

Short-term effects of remedial surgery to restore productivity to *Eutypa lata* infected vines

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Summary. *Eutypa* dieback, caused by the wood infecting fungus *Eutypa lata*, causes a gradual decline in vineyard production. Many growers renew infected vines by removing infected wood. Here we report on the short-term effects of the procedure on 28-year-old own-rooted Shiraz vines. In spring 1999, all vines in six adjacent rows were examined for foliar symptoms of *Eutypa* dieback. The following winter, cuts were made through both cordons and the trunk of each vine to determine the extent of wood discolouration, a symptom of *E. lata* infection. Foliar symptoms were recorded on 35% of the 141 vines, yet discoloured wood was observed in all cuts made through the cordons and in 71% of cuts made through the trunk. However, no association was found between the foliar symptoms observed in the spring prior to surgery and the extent of wood discolouration, i.e. discolouration that was visible on the cut surface of the trunk ($P=0.20$). Furthermore, discoloured wood remaining in the trunk had no effect on the production of watershoots ($P=0.74$), which were produced by 63% of vines in 2000. When re-examined in spring 2001 and 2002, watershoots were observed on 61 and 76% of vines respectively. As in the previous year, no association was observed between the discoloured wood remaining in the trunk and the production of watershoots ($P=1.00$ in 2001, $P=0.21$ in 2002). Foliar symptoms were not observed in 2000, 2001 nor in 2002. Infection with *E. lata* was confirmed by isolation of the pathogen from 92% of discoloured wood samples taken from 14 vines.

Key words: *Eutypa* dieback, grapevine, remedial surgery.

Introduction

Eutypa dieback, caused by *Eutypa lata* (Pers.:Fr) Tul. & C. Tul. (= *E. armeniaca* Hansf. & M.V. Carter), has been recognised as a major fungal disease of grapevines in Australia for over 60 years (Wicks, 1975). In the field, the disease can be diagnosed by the presence of foliar and wood symptoms. Foliar symptoms appear as stunted shoots with shortened internodes and small, tat-

tered leaves. Wood infection is characterised by the presence of a wedge of necrotic tissue from which the fungus can be readily isolated from the margin of the necrotic zone.

Currently there are no means, chemical or other, to eradicate the fungus once it becomes established within a vine. Consequently, many growers renew infected vines using remedial surgery to remove the infected tissue. In spring, growers are advised to tag symptomatic cordons and in winter to cut back affected vines until no discoloured wood remains. Where both cordons are removed, watershoots are trained to replace the lost canopy.

The short-term success of the procedure is determined by removal of the symptomatic wood and

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restoration of the canopy. The long-term effectiveness of remedial surgery is determined by restoration of the vine to productivity (higher yield or quality), failure of symptoms to reappear and increased longevity. The objective of this study was to assess the short-term effectiveness of remedial surgery as a strategy for renewing *E. lata* infected vines. Specifically we asked: Can the foliar symptoms be used to locate wood infections? Do foliar symptoms indicate the extent of wood infection? If infections remain following surgery, do they inhibit watershoot production?

Materials and methods

In a commercial Shiraz vineyard in the Eden Valley, situated approximately 75 km northeast of Adelaide, South Australia, all vines in six adjacent rows were examined for foliar symptoms of *Eutypa* dieback in spring 1999 (9 December). The vines were own-rooted and established on a standard single-wire system in 1971. If foliar symptoms were recorded, the location of symptomatic shoots along the cordons was also noted.

The following winter, three cuts were made through each vine. One cut through each cordon, approximately 20 cm from their junction with the trunk, and the final cut through the trunk, about 30 cm above ground level. The cut surfaces were then assessed for the presence or absence of wood discoloration. Infection with *E. lata* was confirmed by isolation of the pathogen from the margin of the necrotic zone of samples from 14 randomly selected vines (10% of the total) onto potato dextrose agar. Samples were taken from one cordon of each vine and when discoloured wood was present on the cut surface of the trunk, a further sample was taken (11 vines).

Over the next three years, vines were monitored each spring (31 October 2000, 1 November 2001, 13 November 2002) for watershoots and foliar symptoms.

Data were analysed in Genstat (Version 5, 4th edition, IACR Rothamsted, UK) using contingency tables to test for associations between foliar symptoms, wood discoloration and watershoots.

Results

In the spring before surgery, foliar symptoms were recorded on 35% of vines and were restricted

to only one cordon in 47% of vines expressing these symptoms. However, discoloured wood was observed on the cut sections of both cordons on all vines.

Of the 141 vines examined, 71% contained extensive wood discoloration that was visible on the cut section of the remaining trunk. However, no association was observed between foliar symptom expression in the spring prior to surgery and the extent of wood discoloration ($P=0.20$). Furthermore, discoloured wood remaining in the trunk had no effect on watershoot production ($P=0.74$), which were produced by 63% of vines in 2000. When re-examined in spring 2001 and 2002, watershoots were observed on 61% and 76% of vines respectively. Between spring 2000 and 2001, the watershoots of three vines died. In spring 2002, watershoots were produced by 20 vines that had not previously done so. As in 2000, no association was observed between the discoloured wood remaining in the trunk and the production of watershoots ($P=1.00$ in 2001, $P=0.21$ in 2002). Foliar symptoms were not observed in the watershoots in 2000, 2001 nor in 2002.

Eutypa lata was isolated from 92% of discoloured wood samples, 13 taken from cordons and 10 from trunks, confirming infection with *E. lata*.

Discussion

This study has demonstrated that the foliar symptoms cannot be used to locate wood infections. Although all vines contained wood symptomatic of *E. lata* infection in both cordons, foliar symptoms were observed only in 35% of vines and were restricted to one cordon only in 47% of vines expressing these symptoms.

Where only part of a vine exhibits foliar symptoms, current recommendations advocate removing only those sections (Creaser and Wicks, 2000). The results of this study suggest that in vines containing multiple infections, removal of only those sections that express foliar symptoms may not remove all the infected tissue. Similarly, as there was no association between the expression of foliar symptoms and the extent of wood discoloration, it seems that foliar symptoms cannot be used as an indicator of the extent of wood infection. Foliar symptoms were expressed by only 22% of vines that contained discoloured wood on the cut surface of

the trunk. This suggests that other factors may be involved in the expression of foliar symptoms.

Foliar symptoms of *Eutypa* dieback vary from year to year with infected vines expressing symptoms in some years and not in others (Deswarte *et al.*, 1994; Dubos, 1996; Creaser and Wicks, 2001). These symptoms are caused by translocatable toxins produced by the fungus *E. lata* (Mauro *et al.*, 1998; Tey Rulh *et al.*, 1991; Molyneux *et al.*, 2002). Peros and Berger (1994) suggested that fungal virulence could be correlated with the production of toxic compounds and isolates of *E. lata* have been shown to differ in their production of potentially phytotoxic metabolites (Molyneux *et al.*, 2002)

As *Eutypa* dieback is propagated by ascospores, fungal colonies originating from separate infection events are likely to be genetically distinct (Peros *et al.*, 1997). Consequently, vines may contain several isolates of *E. lata* that differ in virulence towards their host. This may go some way in explaining why foliar symptoms were associated with some, but not all, wood symptoms within the same vine and on different vines.

Discoloured wood remaining in the trunk did not inhibit watershoot production. However, vine longevity and the long-term effectiveness of remedial surgery may be affected by these remaining infections.

Remedial surgery to restore *E. lata* infected vines to productivity can be a labour intensive and costly process. Infected tissue must be cut out, wounds treated to prevent new infections, and watershoots trained to replace the lost canopy. In most cases, trellises must be re-wired. Weed control by post-emergent herbicides, such as Glyphosate, will also be more difficult if watershoots are trained up from the base of the trunk (Winkler, 1972). However, the procedure offers many advantages over replanting, the only other alternative, such as preservation of the original clone, fruit quality, and hardiness associated with the remaining root system.

Further work is now required to investigate the genetic diversity of colonising isolates, their toxin profiles, and interactions between isolates colonising the same vine. The effect of remedial surgery

on the reappearance of foliar symptoms and vine longevity must also be monitored, particularly as infections remained in the trunks of most vines.

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