Grapevine Management Guide

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Prepared by

Shayne Hackett
District Horticulturist
NSW Department of Primary Industries
Wagga Wagga

and

Tony Somers
District Horticulturist
NSW Department of Primary Industries
Tocal, Paterson
Identifying and managing bot canker

SANDRA SAVOCCHIA, PLANT PATHOLOGIST, NWGIC, CSU, WAGGA WAGGA
WAYNE PITT, PLANT PATHOLOGIST, NWGIC, CSU, WAGGA WAGGA

Background
The most prevalent grapevine trunk diseases in Australia are Botryosphaeria (bot canker) and Eutypa dieback.

Bot canker is a grapevine trunk disease caused by fungal pathogens that grow primarily in mature wood. The pathogens can infect:
• propagation material, affecting the growth of newly planted grapevines
• established grapevines through pruning or other wounds.

Grapevine trunk diseases can cause loss of productivity in mature grapevines when they should be at their peak of production.

Bot canker is caused by several species of fungi within the family Botryosphaeriaceae. These fungi infect a wide range of hosts, but they are most commonly associated with diseases of woody plants, such as acacia and eucalyptus. The Botryosphaeriaceae are found in most grape-growing regions of Australia.

The economic costs associated with bot canker are due to a combination of factors – mainly yield loss and an increase in production costs (reworking and retraining of grapevines) for management of the disease.

The overall loss caused by this combination of factors is difficult to quantify. In California the disease is estimated to cost $260 million a year.

Symptoms
Bot canker is characterised by a range of symptoms affecting a number of vegetative structures of the grapevine (Table 4).

The symptoms outlined in this table are very similar to some of those of Eutypa dieback, and this often leads to confusion. Also, the symptoms do not always occur together. Do not use these symptoms alone to identify bot canker.

Disease cycle
The fungus overwinters as pycnidia (small dark ‘pimple-like’ structures that are asexual fruiting bodies) on the outside of diseased wood. Throughout the growing season, the pycnidia produce and release conidia (asexual spores).

Following hydration, the conidia are spread by wind and rain splash, disseminating the fungi from vine to vine, and from one part of the vine to another.

The disease develops when the conidia land on:
• wood with fresh pruning wounds
• wood that has been freshly cut from reworking of vines (i.e. the removal of old cordons to re-establish the grapevine structure)
• fresh wounds caused by mechanical damage.

The conidia germinate and invade the woody tissue via the xylem vessels, damaging the vascular system. Cankers form around the initial point of infection. Damage to the vascular system causes wood necrosis (death) and dieback. In some species, pseudothecia (sexual fruiting bodies) form on the outside of the cankers and produce ascospores (sexual spores). Like conidia, ascospores are

Table 4. Symptoms caused by bot canker. These symptoms should not be used alone for disease identification.

<table>
<thead>
<tr>
<th>Plant structure or event</th>
<th>Symptom</th>
<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trunk and cordon</td>
<td>Cankers initiating in wounds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wedge-shaped lesions seen when the trunk is cut in cross-section</td>
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<tr>
<td></td>
<td>Dieback described as ‘dead arm’ and loss of spur positions. This image shows a badly infected crown and trunk requiring intensive reworking.</td>
<td></td>
</tr>
<tr>
<td>Shoot</td>
<td>Stunted appearance during spring</td>
<td></td>
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<tr>
<td>Bud burst</td>
<td>Delayed or lack of growth in one or more spur positions</td>
<td></td>
</tr>
<tr>
<td>Canes</td>
<td>Bleached</td>
<td></td>
</tr>
<tr>
<td>Buds</td>
<td>Necrotic</td>
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disseminated by wind and rain splash and enter the plant via fresh pruning wounds. New pycnidia are formed on the outside of diseased wood.

Strategies to manage and prevent bot canker

There are a number of strategies that can be implemented to manage bot canker (see photos and Table 5), although there are no fungicides registered specifically for control. The aim is either:

- prevention, by breaking the disease cycle, removing the inoculum source, and reducing the risk of further infection, or
- recovery, by bringing diseased grapevines back into full production to reduce economic loss.

As with managing other fungal diseases, it is important to practise good hygiene around the vineyard to remove sources of inoculum and avoid cross-contamination. It is also essential to time operations, such as pruning, to minimise the risk of disease spread by avoiding high-risk infection periods.

Table 5. Strategies to reduce the impact of grapevine trunk diseases in vineyards. These strategies are illustrated in the photos below.

<table>
<thead>
<tr>
<th>Aim</th>
<th>Strategy</th>
<th>Method</th>
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</thead>
<tbody>
<tr>
<td>Prevention</td>
<td>Cultural practices</td>
<td>Avoid pruning during wet weather (spores of Botryosphaeriaceae fungi are released up to 2 hours after rain). Minimise number and size of pruning wounds. Make cuts at an angle to allow water to drain from the wood surfaces. Prune early in the season when spore production is low, or late in the season when wounds are less susceptible and heal more rapidly.</td>
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<tr>
<td></td>
<td>Chemical practices</td>
<td>Pruning wound protection: apply fungicide, paints, pastes or biological control agents directly onto large cuts as soon as possible after pruning. Vinevax™ (biological control agent) and Greenseal™ are the only two products registered in Australia for pruning-wound protection, but both products are registered for the control of Eutypa dieback and not for bot canker. See the research results for more details.</td>
</tr>
<tr>
<td>Management</td>
<td>Removal of infected wood</td>
<td>Remove dead wood of cordon and 20 cm of healthy tissue. Extensively rework infected crown or trunks. Remove all infected wood from the vineyard. Retrain new cordon. Replace trunk with water shoots.</td>
</tr>
</tbody>
</table>

Infected trunks are cut off and removed from the vineyard. Photo: Mark Sosnowski, SARDI.

Infected trunks and cords have been removed and new ones trained. Pruning-wound protectant paint is applied to large cuts. Photo: Cathy Gairn

Infected trunks and cords have been removed and new water shoots trained up. Photo: Sandra Savocchia

Infected cords have been removed and new ones trained. Pruning-wound protectant paint is applied to large cuts. Photo: Cathy Gairn

Remove infected wood from the vineyard to avoid the risk of reinfection with bot canker and other grapevine trunk diseases. Photo: Cathy Gairn
Evaluating fungicides for the management of bot canker in grapevines

Aims
1. Identify fungicides with the potential to inhibit the growth of Botryosphaeriaceae species.
2. Evaluate promising fungicides in the field.
3. Provide recommendations for the management of bot canker.

Methods
Twenty fungicides currently registered in Australia for other grapevine diseases were tested in vitro for their ability to reduce the mycelial growth of four species within the Botryosphaeriaceae family. The most effective fungicides were further evaluated under field conditions. To evaluate the fungicides we applied them to freshly cut pruning wounds and compared their ability to reduce infection with that of three registered pruning-wound protectants and one biological control agent.

Summary of results
Bavistin® (carbendazim), Shirlan® (fluazinam), Folicur® (tebuconazole), Garrison® and ATCS tree wound dressing (a modified water-based acrylic coating) were the most effective pruning-wound protectants, reducing infection by 41% to 65%. Garrison® is a commercial tree-wound paste formulated with the fungicides cyproconazole + iocarb. None of the fungicide-based products is currently registered for the control of bot canker.

Outcomes for industry
Currently there are only two products (Vinevax™ and Greenseal™) registered in Australia for pruning-wound protection, but both of these products are registered for the control of Eutypa dieback and not for bot canker.

Bavistin® is no longer registered for use in Australia. Three of the other fungicides, namely Folicur®, Shirlan® and Garrison®, have the potential to control bot canker.

Future research
Recommended rates for the fungicides currently registered for use on grapevines are based on rates used for the control of other diseases. For efficient and cost-effective application, future research into promising fungicides for control bot canker will involve testing existing application technologies with the ultimate aim of finding products that are suitable for efficient broad-spectrum application to control all grapevine trunk diseases.

References and further reading

Further information on trunk diseases
For more information on trunk diseases and the occurrence of bot canker in Australia, see the following fact sheets available from the NWGIC website:
• Bot canker – incidence and distribution
• Trunk diseases in grapevines.

For information on Eutypa dieback, see the GWRDC Innovators Network fact sheet Eutypa dieback. (www.gwrdc.com.au/webdata/resources/factSheet/GWR_068_Eutypa_Dieback_Management_Fact_Sheet_FINAL.pdf)