm., 2004). At McLaren Vale and Eden Valley, eutypa dieback wood symptoms were observed in 37% and 36% of vines respectively and 49% and 93% of vines respectively, were observed to have wood symptoms characteristic of Petri disease and/or esca (Figure 4). Eutypa dieback foliar symptoms are commonly observed in the two vineyards, however, it is important to note that the external symptoms of Petri disease (young vine decline, shoot dieback) and esca (tiger-striped foliage, apoplexy)

Table 1. Remedial surgery trials on four cultivars of grapevine, in four South Australian wine regions. Vines were either cut through the trunk 30-40cm above the ground (low) or cordons were removed at the crown (high). The percentage of vines with eutypa dieback symptoms was assessed in some trials pre-surgery (for foliar symptoms) and during surgery (for wood symptoms). All trials were assessed each spring following surgery for symptoms in new foliage.

Trial	Cultivar	Region	Height	Year of surgery	Symptoms pre-surgery (%)		Foliar symptoms (%) years after surgery			
					Foliar	Wood	1 y	2 y	3 y	4 y
1	Shiraz	EV	Low	2000	35	71	0	0	0	1.4
2	Malbec	MV	Low	2000	-	-	0	0	0	0.1
3	Shiraz	MV	Low	2000	-	-	0	0	0	0.9
4	Shiraz	CW	High	2002	-	-	0	0		
5	Shiraz	CW	High	2003	56	-	3			
6	Cab Sauv	MV	Low	2002	-	17	0	0		
7	Shiraz	MV	Low	2003	-	37	0			
8	Shiraz	EV	Low	2003	-	36	0			
9	Pinot Noir	BV	Trunk	2003	0	0	0			

EV - Eden Valley, MV - McLaren Vale, CW - Coonawarra and BV - Barossa Valley

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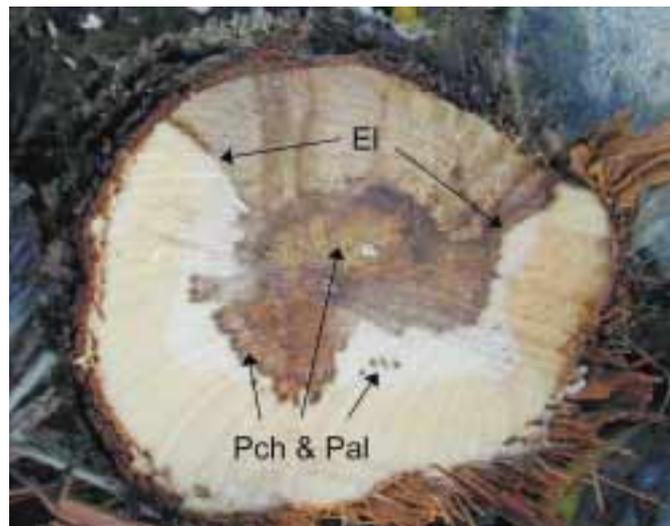


Fig. 4. Cross-section of a Shiraz grapevine trunk cut 30-40cm above the ground showing characteristic wood discoloration. Arrows indicate the locations from which the following fungi were isolated; *Eutypa lata* (E), *Phaeoconiella chlamydospora* (Pch) and *Phaeoacremonium aleophilum* (Pal).

have not been observed in these vineyards and are rare in South Australia. Fungi have been isolated in the laboratory and confirmation of *E. lata* (as cultures and in wood samples) is being carried out by Richard Lardner (University of Adelaide) using DNA markers.

In the Barossa Valley grafting trial, 80% of vines had at least one successful graft whereas only 44% of vines had two successful grafts. Of the vines where both grafts failed, 50% produced watershoots. There was no significant effect of pruning wound treatment on the success of grafts.

Conclusions

Remedial surgery to restore eutypa dieback-affected vines to productivity is a labour intensive and costly process. This research has demonstrated that the short-term effectiveness of remedial surgery as a strategy for managing affected vines is influenced by the extent of infection, grapevine cultivar and district.

Remedial surgery on Shiraz vines appeared to be unsuccessful initially as 71% of vines contained wood symptoms following surgery and only 63% of vines produced watershoots (Creaser and Wicks, 2002b). However, four years later, the incidence of watershoots had increased to 75% and only 1.4% of vines displayed foliar symptoms. Eutypa dieback symptoms occurred only on watershoots from stumps in which infected wood remained after surgery. Hence if the pathogen is not completely removed from the vines, longevity of the reworked vines may be limited. Foliar symptoms were not a reliable indicator of the location or the extent of *E. lata* infection within a vine and, since foliar symptom expression varies from year to year (Creaser and Wicks, 2001), continued monitoring of these vines will be necessary to make conclusions about these results.

These trials have revealed that cultivars respond differently to reworking. Malbec and Pinot Noir produced more watershoots than Shiraz and Cabernet Sauvignon. Preliminary data showed that low levels of symptom developed within four years of surgery. It may be possible that the amount of infected wood tissue remaining will influence the reappearance of foliar symptoms. Cultivar and district may also be important, however, long-term monitoring and more trials are necessary to confirm this.

As *E. lata* infects through wounds, it is important to protect all wounds resulting from remedial surgery. In previous trials, Benlate, Bavistin and acrylic paint were effective at preventing infection on one-year-old canes (Creaser and Wicks, 2002a; Sosnowski *et al.* 2004). We are currently testing these and other products on cordon and trunk wounds.

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Grapegrowers urged to stay on alert for signs of GLR

Grapegrowers are being urged to be on the lookout for an insidious disease that has the potential to decimate wine production in Australia.

In July 2001 an exotic disease caused by the fungus *Phakopsora euvtis* (Grapevine Leaf Rust) was detected in Darwin, the first incursion to be reported in Australia. To date the disease has not been detected outside the Darwin area.

Grapevine Leaf Rust is a disease in tropical and sub-tropical areas in Asia, but before the detection in Darwin no known cases had been reported in Australia. It is a serious disease of grapes in the USA and south-east Asia and occurs as close to Australia as Indonesia.

The disease is most readily identified by clustered small yellow powdery spores on the underside of mature grapevine leaves. Small dark spots also appear on the upper surface. Heavily infected leaves drop prematurely or die on the vine. Over time infected vines may suffer reduced shoot and flower development; reduction of fruit quality and yield loss.

Grapevine Leaf Rust is found in many tropical and sub-tropical regions, but can survive and reproduce in temperate Mediterranean climates. The fungus produces microscopic spores that may be wind-blown (up to 100km) and carried on humans, plant material or equipment. The spores reproduce and a 'pustule' of yellow-orange rusty spots develops on the underside of infected leaves. On the

corresponding upper surface yellow-dark brown spots appear.

An eradication team, attached to the Department of Business, Industry and Resource Development was established in Darwin. The eradication team coordinates and manages the program, beginning with extensive surveys of every Darwin and Palmerston household and property to record all grapevines and remove those infected with the rust disease.

The program will continue with a smaller team working to monitor the remaining healthy vines. There must be two years with no detection of the disease before the Northern Territory can be declared free of grapevine leaf rust.

To date almost \$1.5 million in funding has been provided from Australia's grapegrowing States and the commonwealth to run the eradication program designed to protect Australia's \$4.7 billion a-year wine and tablegrape industries. The grape industry has supported research into resistant grape varieties and effective fungicides.

As part of the national eradication program it is important that all grapegrowing stakeholders keep an eye out for GLR and report suspect detections through the Exotic Plant Pest Hotline 1800 084 881.

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