

GRAPEVINE TRUNK DISEASES

EUTYPA & BOTRYOSPHERAERIA

DIEBACK IN VINEYARDS

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KEY NOTES

- ▶ **The pathogens causing Eutypa and Botryosphaeria dieback survive in infected wood of grapevines and other woody hosts, on which they produce spores that are released during wet weather.**
- ▶ **The spores are spread by rain splash and wind to infect fresh pruning wounds, and the fungi progressively kill cordons and trunks.**
- ▶ **Wounds are most susceptible to infection by fungal spores immediately after pruning and susceptibility decreases rapidly over the first 2 weeks.**
- ▶ **To prevent infection, avoid pruning in wet weather and apply wound protectants promptly post-pruning.**
- ▶ **To control existing infection, remove infected wood and rework vines by growing a water shoot from clean wood to replace the old trunk.**

COMMERCIAL SIGNIFICANCE

Eutypa dieback (ED) and Botryosphaeria dieback (BD) are major grapevine trunk diseases worldwide that cause significant yield and quality reduction. They threaten the sustainability of New Zealand vineyards that are beginning to age and are dominated with highly susceptible Sauvignon Blanc. Losses have been estimated at 30%-60% in infected vineyards in California where net income losses overall were estimated to be US\$260 million a year. In Australia, yield losses of more than 2.6 t/ha have been estimated in Shiraz vineyards with more than 80% disease incidence.

In New Zealand, trunk diseases threaten the entire national crop of 38,680 ha. Potential losses could be reduced substantially – by as much as \$40 million each year – if trunk diseases are effectively managed.

SYMPTOMS

Symptoms of ED and BD appear 3-8 years after infection by causal fungal spores. The fungi kill woody tissue around the infection point, then kill other spurs along the cordon (Figure 1), or cause dead and unproductive areas on the head of cane-pruned vines (Figure 2) as they progress toward the base



Figure 1. Dead spurs along cordon.



Figure 2. Dead and unproductive area on the head of a cane-pruned vine.



Figure 3. Canker, exposed by removing bark, extending from pruning wound towards trunk.

of the trunk. If bark is peeled back, stained brown (dead) wood, known as a “canker”, can be seen extending towards the trunk (Figure 3). On trunks, external cankers are more easily identified as the bark will fall off the trunk, leaving flattened areas (Figure 4). Cross-sections cut through the cankers show wedges of brown, dead tissue as well as central staining (Figure 5). Cankers in the trunks eventually kill vines.

The ED pathogen, *Eutypa lata*, produces toxic metabolites which are translocated to the foliage causing yellow, stunted shoots and cupped leaves with dead margins (Figure 6).

Bunch size can be reduced and berries ripen unevenly. Foliar symptom expression is known to vary from year to year.

Spores of BD pathogens can also infect summer trimming wounds, causing the green shoots to die back (Figure 7). In autumn, infected canes can be bleached and have superficial, raised, black fruiting bodies (Figure 8).

In spring, infected shoots may produce stunted and chlorotic leaves and then die (Figure 9). BD pathogens have also been reported to cause a soft brown rot on berries.



Figure 4. External canker on trunk evident by the flattened area where bark has fallen off.



Figure 5. Cross-section through canker in the cordon (left) with wedge-shaped brown, dead sections common to ED and BD; and through a trunk with central staining only associated with BD (right).



Figure 6. Foliar symptoms of Eutypa dieback, with stunted shoots and cupped leaves with dead margins.

Grapevines as young as 4 years old have been observed with dieback symptoms in New Zealand, and as vines age, incidence of vines with symptoms increases (Figure 10). The delay in symptoms suggests that infections can occur in the vine's first pruning season. Therefore, it is important to begin protecting pruning wounds from infection during the first pruning season. As vines age, the likelihood of them becoming infected by ED and BD pathogens progressively increases each year. This is due to successive years of pruning creating opportunities for infection, more and larger cuts being required as vines age, and the increased time for symptoms to become apparent.

All wine grape varieties can be infected by ED and BD pathogens, but the severity of foliar and dieback symptoms varies among varieties. Sauvignon Blanc and Cabernet Sauvignon are highly susceptible, but the other varieties most commonly planted in New Zealand (Pinot Noir, Chardonnay, Merlot and Pinot Gris) are ranked as having medium to low susceptibility.

DISEASE CYCLE

Grapevine trunk disease pathogens overwinter in dead, infected wood. Fungal spores are released from fruiting bodies during rainfall, and can continue to be released for several days after rain has stopped. Therefore, disease spread is especially important during winter pruning, but infection is possible during other seasons where rainfall coincides with activities resulting in wounds (e.g., shoot thinning and harvest). Spores of ED pathogens can travel in wind up to 50 km from the source, whereas spores of BD pathogens are spread by wind-driven rain splash up to 20 m from their source. Spores land on pruning wounds to infect vines.



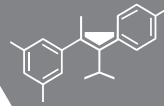
Figure 7. Botryosphaeria dieback in green shoot due to trimming wound.



Figure 8. Bleached cane with black fruiting bodies of Botryosphaeria dieback pathogen (Inset: oozing spores).



Figure 9. Death of shoots affected by Botryosphaeria dieback in spring.



The spores germinate and fungi grow slowly (up to 20 cm/year in 1-year-old canes and up to 5 cm/year in older wood) in the vascular tissue towards the base of the trunk, killing wood tissue and reducing the transport of water and nutrients to foliage.

According to Australian research, wounds are most susceptible immediately after cuts are made and susceptibility decreases over the following 2 weeks, after which natural wound healing reduces the likelihood of further infection. Although age of wood does not affect susceptibility of infection, the larger and more numerous wounds on older vines provide a greater surface area for spores to land. These take longer to heal and so are more likely to be infected. Spur-pruned vines have a greater number and total surface area of smaller wounds than cane-pruned vines. However, wounds on cane-pruned vines are larger, and near the crown, so infection can rapidly move into the trunk.

Many fruit and ornamental trees can host ED and BD pathogens, with common alternative hosts in New Zealand being apricot, cherry, apple, pear, kiwifruit, blueberry, maple and willow. The dead infected wood from these hosts can also release spores which can infect grapevines.



Figure 12. Wound dressing applied to a large wound.

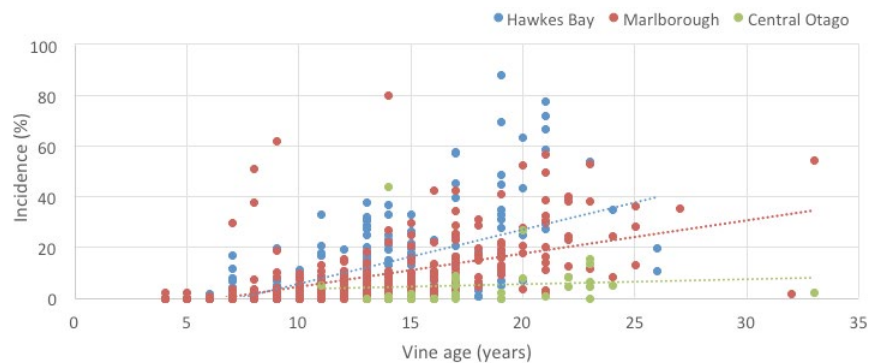


Figure 10. The effect of vine age on incidence of dieback symptoms in three NZ wine regions.

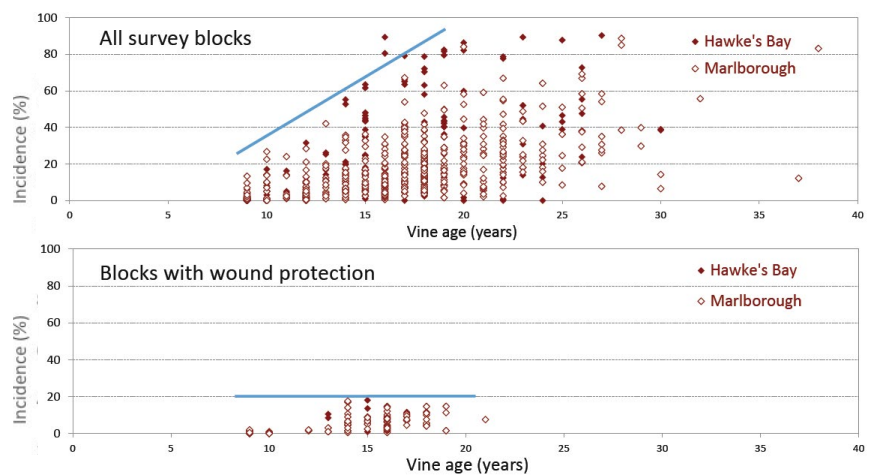


Figure 11. Scatter plots of the incidence of dieback in all blocks surveyed in 2018 (top) and the 102 selected Delegat blocks (bottom) with active pruning wound protection in place since 2006. Blue lines indicate the maximum dieback incidence for vines aged between 10 and 20 years of age.

CONTROL

Cultural practice

Pruning in wet weather should be avoided. Removal of dead wood from grapevines and alternative hosts in and around the vineyard will reduce the potential inoculum level.

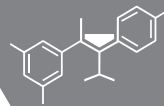
According to research in the United States, infection can be reduced by double pruning, the practice where mechanical pre-pruning is used to leave long spurs in early winter followed by hand-pruning to short spurs in late winter. It is recommended that final wounds be treated with a wound protectant.

Contamination of pruning tools is not a major means of spreading the disease, and application of a fungicide to wounds will eliminate pathogens.

Wound protection

All pruning wounds are vulnerable to infection and should be protected. Incidence of dieback can be limited with regular protection of annual pruning wounds (Figure 11). Use products that have been registered for this purpose (listed in New Zealand Winegrowers Vineyard Spray Schedule under "Wound Dressings").

Paints and pastes: Applications of acrylic paints and the following registered wound dressings are suitable as wound protectants, especially on large wounds and during vine reworking (Figure 12): Greenseal Ultra (tebuconazole and oclthilnone), PruneTec and Vistaseal (tebuconazole).



It is important to ensure good coverage of the wound surface; if sap is flowing, wait until it stops before applying a wound dressing containing a fungicide – or scrape off the exudate before application

Fungicides: Gem (fluazinam) and Megastar (flusilazole) are registered as wound protectants for control of ED and BD. Gelseal Ultra Spray-On (tebuconazole, boric acid and oththilnone) is registered to control ED.

Fungicides can be applied efficiently to annual pruning wounds with tractor-driven spray machines (Figure 13) promptly after pruning. It is important to direct nozzles to target the pruning wound zone and use high spray volumes (at least 600 L/ha) to maximise coverage on wounds.

Organic control: Biological control agents, such as the fungi *Trichoderma spp.* and *Fusarium lateritium* and bacteria *Bacillus subtilis* have controlled ED in trials worldwide, but the results have been variable and control is usually less effective than fungicides, paints and pastes. Vinevax pruning wound dressing (containing *Trichoderma*) is registered for ED control in New Zealand. Although biological control offers long-term protection, the time required for biological control agents to colonise the wound creates a window of susceptibility to infection by pathogen spores.

InocBloc Organic Prune n Paste is a pine tar sealant which can block entry of spores into wounds to control ED and BD.

Remedial control

Vines with foliar symptoms and cordon or trunk dieback should be tagged in spring and all infected wood removed any time by remedial surgery. Trunks should be cut as low as possible to ensure all infected wood is removed. Remaining wounds must be protected against infection as described. Cordons and trunks can be retrained from watershoots (Figure 14).



Figure 13. Applying pruning wound protectant with a sprayer.



Figure 14. Grapevine which has been retrained from a water shoot following remedial surgery.

FURTHER READING

SWNZ spray schedule:

nzwine.com/members/sustainability/spray-schedule/

Fact sheet: Spray application, protecting wounds on dormant vines:

[nzwine.com/media/15748/bri-research-fact-sheet_spray-application-min.pdf](https://nzwine.com/media/15748/bri-research-fact-sheet-spray-application-min.pdf)

Vineyard Ecosystems Programme final reports on Grapevine Trunk Disease management:

nzwine.com/media/15247/nzw-16-102-final-report-jan-2020.pdf

nzwine.com/media/3876/nzw-13-100-final-report-2016.pdf

ACKNOWLEDGEMENT

This fact sheet is based on the original version written by Marlene Jaspers, Lincoln University. Revised guidelines have been developed by Mark Sosnowski, South Australian Research & Development Institute, from information arising from NZW Research Projects 13-100, “Sustaining vineyards through practical management of grapevine trunk diseases”, 16-102 “Optimising management of grapevine trunk diseases for vineyard longevity”, 19-101 “Improving remedial surgery practices for control of grapevine trunk disease to increase vineyard longevity”, and the latest international knowledge. More details are available in project final reports on the members’ site at nzwine.com.

Thank you to NZW Research Advisory Committee; Plant and Food Research; Linnaeus Ltd; and the Vineyard Ecosystems Programme team.