Wine Australia

Best practice management guide

Eutypa dieback

Introduction

Eutypa dieback, caused by the fungus *Eutypa lata*, is a major trunk disease of grapevines. The productivity of infected grapevines gradually declines and vines eventually die. Eutypa dieback costs the Australian wine industry millions of dollars in lost production and additional vineyard costs per annum. Vineyard owners can manage the disease by physically removing infected wood and encouraging shoots from lower, uninfected parts of the vine. Wound treatments should be applied post-pruning to reduce likelihood of new infections.

5 key facts

- Caused by a fungus that is spread by airborne spores
- Spores are released from infected dead wood during rainfall
- Spores infect exposed pruning wounds and the fungus progressively kills spurs, cordons and trunks
- Wounds are most susceptible to infection in the first 2 weeks after pruning
- Disease control can be achieved with preventative wound treatments and curative remedial surgery

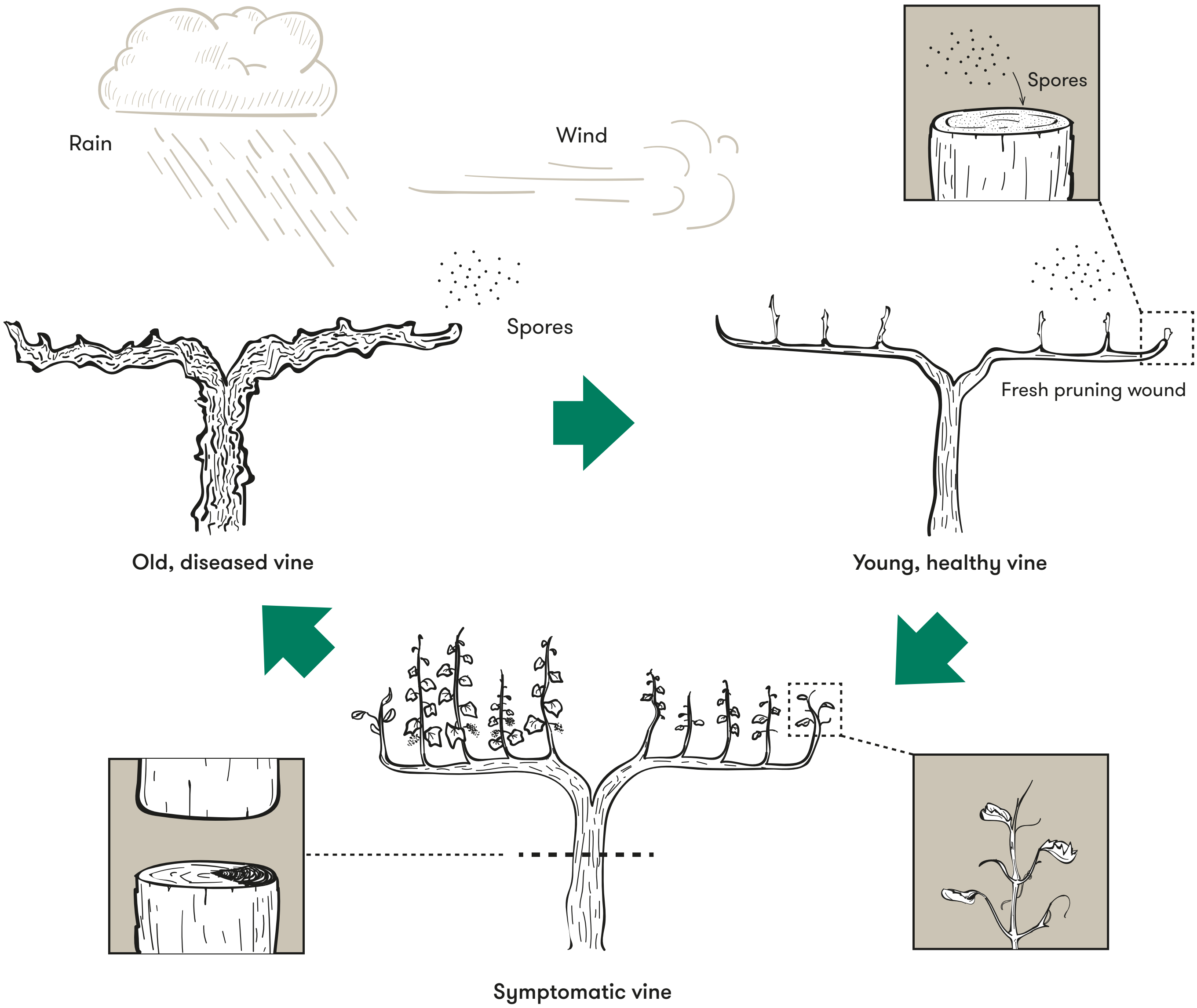

Figure 1. Eutypa dieback disease cycle.

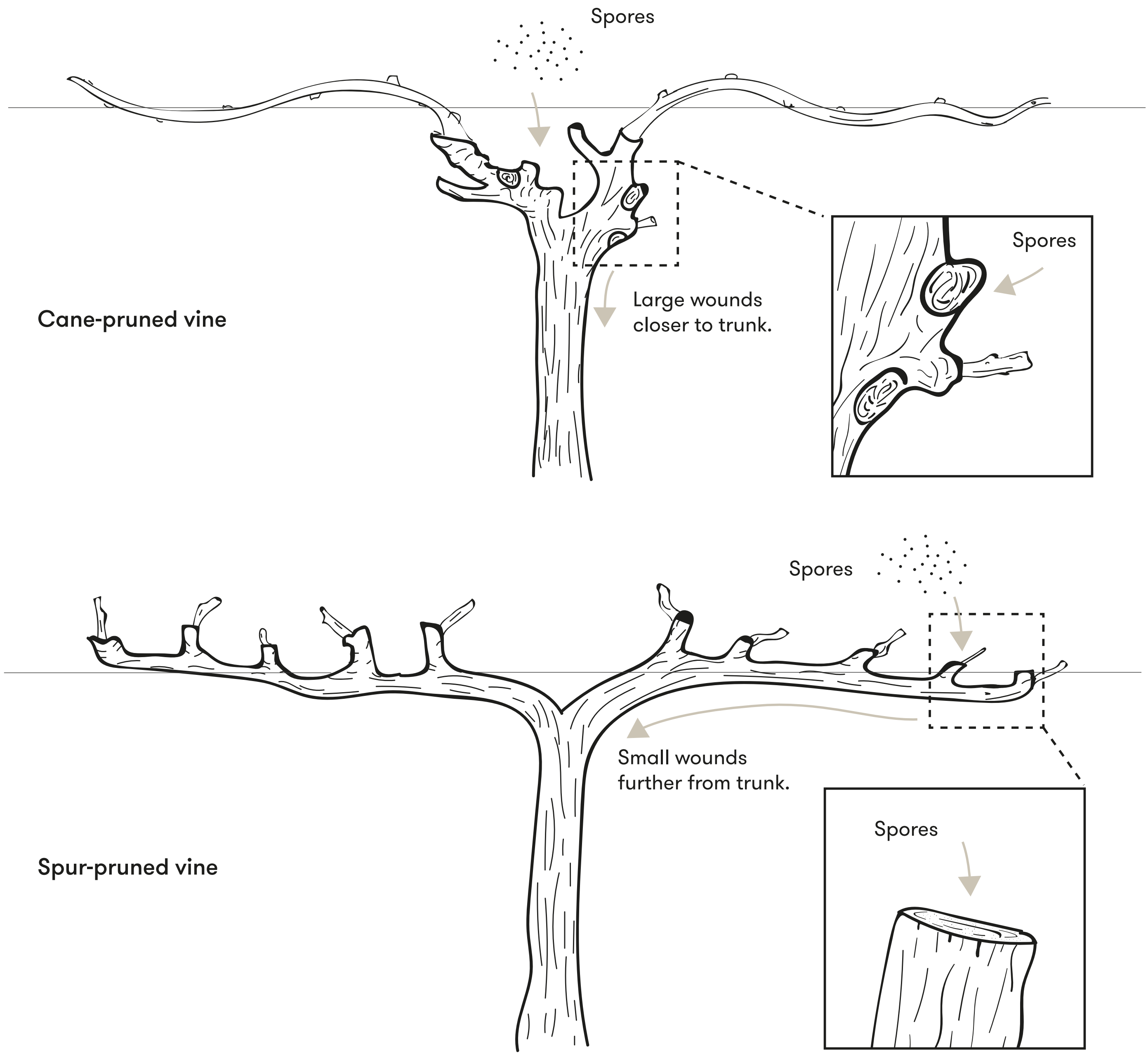

Figure 2. Spur- and cane-pruned vines, showing wound size and proximity to trunk, which have influence on progression of eutypa dieback.

Disease cycle

Eutypa dieback is spread when fungal spores land on an open wound (e.g. pruning cut) and germinate within the woody tissue. The fungus then grows, killing woody tissue and reducing the transport of water and nutrients to the foliage.

Within 2 hours of at least 2 mm of rain, fungal spores are released from old, infected wood and continue to be released for at least 36 hours after rain has stopped. Around 12 days later a new generation of spores can be produced and ready for release. Therefore, disease spread is especially important during winter pruning. In windy conditions, spores can travel up to 50 km from the release point to infect other vineyards.

The *E. lata* fungus grows, on average, at 2 cm/year through the vascular tissue of the cordons towards the base of the trunk. Over several years the woody tissue of cordons and trunk die back. Vine death occurs when all woody tissue (xylem and phloem) is dead, which occludes transport of water and nutrients from the roots. *E. lata* grows to the base of the trunk but not into the roots.

Foliar symptoms associated with eutypa dieback are caused by toxic fungal metabolites produced in the wood and transported to the foliage. Symptoms include yellowing, stunted shoots with leaves often cupped and with dead margins. The expression of foliar symptoms can occur 3–8 years after infection.

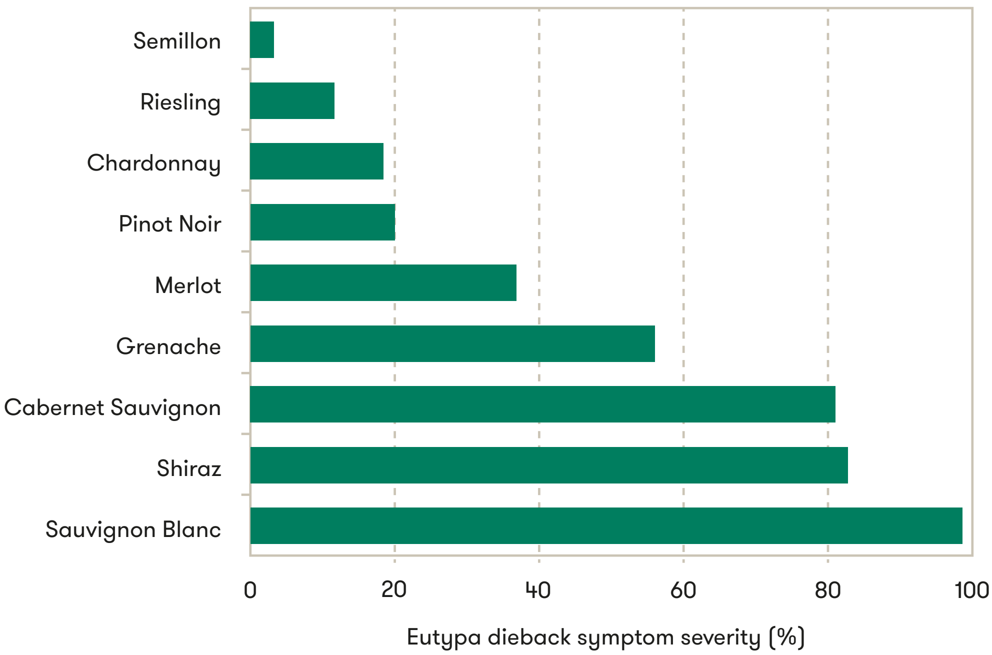

Figure 3. Mean severity of eutypa dieback symptoms (% of vine affected) observed over two seasons in 30–35 year old vines of commonly grown varieties (at the Nuriootpa Research Centre, South Australia). Symptom severity on all varieties assessed is listed in Appendix 2.

Predisposing factors

Wound size and pruning time influence susceptibility of the vine to infection. Large wounds, typically on older vines, provide a greater surface area for spores to land, take longer to heal and are considered more vulnerable to infection than small wounds on young vines. Mature spur-pruned vines have been reported to have greater incidence of eutypa dieback foliar symptoms but lower death rate than that of mature cane-pruned vines. This may reflect a greater total wound surface area on spur-pruned vines, but as wounds on cane-pruned vines are near the crown, infection could move into the trunk, more rapidly killing vines.

Spore release is reported to be greatest later in the pruning season, but wounds are less susceptible in late winter and spring when they heal most quickly. Naturally occurring microorganisms that are antagonistic to *E. lata* are more active in warmer conditions of late winter/early spring and sap flow may ‘flush out’ spores of the pathogen. Wounds are most susceptible immediately after cuts are made and may remain susceptible to *E. lata* for up to 6 weeks. Preliminary data in Australian conditions indicate that wounds are most susceptible to *E. lata* during the first 2 weeks post-pruning. This is the most important period for wound protection in the vineyard.

Alternative hosts

Eutypa lata is known to infect 88 perennial plant species, including fruit trees such as apricot, peach, nectarine, plum, cherry, apple, pear, quince, lemon, fig, olive and walnut (Appendix 1). In apricots, disease symptoms appear as gummosis. Dead, diseased branches of these plants may provide a source of spores for nearby vineyards. *E. lata* has not been recorded on native Australian plants.

Varietal susceptibility

All wine grape varieties are susceptible to infection by *E. lata*, however the severity of foliar and dieback symptoms varies among varieties (Appendix 2). In Australia, eutypa dieback symptoms are frequently observed in the commonly planted varieties Cabernet Sauvignon, Shiraz and Sauvignon Blanc, which corresponds with symptom severity observed in a germplasm collection in the Barossa Valley (Figure 3). The variation in foliar symptoms does not always correlate with the rate of growth of the fungus through woody tissue. Symptom variation has also been observed among clones of the same variety.

Distribution

Eutypa dieback occurs worldwide in grape growing regions with greater than 350 mm of annual rainfall. In Australia, field assessments have confirmed eutypa dieback in vineyards of South Australia, Victoria, Tasmania and southern NSW (Figure 4).

Figure 4. Distribution of eutypa dieback in Australia.

A 15-20 year old Shiraz block with 80% of vines symptomatic could equate to a yield loss of 2.6 t/ha

Impact of eutypa dieback

In Australia, foliar symptoms can take 3–8 years to appear after infection has occurred and symptoms have been observed on vines as young as 7 years old. Evidence of dieback (at least two dead spurs on a cordon) have been observed in vines as young as 5 years old (Figure 5). The delay in foliar 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 eutypa dieback progressively increases each year. This is due to successive years of pruning creating opportunities for infection, larger cuts being required as vines age and more time for symptoms to become apparent.

Research estimates yield loss due to eutypa dieback in Shiraz of 0.8 t/ha where 30% of vines display some level of foliar symptoms. For vineyards with 50% incidence, this increases to 1.5 t/ha and could be as high as 2.6 t/ha at 80% foliar symptoms.

Disease monitoring

Symptoms

Foliar symptoms

Foliar symptoms of eutypa dieback are caused by toxins, produced by *E. lata* in the wood and translocated to the shoots. Thus, the fungus cannot be isolated from green shoots. Foliar symptoms include yellowing, stunted shoots with leaves often cupped and with dead margins (Figure 6) almost always seen together on the same shoot.

Eutypa dieback foliar symptoms can be confused with other damage including herbicide effects, salt toxicity, earwigs, frost and mites (Figure 7).

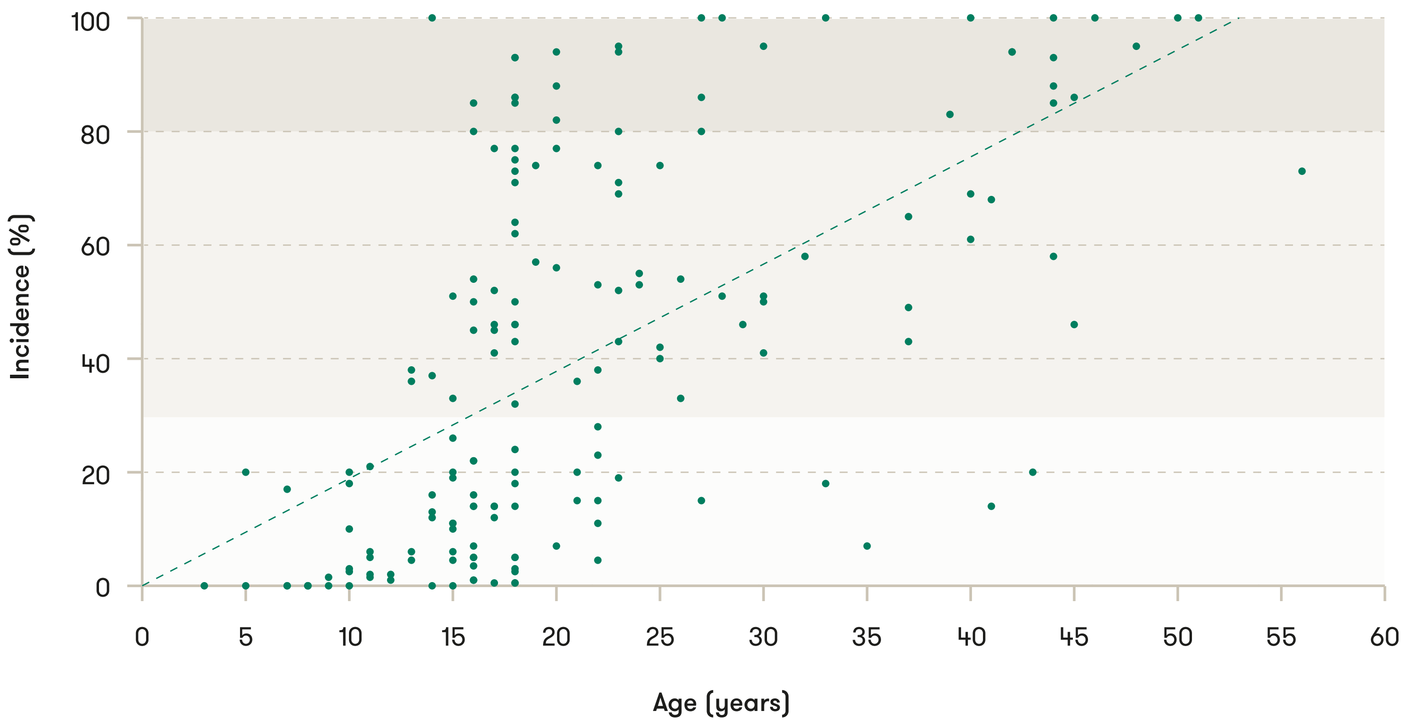

Figure 5. The effect of vine age on incidence of vines with eutypa dieback symptoms (at least one spur with stunted shoots or two dead spurs) from a survey in south-eastern Australia in 2012. Shading indicates level of impact on production (dark grey: high >2.6 t/ha, grey: medium 0.8–2.6 t/ha, light grey: low <0.8 t/ha).

Cordon and trunk symptoms

After entering via a pruning wound, the fungus kills the woody tissue around the infection point (usually spur), then kills other spurs along the cordon as it progresses toward the base of the trunk. (Figure 8 a–b). If bark is peeled back, stained brown (dead) wood, known as a canker, can be seen extending towards the trunk.
On trunks, external cankers are more easily identified as the bark will fall off the trunk (Figure 9 a–b).

If the diseased cordon or trunk is cut through, it appears as a wedge in cross-section (Figure 8 c–d, Figure 9 c–e)

Spores are released from fungal fruiting bodies (stromata) which develop on the surface of old, infected wood. On grapevine wood, masses of fruiting bodies appear as a darkened, almost charcoal-like, surface (Figure 9 f–g).

Figure 6. Eutypa dieback foliar symptoms: a) stunted shoots, b) cordon dieback, c–e) chlorotic shoots and cupped leaves with dead margins.

Figure 7. Eutypa dieback symptoms can be confused with damage caused by: a–b) herbicides, having distorted leaves with no necrotic edge, c–d) salt toxicity, having necrotic edges on leaves but no yellowing, cupping or stunted shoots, e) earwigs, having distorted leaves with no necrotic edges or shoot stunting, f) frost, having necrotic edges with no stunting or yellowing of leaves and g–h) bud mite damage, having very similar appearance to eutypa symptoms.

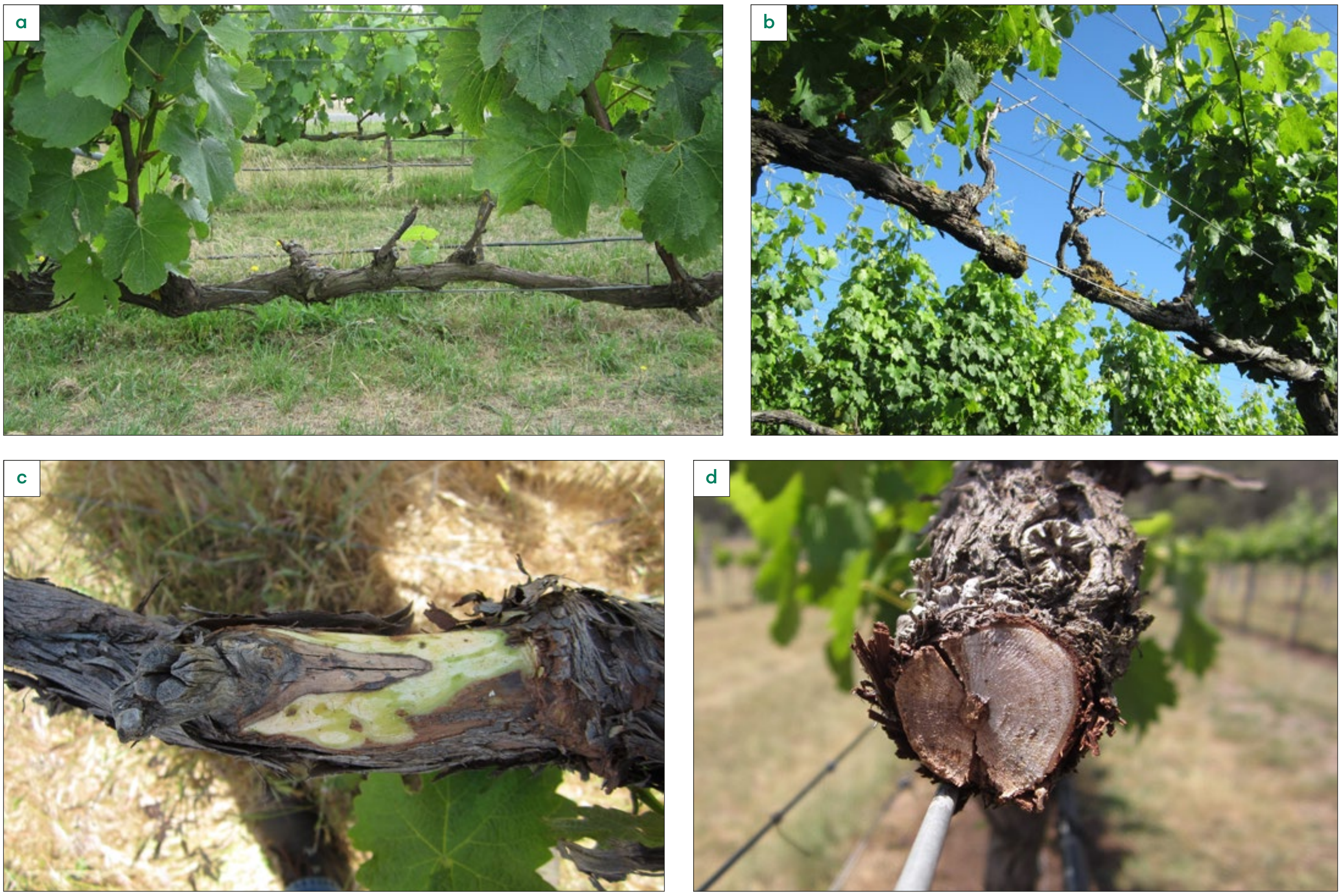

Figure 8. Eutypa dieback cordon symptoms: a–b) dead spurs on cordon, c) canker extending from spur under bark and d) cross-section of infected cordon.

Figure 9. Eutypa dieback symptoms: a–b) external trunk cankers, c–e) internal trunk cankers, f–g) dead wood with fungal fruiting bodies on surface.

Fruit symptoms

Grapevines affected by eutypa dieback often have reduced bunch weight due to fewer and smaller berries. In cases of severe infection, berries do not set and entire bunches can be aborted, resulting in significantly lower yield (Figure 10).

In addition, eutypa dieback can cause uneven ripening, which can cause the resulting wine to be out of balance, with undesirable green flavour, aroma and poor colour.

Figure 10. Eutypa dieback fruit symptoms: a) uneven ripening and reduced bunch size and b) shrivelled bunch.

Diagnosis

Foliar symptoms of eutypa dieback are most obvious in spring when shoots are 30–70 cm long. This provides enough time for healthy shoots to outgrow symptomatic shoots but not obscure them, creating the greatest contrast in foliage. Later in the season as healthy shoots continue to grow, symptomatic shoots are often masked and more difficult to see.

On vines with foliar symptoms, wood symptoms can be observed as external 'cankers' on the trunk or by dissecting the cordon or trunk to assess wood staining. Cutting the vine reveals wedge shaped staining. Note that staining may be difficult to find near the symptomatic shoots due to the variable amounts of toxins being translocated through the vine.

Once the cordon or trunk has been cut, a slice of woody tissue (at least 2 cm thick) can be removed, ensuring the interface of dead and live wood is included. Samples can be placed in a plastic bag and sent promptly to a diagnostic laboratory for confirmation of *Eutypa lata*, typically done by isolation of the pathogen into culture. Contact your local diagnostic laboratory prior to sending:

SA	SARDI Horticulture Pathology Diagnostics	(08) 8303 9585
Vic	DEDJTR Crop Health Services	(03) 9032 7604
NSW	DPI Plant Health Diagnostic Service	1800 675 623
Tas	DPIPWE Plant Health Laboratories	1300 368 550
WA	AGWEST Plant Laboratories	(08) 9368 3721
Qld	DAF Grow Help Australia	(07) 3255 4365

Vineyard survey methods

Vineyard assessment allows a vineyard manager to understand the extent of eutypa dieback across each block in order to develop a management plan. Surveys should be conducted during spring (as noted above), when shoots are between 30 and 70 cm long, before healthy shoots begin to overgrow dead or missing cordon. Vines can be assessed visually for incidence or severity of eutypa dieback symptoms.

Incidence

Assessment of incidence is a quick approach to estimate disease to prioritise blocks requiring attention (can be done at walking pace). Pick an area/series of rows which is representative of the whole block (i.e. avoid low lying areas or those with poor soil). Assess a block of at least 200 vines consecutively within 2–4 rows, counting any vines with typical eutypa dieback foliar symptoms (Figure 6), or at least two dead spurs on a cordon (Figure 8). For cane-pruned vines, look for dead or unproductive areas on the head of vines (Figure 11). Once complete, calculate the percentage of vines with symptoms. This should be repeated annually in a regular monitoring program.

Severity

Assessment of severity is a slower approach (10–15 seconds per vine), but provides a more accurate measurement of the extent of eutypa dieback in the block for developing a management plan. As above, select a representative area/rows of vines and assess at least 200 vines. For each vine, estimate the percentage of unproductive cordon (i.e. dead/missing cordon or stunted shoots unlikely to be fruitful, Figure 12) and then average across all vines for an overall percentage of eutypa dieback severity in the vineyard.

Figure 11. Dead or unproductive areas on head of cane-pruned grapevines.

Figure 12. Eutypa dieback disease severity rating scale for spur pruned vines. Percentage of unproductive cordon (i.e. dead/missing cordon or stunted shoots unlikely to be fruitful).

Disease management

Control

Remedial surgery

Vines showing foliar and dieback symptoms should be tagged in spring when symptoms are most obvious. The vineyard manager can then easily return to the same vine even if the symptoms are no longer obvious. Infected wood can be removed at any time of the year and burnt, buried or removed from the vineyard. Any discoloured cordon and trunk wood should be cut out and an additional 10 cm of cordon or trunk cut away to ensure all infected wood has been removed. This process of cutting the vine off at the trunk is known as remedial surgery.

The lower the cuts are made on trunks, the greater the likelihood of eradicating the pathogen from the vine (Figure 13). Once complete, wounds must be protected from new infections with a paint, paste and/or fungicide.

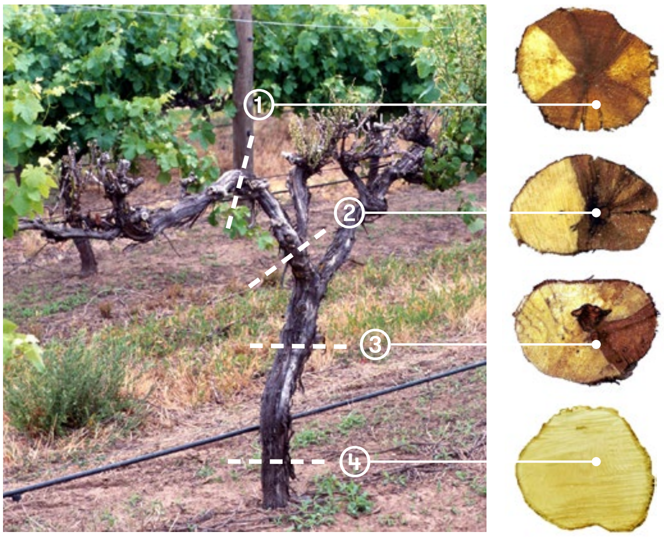

Figure 13. If cross-sectional cuts are made sequentially along the trunk, the wedge of dead wood gets smaller as you progress downwards.

The missing part of the vine is then replaced in the following spring using new shoots arising from the cordon or watershoots arising from the trunk. Depending on the situation, vines undergoing remedial surgery return to full production within 2–3 years (Figure 14).

Figure 14. a) Vine with stunted shoots caused by eutypa dieback on the left cordon emerging from high on the trunk above infected wood and healthy shoots on the right cordon emerging from the bottom of the trunk below infected wood. b) Dead vine in the foreground which was reworked 5 years earlier from the top of an infected trunk and healthy vines in the background where shoots were trained from low down on the trunk.

Layering

If infection has reached ground level in trunks of own-rooted vines, layering can be used to replace missing vines. This involves taking a lignified cane and burying at least 20 cm of the cane beneath the soil surface. The tip of the cane should remain just above the soil surface. Eutypa dieback is not likely to be spread through layering, as 1-year-old non-wounded canes are not infected with *E. lata* and the fungus moves predominantly back towards the trunk. Layering can be used as a future replacement of an affected vine (self-layering) (Figure 15a–b) or used to replace the diseased or dead vine from a neighbouring vine (Figure 15c–d). Layering provides an advantage over replanting as it utilizes the existing mature root system of the parent vine, making successful establishment in a mature vineyard much more likely.

Figure 15. Eutypa dieback affected vines rejuvenated by self-layering (a–b) or by layering from a neighbouring vine (c–d).

Decision making

Remedial surgery significantly increases the longevity of a eutypa dieback affected vineyard but is a costly and labour intensive exercise. Acting early will reduce crop loss and management costs considerably and lead to better disease control.

The decision about when to act and what to do needs to be made on a case by case basis for each vineyard (Figures 16 and 17).

Assess incidence of eutypa dieback

Conduct visual assessment for foliar and dieback symptoms (min. 200 vines) in spring (shoots 30–70cm).

Confirm presence of wood symptoms by cutting cordon and trunks of several symptomatic vines to inspect for stained wood.

Confirm diagnosis with photos/inspection by experienced viticulturist and/or laboratory testing.

Prioritize blocks which maximize vineyard profitability.

Determine extent of infection

Select 20–40 symptomatic vines and cut cordon/trunk every 30cm to assess extent of stained wood. Use as guide for the height of trunk cuts required.

Consider block profitability

Including long term grape price, demand, predicted yield losses. For lower value grapes, apply the whole row/block approach. For higher value grapes, apply the individual vine approach.

Consider remedial surgery costs

Including cutting vines and wires, removal of vine cordon/trunks and wire, burning/burial of vines, disposal of wire, painting wounds, wire replacement, retraining, modified weed management etc.

Develop a long term management plan

Balancing yield losses, costs and labour required over several years to ensure the project is manageable.

Whole row/block approach

Use on lower value grapes with widespread or high % of foliar symptoms (large areas). Minimise yield loss by reworking 20% of block each year.

Individual vine approach

Use on higher value grapes with contained or low % foliar symptoms (smaller areas).

Figure 16. Decision tree for developing a remedial management plan for eutypa dieback affected vines.

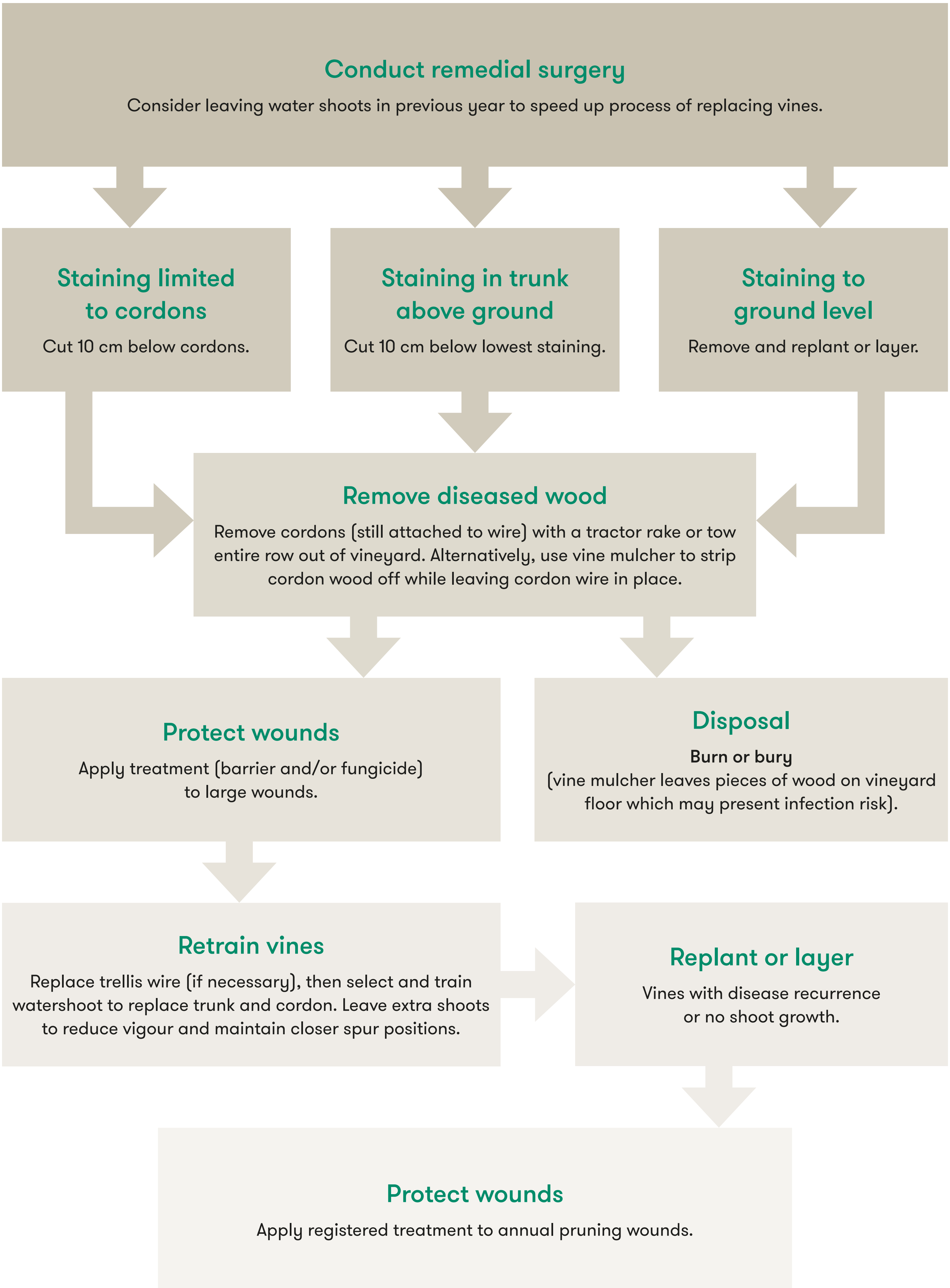

Figure 17. Decision tree for conducting remedial surgery on eutypa dieback affected vines.

Prevention

Cultural practice

Eradication of wind-blown spores is almost impossible, but removal of dead wood from grapevines and alternative hosts in and around the vineyard will reduce the local inoculum levels.

Spores are released into the air after at least 2 mm of rain and release continues for 36 hours. Whenever possible, avoid pruning in wet weather and preferably delay to late winter when wound healing is more rapid and sap is flowing.

In situations where delaying pruning due to wet weather is unrealistic, 'double pruning' can be a useful solution for spur pruned vines. This involves mechanical pre-pruning (in any weather) where longer spurs (eg: 5 buds or longer) are left followed by hand-pruning to short spurs in late winter. However, if the late winter pruning coincides with rain, this will still pose a risk for infection.

Contamination of pruning tools is not a major means of spreading trunk disease and disinfectant is not required if fungicide is used to protect fresh pruning wounds.

Removal of watershoots and shoot thinning during or immediately following rain (>2mm) may pose a risk, but the likelihood of infection is low. Where possible, it is still advisable to avoid wet weather.

Products and wound protection treatment

A range of wound treatments is available for control of eutypa dieback (Table 1).

Large wounds made during remedial surgery should be treated with a fungicide followed by a paint or paste with fungicide added, to provide a physical barrier for maximum protection, applied with a paint brush or applicator (Figure 18 a-b).

Smaller wounds can be treated by application of registered fungicides using a knapsack or canopy sprayer with nozzles targeting the cordon (Figure 18c-d). When canopy sprayers are used, maximum coverage of wounds can be achieved by turning off fans (no air), applying high water rates at low pressure, selecting spray nozzles that produce large droplet size and focussing nozzles towards the pruning wound zone. Recycle sprayers are ideal, maximising efficiency of targeting wounds on dormant vines. Wound coverage should be checked regularly using water sensitive paper or by adding dye to the water used to dilute fungicides.

Preventative wound protection practices should start in 1-year-old grapevines following the first pruning and continue each year thereafter. Disease prevention is significantly less costly than remedial surgery and will maximise grape quality and long-term profitability.

Treatment	Trade name	Active ingredient	Application method
Paint/paste	Acrylic paint	n/a	Paint brush
	Greenseal™	Tebuconazole	Bottle top applicator
	Garrison Rapid®	Cyproconazole + Iodocarb	Bottle top applicator
Fungicide	Emblem®	Fluazinam	Sprayer
	Gelseal™	Tebuconazole	Sprayer
Biological	Vinevax™ Wound Dressing	*Trichoderma atroviride*	Paint brush

Table 1. Treatments available for use as a wound treatment to control eutypa dieback. Follow instructions on label when using registered products.

Critical timing for wound protection

Paints or pastes should be applied immediately after a large wound is made. Remedial surgery usually involves someone painting wounds immediately behind the chainsaw operator. If sap is flowing liberally, once it has stopped paint or paste can be applied over hardened exudate or following removal of exudate with a knife. If sap flow is light, then apply paint/paste immediately as best as possible. Reapplication may be required.

During normal spur/cane pruning, a registered fungicide should be applied within 24 hours of pruning if possible. Pruning wounds of most grape varieties are most susceptible to *E. lata* infection 2 weeks post-pruning.

Vinevax Wound Dressing (biological product) should be applied during dry periods when *E. lata* spores are not likely to be present. Vinevax Wound Dressing requires time to colonise wounds before it can prevent infection.

Figure 18. Applying wound treatments to large reworking wounds with paint brush (a) and bottle top applicator (b), and to annual pruning wounds with a knapsack (c) and canopy sprayer (d).

Further information

http://research.wineaustralia.com/resource_categories/eutypa-dieback/

http://www.awri.com.au/industry_support/viticulture/agrochemicals/agrochemical_booklet/

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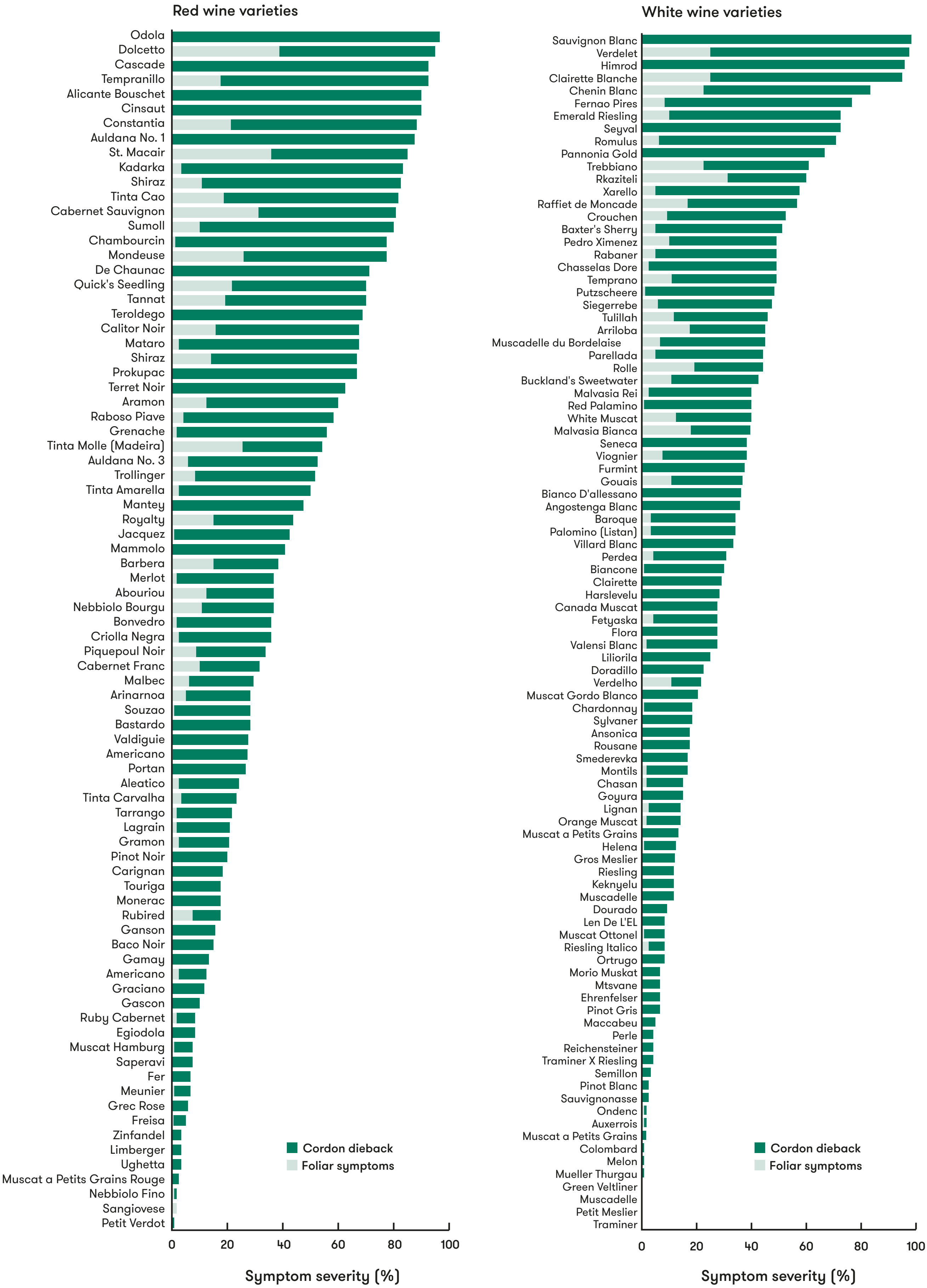
Appendices

Appendix 1. List of reported hosts for *Eutypa lata*, adapted from Carter 1991, originally compiled by A. Bolay.
Regions reported from: A=Australasia, E=Europe, NA=North America, SA=South Africa.

Family	Genera/species	Common name/s	Region
Aceraceae	*Acer campestre* L.	Field Maple, Hedge Maple	E
Anacardiaceae	*Pistacia lentiscus* L.	Mastic Tree	E
	P. terebinthus L.	Terebinth Tree, Turpentine Tree	E
	Schinus molle L.	Peruvian Pepper, Peppercorn Tree	A
	S. terebinthifolius Raddi	Brazilian Pepper	A
Apocynaceae	*Nerium oleander* L.	Oleander	A
Araliaceae	*Hedera helix* L.	English Ivy	E
Berberidaceae	*Berberis darwinii* Hook.	Darwin's Barberry, Berberis	A
Betulaceae	*Carpinus betulus* L.	Hornbeam, European Hornbeam	E
	Corylus avellana L.	Hazel, Hazelnut, Common Filbert	E
Caprifoliaceae	*Lonicera alpigena* L.	Alpine Honeysuckle	E
	L. xylosteum L.	Dwarf or Fly Honeysuckle	E
	Symphoricarpos orbiculatus Moench	Coralberry, Indian currant, Buckbrush	A, E
	Viburnum lantana L.	Wayfaring Tree	E
	V. opulus L.	European or American Cranberrybush, Guelder Rose	A, E
	V. tinus L.	Laurustinus	A
Cornaceae	*Cornus sanguinea* L.	Common Dogwood	E
	C. alba L.	Redosier Dogwood	E
Ebenaceae	*Diospyros kaki* L.	Japanese Persimmon	A
Ericaceae	*Arctostaphylos stanfordiana* var. *hispidula* (Howell) Adams	Gasquet Manzanita	NA
Fagaceae	*Fagus sylvatica* L.	European or Common Beech	E
	Quercus suber L.	Cork Oak	A
	Quercus sp.	American Red or Southern Oak	E
Grossulariaceae	*Ribes nigrum* L.	European Blackcurrant	E
	R. petraeum Wulf.	Currant	E
	R. rubrum L.	Cultivated Currant	E
	R. sanguinea Pursh.	Redflower Currant	E
	R. uva-crispa L.	European Gooseberry	E
Juglandaceae	*Juglans regia* L.	English Walnut	A, E
Leguminosae	*Acacia dealbata* Link	Silver or Blue Wattle, Mimosa	E
	Genista monspessulana L. Johnston	Cape or Montpellier Broom	A
	Genista sp.	Broom	E
Moraceae	*Ficus carica* L.	Common Fig	E
Oleaceae	*Fraxinus excelsior* L.	European or Common Ash	A, E
	Jasminum mesnyi Hance	Japanese Jasmine	A
	Ligustrum vulgare L.	European, Common or Golden Privet	E
	Olea europea L.	African or Black Olive	E
	Syringa vulgaris L.	Common Lilac	E
Pittosporaceae	*Pittosporum undulatum* Vent.	Native Daphne, Sweet Pittosporum, Snowdrop Tree, Mock Orange	A
Platanaceae	*Platanus acerifolia* Willd.	London Plane Tree	A, E

Family	Genera/species	Common name/s	Region
Rhamnaceae	Ceanothus cyaneus Eastw.	San Diego Buckbrush	NA
	C. megacarpus Nutt.	Bigpod Ceanothus	NA
	C. spinosus Nutt.	Redheart, Greenbark	NA
	C. thyrsiflorus Esch.	Blue Brush, Blueblossom	A, NA
	Frangula alnus Mill.	Glossy Buckthorn	E
	Rhamnus alaternus L.	Italian Buckthorn	A
	R. alpina L.	Cascara, Bayberry, bearberry, Californian buckthorn	E
	R. cathartica L.	Common Buckthorn	E
Rosaceae	Chaenomeles japonica Lindl.	Quince, Dwarf or Japanese flowering or ex Spach Maule's	E
	Cotoneaster glaucophyllus Franch.	Large-leaf Cotoneaster	A
	C. pannosus Franch.	Velvet Cotoneaster	A
	C. salicifolius Franch.	Willowleaf Cotoneaster	E
	Crataegus monogyna Jacq.	Hawthorn	A,E
	Crataegus sp.	Common Hawthorn	E
	Cydonia oblonga Miller	Quince	A
	Eriobotrya japonica (Thunb.) Lindl.	Loquat, Japanese Loquat	A
	Malus domestica Borkh.	Apple	A, E, NA
	Prunus armeniaca L.	Apricot	A, E, NA, SA
	P. avium L.	Sweet Cherry	E
	P. demissa (Nutt.) Walp.	Western Chokecherry	NA
	P. domestica L.	European Plum	A, E, SA, NA
	P. dulcis (Mill.) Webb	Sweet Almond	A, E
	P. persica L.	Peach	A, E
	P. salicina Lindl.	Japanese Plum	A
	P. spinosa L.	Blackthorn	A
	Pyrus communis L.	Common Pear	A, E
	Rosa spp.	Rose	A, E
	Sorbus aria (L.) Crantz.	Chess-Apple, Whitebeam	E
	S. aucuparia L.	Rowan, Mountain Ash	E
Rutaceae	Choisya ternata Kunth.	Mexican Orange Flower	E
	Citrus limon (L.) Burm. F.	Lemon	A, E
Salicaceae	Populus italica Mönch	Lombardy Poplar	A, E
	Salix caprea L.	Goat Willow, Kilmarnock Willow, Pussy Willow	E
Sambucaceae	Sambucus nigra L.	Black Elderberry, Elder	E
Tamaricaceae	Tamarix sp.	Athel Pine, Saltcedar, Tamarisk	A
Tiliaceae	Tilia cordata Mill.	Smal Leaf Lime, Littleleaf Linden	E
	T. platyphyllos Scop.	Large Leaf Lime, Largeleaf Linden	E
Ulmaceae	Ulmus scabra Miller	Scotch Elm, Broad-leaf Elm, Wych Elm	E
Verbenaceae	Gmelina leichardtii F. Muell.	White Beech	A
	Lantana camara L.	Lantana	A
Vitaceae	Cissus hypoglauca A. Gray	Water Vine, Jungle Vine, Native Grape	A
	Vitis labrusca L.	Fox Grape	NA
	V. rupestris Scheele	Sand Grape	SA
	V. silvestris C. Gmelin	Wild Grapevine	E
	V. vinifera L.	Wine Grape	A, E, NA, SA
	V. spp. American and French hybrids	Grapevine	E, NA

Appendix 2. Severity of eutypa dieback foliar symptoms (stunted shoots, yellowing with cupped and necrotic leaves) and cordon dieback (at least two dead spurs on a cordon) in 30–35 year old vines in a germplasm collection at the Nuriootpa Research Centre in South Australia.



Wine Australia for Australian Wine

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