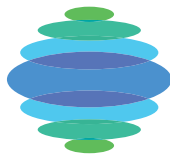


Grapevine management guide 2026–27

NSW PRIMARY INDUSTRIES MANAGEMENT GUIDE



Principal author: Penny Flannery



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Grapevine management guide 2026–27

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Image acknowledgements

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Cover photo

Pinot Noir vines grafted to 110 Richter rootstock with red leaf symptoms due to graft incompatibility leading to vascular restriction.

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Introduction

The *Grapevine management guide* is one of NSW Department of Primary Industries and Regional Development's (DPIRD) flagship publications. Such publications are a crucial means of providing information to viticulture and wine industry professionals.

It is with great pleasure that I invite you to read and benefit from the insights and information presented in the 2026–27 edition.

This year's guide contains articles to help growers adapt to changing market demands and sales opportunities to maintain long-term viability. Through the updated 'Options for vineyards' section (starting on [page 6](#)), we examine some strategies being adopted by growers in New South Wales, including top-working existing vineyards with commercially desirable varieties, rejuvenating older vines to improve yield and fruit quality, replanting with market-driven varieties, disease-resistant cultivars and tolerant rootstocks, or, where necessary, vineyard removal.

The guide also includes business diversification examples ([page 14](#) to [page 21](#)) that can contribute to vineyard profitability while growers continue producing wine grapes in an increasingly competitive environment. On [page 24](#) is an article describing a low-input vineyard system. This is designed to reduce production inputs and assess the potential benefits of lower-yield, higher-quality production that can offer improved returns and greater resilience in changing markets.

I would like to extend my sincere thanks to the following NSW DPIRD staff for their valuable contributions to this edition:

Dr Meena Thakur (Research Horticulturist – Entomology) for her continued work with Riverina growers on managing scale insects and mealybugs ([page 62](#)).

Dr Bruno Holzapfel (Senior Research Scientist – Perennial Crop Physiology) for the ongoing work on disease-resistant selections ([page 89](#)).

Leonie Martin (Plant Biosecurity Officer) provided an update on the new biosecurity threat, grapevine inner necrosis virus or GINV ([page 72](#)) and Xylella preparedness in progress ([page 93](#)).

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Feedback please

NSW DPIRD is committed to providing relevant and practical information to help you grow and strengthen your business. Your feedback is invaluable for shaping future editions of the *Grapevine management guide*. Please do not hesitate to share your thoughts and suggestions with me. If you prefer, you can scan the QR code (Figure 1) to complete a quick survey about the guide.

Thank you,

Penny Flannery

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New guide released: options for vineyards

Penny Flannery, Development Officer – Viticulture, NSW DPIRD

In early 2026, NSW DPIRD released the second edition of *Options for vineyards: reworking, top-grafting, replanting or removing* guide, which has been updated to include case studies of the options. This guide can be downloaded from the NSW DPIRD website (<https://www.dpi.nsw.gov.au/agriculture/horticulture/grapes/case-studies/options-for-vineyard-reinvestment>).

Australian grape and wine businesses are facing challenges due to market oversupply, declining grape prices, increasing disease pressure, and ageing vineyard infrastructure. Additionally, a large proportion of Australia's vineyard area, particularly plantings established during the rapid expansion of the 1990s and early 2000s, is reaching an age where productivity is declining, and other problems are starting to show. Consequently, many growers are reassessing the future of their blocks, with a focus on 4 main redevelopment pathways:

1. reworking
2. top-grafting
3. replanting
4. removing

Each option has different costs, risks and timelines. The best choice will depend on vine health, soil condition, infrastructure status, market outlook and long-term business goals.

Why change a vineyard?

Vineyards rarely decline for one reason. More often, several issues occur, such as:

- trunk disease and cordon decline
- crown gall-like symptoms
- virus infection
- soil compaction and decreasing fertility
- ageing or poor-quality infrastructure
- increasing weed and pest pressure
- changes in wine style, consumer demand or variety suitability
- reduced margins in a competitive and oversupplied market.

Before choosing a redevelopment option, it is critical to identify the primary problem. Without understanding the underlying issue, growers risk investing in the wrong solution.

A practical planning approach includes:

- assessing yield trends, fruit quality, and sales history
- monitoring the percentage of missing or non-viable cordon
- reviewing soil health and drainage
- inspecting for trunk disease or virus incidence
- evaluating the condition of posts, end assemblies, trellis and irrigation
- considering market trends and future business needs.

Choosing the best option

No single redevelopment option is universally 'best'. Each vineyard has a unique combination of:

- soil type
- water access
- climate
- disease status
- variety performance
- market opportunities

- infrastructure condition
- labour availability
- business goals and risk tolerance.

A clear planning process that is supported by timely monitoring, accurate diagnosis, and practical budgeting is essential. Trialling small areas, seeking advice from peers, and revisiting the plan annually can significantly improve outcomes.

Reworking

Reworking restores vine structure by removing old, diseased or poorly performing wood and training new shoots (Figure 2). It is widely used to amend:

- trunk disease (for example, Eutypa dieback or Botryosphaeria dieback)
- cordon strangulation
- spur loss
- mechanical damage.



Figure 2. Shiraz was reworked from spur-pruned cordon to cane-pruned. Photo: Daniel Mortimer, Mortimer Wines.

When is reworking suitable?

A block is suited to reworking if:

- trunk disease has not reached ground level
- vine health and historic performance are strong
- virus levels are low or absent
- infrastructure is sound and suitable for future needs
- replacement spurs or water shoots are available (or top-grafting can fill gaps).

Advantages

- Faster return to production than with replanting.
- Retains established root systems.
- Preserves vine age (which can support wine style or branding).
- Lower cost than full replanting.

Limitations

- It can be labour-intensive as it requires careful shoot selection and training.
- Not all varieties rework well (for example, Cabernet Sauvignon and stressed Semillon).
- Success depends heavily on operator skill and timing.
- Cannot correct fundamental issues, such as poor soil or an unsuitable variety.

Top-grafting

Top-grafting allows rapid varietal or clonal change without removing the root system (Figure 3). It is especially valuable when market dynamics change or when a block is structurally sound but the current variety is no longer commercially viable.



Figure 3. Riesling top-grafted onto Shiraz rootstock.

Top-grafting works best when

- Vines are healthy, virus-free and uniform.
- Infrastructure will last through the reinvestment payback period.
- A reliable labour force is available for intensive training.
- The new variety or clone is well matched to the site and market.

Benefits

- Usually only one harvest is lost.
- It is faster than replanting.
- More cost-effective than removing and replanting.
- Allows well-adapted root systems to be retained.

Risks

- Weather conditions can severely affect success:
 - Top-grafting when it is **wet** can result in excess moisture around the graft union, which causes the callus to swell, increases fungal growth (especially near the graft union) and adhesion of the graft union to the scion, leading to a weak connection.
 - Top-grafting when it is **dry** can result in reduced moisture around the graft, which keeps the graft stable during healing.

- Failures might require re-grafting or eventual removal.
- High skill level required for budwood selection and storage.
- Incompatibilities between scion and rootstock can occur.

Replanting

Replanting, whether partial or full block removal ([Figure 4](#) to [Figure 6](#)), is the most comprehensive option and is recommended when:

- trunk disease is widespread
- vine health is too poor to support reworking
- vines have declined due to age and years of extreme dry and wet conditions
- infrastructure is at the end of its life
- the current variety/clone/rootstock is unsuitable
- virus has compromised block performance.



Figure 4. Two employees using a tractor, trailer, and excavator to remove vines from a block, while leaving the infrastructure for replanting.



Figure 5. A row that has been prepared for replanting.

Key considerations

Grafted vs own-rooted vines

With rising phylloxera risks and the potential benefits of rootstocks having drought tolerance, nematode resistance, and improved vigour balance, grafted vines are preferred.

Dormant rootlings versus potted vines

Dormant rootlings offer stronger establishment and earlier lignification, while potted vines allow faster turnaround but might struggle with heat or drought.

Rootstock selection

Tools such as Wine Australia's [Grapevine rootstock selector](#) help match rootstock vigour and tolerance traits to site conditions and scion variety.

Soil remediation

Replanting provides an opportunity to amend compaction, poor infiltration, salinity, sodicity or nutrient depletion. This can help safeguard the next 20+ years of production.



Figure 6. Vines after planting.

Removing a vineyard

Removal is often considered in cases of:

- persistent economic unviability
- severe trunk disease or vine death
- total market collapse for a variety
- property sales or changing land use
- conversion to other crops or agritourism ventures.

Key considerations

Timing is critical: the sooner a block is removed after the final harvest, the cheaper the process. Neglected vineyards rapidly become more expensive to remove and pose significant biosecurity risks as reservoirs for pests, diseases and weeds.

Growers must also consider the responsible disposal of CCA-treated posts, which cannot be burned or chipped, and must be stored or disposed of appropriately.

When should you act?

Most vineyard decline becomes noticeable at about 20 years of age. However, decisions should begin 5 years earlier with proactive monitoring and planning.

Growers emphasise that waiting too long reduces available options. For example, attempting to rework immediately after drought often fails because stressed vines cannot produce the vigorous shoots needed to rebuild structure.

Abandoned and neglected vineyards

Neglected vineyards ([Figure 7](#)) can become breeding grounds for pests and diseases, posing serious biosecurity risks to neighbouring vineyards.

Under the *NSW Biosecurity Act*, everyone has a general biosecurity duty (GBD). If you are dealing with a biosecurity matter, you are legally obligated to prevent, minimise or eliminate biosecurity risks as far as reasonably practical.



Figure 7. Abandoned vineyards (top and bottom).

Management options for keeping the vines

Even if production has ceased, the vines must be managed by:

- maintaining seasonal pest and disease control programs
- mulching or removing unharvested fruit to reduce the risk of propagating pests
- managing weeds by pasture suppression, such as by grazing, slashing or spraying with herbicide.

Management options for ceasing production

The most effective way to eliminate biosecurity risks is to remove and/or kill the vines. To reduce the spread of pests and diseases:

- cut vines approximately 300 mm above ground level (Figure 8), ideally in late spring
- remove and burn the upper vine material or leave it on the trellis to dry out
- apply a systemic herbicide to the stump immediately after cutting to prevent regrowth
- control weeds by grazing, slashing or spraying with herbicide to remove potential habitat for pests and diseases and reduce fire hazard.

Note: treated trellis posts (CCA or creosote) must not be burned or buried. Dispose of them at a licensed landfill or store them as dry as possible on a waterproof floor until they can be disposed of appropriately.



Figure 8. When ceasing production, the vines are cut down to about 300 mm above ground level and killed with herbicide. The infrastructure is left for future replanting.

Reporting biosecurity risks

If you suspect a biosecurity issue:

- Call biosecurity compliance on 02 9741 4790
- Report online at quarantine@dpird.nsw.gov.au
- Learn more at www.dpird.nsw.gov.au/biosecurityact
- Email biosecuritylegislation@dpird.nsw.gov.au for legislation information.

Conclusion

The *Options for vineyards: reworking, top-grafting, replanting and removing* guide outlines the processes growers could consider adopting. As the industry continues to face economic and environmental challenges, informed and timely decisions will help growers with their vineyards.

Acknowledgements

The *Options for vineyards: reworking, top-grafting, replanting and removing* guide is part of the Regional Program NSW/ACT, which is delivered in partnership with NSW Wine. It is supported by Wine Australia, with levies from Australia's grapegrowers and winemakers and matching funds from the Australian Government, and in-kind co-investment by the NSW Department of Primary Industries and Regional Development.

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Business diversification case study 1: integrating agritourism

Penny Flannery, Development Officer – Viticulture, NSW DPIRD

Overview

Jonathan Hambrook founded Stockman's Ridge in 2002. In 2012, the business moved to its current site in Orange, NSW, where it has developed into the vineyard, winery, cellar door and broader agritourism business it is today.

As a passionate viticulturist, Jonathan uses a practical approach to building the business, with a strong focus on site suitability, wine quality and long-term resilience.

Climate and varieties

Stockman's Ridge is approximately 800 metres above sea level, with cool-climate conditions for premium wine production. Jonathan carefully selects varieties and is currently focusing on Grüner Veltliner (Figure 9), Pinot Gris, Pinot Noir, Primitivo, and Sauvignon Blanc. The varieties are matched to the site's conditions; for example, Pinot Noir is planted on an easterly facing slope to avoid the harsher afternoon sun, which suits this delicate variety.

The vineyard also has Shiraz, which is used to make the sparkling rosé Primrose, while Cabernet Franc and Merlot are expected to contribute to future blends as the vines reach full production.



Figure 9. A block of Grüner Veltliner at Stockman's Ridge. Two styles of wine are made from this block due to the soil type and slope, giving different fruit aspects.

Business diversification

Stockman's Ridge wines are available through the cellar door, at on-site weddings, and throughout NSW at Dan Murphy's. The Orange region, home to more than 35 vineyards and cellar doors, is a well-established tourism destination that attracts visitors for its food, wine and seasonal events.

Weddings or functions are held on-site most weekends during the year, providing an important additional income stream, which has become a valuable part of the business.

Cherries, apples and pears are also grown on the property, with visitors to the farm getting the opportunity to pick their own fruit.

Monitoring data

Jonathan aims to build Stockman's Ridge as a long-term generational operation, so decisions are based on supporting the future of the business, the vineyard and the land itself.

He is highly hands-on and closely involved in every aspect of the operation, from vineyard planning and production through to wine sales and the broader direction of the business. This close involvement has given him a detailed understanding of the site, including its strengths, its limitations and the ways it needs to be managed over time.

With a background in information technology, Jonathan uses data for decision-making. He has developed systems to monitor vineyard inputs, production and wine volumes, which not only help with practical decisions, but also provide information about what each season is likely to deliver. Jonathan monitors weather, irrigation ([Figure 10](#)), temperature, seasonal variation, pest and disease pressure, and general vineyard performance so he can respond to conditions as they change during the season.



Figure 10. Jonathan monitoring the irrigation.

Leaf thinning

In earlier vintages, leaf thinning was done on both sides of the canopy, but is now only done on the easterly side of the north–south rows that get the morning sun. This helps protect fruit from hotter afternoon conditions and reduces the risk of developing overly ripe or jammy characters in the wine.

Soil

To enhance soil function and resilience, organic-based inputs are used instead of synthetic fertilisers. Cover crops with a mix of around 10 species, including rye corn, triticale, lighter nitrogen-fixing clovers, vetch where needed, brassicas, low-growing grasses and daikon radish, are grown each year to help reduce reliance on fertiliser while improving soil structure, biological activity and water-holding capacity.

In the first half of the season, a crimping roller is used to build a thick cover through the mid-rows, helping cool the soil, retain moisture and protect the vineyard from summer heat. Mid-row tillage is used carefully and strategically, with alternate mid-rows cultivated only once every 2 years. Even then, cultivation is never deeper than 100 mm to avoid damaging soil structure and to help preserve the integrity of the soil profile.

To help increase the low organic matter levels inherited with the property, Jonathan has started using carbon granules as part of a longer-term goal of reaching 6% organic matter. This should improve soil condition, nutrient-holding capacity and moisture retention.

He has also introduced a micronised, soluble calcium product to improve calcium movement into the root zone and help bind clay and organic matter. This should improve soil structure so water, air and roots can move more freely through the profile.

Mechanically cultivating the under-vine area has helped open the soil surface and improve infiltration, reducing herbicide use.

Water

Water is managed with a strong focus on efficiency and soil storage. As there is clay on the site, Jonathan uses tools such as a blade plough and under-vine weeder (Figure 11 and Figure 12) to open the soil around the vines so that rainfall and irrigation are more likely to soak in rather than run off. In his view, the best place to store water is in the soil. The property has been reworked to improve drainage and encourage water to flow towards the irrigation dam.



Figure 11. The mechanical weeder used on the property.



Figure 12. The row on the right is where the mechanical weeder was used and left, where the weeder was not used.

Biodiversity

At the back of the property is a native block that was planted to encourage beneficial predators of vineyard pests. Jonathan is looking to enhance this ecological approach by adding wildflower plantings and beehives to encourage a more diverse and balanced system throughout the property.

Fruit

Depending on the season, the 6-hectare block produces 35–50 tonnes of fruit for the Stockman's Ridge label. Fruit for selected wines is also hand-harvested according to vine position and soil at the site. While the vineyard has been carefully matched to the region and the property, Jonathan understands that each season is different and management needs to keep evolving to produce quality fruit and wine.

Key points

Know your site and work with its strengths

- Understand the unique features of the property, including altitude, aspect, soil and water-holding capacity.
- Match vineyard development and management to the conditions of the site rather than taking a one-size-fits-all approach.
- Use first-hand observation and practical experience to guide decisions over time.

Choose varieties carefully

- Select varieties that are well-suited to the climate, soil and vineyard location.
- Consider both established and emerging varieties that can perform well and offer something distinctive.
- Think long-term about varietal mix, wine style and future blending opportunities.

Build a resilient business

- A diversified business model can strengthen long-term viability and create multiple income streams.
- The cellar door, events and agritourism can all play an important role alongside wine production.
- A strong connection between the vineyard and the visitor experience adds value to the business.

Use data to support practical decisions

- Good records and clear data can help with decisions in the vineyard and winery.
- Monitoring weather, irrigation, pests, disease pressure and production helps improve timing of interventions and efficiency.
- Digital tools and tracking systems can help with decision-making.

Farm with the long-term in mind

- Soil health, water management and ground cover should be treated as long-term investments in the future of the vineyard.
- Practices such as organic-based nutrition, cover cropping and careful cultivation can help build resilience.
- Encouraging biodiversity and working with the broader ecosystem can help vineyard health and balance.

Conclusion

Jonathan has developed Stockman's Ridge with long-term thinking, careful observation and a willingness to adapt. Through thoughtful site selection, varietal matching, diversification and a strong focus on soil, water and data, Jonathan has built an operation designed for future generations. While the vineyard has been carefully matched to the region and the property, Jonathan understands that each season is different and management needs to keep evolving to produce quality fruit and wine.

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Business diversification case study 2: integrating olives

Penny Flannery, Development Officer –
Viticulture, NSW DPIRD

Introduction

Steve Barbon (Figure 13) of Barbon Estate, based in the Riverina, is facing significant structural and economic challenges, including unsustainable pricing, abandoned vineyards, disease pressure, water scarcity, and ongoing uncertainty in domestic and export markets. His decades of experience influence his perspective on these challenges as he explains why he replaced part of his vineyard with olive trees.

Industry pressures and economic realities

Pricing and payments

Steve said many growers were struggling with delayed payments and unsustainably low grape prices. Red varieties, especially Shiraz and Merlot, have lost value, and even whites such as Chardonnay, which traditionally offered stability, have had unexpected price drops.

Wineries were also dealing with their own pressures, with massive stocks of unsold wine and aggressive pricing from supermarket private label programs. However, growers were carrying the greatest financial burden as production costs continued to increase while returns declined. The result is a prolonged downturn that growers believe could continue for at least 5 years.

Vineyard management challenges

Resting versus removing

Although some growers consider resting vineyards during downturns, Steve says that could be more costly in the long term. Rested vines still require irrigation, fungicide sprays, and pruning, and they can take years to recover once reactivated. Removing a vineyard is expensive upfront due to disposal rules for CCA-treated posts, but it can be more economical over time.

Water economics and decision-making

Water cost is one of the biggest motivators for change. Temporary water has reached prices where selling water can be more profitable than growing grapes. A vineyard using 5.0–6.0 ML/hectare often generates less income than selling that water allocation. These economics are pushing growers towards alternative crops with lower water requirements or selling water as an income stream.

Diversification: transition to high-density olives

Why olives were appealing

In 2021, Steve removed a 2-hectare block of Shiraz. The block was levelled to improve drainage and left fallow. After 2 failed attempts at replanting Pinot Gris due to consecutive wet springs, Steve began exploring alternative crops. High-density olives emerged as a strong contender for several reasons:

- lower water and spray requirements than vines
- higher tolerance to drought and variable seasons
- can use existing grape machinery and equipment
- lower establishment costs
- rising local demand for olive oil.

Steve then purchased Arbosana olives from Agromillora Australia in South Australia, as they are drought-tolerant and grow well in high-density hedge plantings (Figure 14).



Figure 13. Steven Barbon of Barbon Estate.



Figure 14. Two hectares of olives, planted in previous vine rows.

High-density planting system

Steve's system mirrors grapevine spacing, which suits Arbosana olives:

- row spacing of 3.6 metres
- tree spacing of 1.0 to 1.5 metres
- target height of about 1.5 metres
- hedge-style canopy for mechanical harvesting.

This system ([Figure 15](#)) means the olives can be managed with grape harvesters, sprayers, and herbicide equipment, eliminating the need for new machinery.



Figure 15. Olives with an established vineyard in the background.

Costs and establishment

Olive establishment costs were significantly lower than those for vineyards. For example:

- approximately \$16,000/ha for trees
- minimal to no trellis or infrastructure
- simple training and pruning in the early years.

The trees typically bear small amounts of fruit from year 3, with mature yields reaching 30–40 kg/tree with good management. Young trees should be planted with plastic covers and bamboo sticks or timer stakes to support them. Any suckers at 500 mm from the ground to the lowest branches are pruned to train the trees to grow towards one another instead of towards the mid-row. Keep up good irrigation and fertiliser, especially during the growing season. Control weeds and be prepared to apply copper and oil as required.

Risks and limitations

While olives are more resilient than grapes, they are not risk-free. Issues include scale insects, fruit fly, occasional wind damage to young trees and the potential for sucker growth near the trunk. Early training and tying are essential to avoid trunk damage.

Industry trends and future outlook

Changes in crop choices

Many growers are exploring alternatives to grapevines such as olives, citrus, almonds and pistachios as these are getting good returns at the moment. Steven settled on olives because, in the last 10 years, local growers indicated they broke even with olives, even in the worst-case scenario. Also, input costs such as chemicals are low compared to wine grapes, and there are additional costs with citrus and almonds, such as manual labour and higher water use. Large regional wine companies are also investing in high-density olives, indicating confidence in the crop's future.

The future of wine grapes

Steve believes the industry will survive, but at a reduced scale. Margins remain tight, and younger generations are reluctant to enter grape farming due to financial instability. Replanting vineyards is expensive and requires long-term contracts at viable prices. Steve is planning to stagger the wine grape removal and olive replacement based on the way the industry progresses. However, Steve indicated the cost of removal has increased significantly since he removed the Shiraz in 2021.

Key points

- Start small and learn the system before expanding.
- Conduct proper soil preparation, especially drainage.
- Maintain a flexible farm design to allow a return to grapes if markets recover.
- Keep existing vineyard equipment to reduce capital expenditure.
- Prioritise long-term commercial sustainability over short-term yield.
- Assess variety suitability based on climate, water cost, and market demand.
- Avoid replanting grapes without secure pricing and long-term contracts.
- Consider partial diversification rather than whole farm conversion.

Conclusion

While the wine industry continues to face structural challenges, opportunities for diversification, especially through high-density olives, give growers an option for enhancing economic resilience. By understanding market pressures, reassessing water economics, and embracing new crops or business models, growers can look at other possibilities while keeping long-term options open.

Acknowledgements

This case study was part of the Regional Program NSW/ACT, which is delivered in partnership with NSW Wine. It is supported by Wine Australia, with levies from Australia's grapegrowers and winemakers and matching funds from the Australian Government, and in-kind co-investment by the NSW Department of Primary Industries and Regional Development. This case study was part of activities to provide ideas to viticulturists for business diversification and to optimise sustainable vineyard production.

Business diversification case study 3: integrating potatoes

Penny Flannery, Development Officer – Viticulture, NSW DPIRD

Introduction

Simon Robertson manages approximately 200 hectares of vineyards alongside other farming systems at Tumblong Hills near Gundagai. Following significant market changes, including changes to market demand, Simon has modified the way he manages the vineyard to maintain viability. His approach integrates reduced-input viticulture, varietal diversification, top-grafting, and alternative enterprises such as seed potatoes.

Industry pressures and economic realities

Pricing and contracts

Major changes to grape contracts prompted Simon to consider changes to the business. While medium and smaller premium wineries continue to purchase fruit from Simon, volumes are low and increasing freight and handling complexity add additional costs.

Market access challenges

High costs throughout the bottled wine supply chain are reducing profitability for growers and distributors supplying wine grapes. This has increased the importance of direct-to-consumer wine sales, as well as strong relationships within traditional distribution channels.

Vineyard management challenges

Reduced input system

Simon stopped using glyphosate, pesticides, and water-soluble fertilisers 13 years ago. Instead, mechanical cultivation is used to manage competition in the under-vine area and improve soil structure, creating humus and allowing the vines to feed naturally through their feeder roots (Figure 16). This requires multiple tractor passes with different implements that he refers to as flopping, tilling, and fluffing. Managing under-vine competition is the key to maintaining yields when reducing chemical use.



Figure 16. The results from mechanical cultivation of the under-vine area.

Pruning and canopy management

A combination of cane and spur pruning was used, depending on the variety. Cane pruning was required for varieties such as Nebbiolo, as it works better for fruitfulness. The other varieties, including Barbera, Chenin Blanc, Fiano, Grenache, Nero d' Avola, and Sangiovese, were spur pruned.

Reworking and vineyard transition strategies

Top grafting

Thirty hectares of Cabernet Sauvignon and Shiraz were top-grafted to alternative varieties. This method retains the root system and enables production within 18 months, compared to 3 or 4 years after replanting. The alternative varieties are primarily targeted at estate-grown wines and premium markets.

Risks of grafting

Strike rates can be highly variable, with results as low as 40% in some seasons. Challenges include grafting material quality and the need to manage regrowth from the original rootstock.

Mixed-enterprise diversification

Seed potato production

Seed potato plantings (Figure 17) were introduced to provide cash flow and to offset the planned vineyard removal costs, which are about \$4,000 a hectare. Seed potatoes require at least 4 years of clean soil (without potatoes), so a removed vineyard site was highly suitable. An added incentive for planting seed potatoes was having a direct market through a local seed supplier.



Figure 17. Seed potatoes being harvested from a previous vineyard block.

Challenges

The plan was to use the profits from seed potato production to offset the vineyard removal costs. However, due to common nematodes being in part of the block, the seed potato crop was downgraded to stock feed rather than seed sales.

Soil and pest considerations

Nematodes are soil-borne, small, non-segmented worms that can affect various crops. Their persistence highlights the importance of understanding the soil before planting alternative crops. In hindsight, a brassica rotational crop would have solved the nematode problem.

Industry trends and future outlook

Simon plans to continue to reduce the vineyard area to around 40% of the former size, focusing on removing areas of high risk and low profitability. Planting alternative crops to use existing infrastructure and generate cash flow will diversify income and protect the core asset, which is grape and wine production, is planned.

The future of wine grapes

Simon considers the current wine industry challenges are primarily determined by declining consumption worldwide due to wellness trends and younger generations choosing not to enjoy wine. He says we need to work towards producing wines that will attract the younger generations and packaging that is sustainable and attractive to them; heavy-weight glass bottles alluding to quality do not cut it any more. Without attracting the younger generations, we will not see a turnaround for quite a long time.

Key points

- Use top-grafting to change varieties and reduce downtime and cost.
- Match varieties to market demand.
- Diversify income streams.
- Understand soil constraints before planting different crops.
- Balance reduced chemical inputs with increased labour.
- Stage vineyard removal over time if it is too costly to remove all at once.
- Focus on profitability over production volume.
- Maintain flexibility in business planning.

Conclusion

Simon's approach shows how vineyard businesses can adapt by diversifying and having flexible management strategies to remain economical and resilient.

Acknowledgements

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A low-input vineyard system

Thomas Lefebvre, Extension and Sustainability Officer, Riverina Winegrape Growers

Low-input vineyard systems are designed to minimise operational costs while maintaining commercially acceptable fruit quality. These systems reduce chemical, labour, and mechanical applications, relying instead on practices that balance vine health, sustainability and productivity. This trial shows how strategic reductions in inputs affect vineyard performance, profitability and fruit outcomes.

Foundations of a low-input vineyard

The program involves:

- mechanical pruning – 60 buds/vine average
- 1 herbicide pass – suckers
- 2 fungicide passes – mancozeb/sulfur/copper
- no slashing
- no trimming
- no fertilising
- 2 ML/ha of irrigation.

A low-input vineyard relies on doing only essential management operations while omitting many of the routine practices used in standard programs. Mechanical pruning is designed to leave an average of 60 buds per vine. There is minimal weed and sucker control with one herbicide pass, and a very limited fungicide program consisting of only 2 applications of mancozeb, sulfur, or copper, depending on seasonal pressure.

Notably absent from the program are slashing passes, trimming cycles, and fertiliser applications. Irrigation is maintained at a moderate 2 ML/ha for the season. All key operations (mechanical pruning, 1 herbicide pass and 2 fungicide passes) are completed by contractors, which allows for predictable budgeting and logistical efficiency. The vineyard operates with a streamlined set of interventions aimed at preserving canopy function and fruit development with minimal cost.

Budgeting for reduced inputs

The low-input vineyard model in the Riverina shows how removing selected operations, such as trimming, fertilising, and frequent spray cycles, and relying on mechanisation, can substantially reduce the cost of production. Thomas has determined that in the Riverina, growers usually spend around \$5,000 a hectare a year compared with \$2,120 a hectare in a low-input system.

The low-input budget highlights that cost reductions do not require eliminating all interventions, but only selecting those that offer the greatest return for the least operational expenditure. For growers aiming to stabilise margins under increasing production pressures, this approach highlights a viable alternative to more intensive management styles.

Fruit quality and quantity in a low-input system

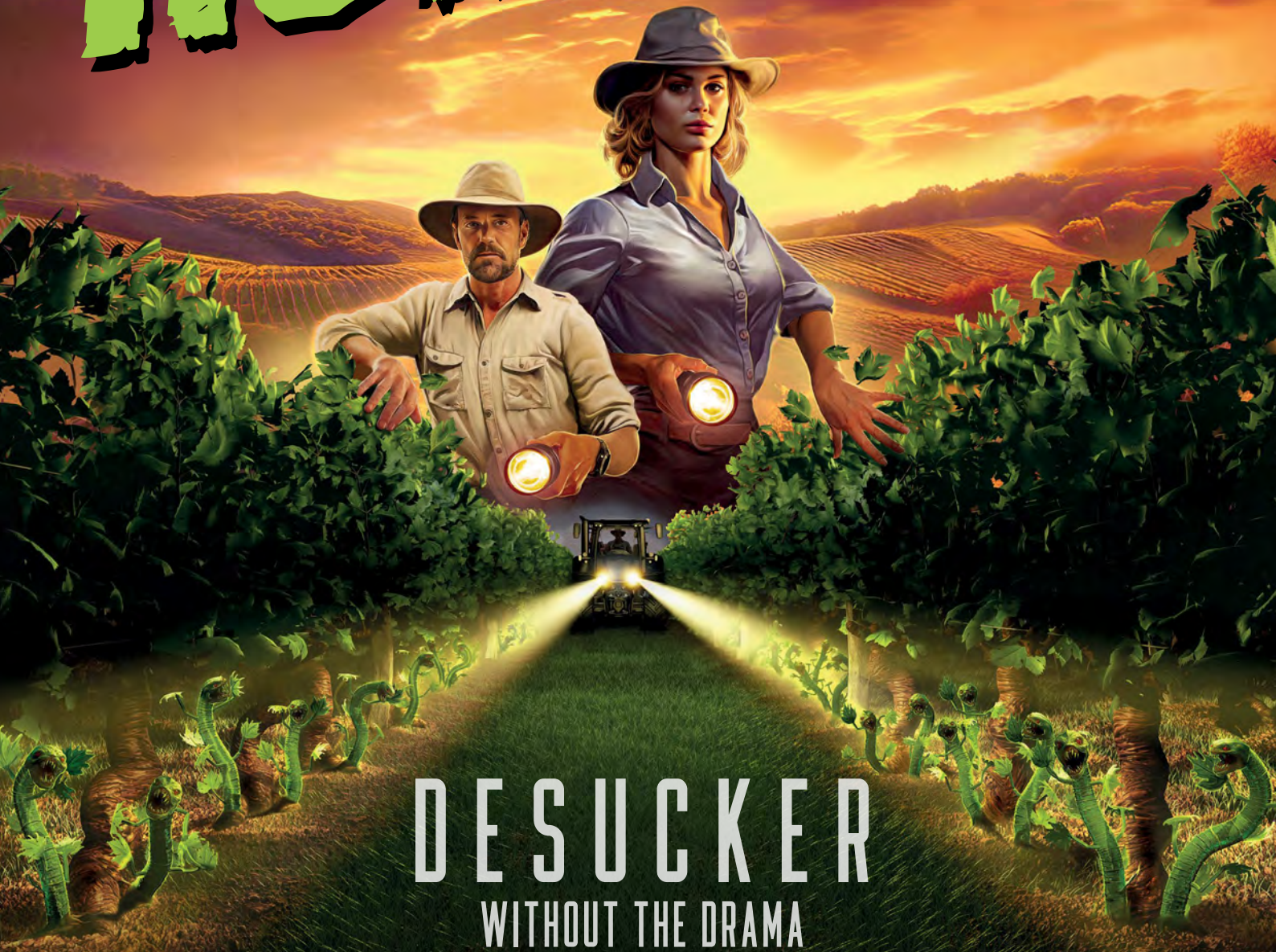
Fruit sampling from February gives a comparison of low-input Shiraz and standard Shiraz in Yenda. The low-input Shiraz had slightly higher sugar concentration, pH and titratable acidity, and greater colour density than the standard Shiraz (Table 1). These results indicate that fruit from the low-input Shiraz would be graded as higher quality than fruit from the standard Shiraz.

The higher titratable acidity in the low-input Shiraz would most likely have been caused by the lower overall soil temperature, due to the vegetation on the vineyard floor (both under the vines and in the inter-rows). In the next phase (years 2 to 3), soil temperature will be monitored.

Table 1. Fruit testing results for low-input Shiraz and standard Shiraz.

	Sugar (Bé)	Acidity (pH)	Titratable acidity (g/L)	Colour (mg/g)
Low-input Shiraz	13.5	4.04	7.82	1.31
Standard Shiraz	13.1	3.92	4.98	0.98

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Vineyard and fruit observations

In the low-input vineyard, canopies were balanced without excessive shoot growth, showing that minimal fertilisation and reduced irrigation can still support adequate leaf area for ripening (Figure 18). The bunches had even development and good exposure, with no evidence of disease, despite the reduced fungicide program.

The absence of slashing and trimming, plus the conservative irrigation, has helped the canopy remain a good size for viticultural tasks (Figure 19) and does not appear to compromise vineyard access or fruit zone structure. Mechanical pruning contributes to a uniform architecture, making management easier and ensuring consistent bud numbers from season to season.



Figure 18. Shiraz fruit ripening was not affected by reduced inputs.



Figure 19. Not slashing the inter-row did not compromise vineyard access or fruit zone structure.

Practical considerations for adopting a low-input system

When deciding if a low-input program is suitable for your vineyard, considerations include canopy vigour, disease pressure, water availability, and fruit quality targets. Vineyards in warm, dry regions with moderate disease pressure, such as the Riverina, are well suited to reduced fungicide and nutrient inputs. Mechanical pruning becomes the basis of the system, providing a predictable canopy shape and reducing annual labour variability. While low-input systems can greatly lower production costs, they rely on careful monitoring to ensure the vines remain balanced and capable of delivering stable fruit quality year after year.

Conclusion

This trial shows that a low-input vineyard system can produce fruit suitable for commercial red wine production, with biochemical metrics reflecting ripeness, colour, and structural potential suitable for winemaking requirements, while substantially reducing operating costs.

In this example, simplifying management practices (for instance, using mechanical pruning, moderate irrigation and reducing spraying) maintained vine performance and fruit quality, highlighting possible opportunities for broader application subject to site-specific conditions.

The per-hectare costs in this trial were reduced from \$5,000 to \$2,120, indicating a more economically sustainable approach could be possible in the Riverina, where climate and mechanisation support its implementation. At a fruit price of \$250 per tonne, this Shiraz block achieved a small positive return, highlighting the potential for economic viability under similar conditions.

As production costs rise and labour availability tightens, these systems provide growers with an efficient path toward maintaining profitability without sacrificing essential vineyard outputs.

Acknowledgements

This trial was conducted by the Riverina Winegrape Growers using the NSW DPIRD Griffith Research Station Shiraz vineyard.

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Rootlings Conference 2026: shaping the future of the Australian wine industry

Penny Flannery, Development Officer – Viticulture, NSW DPIRD

The 2026 Rootlings Conference, held in Canberra, provided a valuable opportunity for young wine industry professionals to discuss the rapidly changing Australian wine industry. Bringing together people from various parts of the industry, topics such as consumer behaviour, innovation, sustainability and industry structure were highlighted.

One of the main points to emerge from the conference was that success in the wine industry is no longer determined by production alone, but by connection to the consumer. The importance of having a clear brand identity, understanding retail pathways, and adapting to trends such as premium varieties and lifestyle-driven consumption were emphasised. Discussions on evolving wine styles and technological advances suggested how producers can stay relevant in a highly competitive and changing market. The conference also highlighted the value of collaboration. With representation from organisations such as Wine Australia and the Australian Wine Research Institute (AWRI), attendees can see how the industry operates and where they can contribute.

Why under-35s in the wine industry should attend

For early-career professionals, the Rootlings Conference offers networking opportunities with industry leaders (Figure 20) and practical insights that might not be available in their usual workplaces. Attendees were encouraged to ask questions and build networks, which are critical steps in a career where relationships often unlock opportunities. The conference also provides clear pathways into industry involvement, from committees and research programs to leadership and governance roles. The conference encourages young professionals to challenge traditional approaches and adapt quickly. In an industry undergoing significant change, those under 35 have a key role to play in shaping the future.

Building the next generation

The Rootling's Conference is not just for teaching young people about the wine industry; it is also about connecting them with other professionals so they can build a support network. If you work in any aspect of the Australian Wine industry and are 35 years or younger, why not [join the Rootlings Network](https://www.rootlings.com.au/join/) (<https://www.rootlings.com.au/join/>)?

Acknowledgements

The 2026 Rootlings Conference was supported in part by the Regional Program NSW/ACT, which is delivered in partnership with NSW

Wine. It is supported by Wine Australia, with levies from Australia's grapegrowers and winemakers and matching funds from the Australian Government, and in-kind co-investment by the NSW Department of Primary Industries and Regional Development.



Figure 20. Rootlings conference attendees at Four Winds Vineyard.



More than leadership: building a network for the future of Australian wine

Daniel Mortimer, General Manager, Mortimers Wines

When I was asked to write about my experience in Wine Australia's award-winning Future Leaders program, I immediately walked over to my bedside table and opened my Future Leaders 2025 journal. Still attached to the title page was a fluoro orange sticky note with a famous quote attributed to Michelangelo, scribbled in my own handwriting. When asked how he crafted the incredible detail in one of the world's most celebrated sculptures, David, he supposedly replied, 'Simple, I just removed everything that wasn't David'.

The all-encompassing nature of this program was to leave your work behind, your stress behind and in many ways, your understanding of yourself behind. From the first session in Casuarina, we were challenged to break down who we thought we were and start again. To remove everything that was not 'Daniel'. To become truly vulnerable and begin to understand our identity. Who we are at our core.

I do not intend to go into the nitty-gritty of the program. In fact, there seems to be some sort of unwritten pact among Future Leader alumni when discussing the program with potential participants. When I pushed some local alumni for more details about what to expect, I was met with tight lips and vague answers. The overwhelming response was simply:

'Just do it, it's life-changing'.

At the time, I found that both frustrating and intriguing. Looking back now, I understand why. The magic of the program is not something that can easily be explained. It is something that needs to be experienced.

I am not going to lie, it is a significant commitment in time, money and effort. The program consists of 5 sessions held in 4 states, each involving an intensive 3-day schedule of workshops, presentations, experiences and networking opportunities. For those of us balancing careers, businesses, families and the everyday pressures of the wine industry, stepping away from work can often feel impossible; but that is precisely the point. To get the most out of the program, you need to give yourself permission to step away from the daily grind and fully immerse yourself in the experience.

'And what an experience it was'.

When I was selected to take part in Wine Australia's Future Leaders program, I expected to learn more about leadership. What I did not expect was that some of the most valuable lessons would come not from the presenters, but from the 14 other participants sitting around the room. The cohort consisted of 15 participants from throughout Australia, representing a diverse range of regions, businesses and roles within the wine sector. Some worked in production, others in viticulture, sales, marketing, research, regional organisations and industry leadership roles. While our day-to-day experiences differed, we shared many of the same challenges and aspirations.

The Future Leaders program is structured around 5 key themes:

1. identity of leadership
2. science of leadership
3. art of leadership
4. future of leadership
5. a final integration session that brings the concepts together.

Each session explored leadership from a different perspective, providing participants with practical tools as well as opportunities for self-reflection.

The program could not have come at a better time for me. As general manager of our family business, Mortimers Wines, I was learning the ins and outs of the wine industry while navigating the balancing act that is growing grapes, making wine and selling wine. Every day seemed to bring a new challenge, and while I was enjoying the journey, there was always a bigger question looming in the background. Six months earlier, my father told me that he was nearing the end of his time at

Mortimers Wines; a business he and my mother had built from a bare block of land 31 years ago. I always knew that conversation would come eventually, but hearing those words was confronting. We agreed to give it another 12 months and assess the business before making any decisions. Deep down, I was not sure I was ready. The responsibility of taking over a family business carries a weight that is difficult to explain until it is in front of you.

A few weeks later, an email landed in my inbox. A former local Future Leaders alumnus had forwarded the Wine Australia Future Leaders 2025 application information with just one additional sentence:

'Hey, you should do this.'

What she could not have known at the time was how much I needed that email. Looking back now, it feels like one of those moments in life that was meant to happen. With more than 100 applicants vying for a place and only 15 participants selected (Figure 21) from within Australia, I felt incredibly fortunate to be accepted into the program. I joined it hoping to develop skills that would help me navigate the challenges of succession, business growth and leadership. What I found was a program that challenged the way I think about leadership and broadened my understanding of the Australian wine sector. I quickly realised that the future of Australian wine will not be shaped by individual businesses operating in isolation. It will be shaped by collaboration, knowledge sharing and a willingness to learn from one another. In that sense, the Future Leaders program is about far more than developing individual leaders. It is about strengthening the leadership capacity of the industry as a whole.

The program delivered by Ali and Darren Hill from Pragmatic Thinking is exceptional, but I am not going to try to explain it because it is a deeply personal journey that will mean something different for every participant. What I can guarantee is that your cohort will become much more than classmates. The greatest strength of the program is its people. Throughout the program, the 14 other participants became trusted peers, supporters and friends. Today, long after the formal sessions have concluded, our cohort remains closely connected. We continue to share ideas, ask



Figure 21. Graduation day at Adelaide, celebrating the 2025 Wine Australia Future Leaders.

questions, celebrate successes and support one another through challenges. It is not uncommon for me to pick up the phone or send a message to someone from the group when I am facing a difficult decision, seeking advice, or simply looking for a different perspective. What makes this network particularly valuable is the diversity of experience it offers. Our cohort spans different wine regions, businesses and sectors throughout Australia. Whether the challenge relates to viticulture, winemaking, sales, marketing, people management or succession planning, there is almost always someone who has faced a similar situation or can offer insight from a different angle. The ability to tap into that collective knowledge is incredibly powerful.

One of my favourite memories since completing the program was hosting the majority of our cohort in my hometown of Orange in May this year. We spent 3 fantastic days catching up, sharing stories and exploring the Orange wine region together (Figure 22). It was a reminder that while the formal program might have ended, the relationships certainly had not. The support network does not stop with the cohort. Every participant is thoughtfully paired with a Future Leaders coach, usually a former alumnus, who provides an additional source of support throughout the program and beyond. These coaches are carefully matched based on personality, experience and leadership style. I was fortunate enough to be paired with a coach who had recently written a thought journal on succession planning. At a time when I was going through my own succession journey, having someone who had lived and studied many of the same challenges proved invaluable. To this day, he remains one of my most trusted sounding boards.

As I prepare to take over Mortimers Wines from my parents, the experience has given me confidence that I do not have to go through this next chapter alone. The program provided practical tools and frameworks, but more importantly, it connected me with a network of people who continue to challenge, support and inspire me.

So, if you are considering applying and wondering whether it is worth the commitment, I will leave you with the same advice that landed in my inbox and changed my life.

'Hey, you should do this.'



Figure 22. The 2025 cohort reunited in Orange in May 2026, exploring the local region featuring Jeff from Byrne Farm.



Managing productivity and resilience in NSW vineyards

Penny Flannery, Development Officer – Viticulture, NSW DPIRD

The NSW Department of Primary Industries and Regional Development (DPIRD) delivered a series of viticulture field days and workshops during spring 2025 in 3 regions: Murrumbateman (Figure 23), Griffith and the Hunter Valley. These events brought growers together to discuss practical vineyard management strategies, current industry challenges and emerging opportunities to improve vineyard resilience, sustainability and profitability.

At all 3 events, common themes emerged, including:

- adapting vineyard practices to current market and climate pressures
- managing pests and diseases more effectively
- improving soil and under-vine management
- exploring new options for vineyards and varieties.

The discussion among growers during the field days provides valuable support for each other as they manage their vineyards during challenging times.



Figure 23. Attendees at the viticulture field day held in Murrumbateman.

Industry updates and priorities

Each event began with an update on current NSW DPIRD priorities, which include the need for adaptable vineyard management approaches in response to economic conditions, biosecurity risks and climate variability. Emphasis was placed on practical, regionally relevant solutions to help growers maintain production, transition blocks, or consider resting a vineyard.

Renewing ageing vineyards: reworking, removing and replanting

Many vineyards in NSW were planted during the 1990s and the early 2000s expansion and are now 20–30 years old. Some have declining infrastructure, soil health issues and increasing trunk disease pressure. NSW DPIRD's Triple R (reworking, removing and replanting) program provides structured guidance to help growers assess vineyard conditions and select the most appropriate renewal pathway. Refer to [Options for vineyards: reworking, top-grafting, replanting or removing](https://www.dpi.nsw.gov.au/agriculture/horticulture/grapes/case-studies/options-for-vineyard-reinvestment) (<https://www.dpi.nsw.gov.au/agriculture/horticulture/grapes/case-studies/options-for-vineyard-reinvestment>) for details.

Reworking vines to extend vineyard life

Reworking remains a cost-effective strategy where vines and infrastructure are fundamentally sound. It involves removing diseased trunks or cordons and retraining new shoots, effectively performing remedial surgery on vines affected by trunk diseases such as *Eutypa* dieback and *Botryosphaeria* dieback.

Key considerations with reworking highlighted at the workshops included:

- **Disease position** – the further away from the trunk the disease is, the greater the chance of reworking success.
- **Historical yield and fruit quality** – reworking could be a viable option if yield and quality are continually declining.
- **Infrastructure condition** – the infrastructure should be able to support the vines for the next 10–20 years.
- **Variety suitability** – some varieties are easily reworked, while others are not.

Reworking is a preventative strategy; it is not a 'cure' for trunk disease. Correct timing, careful cutting, and wound protection were identified as essential to success.

A case study on reworking a vineyard in Orange, NSW, showed what is possible when combined with changes in the pruning system. Transitioning from spur to cane pruning, combined with cordon replacement and wound protection, increased yields by more than 40% while reducing disease pressure and, in turn, fungicide requirements over 3 vintages.

Top-grafting for rapid varietal change

Top-grafting is an option when vines are healthy but varieties are no longer suited to market demand or business requirements. By grafting a new scion onto an existing vine, growers can change a variety while preserving established root systems and avoiding long re-establishment periods.

Critical success factors for top-grafting included:

- ensuring vineyard viability before investing
- using certified, virus-free scion and rootstock material
- high-quality cuttings that must be prepared and stored carefully
- intensive management after grafting, including multiple shoot training passes.

A case study at Braidwood, NSW, illustrated the benefits of this approach, with top-grafting from Shiraz to Riesling achieving over 98% graft success and a faster return to production than replanting.

Removing and replanting: when starting again makes sense

Where vineyards are severely compromised by disease, have an unsuitable layout or outdated varieties, removing and replanting might offer the best long-term outcome. **The vineyard must be fit for purpose to be redeveloped.** This includes soil remediation, a fallow period, selecting appropriate rootstocks, and ensuring all biosecurity protocols are checked and certified before planting.

Growers were encouraged to use tools such as the [Grapevine rootstock selector](#) on the Wine Australia website to match rootstocks to site conditions, including salinity, drought risk and vigour balance.

Case studies in Orange and nearby areas showed how strategic removal can reduce costs, overcome biosecurity risks and create opportunities to make vineyards more suited to current markets.

Managing vineyards for reduced production

In response to market oversupply and low prices, NSW DPIRD presented research on resting vineyards, based on a multi-year trial with Chardonnay at Griffith. The goal was to find methods to significantly reduce short-term yield without compromising vine health or future production.

The trial compared several approaches, including removing fruit, double pruning, reducing irrigation and using plant growth regulators. Results showed:

- Most treatments reduced yields by more than 50% for at least one season.
- Reducing irrigation only had a minimal residual effect when full irrigation was restored.
- Double pruning and ethephon had some residual effects, but these had gone by the second season.

This work showed that resting a vineyard can be a viable economic strategy when market conditions demand temporary yield reduction, providing growers with flexibility without locking in long-term losses.

Thomas Lefebvre of the Riverina Wine Grape Growers ([Figure 24](#) and [Figure 25](#)) is continuing this work at the NSW DPIRD site with Shiraz, exploring options for a low-input vineyard. Thomas has been measuring inputs, costs, fruit yield, quality and potential income from this vineyard. So far, the results appear to be profitable. For more details, refer to [page 24](#).



Figure 24. Thomas Lefebvre of the Riverina Winegrape Growers discussing the low-input vineyard.



Figure 25. Thomas Lefebvre of the Riverina Winegrape Growers in the Shiraz block at the NSW DPIRD Griffith site discussing the low-input vineyard to attendees.

Under-vine management

There is growing interest in having under-vine ground cover to improve soil health, reduce herbicide use and operating costs. Trials and case studies in Orange, the Lower and Upper Hunter and Mudgee, involving a range of pasture and clover species under different climatic and irrigation conditions, were discussed.

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Key findings included:

- species selection must be region-specific
- autumn sowing improves establishment
- annual clover can provide weed suppression and nitrogen benefits
- permanent ground cover can increase microbial activity and soil carbon, and reduce the need for herbicide applications.

At the Orange trial site, red clover provided the greatest soil nutrient and microbial benefits, while in the Upper Hunter, crimson clover was highly effective for weed suppression and seasonal fit. These trials reinforced that under-vine vegetation can be both agronomically beneficial and operationally efficient when appropriately managed.

Integrating sheep into vineyards

One of the most widely discussed topics was grazing sheep for under-vine weed control and vineyard floor management. Case studies from multiple NSW regions, along with examples from New Zealand, showed potential benefits including:

- reduced labour and herbicide costs
- improved soil structure and biological activity
- fewer tractor passes and reduced diesel use
- additional income from meat, wool or agistment.

Successful integration of sheep into the vineyards depended on:

- careful breed selection, with calm, low browse breeds such as Babydoll Southdowns, Dorpers and Merinos being the most suitable
- infrastructure investment, such as additional fencing, might be required
- timing of grazing, with growers consistently emphasising that sheep must be removed when the vines are at sensitive growth stages.

Pest and disease management

Effective pest and disease control remains central to maintaining vineyard productivity. Workshops in Griffith and Murrumbateman on **managing scale insects and mealybugs** were delivered by Dr Meena Thakur (NSW DPIRD), who described her research and [Australian Wine Research Institute \(AWRI\) resources](https://www.awri.com.au/industry_support/viticulture/pests-and-diseases/) (https://www.awri.com.au/industry_support/viticulture/pests-and-diseases/). Key points included:

- understanding pest life cycles helps improve the timing of control measures
- monitoring should be part of routine vineyard operations
- secondary issues such as sooty mould and virus spread should be reduced.

Disease management was discussed during a session on **crown gall-like symptoms**. Dr Toni Chapman (NSW DPIRD) explained that crown gall, traditionally associated with the bacterium *Allorhizobium vitis*, is now more complex than previously thought. Between 2022 and 2025, pathogenic *A. vitis* was detected in only one of 272 grapevine cane samples submitted with gall-like symptoms. Instead, a range of bacteria within the Rhizobiaceae family were isolated, including several *Agrobacterium* spp. and *Neorhizobium* spp. Notably, the symptoms observed often differed from classic crown gall, with galls appearing to develop internally before causing stem swelling, tissue rupture and vascular damage, rather than the typical external tumour formation. These findings highlight a change from a single-pathogen model towards a disease complex involving multiple bacterial species.

Pathogenicity testing confirmed that several non-vitis Rhizobiaceae isolates can induce gall-like symptoms, although their aggressiveness and consistency varied. Some strains caused only mild callusing, while others led to severe galling and stem splitting, suggesting that both bacterial genetics (such as Ti plasmid activity) and environmental factors could influence disease expression. For the grape and wine industry, this means that relying on traditional diagnostics might overlook emerging or non-classical pathogens, and misinterpreting results could lead to unnecessary biosecurity responses. Toni emphasised the need for ongoing surveillance, improved diagnostic tools and increased industry awareness to better manage crown gall-like diseases as an emerging grapevine health issue in Australia.

Gen 1 and 2 vineyard and disease-resistant selections

Disease-resistant opportunities were discussed at the Hunter Valley workshop. Liz Riley of Vitibit described the selections that are currently in quarantine, waiting to be released and sold by Australian nurseries. For further information, refer to the disease-resistant article on [page 84](#).

At the Murrumbateman and Hunter Valley workshops, Dr Bruno Holzapfel explained how NSW DPIRD and CSIRO (funded through Wine Australia) are evaluating the new disease-resistant winegrape selections. These selections should have reduced fungicide needs while maintaining wine quality.

First-generation (Gen 1) mildew-resistant selections, carrying resistance genes for powdery and downy mildew, have now been assessed in multiple regions, including Orange and the Riverina. Results show several selections perform comparably to Cabernet Sauvignon, Chardonnay, Riesling, and Shiraz for yield, ripening timing and wine sensory quality, with some also offering more open bunch architecture, which is advantageous in regions with high botrytis risk. Importantly, Gen 1 material retains >98% *Vitis vinifera* genetics, which is good for keeping wine style and market acceptance.

Second-generation (Gen 2) selections have been developed by stacking multiple mildew resistance genes using marker-assisted selection, increasing the durability of resistance. Gen 2 vines have been planted in Orange and the Riverina from 2023 and are now entering early production, with performance and wine quality assessments underway.

These selections show strong potential to significantly reduce spray costs, labour and environmental impact without compromising wine quality.

Limited cuttings of selected Gen 1 selections are available for on-farm evaluation, providing growers with a low-risk opportunity to trial disease-resistant options before broader adoption. For further information, refer to [page 89](#).

Reducing bunch rot by mechanical shaking

Mechanical shaking is an innovative, low-input option for managing bunch rot, particularly botrytis. Demonstrations at Orange and the Hunter Valley showed that existing mechanical harvesters can be repurposed to remove debris from bunches after berry set and before bunch closure, reducing moisture retention and disease risk.

Results showed up to a 40% reduction in botrytis compared with untreated rows, which is comparable to vines receiving fungicide programs but with fewer chemical applications and tractor passes. This approach was particularly attractive to organic growers seeking alternatives to chemical control. Refer to [page 47](#) for details from the mechanical shaking event held in the Hunter Valley.

Carbon farming and future pathways

Carbon farming opportunities were also discussed in Griffith, reflecting growing interest in reducing emissions and alternative income streams for viticulture businesses. While still an emerging area, the session encouraged growers to consider how vineyard practices such as maintaining ground cover and improving soil carbon could align with future market demands, improve soil water retention and soil structure.

Engaging growers and feedback

Each event concluded with feedback sessions, so that NSW DPIRD's direction is aligned with the current needs of industry. Grower input helps to shape future research, extension priorities and field activities, ensuring that the Regional Program remains practical, adoptable and regionally relevant. Through practical demonstrations, applied research and grower experience, the program provided NSW viticulturists with a clearer pathway for managing vineyards during challenging times.

Acknowledgements

The viticulture workshops are part of the Regional Program NSW/ACT, which is delivered in partnership with NSW Wine. It is supported by Wine Australia, with levies from Australia's grapegrowers and winemakers and matching funds from the Australian Government, and in-kind co-investment by the NSW Department of Primary Industries and Regional Development.



Adapting viticulture to seasonal climate variability and drought

Dr Jason Smith, Senior Research Fellow, Charles Sturt University

Penny Flannery, Development Officer – Viticulture, NSW DPIRD

Water availability is becoming a defining constraint in cool-climate viticulture, with increasing temperatures, variable rainfall and drought placing ongoing pressure on vineyard productivity and sustainability. Growers are increasingly required to operate and plan for conditions where water is limited, costly to use, and potentially not sufficient to meet needs. This is changing the focus to making the best use of existing water resources and leading to a review of varieties and the area of vineyards that can be sustainably and profitably managed.

Supported by the Australian Government's Future Drought Fund and led by Charles Sturt University, in partnership with NSW DPIRD and the University of Tasmania, the 'Adapting temperate viticulture and horticulture to seasonal drought and climate volatility' project team is investigating practical strategies to improve water use efficiency in vineyards. The aim is to develop management approaches that are both effective and feasible in commercial conditions.

The 5-year project will include long-term trials, demonstration sites and grower case studies in southern NSW and Tasmania. These activities are designed to assess the seasonal variability in perennial cropping systems, allowing researchers and growers to improve their understanding of how vineyard practices perform with different climatic conditions and varied water availability.

Early observations from vineyards in the Orange and Hilltops regions suggest that water limitation is not only a function of supply, but also of how efficiently water can be used. Understanding how vineyards can be managed to use existing water most efficiently, and to focus water use on the vines in a dry season, might be more helpful than increasing access to water. Vineyards operating with limited irrigation, or relying primarily on rainfall, must maximise the capture, storage and effective use of soil moisture, particularly during the vine's main growth stages.

A focus of the project is what happens below ground ([Figure 26](#)) and factors influencing how the vine root system accesses available water. Deeper, well-distributed roots have access to greater soil volume and soil moisture reserves that can last longer in a dry season. However, competition from grasses and other mid-row vegetation can be significant, particularly in the upper soil profile where the root length density is much higher than the grapevine can develop. Management practices minimising early competition and encouraging deeper root development can significantly improve resilience to drought conditions.



Figure 26. Soil cores being taken to map root distribution and calculate water holding capacity. Photos: Dr Jason Smith, Charles Sturt University.

Ground cover management is a trade-off between soil health and water conservation. While permanent swards provide benefits such as improved soil structure, reduced erosion and increased biodiversity, they can also extract significant soil moisture during the growing season. This competition is most critical in spring and early summer when vines are establishing canopy and reproductive growth. As a result, some growers maintain flexible management approaches, adjusting ground cover based on seasonal conditions, reducing vegetation in dry years or alternating rows to balance benefits and competition.

Where irrigation is available, its effectiveness is strongly influenced by system design and application strategy. Well-targeted irrigation applied at critical growth stages can significantly improve vine performance while minimising water use. Poorly designed systems can increase evaporation losses or promote weed growth, reducing efficiency. Monitoring tools, including soil moisture sensors, provide opportunities to improve timing and decision-making, although their adoption is often limited by cost and complexity.

Another important consideration is variability within vineyard blocks. Differences in soil type, depth and water-holding capacity can result in uneven vine growth and yield, as well as inefficient water use. In many cases, irrigation decisions are influenced by the driest areas in a block, leading to over-application in other areas. Improving understanding of this variability and developing more targeted management approaches provides an opportunity to increase overall efficiency and consistency in production.

At all sites, growers emphasised that adoption of new practices depends on practicality and economic viability. Management strategies must be cost-effective, simple to implement and scalable to vineyard operations. Constraints such as labour availability, capital investment and the complexity of interpreting data often limit adoption, highlighting the need for clear, actionable recommendations that deliver measurable benefits.

The next phase of the project will focus on implementing and monitoring field trials to quantify the effects of different management strategies on water use efficiency, vine performance and economic outcomes. These trials, along with demonstration sites, will provide data to support the development of practical recommendations for industry. Findings will be delivered at workshops, field days and via extension materials, including fact sheets and a vineyard management guide, ensuring that knowledge is accessible and applicable to commercial growers.

Drought resilience in viticulture will be achieved not by increasing water supply alone, but by improving how water is captured, stored and used within the system. Integrating soil and root management, competition control, irrigation efficiency and practical decision-making will be critical to maintaining productivity under increasingly variable climatic conditions.

Acknowledgement

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VitiCert Australia: a new certification program for grapevine planting material

Nick Dry, Coordinator, National Grapevine Collection program

Key points

- VitiCert is a new national certification system for grapevine planting material.
- It verifies varietal identity, health status and production standards.
- Certification applies across the entire propagation supply chain.
- Using certified vines can reduce establishment risks and support long-term vineyard performance.

What is VitiCert?

VitiCert is a new, national certification system for grapevine planting material, which was launched in May 2026.

Once operational, the program will apply to the entire propagation supply chain, including:

- grapevine collections
- source blocks
- nurseries
- planting material supplied to growers

Planting material produced under the VitiCertified trademark (Figure 27) will be:

- verified against a nationally consistent standard
- independently audited.



Figure 27. The VitiCertified logo.

Why VitiCert has been developed

Increasing pressure from plant diseases, biosecurity risks and industry expectations about traceability has highlighted the need for a consistent, nationally coordinated certification system.

VitiCert builds on decades of industry effort and research investment to provide a durable, national system to help vineyard establishment decisions.

Objectives of certification

VitiCert aims to ensure planting material is:

- **True-to-type:** genetic identity is verified to ensure correct varietal and clonal selection.
- **Healthy:** vines are tested and managed to minimise economically significant viruses.
- **Produced to best practice:** hygiene and disease prevention standards are applied during propagation.
- **Fit for establishment:** minimum physical quality standards support reliable establishment in the vineyard.

VitiCert focuses on the quality, health and integrity of planting material. These factors are often not visible at planting but influence vineyard performance for decades.

Why certification matters

Establishing a vineyard is a long-term capital investment. Issues introduced at planting can take years to become evident and are often costly to correct.

Potential risks include:

- virus infection
- trunk disease
- incorrect varietal identity

Using certified planting material can help to:

- reduce the risk of poor establishment and uneven growth
- improve confidence and predictability of vine performance
- protect capital investment at planting
- support yield and fruit quality outcomes
- extend the productive life of the vineyard.

How the program will work

Certification will apply from grapevine collections through to nurseries supplying planting material. Suppliers will be independently audited against a national standard.

Participation in VitiCert will be voluntary for both suppliers and growers. Suppliers who do participate in the program will clearly identify their certified material at the point of sale, making it easy to identify for growers who wish to use it.

Program delivery and governance

VitiCert Australia is supported by Wine Australia, will be guided by an industry-based standards committee, and delivered through [Greenlife Industry Australia](https://greenlifeindustry.org.au/) (GIA, <https://greenlifeindustry.org.au/>).

Greenlife Industry Australia will provide:

- independent auditing systems
- nursery best-practice program management
- technical support for propagators.

The program is designed to be:

- independently governed and audited
- financially sustainable
- adaptable to evolving research and industry needs.

Program development timeline

May 2026: program launch.

Next steps:

1. establish a Grapevine Standards Committee
2. develop grapevine nursery stock specification (i.e. the underlying standard)
3. update certification and auditing processes
4. enable industry participation with technical support.

2028: first VitiCertified cuttings available.



Naturally occurring white clover helps soil chemistry and microbiology

Penny Flannery, Development Officer – Viticulture, NSW DPIRD

Naturally occurring white clover can play an important role in supporting soil chemistry and microbial activity. At the Gen 1 trial vineyard at the Orange Agricultural Institute (OAI), a naturally established under-vine sward of white clover and native grass species provided an opportunity to assess these potential benefits. Soil testing was conducted before and after applying a glyphosate-free organic herbicide to the under-vine area, allowing comparison of soil conditions influenced by the naturally occurring clover strip. As this is a trial site, the under-vine area has to be kept clean so the vine growth can be used for cuttings.

Site: Orange Agricultural Institute (OAI), Orange, NSW

Sampling depth: 0–10 cm

Sampling date: 27 October 2025

Aims

- Compare under-vine pasture and a herbicide strip for effects on soil chemistry and soil microbial activity.
- Identify options to improve soil health while maintaining effective weed suppression.
- Provide practical, Orange region-specific recommendations for vineyard managers.

Methods and treatments

Four treatments in the under-vine strip were used:

1. No herbicide + clover
2. No herbicide + no clover
3. Herbicide + clover (Figure 28, left)
4. Herbicide + no clover (Figure 28, right)

All samples were taken from the top 10 cm of the soil profile in the under-vine zone and analysed by CSBP Soil and Plant Analysis Laboratory. A microbiology soil test was submitted and analysed by Microbiology Laboratories Australia.



Figure 28. The vine rows with the white clover underneath.



Figure 29. Left row, herbicide and clover (Treatment 3); right row, herbicide and no clover (Treatment 4).

Results

Soil chemistry

The soil chemistry results are shown in [Table 2](#). Nitrogen (N) and phosphorus (P) were highest in the clover rows (Treatments 1 and 3). Potassium was highest in the no-clover rows (Treatments 2 and 4). Carbon (C) and sulfur (S) were highest in the no-herbicide and no-clover rows (Treatments 1 and 2). Soil in treatments 2, 3 and 4 was more acidic than in Treatment 1, and all pH values were higher when measured in water than in calcium chloride (CaCl₂).

Table 2. Soil chemistry results from the under-vine area.

		Treatment			
		1. No herbicide + clover	2. No herbicide + no clover	3. Herbicide + clover	4. Herbicide + no clover
Colour	na	Brown	Brown	Brown	Dark brown
Gravel	%	0	0	0	0
Texture	na	2.5	3.0	3.0	3.5
Ammonium nitrogen	mg/kg	3	3	2	2
Nitrate nitrogen	mg/kg	15	6	18	9
Phosphorus Colwell	mg/kg	47	36	60	34
Potassium Colwell	mg/kg	267	301	253	301
Sulfur	mg/kg	2.8	3.2	3.0	2.7
Organic carbon	%	2.44	2.71	2.33	1.39
Conductivity	dS/m	0.098	0.089	0.096	0.066
pH (CaCl ₂)	na	6.1	6.6	6.6	6.5
pH (H ₂ O)	na	6.8	7.3	7.4	7.2

Soil microbiology

The rows with natural clover and with no herbicide applied had the best soil microbiology results ([Table 3](#)), with more microbial activity and soil carbon.

Table 3. Soil microbiology results from the under-vine area.

Treatment	Microbial activity indicator (guide 80)	Potential activity indicator (guide 668)	Soil microbial biomass C, mg C/kg (guide 4,000)	MLabs comment
1. No herbicide + clover	66.4	569	3,377	Good activity; scope to increase via carbon inputs and balanced C–N ratio.
2. No herbicide + no clover	61.1	529	3,135	Good; similar guidance on building C while watching C–N ratio.
3. Herbicide + clover	55.2	483	2,864	Fair; recommended to add organic conditioners and manage C–N ratio.
4. Herbicide + no clover	49.7	440	2,615	Fair; same improvement guidance.

Discussion

The higher organic carbon in the no herbicide + no clover row highlights that both ground cover type and herbicide application interfere with the nutrient–carbon system. Repeating these measures after harvest and at the end of winter will help separate treatment effects from seasonal effects.

Microbial results from the no herbicide + clover strip indicate an active community not far below guideline values, showing that living ground cover and plant–microbe interactions supply root exudates and residue. Further replication of microbial testing is recommended next season to confirm treatment results.

Practical recommendations

1. Aim to have living ground cover in the under-vine area to help with carbon inputs and balance the C–N ratio.
2. Consider throwing the clippings from slashing into the under-vine area to increase the amount of organic matter under the vines.
3. Consider a targeted nutrient strategy:
 - If aiming to increase the amount and activity of the microbial biomass carbon, add modest, frequent organic inputs such as composted mulch while monitoring the mineral nitrogen content to prevent immobilisation.
 - Sulfur was uniformly low (2.7–3.2 mg/kg); this should be confirmed with plant tissue tests to determine if sulfur additions are required.
4. pH was slightly acidic (CaCl_2 6.1–6.6); this should be maintained with calcareous amendments only if needed and prioritise the calcium balance with gypsum where structural benefits are sought without raising pH.
5. Repeat sampling (late winter and post-vintage) in all rows to determine any seasonal effects.

Take-home messages

- Having a natural under-vine sward of white clover improves soil health.
- At OAI, having clover and not using herbicide provided good microbial results and adequate fertility for phosphorus and potassium.
- Organic carbon can be higher when herbicides are not used, but having clover does not automatically equate to higher values; this needs to be assessed over time.
- Incremental gains in microbial activity are most likely via regular organic inputs and balancing the C–N ratio, alongside maintaining living under-vine ground cover where practical.

Acknowledgements

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Installing drape netting on Gen 2 grapevines

Penny Flannery, Development Officer – Viticulture, NSW DPIRD

In early January 2026, drape netting was installed on the NSW DPIRD Gen 2 vineyards at Orange ([Figure 30](#)) and Griffith ([Figure 31](#)) to protect the crop from hail and bird damage. The netting was applied using a tractor and spike set-up as this method is more suitable for smaller jobs; usually a net-wizz is used.

The Gen 2 grapevines are crosses made by CSIRO that have resistance to powdery mildew and downy mildew, with 2 genes for each of the diseases. Gen 1 has single-gene resistance.



Figure 30. The netting was securely fastened to the end posts and the bottom wire with a series of clips. Photo: Kim and Michael Cunial, Drape Net.



Figure 31. The drape netting installed at the Griffith NSW DPIRD site. Photo: Kim and Michael Cunial, Drape Net.

A 3-step process was used to install the netting. First, a bullhorn post was added to the top of each vineyard post (Figure 32). Then the netting was installed using a tractor and rollers (Figure 33). Finally, the netting was securely fastened to the end posts and the bottom wire with clips.

Vine performance is being assessed at both sites. As higher yields are being produced at the Griffith site than at the Orange site, grapes from the Griffith vines will be used for small-scale winemaking.

The dates for bud burst, flowering and harvest are being recorded and will determine the initial suitability of these new selections in warm and cool climates. They will also help with selecting the best selections for the wine industry. Berry and bunch size, as well as total acidity and pH are also being assessed for both sites. Total soluble solids (Brix) for each selection at the Orange site are being measured. The target harvest ripeness for whites is 22% Brix (21–23%) and for reds is 24% Brix (23–25%).



Figure 32. The first step in installing the drape net is adding a bullhorn on top of each vineyard post. Photo: Kim and Michael Cunial, Drape Net.



Figure 33. The second step is installing the drape net using the tractor and rollers. Photo: Kim and Michael Cunial, Drape Net.

Acknowledgements

This work is supported by Wine Australia, with levies from Australia's grapegrowers and winemakers and matching funds from the Australian Government, and in-kind co-investment by the NSW Department of Primary Industries and Regional Development.



Mechanical shaking for rot reduction in the Hunter Valley, NSW

Penny Flannery, Development Officer – Viticulture, NSW DPIRD

As the wine industry faces increasing pressure from rising costs, mechanical shaking is proving to be an effective technique for reducing botrytis and other bunch rots using existing vineyard machinery. In November 2025, NSW DPIRD hosted a demonstration to show how mechanical shaking can improve fruit quality and mitigate the risks associated with bunch rot in the Hunter Valley. Additional demonstrations were carried out at Broke with a contractor.

The demonstration, which featured insights from experts Mark Allen of Allen Vineyard Advisory (NZ) and Liz Riley of Vitibit, showed how this technique can improve grape cleanliness and reduce the incidence of botrytis (grey mould) and other bunch rots during the critical pre-harvest period.

The purpose of mechanical shaking for rot reduction

The primary aim of mechanical shaking is to reduce excess debris, such as leaves, stems and unformed berries, which accumulates in the grape bunches during the growing season. If left in the bunches, these materials can trap moisture and create the perfect environment for diseases such as botrytis, particularly as harvest approaches and conditions become wet. Shaking the vines after berry set and just before bunch closure removes the debris from the canopy, leaving the bunches clean, significantly lowering the likelihood of botrytis infection, especially in seasons with high humidity or rainfall near harvest.

Mark Allen, author of [Mechanical shaking for rot reduction](#) and an experienced viticulture consultant from Marlborough, New Zealand, shared his expertise on mechanical shaking.

Having first been involved with this technique in 2010, Mark explained how it evolved from bunch thinning to become a critical tool for botrytis control, which is now widely adopted in Marlborough vineyards. After years of trials, he and his team have perfected the settings to optimise botrytis pressure reduction and the ideal timing, which is after fruit set and before bunch closure.

According to Mark, mechanical shaking significantly reduces botrytis risk, particularly in high-pressure seasons.

'We have found that after fine-tuning the equipment, we can achieve up to a 50% reduction in botrytis in certain varieties.'

Hunter Harvesting used their self-made Mecca harvester to demonstrate the process. Mark worked with the operators to set the machine up and to understand the different points of adjustment (beater speed, amplitude, travel speed, and acceleration) that could be tweaked to refine the process.

The machine was run along a section of a row with the debris being collected on trays under the shaken vines. The debris on the trays was then assessed ([Figure 34](#)), and some adjustments were made to find the optimum settings where the maximum amount of debris could be removed while causing minimal damage to bunches or berries. Adjustments and assessments were repeated for different varieties with Chardonnay, Pinot Gris and Pinot Noir all being shaken.

Mark noted that the shaker needs to be 500 mm away from the fruiting zone to reduce the risk of accidental bunch thinning or removal. At one vineyard they used a single set of rods on the trunk side and 2 sets of rods above the fruit zone ([Figure 35](#)).

Results

Disease pressure was low during the 2025–26 season in the Hunter Valley. While there was some rain after a very dry season, it was not sufficient to cause any significant disease, although no formal assessments were carried out.

There was greater disease pressure in the Chardonnay block in Broke, where another demonstration was done, this time by an independent grower and contractor. A bunch assessment after the vines were shaken showed a substantial reduction in the level of disease ([Figure 36](#) and [Figure 37](#)).



Figure 37. Bunches that were not shaken (left) compared with bunches that were shaken (right).

Economic benefits of mechanical shaking

Mark highlighted the cost-effectiveness of mechanical shaking, particularly when compared to the potential costs of botrytis-related crop losses.

'A single pass of the harvester at 5 km/h is a relatively inexpensive way to control botrytis risk. In years with higher disease pressure, the results can be considerable. For a relatively low cost, fruit quality at harvest can be significantly improved.'

The cost of using the harvester is minimal compared with the potential losses caused by botrytis. For many vineyards, mechanical shaking has become a vital tool for managing disease, especially in seasons when fungal pressure is high.

Challenges and considerations

While the economic and agronomic benefits of mechanical shaking are evident, there are several challenges to consider, such as:

- **High initial investment:** mechanical harvesters are a significant investment, and their high upfront cost could be a barrier for some.
- **Vineyard suitability:** mechanical shaking is most effective in flat or gently sloped vineyards with adequately spaced rows. Steep terrain or narrow vine spacing might prevent mechanical harvester use. Additionally, some delicate grape varieties might not respond well to mechanical shaking.
- **Contractor engagement and confidence:** contractors are often reluctant to engage in new practices such as shaking. Being able to show them how it is done and the appropriate settings for the machinery is valuable to help them consider offering this as a commercial service.
- **Machine calibration and training:** appropriate calibration of the harvester is critical to avoid damage to the vines or fruit. Vineyard managers need to ensure proper training and regular maintenance to avoid costly mistakes.
- **Cultural control:** pruning and training the vines so they have the right amount of foliage and fruit will increase airflow, reduce bunch rots and the dependence on synthetic botryticides.

The future of mechanical shaking in viticulture

With the increasing pressure to reduce costs and improve efficiency, mechanical shaking is expected to be used more in the wine industry. As technology advances, autonomous harvesters and advanced data-driven systems that optimise shaking settings could make the process even more efficient and precise.

For growers and contractors with mechanical harvesters, using this machinery for an additional purpose, such as enhancing fruit quality, is a great advantage. Ongoing research into reducing botrytis and other vineyard strategies aims to further refine the practice, ensuring it becomes a standard tool for disease management and improved fruit quality in NSW wine regions.

This ongoing project will continue to explore the potential of mechanical shaking as an effective and low-cost solution for managing botrytis and improving overall grape quality.

Conclusions

Mechanical shaking is proving to be a valuable tool for viticulturists looking to minimise the risk of botrytis and other bunch rots and improve harvest quality. This cultural/mechanical control method could significantly reduce dependence on synthetic botryticides. This would be especially important because dicarbon monoxide is no longer effective. Also, botrytis and other bunch rots are developing resistance to anilino pyrimidines.

As shown at vineyards in Orange and the Hunter Valley, this technique offers a low-cost method for reducing disease pressure and improving the cleanliness of grape bunches before harvest. With further research and refinement, mechanical shaking could become a standard practice in vineyards, offering both economic and agronomic benefits.

Acknowledgement

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Reference

Allen M (2019) *Mechanical shaking for rot reduction*. Bragato Research Institute, Blenheim, NZ, <https://bri.co.nz/2019/06/01/mechanical-shaking-for-rot-reduction/>

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Pruning debris disposal: reducing *Botryosphaeria* dieback pathogens in vineyards

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Introduction

Pruning vineyards is an annual event that focuses on vine health and fruitfulness. However, little attention has been given to the disposal of the pruning debris, which is commonly left on the ground below the vines (Figure 38) or mounded in the vineyard. Pruning debris can be a source of inoculum for several fungi infecting grapevines, including *Botrytis cinerea* (Jaspers et al. 2013), *Phomopsis* spp. (van Niekerk et al. 2005), *Phaeoacremonium tuscanum* and pathogens causing *Botryosphaeria* dieback (BD; Arabnezhad and Mohammadi 2013; Elena and Luque 2016). Other research has identified the feasibility of using pruning debris as mulch to help maintain soil moisture in the vineyard (López-Urrea et al. 2020) or incorporating the canes into the soil to build up soil carbon (Pike et al. 2023).



Figure 38. A vineyard with plant debris left on the ground below the vines after pruning.

Recognising pruning debris as a potential inoculum source of BD pathogens, this study evaluated the risk posed by different vineyard practices, including leaving infected pruned canes on the soil surface, burying the canes in the soil, or mulching the canes and leaving them on the soil surface.

Methods

Disease-free Cabernet Sauvignon canes were collected from a commercial vineyard and inoculated with two BD pathogens (*Diplodia seriata* and *Neofusicoccum luteum*). Plastic containers (350 mm × 250 mm × 130 mm) were filled with soil taken from the vineyard. The inoculated treatments included:

1. canes placed on the soil surface (surface)
2. canes buried 100 mm below the soil surface (bury)
3. mulched canes placed on the soil surface (mulch).

The control (no treatment) consisted of non-inoculated canes placed on the soil surface. There were 3 replications per treatment group. The containers with the different treatments were placed outdoors in a birdproof cage and maintained for 12 months. Samples from each treatment were processed after 3, 6, and 12 months to assess inoculum viability using artificial media.

Results

None of the non-inoculated controls had any BD pathogens during the experiment. Inoculum viability was lowest when the *D. seriata*-infected canes were buried in the soil (Figure 39, left). When canes infected with *D. seriata* were placed on the soil surface, inoculum viability increased (67% to 100%) but decreased when they were buried (67% to 12%). When the infected canes were mulched, inoculum levels decreased at 6 months but then increased at 12 months.

When canes infected with *N. luteum* were placed on the soil surface, inoculum levels decreased from 3 to 6 months (6% to 0%), but increased between 6 and 12 months (0% to 22%; Figure 39, right). Likewise, viable inoculum increased between 3 and 12 months when the infected canes were buried (11% to 22%) and mulched (6% to 39%).

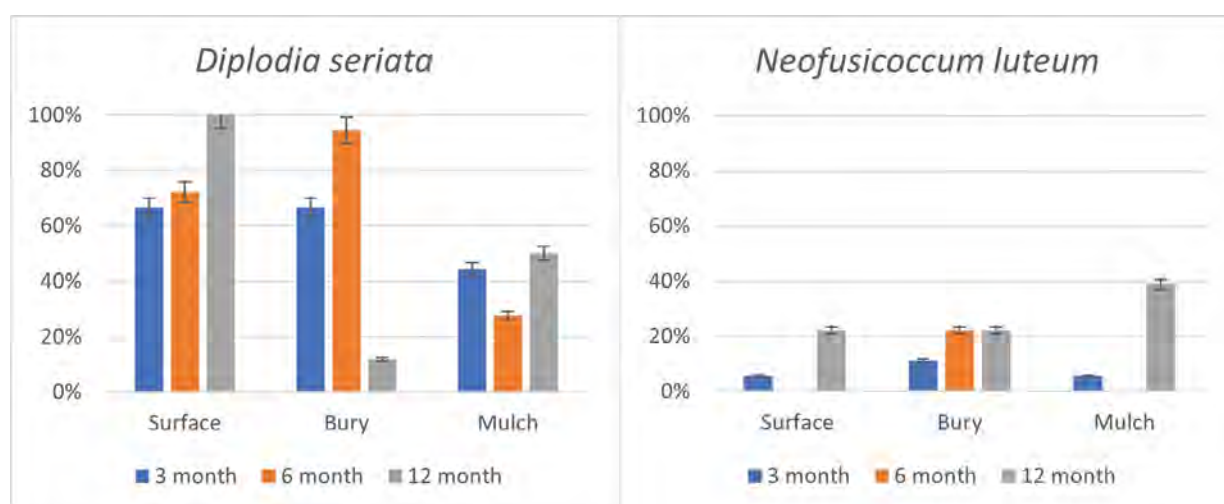


Figure 39. The percentage of agar plates with *Diplodia seriata* and *Neofusicoccum luteum* for each treatment and at each sampling time. Note: treatment groups are pooled.

Conclusion

This study evaluated the survival of inoculum produced by BD pathogens in pruning debris over 12 months. The highest risk was when infected pruning debris was left on the soil surface and exposed to the environment, with inoculum remaining viable 12 months after pruning.

Mulching canes infected with *D. seriata* and *N. luteum* gave variable results, but generally, the amount of viable inoculum of both pathogens was increased at 12 months. A similar inoculum persistence in apples was reported by Jacobs et al. (2024), while Labarga et al. (2025) warned of the risks when using grapevine material as mulch due to the potential for pathogen introduction.

Burying infected pruning debris is recommended to reduce the amount of inoculum (Gramaje et al. 2018; Úrbez-Torres et al. 2013). Our study found that while the *D. seriata* inoculum initially increased between the 3- and 6-month sampling times, it then declined significantly at 12 months. In contrast, *N. luteum* inoculum increased between 3 and 6 months and remained at the same level at 12 months. However, the long-term viability of the inoculum could pose an ongoing risk of infection, especially when the soil is disturbed to incorporate new debris.

While burying pruning debris can offer benefits such as improved organic matter and reduced water loss, it also poses the risk that the pathogens can survive on that debris. Removing all pruning debris from the vineyard is the optimal approach to minimise pathogen presence and to safeguard vine health.

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Can secateurs spread *Botryosphaeria* dieback pathogens?

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Introduction

Botryosphaeria dieback (BD) pathogen spores are spread by raindrops, with wind contributing to long-distance dispersal. These spores can land on open wounds in grapevines, where they germinate, and the resulting hyphae (the filaments that make up fungi) slowly penetrate the plant tissue. This can cause cankers, necrosis and eventual grapevine death (Billones-Baaijens and Savocchia 2019; Úrbez-Torres 2011; Úrbez-Torres and Gubler 2011). Following infection, the visual symptoms can take several years to develop.

While much research has been conducted on the treatment, inoculum sources, spread of BD pathogens, and pruning wound susceptibility, relatively little research has been conducted on the potential for secateurs and other vineyard equipment to spread the pathogens. Therefore, this study evaluated:

1. if BD pathogens could be re-isolated from secateurs after pruning infected grapevines
2. the frequency at which the secateurs could transfer the pathogens
3. if pathogens could be transferred from grapevine to grapevine when pruned with the same secateurs.

Methods

Two Cabernet Sauvignon vineyard blocks (Block 1 and Block 2) at Charles Sturt University (Wagga Wagga, NSW), with a history of BD pathogens (*Neofusicoccum luteum* and *Diplodia seriata*), were used for the field trial. Secateurs were initially surface sterilised by spraying with 70% ethanol and flaming (control). The cane targeted for pruning (2 bud spurs) was marked with a cable tie, and 5 cuts were made along the spur, approximately 5 mm apart. The secateurs were left for 5 minutes before running the blades twice through potato dextrose agar (PDA) in Petri plates. Each run was 50 mm long and placed approximately 40 mm apart. The Petri plates were sealed with Parafilm® and incubated at 25 °C for 7 days before visual assessment and fungal identification. The second-year cane growth was also assessed similarly to the first-year growth in both blocks, and all cuts were marked with cable ties (Figure 40).



Figure 40. A vine used for pathogen transfer. The coloured cable ties were used to show where cuts were made for sample collection.

Another trial was conducted to see if secateurs could become contaminated with BD pathogens while pruning grapevines and then transfer the pathogen inoculum to other vines. Similar to the method described above, secateurs were sterilised and used to cut disease-free one-bud detached canes (soaked in 2.5% sodium hypochlorite solution) as the control. Secateurs were also used to cut the BD-infected field vine. After 5 minutes, they were used to cut one-bud detached canes sequentially, 1 to 5. The detached canes were placed in polystyrene boards, floated on water, and incubated for 16 weeks before being assessed for signs of infection. The top 5 mm of desiccated woody tissue was removed and discarded. The cane section just below the woody tissue was grated with a household grater, and 10 mg of shavings were placed on PDA at 5 locations on the plate.

Results

Pathogen transfer from secateurs to PDA was low to moderate for grapevines pruned in the field (Table 4). Secateurs became contaminated from pruning both the one- and two-year-old canes. Pathogen transfer was highest after pruning first-year growth, with 24% of samples being positive for BD pathogens, compared to 16% of samples from second-year growth, in both vineyard blocks.

Table 4. The percentage of samples positive for Botryosphaeria dieback (BD) pathogens following pruning of first-year and second-year growth in 2 vineyard blocks with secateurs.

	Percentage positive to BD pathogens (%)
Control	0
Block 1 first-year growth	24
Block 1 second-year growth	16
Block 2 first-year growth	24
Block 2 second-year growth	16

When secateurs were used to prune BD-infected vines in the field and later used to cut visually disease-free detached canes, 11% were positive for BD pathogens from pruning block 1 and 20% were positive from pruning block 2 (Table 5). One detached cane from the negative control group of 10 was positive for BD pathogens, which was attributed to background infection.

Table 5. The percentage of detached canes positive for Botryosphaeriaceae dieback (BD) pathogens, following cutting with secateurs used to prune BD-infected field vines.

	Percentage positive to BD pathogens (%)
Control	10
Block 1	11
Block 2	20

Summary

The findings from this study show that BD pathogens can be transferred via secateurs to canes, although at low frequency. While secateurs might not be the main mechanism for transmitting BD pathogens, they can still contribute to their spread within vineyards. This emphasises the importance of vineyard sanitation, including disinfecting pruning equipment frequently, especially when pruning vines known to be infected with GTD pathogens.

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Hunter LLS workshops – identifying grasses and managing weeds

Penny Flannery, Development Officer – Viticulture, NSW DPIRD

During May 2026, Hunter Local Land Services (LLS) held 2 workshops to help growers identify grasses and manage priority weeds.

Grasses ID workshop

The Grasses ID workshop focused on how to identify grasses in the field using a guidebook and digital tools. Participants learned from the co-author of *Grasses of coastal NSW*, Harry Rose (Figure 41), about how to use the guide to narrow down species based on characteristics, such as flower heads, spikelets (clusters of tiny flowers), number of florets per spikelet, presence of hairs or bristles, and the arrangement of flower heads, rather than relying on leaves or general overall plant appearance. Harry also suggested using apps such as *iNaturalist* (<https://www.inaturalist.org/>) to help with species identification.

The session also included broader concepts such as differences between native and introduced species, annual vs perennial growth, and how to prioritise management based on whether grasses are declared as regional priorities, generally invasive or helpful.

Overall, the aim of the workshop was to build confidence in identifying grasses, improve observation of finer plant details, and know how to report a highly invasive species if found. Ultimately, this should help with better decision-making for pasture management.



Figure 41. Harry Rose showing grass height and flower structure to workshop participants.

Wine country – weed management for vineyard surrounds workshop

This workshop was based on managing woody and invasive weeds in vineyards and nearby areas, especially waterways. Participants learned how to assess their landscape (including riparian zones, biodiversity areas, and production blocks), select appropriate control methods (chemical, mechanical, cultural, and biological), and manage risks such as herbicide drift, residue damage, and legal restrictions.

Biological controls, using host-specific insects or fungi to suppress weeds such as African boxthorn (Figure 42), were also discussed, highlighting both the benefits and limitations compared to chemical methods.

Also included were planning, prioritising (e.g. containment vs eradication), hygiene, and long-term monitoring, showing that effective weed management requires an integrated approach, adapting to site conditions, and working collaboratively with agencies and neighbours to achieve outcomes.



Figure 42. African boxthorn was found in a waterway near the vineyard.

The Local Land Service runs many events throughout NSW. To find upcoming events in your local area, refer to the [LLS events website](https://www.nsw.gov.au/departments-and-agencies/local-land-services/events) (<https://www.nsw.gov.au/departments-and-agencies/local-land-services/events>).

To purchase the resources mentioned above or any others, refer to [Collections – Regional NSW](https://shop.regional.nsw.gov.au/products) (<https://shop.regional.nsw.gov.au/products>).

Acknowledgements

The 'Grasses ID' and 'Wine country – weed management for vineyard surrounds' workshops were sponsored by Hunter Local Land Services via Hunter Catchment Contributions. The project received funding from the Australian Government's Future Drought Fund. The 'Wine country – weed management for vineyard surrounds' workshop was also initiated by the Hunter Valley Wine Country Landcare Group.



ASVO seminar: viticulture in challenging times

Penny Flannery, Development Officer – Viticulture, NSW DPIRD

The 2026 ASVO (Australian Society of Viticulture and Oenology) seminar in Mildura brought together industry leaders, researchers and growers (Figure 43) to discuss the realities of managing vineyards under increasing economic, climatic and market pressures. Over 4 sessions, the consistent focus was on practical decision-making, prioritisation, and business resilience.

The core message throughout the seminar was clear: growers must be more strategic, disciplined and adaptable in both vineyard and business operations to remain viable.



Figure 43. Attendees at the 2026 ASVO viticulture seminar held in Mildura.

Session 1: endurance and adaptation

To help growers get through the current downturn, they were encouraged to consider the whole of the business when making decisions. For example, decisions on managing the vineyard should also consider commercial implications. In practice, this might mean prioritising high-performing or contracted blocks, while reducing inputs or deferring work in other areas.

Acting early with data-driven decisions is critical to maintaining long-term viability. Technology, particularly in water monitoring and automation, can help with efficiency but must deliver clear economic value. Growers also need to remain flexible, adjusting operations, scaling production or exploring alternative income streams as conditions change.

Sustainability was reframed as a business tool that improves efficiency, risk management and decision-making through better data and resource visibility.

Key point: resilience comes from being adaptable and using data to inform decisions, and not necessarily maintaining all operations equally.

Session 2: smart pest and disease management

Improving how pests and diseases are controlled comes from getting the fundamentals right, rather than increasing inputs. Using type, timing and technique as the 3 Ts was identified as essential for successful spray programs. Many failures arise from poor timing or coverage, not necessarily from ineffective products. Early, preventative control is more cost-effective than reactive spraying.

Understanding pest life cycles and monitoring vineyard-specific conditions will help with targeting vulnerable life stages and reduce unnecessary inputs. Biological products should be incorporated into integrated programs but are not always stand-alone solutions. Effective management requires combining cultural, biological and chemical controls with realistic expectations.

Interest was expressed for grower-led trials, where simple on-farm experiments can improve confidence, relevance and adoption of new practices.

Key point: using type, timing and technique as the 3 Ts is essential for successful spray programs.

Session 3: investing in technology without breaking the bank

Growers were encouraged to start with a clear decision (e.g. harvest timing, irrigation, investment) and then apply only the data needed to support that. Excess data without purpose costs money and creates confusion. Low-cost, practical tools such as soil moisture probes, weather stations, remote sensing and real-time risk monitoring (e.g. smoke detection) are already adding value by reducing uncertainty and improving timing.

Adoption should be fit-for-purpose, focusing on tools that are easy to use and give measurable benefits. Emerging technologies such as AI and automation offer potential but should support, not replace, management decisions.

Structured decision-making processes, starting with clearly defining the question early and identifying the risks, were highlighted as critical to improving outcomes.

Key point: technology should be helpful for decisions, not complicate them.

Session 4: building resilient vineyard businesses

This session reinforced that the current downturn is demand-driven, requiring growers to rethink business models, adapt production levels and focus on creating value through differentiation and strong relationships.

Profitability is often lost through weak contracts, unclear agreements and limited commercial awareness. Growers could strengthen their business foundations by understanding costs, having clearly written contracts, and carefully managing risk.

Diversification was a key theme, with many successful businesses adding income to the vineyard with tourism, hospitality and other alternative revenue streams.

Sustainability and ESG (environment, society, and corporate governance) frameworks were presented as core business strategies, improving efficiency, reducing costs and supporting market access through certification and accountability.

Key point: long-term resilience depends on strong business management, diversification and proactive adaptation.

Highlights for growers

The consistent message from the seminar was that resilient vineyard businesses are built on informed decision-making, not more inputs.

Growers should:

- prioritise profit and performance in the blocks and the overall business
- have the fundamentals right before adding complexity (such as technology)
- use data and tools selectively to help make decisions
- consider diversifying, innovating and being adaptable.

Acknowledgements

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Seasonal mealybug and scale insect activity in Riverina vineyards

Dr Meena Thakur, Research Horticulturist – Entomology, NSW DPIRD

Summary and background

Mealybugs (Figure 44) and scale insects (Figure 45) are important viticulture pests because they can weaken vines, reduce fruit quality through honeydew and sooty mould, and in some cases contribute to grapevine virus transmission (Ben-Dov and Hodgson 1997; Gullan and Kosztarab 1997; Daane et al. 2012). The challenge of managing these pests is increased by their cryptic habits and highly variable seasonal development, which makes population trends difficult to predict from year to year.



Figure 44. Female long-tailed mealybug (*Pseudococcus longispinus*) with freshly emerged live crawlers.



Figure 45. A scale (*Parthenolecanium* spp.) insect turned over (left) with an egg mass that was underneath (right). Black sooty mould is on the grape surface due to honeydew production.

Long-tailed mealybugs (LTMB, *Pseudococcus longispinus*) and soft scale insects (*Parthenolecanium* spp.) are particularly relevant in the Riverina region. Both species live in protected sites such as bark crevices, cordons, and bunches, where numbers can build up largely unnoticed, allowing populations to become established before detection and making effective control far more difficult.

Recent demonstration trials and surveys in Riverina vineyards (2024–25) highlighted this challenge, showing that mealybug populations can remain very low for extended periods before increasing rapidly in late summer (Thakur 2025). Scale insect monitoring also showed a consistent spring pattern, with crawler (Figure 46) activity concentrated over a short seasonal window. However, locally generated multi-season phenology¹ datasets of mealybugs and scale insects in grapevines are limited, making it difficult to develop region-specific forecasting tools.

International viticulture research has shown that pest dynamics in perennial systems are strongly influenced by interactions between temperature, vine phenology, and natural enemy activity (Daane et al. 2012). As a result, there is increasing emphasis on phenology-based monitoring and temperature-based risk frameworks to improve integrated pest management (IPM) decision-making.

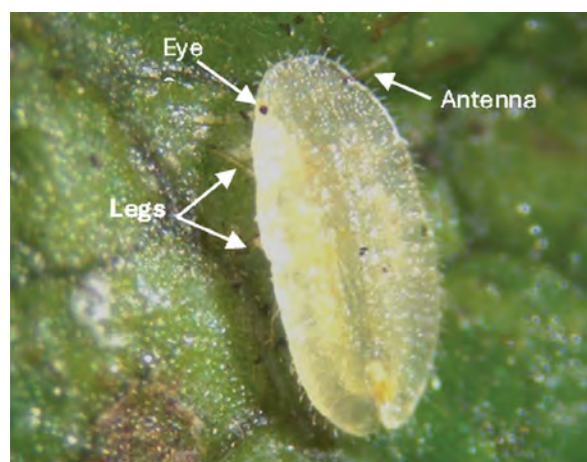


Figure 46. First-instar scale insect (crawler stage) with antennae, eyes, and legs.

¹ Phenology is the systematic study of the influence of climate on the recurrence of such annual phenomena of animal and plant life.

To overcome this knowledge gap, detailed seasonal monitoring was conducted during the 2025–26 growing season to characterise pest dynamics and explore associations with environmental conditions. The study also provides early evidence of how pest activity aligns with temperature trends and vine growth stages in Riverina vineyards, supporting the future development of temperature- and phenology-based risk tools.

The study aimed to:

- describe seasonal pest phenology
- identify key periods of pest risk
- examine associations between pest activity and climatic conditions
- explore pheromone trapping for LTMB.

In both seasons, the message was that management decisions should be based on monitoring and current pest pressure rather than historical infestation records alone.

Why monitoring matters

Effectively managing mealybugs and scale insects relies on understanding current-season population dynamics rather than historical infestation records. This is because pest abundance (population density) varies greatly between seasons and is strongly influenced by environmental conditions, vine growth stages, and local management practices. In perennial systems, pest populations can remain at low levels, often being undetected for extended periods before increasing rapidly when conditions become favourable. This is why relying on past infestation history alone can lead to inaccurately assessing current risk.

Study sites and monitoring

During the 2025–26 growing season (October 2025–April 2026), LTMB monitoring was conducted in a Traminer vineyard at Tharbogang (Griffith) and scale insect monitoring was done in a Pinot Grigio vineyard at Wamoon (Leeton). These are commercial vineyards with different cultivars and pest histories in the Riverina region of NSW, which has a hot, semi-arid climate.

Mealybug monitoring targeted vine structures and grape bunches on 12 randomly selected, tagged vines to capture within-canopy distribution patterns. Scale insect monitoring focused on leaf-associated populations and crawler emergence, measured using 4 double-sided sticky tape installations on 12 randomly selected vines.

Natural enemies, including lacewings, ladybird beetles, spiders, and parasitic wasps, were also recorded during routine monitoring to provide an indicative record of biological activity in the vineyard.

Climatic data from on-site weather monitoring stations at each vineyard were collected so accurate temperature and relative humidity could be recorded.

Male long-tailed mealybug monitoring – pheromone exploratory study

A preliminary pheromone trapping study for long-tailed mealybug was conducted using lure dispensers and traps to see if male (Figure 47) activity could be detected using this method in Riverina vineyards.

All monitoring and trapping were undertaken within existing commercial vineyards, with no experimental treatments imposed.



Figure 47. A male long-tailed mealybug (*Pseudococcus longispinus*) with prominent white caudal filaments emerging from its cocoon (left) and searching for females (right).

Results

Long-tailed mealybugs: a later-season pest with cryptic development

Mealybug activity coincided with the warmest part of the season, with none detected before mid-December and peak levels detected during January and February, when maximum temperatures often exceeded 35 °C (Figure 48).

Infestations were predominantly associated with grape bunches and other protected canopy areas, particularly within bunch zones and around tightly packed fruit clusters, while detections on exposed vine structures and outer canopy leaves remained very low (Figure 48). This highlights the cryptic nature of mealybug infestations and shows that effective monitoring requires inspection inside bunch zones and within dense, shaded canopy areas, rather than relying solely on observations of exposed vine surfaces.

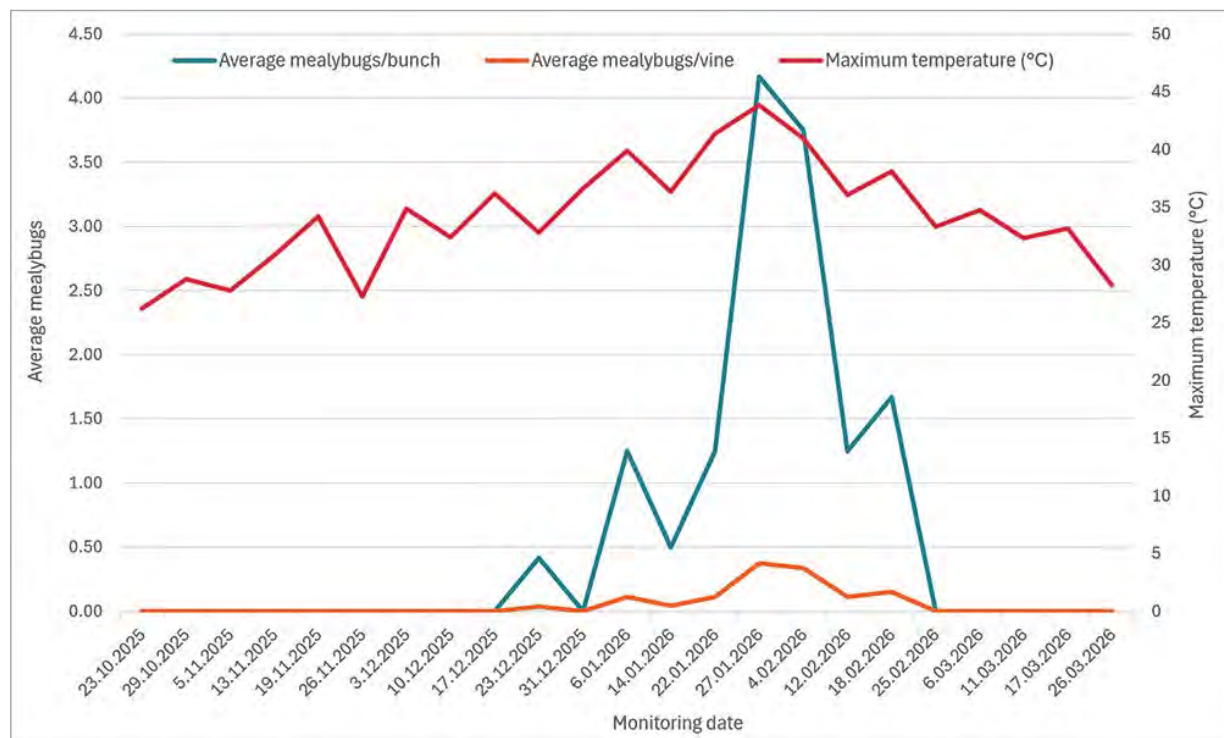


Figure 48. Weekly average long-tailed mealybug (*Pseudococcus longispinus*) populations on grape bunches (orange line) and vine structures (blue line), and maximum temperature (red line) in a commercial Traminer vineyard at Tharbogang, Riverina, NSW, during the 2025–26 growing season. Peak infestation was during late January and early February, coinciding with the warmest period of the season.

Natural enemies and biological regulation

Beneficial arthropods were regularly seen during monitoring. Lacewings, ladybird beetles, spiders, and parasitic wasps were common and could have helped naturally suppress pest populations.

Pheromone trapping: exploratory evidence of male activity

Male long-tailed mealybugs were caught on the delta trap (Figure 49), including when infestations within vines appeared low or absent. This shows that pheromone trapping could show reproductive activity that is not seen with routine visual inspection. Trap catches increased during mid to late summer (Figure 50), broadly aligning with the peak field infestations in bunches (Figure 48).



Figure 49. Pheromone-based monitoring system (Desire™, UPL)* for *Pseudococcus longispinus* showing (left) pheromone septum placed on a white sticky base used in the delta trap, and (right) a delta trap deployed in the vine canopy for field monitoring of adult male activity in a commercial Riverina vineyard during the 2025–26 season. Note: Desire™ is not yet commercially available and is being trialled in Australia for efficacy.

A second dataset collected during the 2024–25 season, when traps were deployed from October to April (Figure 51), showed a similar seasonal pattern of male activity concentrated during mid to late summer (January–March). However, differences in trap deployment duration and sampling intensity between seasons prevent direct comparison of trap catch data between years.

Overall, pheromone trapping provided consistent evidence of seasonal male activity and appears to reflect the timing of reproductive activity in the field. However, at this stage, trap catches should be interpreted as an indicator of seasonal presence and activity rather than a direct measure of population density. Further work is needed to determine the relationship between trap captures, infestation levels, and environmental factors before pheromone trapping can be used as a quantitative decision-support tool.

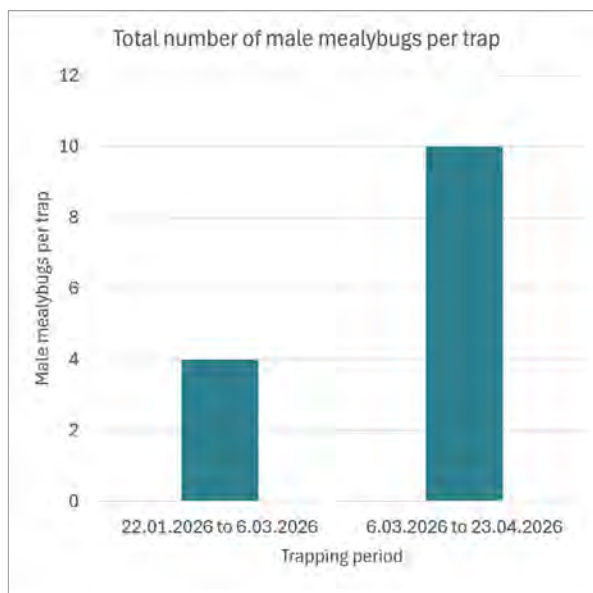


Figure 50. Male long-tailed mealybugs (*Pseudococcus longispinus*) captured in pheromone traps between January and April 2026 in a commercial Traminer vineyard at Tharbogang, Riverina, NSW.



Figure 51. Male long-tailed mealybugs (*Pseudococcus longispinus*) captured in pheromone traps between October and April 2025 in a commercial Traminer vineyard at Tharbogang, Riverina, NSW.

Scale insects: spring crawler emergence is the critical management period

Scale insects had a highly synchronised seasonal pattern. Crawler activity started during late October, increased rapidly during spring, and reached a distinct peak in November (Figure 52). Activity then declined during summer and autumn.

Scale insect abundance on leaves increased rapidly during early to mid-spring, reaching a peak in November before declining during summer and autumn. Settled scale insect abundance increased after crawler emergence, with a short lag between the 2 observations reflecting progression from mobile crawlers to settled developmental stages.

Crawler emergence and population increase coincided with seasonal warming. Crawler activity increased during spring as maximum temperatures rose and remained above 30 °C. The observed timing of crawler activity suggests that scale insect development is associated with seasonal warming.

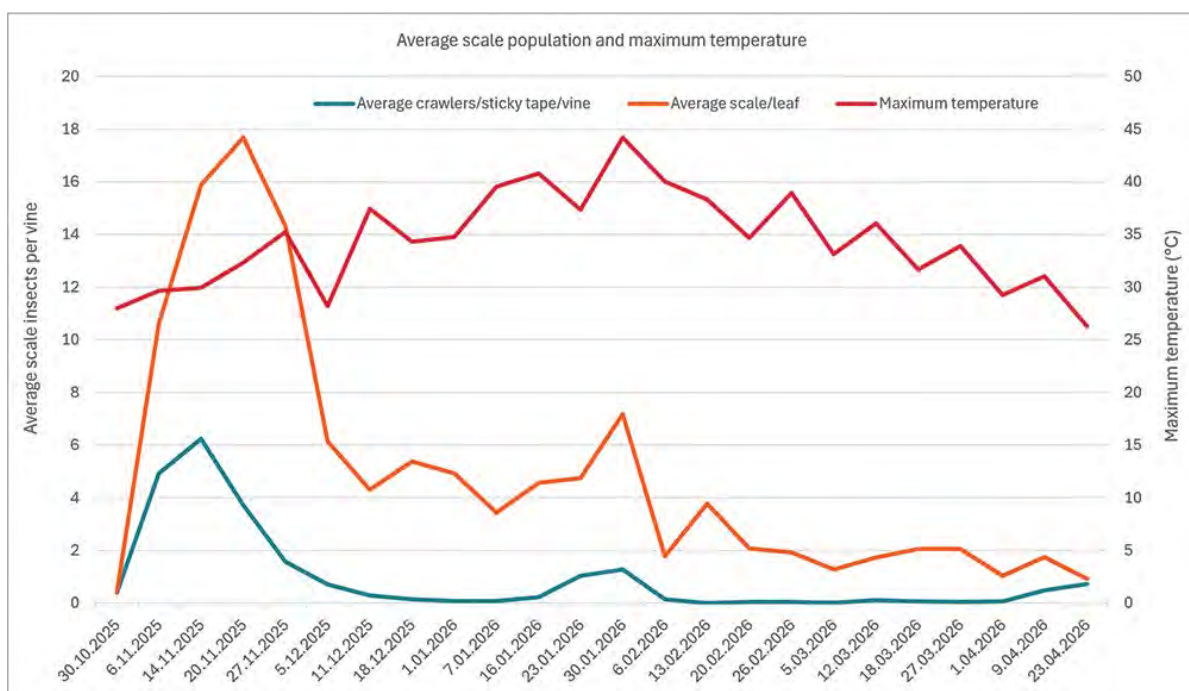


Figure 52. Weekly average scale insect (*Parthenolecanium* spp.) crawler and sessile stages on grapevines and maximum air temperature in a commercial Pinot Grigio vineyard at Wamoon Riverina, NSW, during the 2025–26 growing season.

Discussion

The observations from the 2024–25 season and current season monitoring data show that long-tailed mealybugs and scale insects follow distinct and relatively predictable seasonal patterns in the Riverina. Long-tailed mealybugs were more likely during summer, while scale insects were predominantly a spring pest. This separation in seasonal activity suggests that monitoring and management efforts can be timed more strategically, rather than keeping the same level of surveillance throughout the growing season.

These patterns define 2 practical risk windows:

- **Mealybugs:** late November–February (population establishment and development period, with peak bunch infestations typically occurring during late January–early February)

For mealybugs, surveillance from late November is recommended as a precautionary lead-in period to detect early population build-up under favourable conditions, even though visible field detections in this study generally occurred later (from late December). This reduces the risk of missing early cryptic establishment that can lead to rapid summer population increase.

- **Scale insects:** late October–mid-November (crawler emergence and establishment).

The seasonal timing seen during 2025–26 was consistent with earlier Riverina observations (Thakur 2025), despite differences in pest abundance between seasons and vineyards. This repeatability shows that the timing of activity is relatively stable under Riverina conditions and might provide a more reliable guide for assessing pest risk than pest abundance alone.

An important limitation of the current study is that mealybug monitoring was only conducted in an early-maturing Traminer vineyard. Harvest happened before the end of summer, so the full extent of late-season population development might have been missed. In later-maturing varieties, where fruit remains on the vine for longer, mealybug populations might persist or continue increasing into March, potentially extending the period of infestation risk and resulting in higher infestation levels.

Pheromone trapping provided useful insights into mealybug activity. Male mealybugs were detected throughout summer, including when few or no mealybugs were seen during visual assessments. This suggests that part of the population cycle might occur at levels or in locations that are not easily detected through routine visual inspection alone (Charles 1982; Geiger and Daane 2001; Godfrey et al. 2002; Grasswitz and Burts 1995). Visual inspections might underestimate the duration of population activity and reproductive activity might continue beyond the period when obvious infestations are visible. At this stage, trapping should be seen as a useful indicator of seasonal activity rather than a measure of population size.

For scale insects, the crawler stage is particularly important because it is the most exposed and vulnerable phase of the life cycle. Once crawlers settle and develop protective coverings, populations become considerably more difficult to manage (Ben-Dov and Hodgson 1997). Aligning monitoring with crawler emergence, therefore, offers the best opportunity to detect populations and, where necessary, implement timely management.

Temperature patterns influenced pest activity. Mealybug activity increased during the hottest part of summer, while scale insect crawler emergence coincided with the first sustained period of seasonal warming. Although these relationships were observational and not formally tested, they support the broader understanding that temperature is important for insect development in perennial cropping systems (Charles 1982; Ben-Dov and Hodgson 1997).

From a practical perspective, these findings reinforce why monitoring efforts should be focused on known activity periods. The seasonal windows found in this study are not fixed thresholds and will vary with seasonal conditions. However, initiating surveillance from late November for LTMB provides a precautionary buffer for early establishment under favourable seasonal conditions, where populations can build rapidly once detectable activity begins. Nevertheless, they provide a useful framework for improving monitoring efficiency and support the development of phenology-based decision-support tools for Riverina vineyards.

Conclusion

In the last 2 seasons, long-tailed mealybugs and scale insects showed clear and consistent seasonal patterns in Riverina vineyards. Long-tailed mealybugs were predominantly active during summer, while scale insects were active mainly in spring. This means that pest history alone is not a strong

guide for predicting risk. Some years might have higher or lower numbers, but the seasonal pattern stays broadly the same.

Exploratory pheromone trapping successfully detected male long-tailed mealybug activity in Riverina vineyards. It provided additional evidence that seasonal reproductive activity might continue beyond what is detected during routine visual inspections. The results show the potential value of pheromone-based monitoring for this cryptic pest. However, further research is required to establish relationships between trap catches, field infestation levels and environmental conditions before pheromone trapping can be used as a quantitative decision-support tool.

Beneficial insects were seen in both seasons, suggesting they are contributing to the natural suppression of these pests in vineyards, reinforcing the importance of adopting sustainable, IPM-based approaches that conserve and support natural enemy populations over time. Given that all interventions also incur direct costs, growers should weigh the economic benefit of any action against current pest pressure and historical trends, rather than applying routine or calendar-based treatments.

Overall, these results support a clear operational principle: management decisions should be based on current-season monitoring and observed pest pressure rather than historical infestation records. Monitoring during the season provides a more accurate picture of risk and supports better-timed, more targeted decisions.

In many cases, the most appropriate intervention is informed non-intervention, particularly where pest pressure is low and beneficial activity is included in an IPM framework.

Do not assume you need to spray every year simply because you had mealybugs or scale insects previously. Monitor first, assess pest pressure and beneficial activity, then make a decision.

Implications for monitoring programs

Results from both monitoring seasons support a more structured surveillance approach.

- **Mealybug surveillance should begin in late November** as an early risk window and continue through late summer, particularly in previously affected blocks.
- **Monitoring should prioritise bunches and sheltered canopy sites** where mealybugs are most likely to establish and persist, particularly in dense canopies where reduced light and airflow favour pest concealment.
- **Scale insect monitoring should start from late October**, with peak attention during November when crawler activity is highest.
- **Beneficial insect activity should be recorded** alongside pest observations to support IPM-based decision-making.
- **Management actions should be targeted to confirmed hotspots** rather than applied uniformly throughout blocks. Canopy management practices that improve light penetration and airflow can further support this approach by reducing favourable habitats for pest persistence and improving spray and monitoring effectiveness.

These results reinforce that timing is the critical factor in improving detection efficiency and reducing unnecessary intervention.

Looking ahead

This two-season dataset provides an important baseline for understanding mealybug and scale insect phenology in Riverina vineyards. However, it also highlights clear limitations in predictive capacity due to the short temporal scope and variability in pest expression between seasons.

Future work should move from descriptive monitoring toward predictive modelling frameworks that integrate:

- multi-season pest datasets
- temperature-driven development models
- vine phenology stages
- natural enemy activity
- pheromone trap data as potential indicators of reproductive activity (research phase).

In particular, future work should focus on linking pheromone-based detection with field infestation data and environmental variables to determine whether male flight activity can reliably reflect population development and reproductive timing. If validated, this would provide a valuable early indicator of population build-up for cryptic pests such as LTMB.

Integrating multi-season monitoring datasets with emerging pheromone technologies, climatic models, and vine phenology has strong potential to support the development of regionally calibrated decision-support tools capable of forecasting risk windows rather than simply describing past outbreaks.

Ultimately, the most effective pest management strategy in vineyards is proactive rather than reactive, based on understanding when pests are active, where they are, and how their populations respond to seasonal conditions.

Acknowledgements

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Crown gall-like symptoms follow-up

Penny Flannery, Development Officer – Viticulture, NSW DPIRD

Background

Crown gall-like symptoms ([Figure 53](#)) were first observed in a vineyard in the Orange region in January 2024. Diagnostic testing identified *Agrobacterium* species, including biovar 1, *A. fabrum* and *A. tumefaciens*. In rootlings, additional *Neorhizobium* species were detected.

Initial incidence and vine loss

About 25% of newly planted vines showed symptoms in 2023 and 2024. The vine guards were removed to reduce humidity and the affected vines were reworked where possible, selecting healthy shoots. Fewer than 1% of vines died ([Figure 54](#)) in the first year, with only 4 additional vines lost subsequently.

Symptom expression and vine performance

Some vines continued to show visible galls but maintained vigour. Overall vine development throughout the block was slow, and yield reduction was estimated to be about 20% less than potential.

Diagnostic confirmation

Samples submitted to NSW DPIRD confirmed the presence of multiple *Agrobacterium* species. Field observations in December 2025 showed healthy Chardonnay blocks ([Figure 55](#)) with isolated vines still having galls but remaining productive.



Figure 53. Crown gall-like symptoms on a vine.

Management actions

- Removed vine guards to reduce moisture accumulation.
- Manually removed lesions where feasible.
- Selected and trained 2 healthy replacement shoots.
- Applied additional fertigation in the year symptoms were discovered.

Outcomes

Despite high initial symptom expression, vine mortality remained low. Early intervention and reworking reduced the long-term effects. Persistent galls did not necessarily correlate with reduced productivity. Ongoing monitoring and post-harvest assessment continue to guide management decisions.



Figure 54. A vine that died from crown gall-like symptoms.



Figure 55. A healthy Chardonnay block in December 2025.



Grapevine berry inner necrosis virus

Leonie Martin, Plant Biosecurity Officer, NSW DPIRD

Key points

- Grapevine berry inner necrosis virus (GINV) is a newly detected virus in Australia affecting grapevines, primarily table grapes.
- Symptoms can be subtle or absent, so laboratory testing is essential.
- The virus spreads via infected plant material and mites, so strict biosecurity practices are critical to prevent it from spreading.
- Early reporting helps protect the health and productivity of Australia's grape industry.

Grapevine berry inner necrosis virus (*Trichovirus necroacini*) affects grapevines, including wine grapes, table grapes, and rootstocks. The virus spreads primarily through infected propagation material, including cuttings, grafts, and rootstocks, and can be spread by the erineum mite (*Colomerus vitis*), which is widespread and established in Australia. Scientifically, grapevines are the only plants it naturally affects in vineyard conditions. There is no known cure for infected vines.

Current situation

Grapevine berry inner necrosis virus (GINV) was first detected in Australia in October 2025 in both table and wine grape varieties. Although dried fruit varieties are also susceptible to the virus, no detections have been reported in Australia to date. It has been detected in several table grape varieties and rootstocks in Victoria and Queensland. GINV has also been detected in NSW and more recently confirmed in asymptomatic table grapevines in South Australia. The extent of the virus's distribution across Australia is currently unknown.

There are currently no domestic or international trade restrictions in place because of this detection.

Description

The virus was first recognised in Japan in the 1980s and has since been reported in other grape-growing regions, particularly in parts of Asia. The disease is now established in China and Japan, where it is known to affect the health and productivity of susceptible varieties.

GINV affects plant growth and causes problems with both the leaves and fruit. Symptoms can vary depending on grape variety and environmental conditions.

Visual symptoms can include:

- reduced vine growth and vigour ([Figure 56](#))
- delayed bud burst
- stunted or zig-zag shoots
- internal browning or necrosis of berries
- smaller leaves
- leaves might have yellow blotches or mosaic-like patterns ([Figure 57](#)) or small rings or irregular discolouration
- uneven fruit ripening
- internal browning of shoots ([Figure 58](#)).

Bunches might be more compact and unusually tight. Berries can be smaller and ripen slowly with reduced productivity, including reduced sugar and acid balance, compromising fruit quality.



Figure 56. Reduced vigour and restricted shoot growth associated with grapevine berry inner necrosis virus (GINV) in table grape vine pre-flowering. Photo: The Australian Wine Research Institute.



Figure 57. Leaf mottling, yellowing and mosaic patterns associated with grapevine berry inner necrosis virus (GINV) in table grape vine pre-flowering. Photo: The Australian Wine Research Institute.

Research by Fan et al. (2017) showed that some infected cultivars did not show any symptoms. This might be related to the characteristics of certain cultivars and the environment, which result in latent GINV symptoms in grapevines. This potential latent status makes it necessary to detect GINV before vines are propagated to avoid unnecessary economic loss. As vines might not show symptoms, visual inspection alone is not appropriate for diagnosis; laboratory testing is required to confirm GINV.

Transmission and vectors

GINV is spread mainly by infected propagation material, such as cuttings, grafts, and rootstocks. The virus can also be transmitted by the erineum mite (*Colomerus vitis*), also known as the grape leaf blister mite or bud mite.

Other potential vectors include people, machinery, and equipment that can carry mites or plant material between vineyards.

Prevention and management

Good vineyard hygiene and biosecurity practices are essential to avoid spreading the virus. To reduce the risk of introduction and spread:

- avoid sharing cuttings or propagation material with unknown health status
- only use certified virus-tested planting material from reputable suppliers
- maintain records of vine and propagation material sources
- monitor vineyards regularly for unusual symptoms
- manage mite populations by using integrated pest management (IPM) approaches, including biological, cultural, and chemical controls
- report anything unusual to the **Plant Biosecurity Hotline on 1800 084 881**
- maintain strict farmgate hygiene, including cleaning machinery and equipment between vineyards
- work in uninfected vineyards before entering infected areas to reduce cross-contamination
- GINV cannot be eradicated.



Figure 58. Internal shoot necrosis associated with GINV in table grape vines from EL17 to EL29 (12–16 leaves separated). Photo: The Australian Wine Research Institute.

If you see anything unusual or have any concerns, you can log an online request or report to NSW DPIRD [here](https://www.dpi.nsw.gov.au/dpi/biosecurity/report-a-pest-or-disease) (<https://www.dpi.nsw.gov.au/dpi/biosecurity/report-a-pest-or-disease>).

Sample collection and submission

If you wish to get samples tested, you can contact New South Wales Department of Primary Industries and Regional Development by:

Phone 1800 675 623 or email laboratory.services@dpi.nsw.gov.au

Samples can be sent to either:

Plant Health Diagnostic Service Elizabeth Macarthur Agricultural Institute, Woodbridge Road, MENANGLE NSW 2568	Plant Health Diagnostic Service Elizabeth Macarthur Agricultural Institute, Private Bag 4008, NARELLAN NSW 2567
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Red leaf symptoms, vine decline and suspected graft incompatibility

Penny Flannery, Development Officer – Viticulture, NSW DPIRD

Introduction

In October 2023 at a vineyard in Orange, NSW, some Pinot Noir vines grafted to 110 Richter rootstock showed distinct red leaf symptoms, stunted growth, and inconsistent performance in multiple rows. While initial observations suggested phosphorus deficiency, closer inspection revealed symptoms more consistent with virus expression.

Field symptoms, graft union swelling and necrosis, and clone/rootstock specificity were consistent with the syndrome described by Rwahni et al. (2012) as grapevine necrotic union (GNU), which is an emerging disease with an unknown cause reported in California on Pinot Noir clones (including 667 and 777) grafted on 110 Richter.

Graft incompatibility was also considered based on the progression of symptoms over 4 to 5 years and the appearance of early symptoms in replacement vines planted in 2021.

Vineyard observations

Symptoms were sporadic, affecting approximately 2–5% of vines in clusters about every 15–20 vines along several rows. Leaves progressed from having slight chlorosis to solid red lamina ([Figure 59](#)). On some vines, veins remained green earlier in the season, consistent with grapevine red blotch virus (GVRB), before developing uniform reddening ([Figure 60](#)).

Affected vines had thinner trunks and canes, and smaller canopies ([Figure 61](#) and [Figure 62](#)), indicating reduced sap flow. Their graft unions were swollen or disfigured ([Figure 63](#)), while neighbouring vines remained vigorous under identical irrigation and soil conditions.



Figure 59. Red leaf symptoms started in October 2024.



Figure 60. Leaf reddening with the veins remaining green.



Figure 61. Stunted vines in October 2024.



Figure 62. Stunted vines and yellowing of the leaves before they turn red in November 2024.

Evaluating potential causes

1. Phosphorus deficiency

Although early assumptions suggested phosphorus (P) deficiency, field patterns did not support this because:

- deficiency would appear over a broader area, not on isolated single vines
- adjacent vines with identical irrigation and soil conditions remained unaffected
- red leaves with green veins were inconsistent with phosphorus deficiency patterns.

2. Viral infection

Symptoms suggesting viral involvement included:

- reddening of the lamina
- clone and rootstock-specific sensitivity
- sporadic, vine-specific expression.

While symptoms were not widespread enough to strongly support a virus as the primary cause, the vines were tested for grapevine red blotch virus, returning negative results. Some Pinot Noir clones naturally redden when stressed. However, symptoms were restricted to Pinot Noir (clone 777) on 110 Richter in this block, while neighbouring rootstock–scion combinations were unaffected, suggesting a union-specific problem. Testing also confirmed the absence of phytoplasmas (parasites that infect the plant phloem tissue and are transmitted by sap-sucking insects).

3. Graft incompatibility

Symptoms appeared only in the block with a graft union between Pinot Noir (777 clone) and 110 Richter. Compatible vines displayed vigorous growth, while affected vines showed declining performance despite identical management.

- Younger vines had reduced sap flow, poor nutrient translocation, and smaller canopies.
- Vascular connection issues usually produce symptoms only on affected vines, matching observations.
- Some vines showed physiological ‘bottlenecking’, where nutrients failed to reach leaf tips.

4. Crown gall or crown gall-like bacteria

Several vines showed galling or union disfiguration resembling *Agrobacterium* spp. infection, such as hard, knotty galls near the graft union, reduced xylem/phloem connectivity, and stunting and reddening due to impaired nutrient transport.

Crown gall is typically expressed following physical injury, frost, graft stress or wet, cold conditions.

5. Grapevine necrotic union syndrome

GNU’s hallmark is a necrotic band at the union (with scion swelling) rather than classic tumorous gall tissue. Where galls were present, targeted testing for *Agrobacterium* spp. and *Rhizobium* spp. was warranted to rule out crown gall. This can be done at [Plant Health Diagnostic Services](https://www.dpi.nsw.gov.au/about-us/services/laboratory-services/plant-health) (<https://www.dpi.nsw.gov.au/about-us/services/laboratory-services/plant-health>).



Figure 63. Galling of the union between Pinot Noir on 110 Richter to clone 777, October 2024.

Based on field observations, virus testing and discussions with owners and viticulturists at the vineyard, the most likely cause of the symptoms was graft incompatibility leading to vascular restriction.

Diagnostic recommendations

1. Submit samples for pathogen testing

Recommended tests:

- crown gall (*Agrobacterium* spp. and *Rhizobium* spp. complex)
- expanded virus panel (including Pinot Gris virus, grapevine leaf roll virus)
- sap flow or petiole nutrient testing; these tests need to be done early in the growing season at flowering.

2. Dig up one symptomatic vine

A full root and union inspection can reveal gall formation, graft failure, vascular browning and rootstock–scion disconnection.

3. Compare with healthy neighbouring vines

Direct comparison helps confirm whether the issue is structural rather than nutritional.

Management considerations

Short term (current season)

- A foliar phosphorus spray might help with growth, but will not reverse leaf colour.
- Avoid fertigation targeting the whole block as weaker vines might not respond proportionally, and excess nitrogen can encourage vegetative growth in unaffected vines.
- Maintain irrigation consistency to prevent additional stress.

Medium term

If graft incompatibility or crown gall is confirmed, options include:

- replacing symptomatic vines
- regrafting using a more compatible Pinot Noir clone
- monitoring for progression over different seasons.

Long term

- review rootstock choice for Pinot Noir plantings
- establish ongoing virus and crown gall monitoring, particularly before propagating or grafting programs
- record vine performance trends block by block.

Submitting diagnostic samples, further anatomical investigation, and monitoring vine trends will provide clarity and guide management decisions.

If you see any strange symptoms in your vines, please contact [NSW DPIRD Biosecurity](https://www.dpi.nsw.gov.au/dpi/biosecurity) (<https://www.dpi.nsw.gov.au/dpi/biosecurity>).

Even if you are not sure, it is always best to report it. To [report a pest or disease](https://www.dpi.nsw.gov.au/dpi/biosecurity/report-a-pest-or-disease) (<https://www.dpi.nsw.gov.au/dpi/biosecurity/report-a-pest-or-disease>):

- Call the Exotic Plant Pest hotline on **1800 084 881**
- Report using our [online form](https://forms.bfs.dpi.nsw.gov.au/forms/9247) (<https://forms.bfs.dpi.nsw.gov.au/forms/9247>)
- Email: biosecurity@dpird.nsw.gov.au

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NSW DPI Biosecurity – Report a pest or disease, <https://www.dpi.nsw.gov.au/dpi/biosecurity/report-a-pest-or-disease>

NSW DPI Plant Health Diagnostic Services, <https://www.dpi.nsw.gov.au/about-us/services/laboratory-services/plant-health>



Young vine decline in Australia

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Young vine decline

Botryosphaeria dieback (BD), black foot disease (BFD), and Petri disease (PD) can affect vine establishment, causing leaf chlorosis, stunted growth, and sudden vine collapse (Figure 64). In young vines, these diseases are collectively known as young vine decline (YVD). Reported worldwide, these symptoms can result in costly replanting in the first 5 years, before any return on investment is realised.

The fungi responsible for BFD are commonly found in soil and are considered weak pathogens, often associated with waterlogged vines. The PD fungi can be aerially distributed and/or soilborne. Some PD fungi live naturally in grapevine tissues with other microorganisms. These fungi are thought to be latent pathogens, predominantly causing harm in stressed grapevines, while otherwise healthy vines often show no symptoms. In symptomatic vines, internal symptoms include brown or black wood staining or black dots (Figure 65).



Figure 64. Left, a vine with stunted growth and right, sudden vine collapse in mid-to-late summer.



Figure 65. Left, brown staining arising from the base/roots and right, black dots are commonly associated with black foot and Petri disease.

Research conducted by staff from the Gulbali Institute, Charles Sturt University, and the South Australian Research and Development Institute (SARDI), with funding from Wine Australia and industry, has been focusing on YVD to determine whether:

1. the fungi are in the grapevine nursery source blocks and nursery material
2. it is a concern for the Australian wine industry.

Research highlights

Nursery source block testing

A 3-year study is in progress to detect and quantify YVD fungi in dormant canes collected for propagation of nursery vines. In the first 2 years, 80 composite samples of 5 dormant canes were analysed, with 16% of samples having variable quantities of YVD fungi, which were predominantly the BD fungi.

Nursery vine testing

Commercial nursery vines propagated from the tested source blocks were analysed for the same YVD fungi. While the presence of the BD fungi remained low to non-existent in most vines, BFD and PD fungi were found in most vines in varying quantities.

Young vineyard surveys

To determine whether YVD is an issue in Australia, a survey of 31 vineyards aged up to 5 years, was completed in New South Wales, Victoria, and South Australia (Figure 66).



Figure 66. Locations of vineyards with young vines surveyed for symptoms.

Overall, 50,000 vines were surveyed, with only 1.4% of vines displaying symptoms characteristic of YVD. Thirty-four vines that were visually assessed as symptomatic were taken to the Gulbali Institute for laboratory analysis, of which 50% were identified as containing YVD fungi. Symptomatic vines were often found in vineyards with other issues, such as water stress, waterlogging, and J-rooting (Figure 67). Lack of water has previously been identified as a factor in the development of YVD symptoms.

How infection affects vine health

A multi-year field trial was established at the Gulbali Institute research vineyard in Wagga Wagga, NSW, in 2024 to investigate the effect of YVD infection on vine health. Dormant canes were inoculated with varying quantities of YVD fungi and then propagated and planted in the vineyard. In the first 2 years of the trial, the vines appeared healthy with no symptoms or effect on above-ground growth (Figure 68).

Summary

These outcomes are providing new information and clarity on the presence and effect of YVD in Australian vineyards. While YVD is uncommon in Australia, the fungi causing it are in nursery material and young vines. Although not all infected vines display symptoms, research is underway to determine why symptoms develop. Current knowledge suggests that vine stress, in particular water stress, is a major factor in symptom development, and surveys in Australia are confirming this.

Future research in Australia aims to evaluate biological control strategies and to update management guides for source blocks and nurseries to prevent and control YVD. This research will help us learn how various quantities of YVD fungi in the grapevine can affect overall vine health. Understanding the infection thresholds for symptoms to appear will help with managing this disease, as it will assist in predicting whether a vine is likely to become symptomatic or remain asymptomatic.



Figure 67. A symptomatic vine with J-rooting.



Figure 68. Two-year-old vines initially infected with varying quantities of young vine decline fungi. Photo taken in January 2026.

Acknowledgements

The authors would like to thank the surveyed vineyard and nursery owners for their input.



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Disease-resistant varieties for Australian viticulture

Penny Flannery, Development Officer – Viticulture, NSW DPIRD

At the Australian Wine Industry Technical Conference held in July 2025, there was a discussion panel on a novel approach to traditional varieties (Figure 69). This focused on the introduction of disease-resistant grapevine varieties to Australia. At the conclusion of the workshop, wines from these varieties were tasted.



Figure 69. The panel at the Australian Wine Industry Technical Conference (AWITC19). Liz Riley (Vitibit, Chair, standing), Kim Chalmers (Chalmers Wines), Steve Partridge (ARM Nursery and Vine Improvement Industry Nurseries Association), Bethany Collins (Yalumba Nursery), Leanne Altmann (Trader House), and Jim White (Cloudy Bay Vineyards).

Understanding the rise of disease-resistant varieties

Disease-resistant grapevine varieties have emerged as one of the most significant changes in viticulture. Their development stems from long-standing challenges, mainly that *Vitis vinifera* has no natural resistance to powdery mildew, downy mildew, or phylloxera, which have all had a substantial effect on viticulture since the late 1800s. While grafting onto resistant rootstock can solve the phylloxera crisis, fungal diseases have continued to require heavy reliance on preventive and chemical control. This increased reliance has also caused increased fungicide resistance, which prompted the industry to adopt disease-resistant varieties.

Breeding programs in Germany, France, and Italy began decades ago and have now developed high-quality, resistant cultivars that can maintain *Vitis vinifera* traits while including resistance genes from American and Chinese *Vitis* species. These new varieties have only a small proportion of non-*vinifera* genetics, yet this fraction carries powerful resistance capabilities without imparting the undesirable wine characters once associated with those early hybrids.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO), with Australian breeding programs, have also been working on this for the past couple of decades, led by Dr Ian Dry. Dr Bruno Holzapfel from NSW DPIRD is also still working on these varieties, refer to [page 89](#).

How resistance is bred into grapevines

Breeding disease-resistant varieties is a long, multi-generational process. Breeders begin by crossing elite *Vitis vinifera* varieties with wild American or Chinese species that have resistance genes. Early generations might contain half-wild ancestry, but repeated backcrossing gradually restores the *Vitis vinifera* character while keeping desired resistance traits.

Molecular markers now allow breeders to test seedlings for the presence of specific resistance genes before the seedlings reach maturity. Even with modern technology, each new variety still involves decades of work, followed by rigorous viticultural and winemaking trials to ensure commercial quality.

Genetic sources of resistance

Resistance develops primarily from 3 gene groups. Ren and Run genes contribute to powdery mildew resistance, while RPV genes provide downy mildew resistance. These genes are part of the resistance loci that have resistance to powdery and downy mildew and are crucial for the development of disease-resistant grapevine varieties. American *Vitis* species, particularly those originating from the humid southeastern United States, are rich sources of these genes. More recently, Chinese *Vitis* species have provided additional resistance traits that support polygenic protection. Polygenic resistance is now considered the gold standard because it makes it far more difficult for pathogens to overcome plant defences, as they have multiple genes with resistance to these mildews.

Why do disease-resistant varieties matter?

Reducing fungicide applications is of global interest. In regions where disease-resistant varieties have been planted, some producers have reported an 80% reduction in fungicide use. This brings added benefits, such as reduced labour costs, demand and time, fuel use, CO₂ emissions, and soil compaction, along with a healthier work environment with improved sustainability for the vineyard and the overall business.

Sustainability

Disease-resistant varieties contribute meaningfully to environmental, social, and governance (ESG) goals by reducing chemical use, improving soil health, lowering carbon emissions, enhancing biodiversity, and supporting a safer work environment. When combined with advances in autonomous machinery, renewable energy systems, and improved rootstock choices, they contribute to climate-resilient viticulture.

Integration with emerging technologies

These varieties align with new vineyard technologies such as autonomous sprayers, ultraviolet C (UVC) disease control systems, robotics, and low-impact machinery. As application frequency declines, producers might reconsider investing in large sprayers and tractors. Using solar-powered or autonomous equipment offers further sustainability advantages, reduces labour demands, and could modify vineyard work requirements.

Winemaking characteristics and sensory outcomes

Modern disease-resistant varieties have advanced from the hybrids of the past. Wines now commonly express vinifera-like aromatic profiles, fresh acid lines, and regional characteristics. Italian-derived varieties can express savoury notes, phenolic grit, and variety bitterness reminiscent of their origins. French-derived varieties often lean toward Sauvignon-like aromatics, orchard fruit characters, or delicate florality, depending on their parentage.

Early trials suggest that red varieties related to Pinot Noir express fruit-forward aromatics, spice, and balanced acidity, while benefiting from naturally loose clusters that reduced disease pressures without compromising wine style.

Wines tasted during the session

1. Soreli
2. Fleurtaï
3. Sauvignac
4. Floreal
5. Pinot Iskra
6. Pinot Kors



Figure 70. Wines for tasting: 1 Soreli, 2 Fleurtaï, 3 Sauvignac, 4 Floreal, 5 Pinot Iskra, 6 Pinot Kors.



Figure 71. Wines made from disease-resistant grape varieties.

Market acceptance and consumer response

Market trials conducted in restaurants and wine bars show promising consumer acceptance. Guests typically respond to flavour rather than technical background, and most do not question novelty in grape varieties when wines have familiar quality cues. Sommeliers at this workshop indicated that concise messaging about sustainability and reduced intervention is more successful than complex explanations about genetics or breeding.

Internationally, resistant varieties are gaining popularity in markets such as London and Europe, where producers are blending or bottling single variety versions without hesitation. Retailers such as Tesco have added resistant variety wines to premium ranges, suggesting mainstream potential in the United Kingdom.

Viticultural management considerations

While disease-resistant varieties reduce chemical inputs, they do not eliminate them. Strategic preventative sprays, particularly during flowering, remain important to protect resistance mechanisms and prevent hypervirulent pathogen strains. Growers cannot assume immunity but can expect simplified disease control programs.

Canopy management could also change. Reduced disease pressure will allow growers to reconsider the need for complete leaf removal, and provide opportunities for different airflow strategies and chemical interventions. The looser bunch architecture and thicker skins common in these resistant varieties also help further reduce botrytis and other bunch rots. Some varieties are very botrytis-tolerant compared to their *Vitis vinifera* parents.

Managing intellectual property, regulation, and biosecurity

Resistant varieties are protected by strict intellectual property frameworks. Nurseries entering propagation agreements are required to manage licensing obligations, track plantings via GPS, and comply with strict quality and traceability requirements. These systems are significantly more structured than traditional open-source propagation common in Australia.

Importation is limited by quarantine timelines, which can extend beyond a year and incur high costs. Some varieties require virus elimination before being released to the nurseries. These constraints place added responsibility and costs onto nurseries and highlight the importance of long-term planning by growers if they are looking to plant these varieties.

Economic considerations for growers

Despite higher upfront plant costs and stricter management agreements, these varieties can significantly reduce annual vineyard operating expenses. Lower fungicide use, fewer tractor passes, and reduced labour demands offer attractive financial incentives to growers. For commercial producers, resistant varieties could provide some protection against disease-driven crop loss and climate variability.

Growers who sell fruit rather than make wine might need assurance that wineries will accept and market these varieties. Early adoption will most likely be led by estate producers, innovators, and sustainability-focused brands.

Future directions for Australian growers

Australian producers can integrate new varieties as they become available and explore regional suitability. Collaboration between growers, nurseries, winemakers, and research bodies will be essential. Regional tastings, shared trials, and coordinated variety variety can accelerate learning and reduce risk.

Industry associations and regional collectives have an opportunity to lead education and normalise these varieties for future generations of viticulturists and winemakers. Growers can make the commercial decision to proceed with these new varieties as they could do with any of the alternative varieties currently available.

The varieties that have been imported into Australia will be registered with Wine Australia and added to the official list of varieties in Australia.

Looking ahead

Viticulture is changing rapidly, and disease-resistant varieties are moving from experimental and research plots to mainstream vineyards. As plantings increase throughout Europe, Australian and New Zealand producers have an opportunity. Early adopters will lead the way and show regional potential, while building the market foundations for others.

This could be a significant turning point. With thoughtful management, robust industry collaboration, and a clear sustainability vision, disease-resistant grapevine varieties can help secure the future resilience of vineyards in diverse climates and production styles.

Table 6. Disease-resistant variety details.

	1	2	3	4	5	6
Wine	Limine 2023 Terre di Ger	Ad Maiora La Fornase (Pasio Di Pn) 2022	Nathy Sauvignac 2024	Floreal St Georges D'Ibry 2024	Pinot Iskra – VCR trial wine 2024	Pinot Kors – VCR trial wine 2023
Red/white	White	White	White	White	White	Red
Variety name	Soreli	Fleurtaï	Sauvignac	Floreal	Pinot Iskra	Pinot Kors
Parentage includes	Tocai Friulano	Tocai Friulano	Sauvignon blanc × Riesling	Villaris and Muscadinia rotundifolia	Pinot Blanc	Pinot Noir
Resistance traits	• Downy • Powdery • Reduced sensitivity to botrytis and acid rot • Good winter hardiness to –24 °C	• Downy • Powdery • Reduced sensitivity to botrytis • Good winter hardiness to –23 °C	• Downy • Powdery	• Downy • Powdery • Susceptible to Mg deficiency	• Downy • Powdery • Good winter hardiness to –20 °C	• Downy • Powdery

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Disease-resistant varieties are one of the options that growers could look to adopt for their vineyards. Attendance at the Australian Wine Technical Conference was funded by the Regional Program NSW/ACT, which is delivered in partnership with NSW Wine. It is supported by Wine Australia, with levies from Australia's grapegrowers and winemakers and matching funds from the Australian Government, and in-kind co-investment by the NSW Department of Primary Industries and Regional Development.



Advancing disease-resistant grapevines for Australian viticulture: from Gen 1 to Gen 2

Penny Flannery, Development Officer – Viticulture, NSW DPIRD

Dr Bruno Holzapfel, Research Physiologist, NSW DPIRD

Fungal diseases such as powdery and downy mildew continue to impose high economic, operational and environmental costs on Australian viticulture. Beyond yield losses, disease management relies heavily on fungicide inputs that increase production costs, labour requirements and carbon footprint. In response, NSW DPIRD is working with CSIRO and Wine Australia and is progressing its research in a long-term breeding and evaluation program to develop and validate **disease-resistant winegrape selections** suited to Australian and, in particular, New South Wales warm and cool climates, while maintaining wine quality.

This article summarises progress from the evaluation of **first-generation (Gen 1)** mildew-resistant selections through to the **second-generation (Gen 2)** selections now being assessed in 2 NSW wine regions.

Why disease-resistant selections?

Powdery and downy mildew have historically cost the Australian grape and wine industry more than \$150 million per year through yield loss, spray programs and operational losses (Lawson 2023). These diseases occur in a wide range of climates, with heightened pressure in cool-wet regions, making genetic resistance an attractive long-term solution.

Wild *Vitis* species from America and Asia contain natural disease resistance genes not found in *Vitis vinifera*. Using advanced breeding techniques, these resistance traits can be introgressed (the transfer of genetic material from one species into the gene pool of another through hybridisation and repeated backcrossing) into *vinifera* backgrounds while retaining wine quality characteristics expected by growers, winemakers and markets.

Gen 1 mildew-resistant selections: field and wine evaluation

The first generation of mildew-resistant selections was developed by introgressing resistance genes for powdery mildew (RUN1) and downy mildew (RPV1) into *vinifera* backgrounds through successive backcrossing. The resulting selections retain approximately **98.4% *Vitis vinifera*** genetics.

Gen 1 selections were planted and evaluated in multiple regions in Australia, including the Riverina and Orange, to assess their performance in different climates. Evaluation focused not only on disease resistance but also on yield components, phenology, fruit composition and wine sensory attributes.

Key findings from the Gen 1 evaluations included

- Several selections performed **comparably to Cabernet Sauvignon, Chardonnay, Riesling, and Shiraz** in wine sensory assessments.
- Harvest timing for selected Gen 1 selections aligned well with existing commercial harvest windows in warm and cool regions.
- Some selections displayed **more open bunch architecture** than traditional selections, reducing botrytis risk in high rainfall areas.
- Wine quality, while variable between seasons, showed strong potential for premium production.

Based on these outcomes, selected Gen 1 vines are being maintained at Orange until 2027, with cuttings made available to interested growers for on-farm evaluation under Plant Evaluation Agreements. Please contact Bruno Holzapfel on bruno.holzapfel@dpird.nsw.gov.au, 02 6933 4023, or 0458 723 664 to enquire about the Gen 1 selections.

You are always welcome to visit the NSW DPIRD Orange Agricultural Institute to see the Gen 1 selections at different development stages ([Figure 72](#) and [Figure 73](#)). Please contact Penny Flannery on 0439 230 829 to arrange a visit.



Figure 72. One of the Gen 1 white selections at the Orange Agricultural Institute. Photo taken February 2026.



Figure 73. One of the Gen 1 red selections at the Orange Agricultural Institute. Photo taken February 2026.

Gen 2 mildew-resistant selections: stacking resistance for durability

Building on the success of the Generation 1 (Gen 1) selections, the CSIRO breeding program has **progressed to second-generation (Gen 2) selections**. This program uses selected Gen 1 material and a CSIRO breeding line incorporating powdery mildew resistance from the wild Chinese species *Vitis romanetii*, using the advantages of micro-vines. As a result, the Gen 2 selections carry 2 powdery mildew resistance genes (RUN1 and REN4) and 2 downy mildew resistance genes (RPV1 and RPV16), providing enhanced durability of mildew resistance in the field.

Marker-assisted selection (MAS) was applied to seedlings to ensure all 4 resistance genes were present before planting in the vineyard. The initial plantings were in the Barossa Valley. The Gen 2 progeny include red-fleshed, red-skinned, and white selections.

Cuttings were later taken from these plantings, and more seedlings were supplied by CSIRO for evaluation in New South Wales. These were planted in the Riverina (Griffith) and Orange regions, and most were established in spring 2023, with some additional plantings completed in summer 2024. Most vines have now completed 2 full growing seasons.

Cordon training systems reflecting regional practices and growing conditions are being applied over multiple seasons, as the development of the selections is variable. In the **Riverina**, bilateral cordon systems suited to warm climate production are being used, while in **Orange**, lower vigour unilateral systems are appropriate for cool climate vineyards.

Current focus: 2026 vintage measurements and winemaking

During the 2026 vintage that lasted several months, detailed viticultural assessments were undertaken for each Gen 2 selection at both the Orange and Griffith sites.

Measurements collected include:

- total soluble solids (in °Brix) during maturation (Figure 74) and at harvest (Figure 75)
- bunch size and structure
- berry weight (Figure 75) and bunch weight (Figure 76).

These data will provide critical insight into selection consistency for at least 2 growing seasons, as well as yield potential and fruit quality in different climates.



Figure 74. Measuring °Brix on the Gen 2 selections.

Importantly, **wine has been produced from the 2026 Gen 2 harvest** at the Griffith (Riverina) site.

The first formal sensory assessment of Gen 2 selections grown in warm NSW conditions was done in July this year. In the Riverina, these assessments were undertaken on nearly 350 selections; 126 of these produced sufficient fruit (at least 1.5 kg per vine) for small lot wine production (Figure 77).

Chemical data are being collected from both juice and wine for each fermentation. This will be followed by sensory assessment of approximately 50 wines, selected based on genetic background, viticultural performance, and juice and wine composition. This represents a major milestone in determining whether Gen 2 selections can deliver both durable disease resistance and commercially acceptable wine styles.

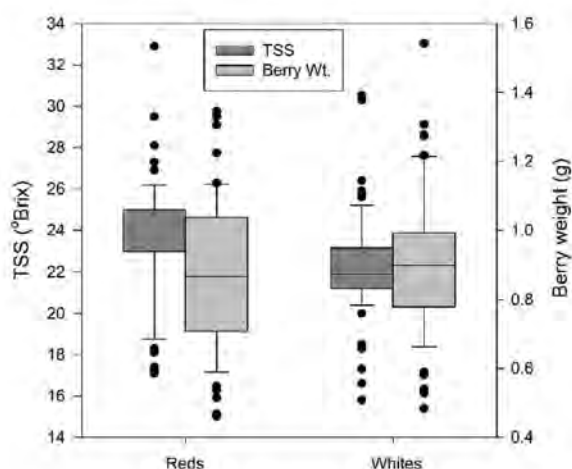


Figure 75. Total soluble solids (TSS) and berry weight from the selections.

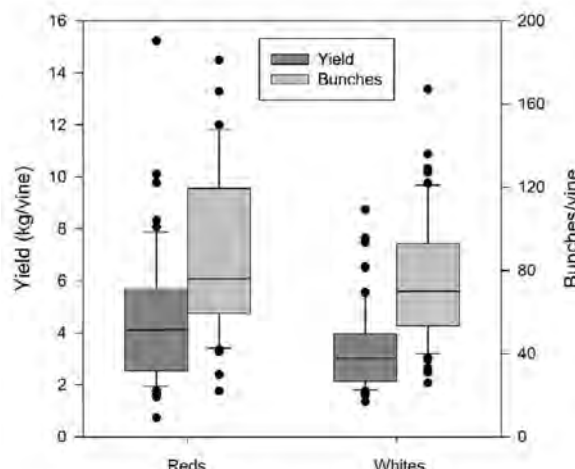


Figure 76. Yield and bunches per vine from the selections.



Figure 77. The Griffith vineyard after vintage 2026 (left) and small ferments from some of the selections (right).

What this means for growers

The disease-resistant grapevine program offers growers a way to:

- reduce fungicide applications, labour and machinery passes
- lower production costs and environmental impact
- maintain or improve fruit quality in disease-prone regions
- increase resilience to seasonal variability and future regulatory constraints.

While no selection will eliminate disease management entirely, early evidence suggests that selected Gen 1 (low spray) and emerging Gen 2 selections (no spray) could significantly reduce disease pressure while producing wines comparable to established commercial benchmarks.

Growers considering future replanting, selection change or long-term vineyard sustainability are encouraged to monitor results from the Gen 2 evaluations and, where appropriate, trial Gen 1 material under local conditions.

Looking ahead

Gen 2 vine performance and wine attributes will be assessed over the next 2 growing seasons. The results will inform future selections. The most promising Gen 2 vines will have plantings of 10–20 vines to produce 50–100 kg, allowing for larger ferments. This will be followed by grower trials and potential commercial release pathways early in the next decade. This phased, evidence-based approach is critical to ensuring disease-resistant selections meet the agronomic, economic and market expectations of the Australian grape and wine industry.

Reference

Lawson K (2023) A fine blend of science with heritage grapevines to future proof Australian wines. CSIRO, <https://www.csiro.au/en/news/All/News/2025/April/A-fine-blend-of-science-innovation-and-heritage-grapevines-to-future-proof-Australian-wines>

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Xylella preparedness in progress

Leonie Martin, Plant Biosecurity Officer – Plant Pest Response, NSW DPIRD

Two Xylella awareness and preparedness workshops were held in Pokolbin and Orange (Figure 78) in December 2025 with representatives from the viticulture and olive industries. These workshops provided valuable information to growers about Xylella and the potential effect it could have on plant industries in Australia.



Figure 78. The Xylella awareness and preparedness workshops held at NSW DPIRD Head Office, Orange.

Workshops have targeted several specific plant industries that have been significantly affected by Xylella overseas, allowing us to build awareness and consider preventative action for an outbreak in Australia. These workshops also allow us to capture what is important to the industry if a Xylella response is required. This ensures we are better prepared and aware of potential issues early.

Feedback about these workshops has been positive, with both the almond industry and olive industry requesting the creation of their own Xylella on-farm preparedness guides to support industry prevention and preparedness.

The [Xylella fastidiosa: on-farm preparedness guide for vineyards](https://www.dpiird.nsw.gov.au/__data/assets/pdf_file/0008/1584575/Xylella-on-farm-preparedness-guide-for-vineyards.pdf) is on the NSW DPIRD Grapes website (https://www.dpiird.nsw.gov.au/__data/assets/pdf_file/0008/1584575/Xylella-on-farm-preparedness-guide-for-vineyards.pdf).



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What you need to know about **H5 bird flu**

Why it matters:

- H5 bird flu causes illness and high mortality in poultry, wild and domestic birds and some mammals (particularly marine mammals).
- While H5 bird flu is rare in cats and dogs globally, it is still important to ensure that pets are not exposed to sick or dead birds or other animals.
- Bird flu rarely spreads to humans but may occur if there is close, unprotected contact with infected animals or contaminated environments. Avoid direct contact with sick or dead birds or wildlife.

What to do:

Avoid:

contact with sick or dead wildlife and their environment

Record:

the date, time, location and take a photo

Report:

sick or dead birds or other animals to the **Emergency Animal Disease Hotline** on **1800 675 888**



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