

What can be done in the vineyard to manage risk in difficult seasons?

Part 1: What can viticulturists do in particularly dry and wet seasons to minimise their risk?

This paper was delivered by Mary Retallack, managing director, Retallack Viticulture, at Finlaysons Wine Roadshow XX, at nine different venues around Australia between 30 July and 31 August 2012.

Mary Retallack

Introduction

Key challenges faced in recent vintages

WINEGROWERS ARE FACED with the task of navigating their way through a range of challenges each growing season. Recent challenges include the prolonged drought conditions that prevailed throughout many Australian wine growing regions from 2006-07 to 2009-10, and in stark contrast, season 2010-11 which was one of the wettest on record across many of the central and eastern states.

Although seasonal conditions were reasonably kind and fruit quality from vintage 2012 is widely regarded as being of very good to exceptional quality, yields for the most part were significantly below expectation, with the exception of the Riverland and many wine-growing regions in Western Australia.

Winegrowers are now struggling to recover from the impact these seasons have had on cash flow and/or vine health. Some of the key challenges faced by winegrowers include technical and logistical challenges, responding quickly to seasonal conditions, managing contractual negotiations to ensure the smooth sale of wine grapes and juggling financial and human resources.

Some of these challenges are explored further below in the context of particularly wet and dry seasonal conditions. It is important to take stock of what has occurred in the past and this provides a useful checklist for future seasons so wine growers can be on the front foot and minimise their risk.

These weather extremes result in greater uncertainty and the challenge in the past has been to manage for the unknown. In recent years these extremes have become more familiar. We have access to better tools and we are now in a better position to respond with greater confidence.

A vast amount has been written in the literature about how to respond to the recent difficult seasons and I will focus on some of the key learnings that have come out recent seasons.

Table 1. Key challenges faced by winegrowers when managing vines in particularly dry seasons.

Seasonal conditions	Key challenges
Drought conditions	<ul style="list-style-type: none"> • Less water is available when it is needed the most and higher temperatures are experienced. • Greater temperature extremes (frost and heat waves). • Often there is more wind resulting in higher rates of evaporation. • Greater financial outlays for the purchase of water and delivery costs are likely to be greater. • Underlying issues (salinity, nematodes, borers and trunk diseases) are often exacerbated, vine health issues become more pronounced and vineyard uniformity is often compromised. • Disruption of photosynthesis may lead to reduced carbohydrate reserves (smaller shoots and delayed ripening), and basal leaves may be lost earlier (resulting in exposed fruit). • There is a greater likelihood of smoke taint and/or fire damage at high-risk sites. • There may be confusion about how to assess damaged fruit (sunburn, dry, shriveled berries etc). • High temperatures may result in fruit quality being compromised. • Lower crop or complete crop loss may occur due to poor set, sunburn damage, or severe frost(s).

Table 2: Key challenges faced by winegrowers when managing vines in particularly wet seasons

Seasonal conditions	Key challenges
Wet season	<ul style="list-style-type: none"> • Higher frequency and volume of rainfall (and sometimes hail). • Greater humidity and conditions are conducive to increased pest and disease activity. • Winegrowers may not be familiar with seeing, or it may be many years since they have observed Phomopsis, downy mildew or bunch rots other than Botrytis in the vineyard. • Soils may become anaerobic (without oxygen) if they remain wet for prolonged periods and vine health may decline. • Management inputs to control disease pressure (time, fuel, chemical) may be higher. • Management options may be compromised due to vineyard accessibility, poor spray coverage on large canopies, tighter bunches, the need for reduced spraying intervals, machinery limitations, withholding period (WHP) restrictions, and/or a lack of knowledge about product chemistry. • If late season disease takes hold winegrowers are more likely to 'revenge spray' (late season sprays are rarely effective once disease activity has a foothold). • Canopies tend to be bigger (may shade bunches in the current season and suppress fruitfulness in the following season) and weed growth may be greater (problem weeds may proliferate). • Larger crop loads can cause scheduling difficulties; reds and whites may ripen at the same time causing a processing 'bottle neck'. Hold ups may occur if damaged fruit takes longer to process. • Fruit quality may be compromised due to pest and/or disease damage. • Fungicide resistance can occur if chemicals are not applied in accordance with label recommendations. • People panic as they can see their fruit 'packing up' before it has reached minimum 'Baume'. • There may be confusion about the best way to assess damaged fruit (i.e., powdery mildew, Botrytis and a range of bunch rots, sooty mould, uneven ripening, secondary crop etc). • Decisions need to be made quickly and there is often a lot of money at stake. • Yields may be higher if fruit can be kept 'clean' or lower due to pest and disease damage. • Fruit quality may be variable due to uneven, slow ripening or shading. • In some cases complete crop loss is experienced.



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What can winegrowers do to prepare for difficult seasons?

Some of the strategies that winegrowers can adopt to prepare for difficult seasons include:

- Spread your risk by tailoring your management approach for different varieties, plant vineyards in different regions if this is feasible and produce fruit that will suit different wine styles.
 - Match varieties that do well on particular sites and be ruthless about removing those varieties that do not prosper.
- Have a well-thought-out plan in place and be on the 'front foot' with a number of contingency strategies to draw on if things don't go to plan, and know when to action them.
 - Track your progress during the season and keep good records.
 - Ensure pruning levels are set to the desired cropping level, yield estimations are updated regularly, the timing of canopy and crop manipulation is optimised, watering regimes and fruit quality parameters are matched to seasonal conditions.
- Know the profitability of each block and focus your efforts on the blocks

that are likely to give you the best return.

- Know where to cut costs and where not to (don't skimp on inputs that will have a long term impact on vine health like vine nutrition, soil health, irrigation, pest and disease control and pruning).
- If issues start to arise, inform the grape purchaser early, so remedial options can be explored and questionable claims are not made after the fact.
 - Always present a solution at the same time as a problem is identified.
 - Have a fall back position in place (chemical on site if it is in high demand, higher bud numbers at pruning if bud fruitfulness is likely to be lower, ensure water is held in reserve for heat waves).

Plan for extreme weather events in the future and have strategies in place to meet these challenges and to minimise your risk

Being ready to manage drought conditions

The following checklist will help you to prepare for drought or particularly dry conditions:

- Be prepared for a heightened frost risk (have frost prevention measures in place)
- Safeguard your water supply.
 - Ensure there is adequate soil moisture available in a dry winter and the soil profile is full early in the growing season,
 - Pump good quality water into holding dams or down aquifers as insurance,
 - Reduce evaporation from dams by using polymers or physical covers,
 - Purchase temporary 'top up' water when the price is low,
 - Apply water to high value blocks in preference to deficit applications across all blocks, turn off water to blocks that are unviable,
 - Monitor water usage closely, using soil moisture monitoring equipment (including a shovel),
 - Keep some water set aside for peak demand during heatwave events. Ensure your irrigation system has the capacity to meet peak demand and irrigate at night if possible, and
 - Shandy saline water with good quality water to dilute the salts.
- Leach salts from the profile following winter rainfall.
- Vines on sandy soils with low organic

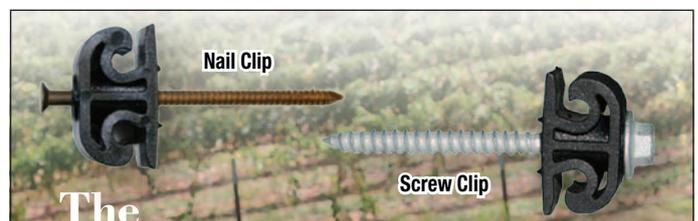


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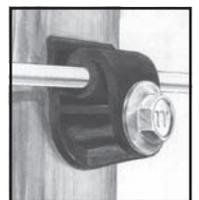
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Table 3. Practical considerations for wine growers in dry seasons¹

Drought related issue	Key challenges	Vineyard management options
Lack of early season soil moisture (the soil profile is not full at the end of winter)	Significant reduction in vine vigour and fruit set is likely if vines are stressed at the start of the growing season.	Monitor soil moisture during winter months and in the lead up to budburst. Apply winter or an early season irrigation to ensure the soil profile is full from budburst, if required.
Less water available Less water in storage and allocations of irrigation water may be reduced	Reduced water availability may result in vine stress early in the growing season. Careful timing and use of available irrigation water is critical to vine health. Do not grow a large canopy if you do not have the water to ripen a large crop, or maintain the additional shoot area.	Develop an irrigation budget and determine if additional water needs to be purchased (if available and a cost benefit analysis warrants additional purchase). Monitor soil moisture reserves and vine growth carefully ensuring irrigation is applied at key times without encouraging excessive shoot length.
Frost Intensity of frost events may be higher due to dry soils	Frost can cause severe damage to emerging shoots and even dormant buds if the frost is cold enough. If the primary bud (or shoot) is damaged, the secondary bud may produce a shoot to take its place (often the fruitfulness is lower).	Frost mitigation strategies include retaining a moist soil profile, slashing mid and under-vine vegetation, the use of frost fans, overhead sprinklers etc. Tiny tags can also be used to monitor temperature fluctuations. You may find that buds burst from undesirable (non count) positions producing water shoots and they will need to be removed either by shoot thinning during the growing season or at pruning time.
Salinity Irrigating with saline water (or where soil salinity is high)	If saline irrigation water is applied this will add to the salts entering the soil. Depending on the level of water salinity and the build up of salts in the rootzone, this may reduce vine vigour and adversely impact on vine health and fruit quality. If replanting your vineyard and salinity is an issue consider planting onto salt resistant rootstocks.	Consider applying a leaching irrigation in winter following a rainfall event and apply regular irrigations during the growing season to push the salts beyond the rootzone. Minimise the use of fertilisers that may add to the 'salt load' in the root zone. Mound under-vine to provide a larger area for roots to explore (above an existing water table) and apply mulch undervine to minimise water loss.
Wind There is often more wind with greater evaporation	Leaf stomata will close frequently in windy conditions (winds of 11-14 km/hr are sufficient to cause their closure). This will reduce the level of transpiration and limit the production of photosynthates. Prolonged exposure to windy conditions may result in poor vine growth.	Install windbreaks; apply under-vine mulch to maintain soil moisture.
High temperatures	Grape berries exposed to bright sunlight on calm days can be warmed up to 15°C above the air temperature. Wind cools because it removes some of the stored heat from the surface of the berry. Recovery from heat stress is rapid (two to five days) if tissue damage is avoided.	Vines with sufficient leaf area to provide protection and a deep root system, tend to cope with heat better than weak vines with poor vigour. Apply regular irrigation applications prior to and during a heatwave (and overhead irrigation can be used to help cool the canopy) to reduce vine stress. Particle film technology (PFT) sprays can be used to provide a physical 'sunscreen' barrier to bunches and reduce the temperature at the bunch zone.

Modified from materials prepared for Murray Valley Wine growers' Inc – 'Advanced Viti: Grapevine Biology and Function Notes'

matter will dry out quickly. Mulch shallow profiles and areas of uneven vine growth (use aerial maps and vine vigour to determine a differential mulching program).

- Broadly spaced drippers may result in a 'pruned' root system and a 'dry-wet-dry' wetting pattern (or 'silos') in the soil, may cause vine stress and predispose vines to damage by root rotting fungi.
- Particle film technology (PFT) products such as processed and refined kaolin clay (Surround®, Screen®) or calcium carbonate crystals (Parasol®) can be used as sun protection agents to provide a physical barrier to sunburn and to help 'cool' canopies during heatwaves.
- Apply foliar nutrients to improve leaf function if leaves are senescing or 'yellowing' prematurely, to retain optimal leaf function, maximise photosynthetic capacity and ensure fruit ripens fully.
- Harvest fruit as soon as it is ripe and exhibits optimal varietal characters, to minimise the harvesting of overripe fruit that will lead to particularly high alcohol wines.

Post drought season considerations

Consider the following points when managing your vineyard after a succession of dry seasons:

- Apply post harvest irrigation and nitrogen if there are actively functioning leaves and feeder roots are present, to replace some of the carbohydrates used, prior to the following season.
- Evaluate vine performance and health.
 - Remove vines that have not recovered after prolonged drought conditions due to salinity, frost events, nematodes, root diseases and trunk diseases (*Eutypa*, *Botryosphaeria*).
 - Remove sections of vines that have dead cordons due to trunk diseases or frost damage. A 'cordon shredder' can be used to remove parts of dead cordon, while retaining healthy sections and the wire if it is in good condition.

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- Seek out varieties that do well in drought conditions, during severe weather events and are suited to your site.
- Use Normalised Difference Vegetation Index (NDVI) maps (capture data at veraison) to identify areas of vine vigour variation in the vineyard. Focus your efforts on improving vine health and applying mulch to weak areas.
- Replant missing or unthrifty vines (preferably on rootstock).

Practical considerations for wet seasons

Being ready to manage wet seasons

The following checklist will help you to prepare for wet seasons:

- Have a robust spray program in place
 - Check sprayer setup and coverage at the start of the season. If you do not have good spray coverage you are unlikely to get the upper hand, regardless of the spray interval employed or the products used.
 - Work closely with your chemical reseller to ensure the

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products you require will be available when you need them. Identify potential supply issues early and have a plan in place to manage supply disruptions.

- Stay on the 'front foot' and focus your efforts using a conservative and preventative spray program; if things start to unravel by Christmas this may be an indication that your early season approach was not robust enough, or seasonal conditions have been exceptionally challenging.
- Don't get into the habit of 'revenge spraying'; if you are on the 'back foot' late in the season, it is often too late to overcome significant crop damage. Know when to cut your losses.
- Powdery mildew
 - Early season control is critical. If you spray early enough, with sufficient product and achieve good coverage, you will be in a strong position to maintain good powdery mildew control.
 - Adequate spray volume is needed for good spray coverage; match the volume to canopy size.
 - Use the higher sulphur rate with good coverage to give yourself the best chance of control in bigger canopies that favour the spread of powdery mildew. This may have a short-term detrimental effect on beneficial insects, but if your primary aim is to preserve your crop, then in difficult seasons this approach may be necessary.
 - Measure leaf/shoot expansion to help set spray windows (mark and measure individual leaves) to ensure new growth is protected.
- Botrytis
 - There is an elevated risk of bunch rots on thin-skinned varieties with compact bunches, in humid conditions, where there is poor airflow in the canopy.
 - Monitor regularly. Keep a close eye on the level of infection, as diseased berries can spread very quickly in a humid vineyard with wet canopy.
 - Ensure you apply chemicals at label rates, otherwise you risk building up resistance in the vineyard. Target the bunch zone and aim for thorough coverage.
 - Ensure you use the right product for disease control. Not all bunch rots will respond to the application of Botryticides.
 - Focus on keeping flowers 'clean' at cap fall and ensure good control prior to bunch closure, as this is your last chance to obtain good coverage inside the bunch.
 - If the late season Botrytis infection is inside bunches or at the back of bunches, the spraying of sporulating berries is likely to be of little benefit regardless of the chemical used.
 - Manage Light Brown Apple Moth (LBAM) to minimise the physical damage caused to berries and potential infection sites.
 - If you are unsure about the % infection, have an independent assessor inspect the vineyard.
 - Work closely with the fruit purchaser to manage picking times. If in doubt, pick early (at a lower than target °Baume) to safeguard your position, rather than risk outright rejection (unfortunately the situation is not going to get any better if bunch rots have taken hold late in the season, only worse). It may be better to receive a small penalty rather than 'lose the lot'.
- Waterlogging may occur
 - This may create anaerobic conditions that are detrimental to root growth and may lead to vine decline.
 - Vineyard access may be restricted at the key times needed to carry out essential functions such as disease control.
 - Ensure good soil drainage and reduce the likelihood of water pooling in wheel ruts for extended periods of time as free water often encourages disease activity.
- An open canopy and good airflow (along with spray

Drought related issue	Key challenges	Vineyard management options
Carbohydrate reserves Vine's stored carbohydrate (sugars and starch) reserves are lower	Grapevines rely on stored carbohydrate reserves early in the season for root and shoot growth (until leaves are full size and can contribute to the vines' energy requirements). Low carbohydrate reserves will impact on vine vigour; shoot length and fruit ripening processes.	Avoid significant vine stress, as this will reduce photosynthesis and carbohydrate production. Maintain the functioning leaf area post-harvest so vines can produce and store carbohydrate reserves. Apply sufficient water and fertiliser early in the season to assist vines in replenishing carbohydrate reserves early in the growing season
Poor root distribution	Vine roots are usually concentrated in the top metre of soil directly under the vine canopy. Wide dripper spacings may create 'silos' of alternating wet and dry areas resulting in the root area being 'pruned'. Vine roots produce a plant hormone called abscisic acid (ABA) in response to stress. This signals the vine to 'shut down' until conditions improve.	Install drippers with closer emitter spacings or install additional drippers to maintain a wetted 'strip' undervine. This will encourage greater root exploration (mulch to retain water for longer).
Nutrient application Application of fertiliser	Vines appear to have a main peak of root growth coinciding 4 to 6 weeks after budburst. Ensure mobile fertiliser (nitrate) is applied when feeder roots are present. A second flush of root growth may occur after vintage but this is not the case every season (use a shovel to check for feeder root activity).	Consider the best way to apply fertiliser. Some nutrients are highly mobile and some are less mobile, this will affect the method of application. Some foliar nutrients need to be applied at key times (during spring and/or pre-flowering).
Short shoots Fewer functional leaves to ripen the crop	Unbalanced (over cropped) vines will result in longer-term vine health issues and poor fruit quality.	Apply irrigation to grow sufficient shoot area to ripen the crop. If the shoot length (or leaf function) is reduced then reduce the crop load accordingly.
Flowering may occur earlier than in a normal year and conditions may not be conducive to set	Frosty, dry, and/or windy conditions during flowering are not conducive for optimal fruit set. High and/or prolonged low temperatures can also reduce set.	Be ready to apply pre-flowering nutritional sprays at optimal timing (Boron, Zinc etc). Ensure vines are not moisture stressed up to and during flowering.
Vine canopy stress Ongoing stress may result in significant basal leaf loss	Basal leaf defoliation will reduce the photosynthetic capacity of the vines (if the basal leaves are still functioning). Lack of fruit protection may result in uneven ripening, lower fruit quality (sunburn, phenolics characters, berry shrivel) and lower yield.	If hot weather is forecast, start irrigating several days prior (preferably at night) to minimise vine stress. Maintain irrigation application throughout hot period (monitor how deep the irrigation is going down the profile).
Post harvest care Getting ready for the next growing season	Vines will export nutrients with the fruit produced. It is important to maintain vine health and build up the vines carbohydrate reserves prior to senescence. Vines will continue to function normally while actively functioning leaves are present.	Maintain irrigation until leaf senescence (while there are functioning leaves the vine will produce carbohydrates). Apply post harvest fertiliser if functional leaves and feeder roots are present to replace nutrients removed at harvest. Do not encourage new shoot growth at this time.

coverage) is your best friend in wet seasons. Cultural practices such as the timing, careful selection and use of foliage wires, shoot thinning (removal of non-count shoots) and shoot trimming can be used to keep the upper hand.

- Drop damaged bunches prior to machine picking or selectively hand pick damaged sections.
- Consider the use of new technologies when picking grapes such as Pellenc's Selectiv' Process linear de-stemmer, to remove petioles and other material other than grapes (MOG) in the vineyard, or Pellenc's Selectiv' Process Vision at the winery (sorting table) to maximise fruit quality at harvest.

Post wet season considerations

Consider the following points when managing your vineyard after particularly wet seasons:

- Assess what worked well and what didn't. Put processes in place to avoid the pitfalls in the following season.
- Consider ways to reduce the disease inoculum load for next season.
 - The application of mulch has been shown to reduce overwintering spores of Botrytis by increasing the decomposition of vine debris and 'mummified' berries, however these gains may be minimal (focus your efforts on 'in season' control).
- Be prepared to manage a higher disease inoculum level at the start of the following growing season.
- Consider the impact the previous season may have had on bud fruitfulness (physical damage, shading of the renewal zone, large crops) for the following season and adjust node numbers retained accordingly.
- Additional hand clean up may be required during winter pruning to remove non-count shoots and potential crowding along the cordon.

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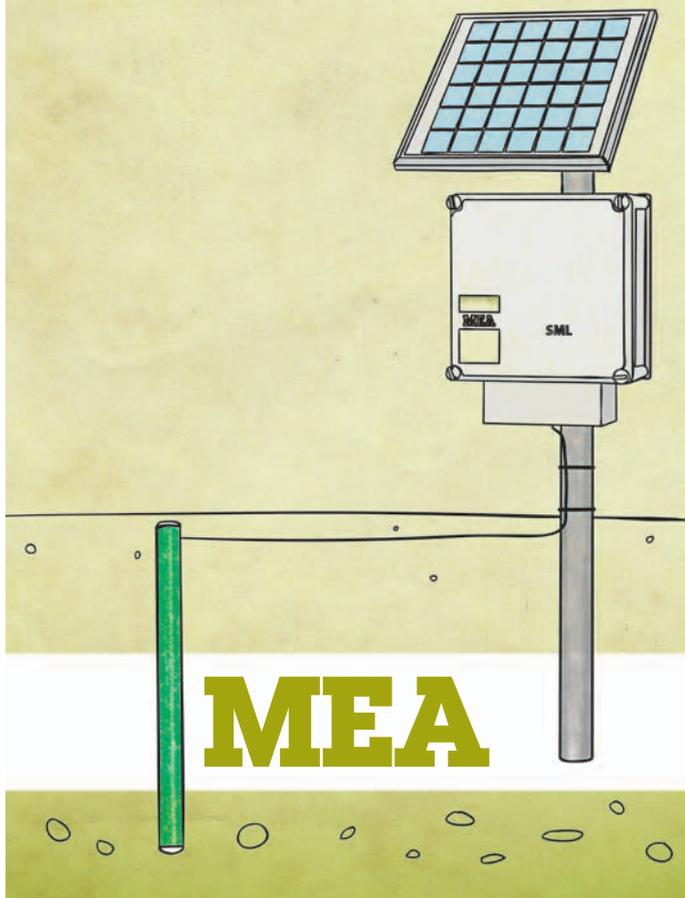
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For more information, see www.bom.gov.au/weather-services/about/forecasts/about-graphical-forecasts.shtml

Bureau of Meteorology (BoM) Seasonal Outlooks

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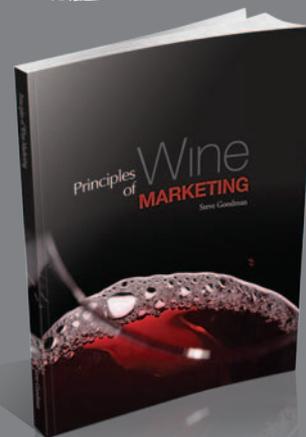
Cordon shredder

Nepenthe's cordon shredder can be used to remove diseased and dead sections of the vine cordon while regaining the wire (if the wire is in good condition). The removal of cordon due to frost or trunk disease damage can be done while leaving healthy parts of the cordon intact, ensuring vineyard uniformity. New wood can be retrained along the cordon wire without having to run new wires.

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Table 4: Practical considerations for winegrowers in wet seasons

Wet season related issue	Key challenges	Vineyard management options
Excess soil moisture	Soil profiles are full and soil moisture is unlimited. This can result in excessive vine vigour. Vines with continually 'wet' feet may be more susceptible to root rotting fungi such as Pythium, Phytophthora or Rhizoctonia.	Drain water from the vineyard if this is practical (pump water away from the vineyard if free water is present, install agri-drains if areas are consistently wet). Ensure soils are free draining (ie good soil structure and no impervious layers). Plant a cover crop (ie Chicory) that can 'soak' up excess water and actively compete with vines to reduce their vigour. Employ a deficit irrigation regime to try and reduce vine vigour. Monitor vine health and assess the root function of vines that are showing signs of decline.
Greater rainfall and humidity	Access to the vineyard may be compromised and there may be a reduced window for fungicide application, while there is a greater need for fungal control.	Access seven-day weather forecasts (see resources section) to help plan your spray strategy. Monitor the vineyard regularly, ensure you have access to machinery which can be used to cover large areas quickly, shorten your spray window, use a preventative strategy and use eradicant sprays as required. Manipulate the canopy to facilitate airflow.
Wet season related issue	Key challenges	Vineyard management options
Cool temperatures	Cooler temperatures and higher crop loads may delay key phenological stages and slow the ripening of grapes.	Ensure canopies are open enough to provide adequate (dappled) sunlight into the canopy, assess vine balance (fruit to shoot ratio), and manipulate fruit load if vines are overcropped.
Higher vine vigour	Excess vine vigour can increase shading in the renewal zone (resulting in lower bud fruitfulness the following season) and poor fruit development. Increased shoot length and density may result in increased humidity and elevated pest and disease pressure.	Use fixed and/or movable foliage wires, and install additional foliage clips so more than one lift can be carried out during the growing season to adequately capture the foliage if required. Alter the microclimate in the bunch zone (leaf pluck, shoot thin and/or crop thin), adjust pruning level and review trellis type, review inputs (water and fertiliser), and plant competitive mid row crops.
Greater likelihood for 'wet' season diseases	Wet winters can result in greater risk of trunk disease (Eutypa, Botryosphaeria) and Phomopsis infection.	If restructuring is necessary, make larger pruning wounds on dry days if possible and protect large wounds as they are made.
Greater likelihood of diseases during the growing season	Effective management of downy mildew, powdery mildew (a dry weather disease favoured by mild cloudy weather), Botrytis and other bunch moulds may be difficult.	Timing, target, treatment and technique! Monitor vines regularly, check weather forecasts, check spray coverage, tighten spray interval, choose treatment options carefully, and manage the canopy to promote airflow. Keep your options open! Avoid planting highly susceptible varieties in low lying areas with poor air flow
Post harvest care Getting ready for the next growing season	A higher disease inoculum load may be present going into the following growing season; vine carbohydrate reserves may be lower due to higher vegetative growth.	Apply post harvest irrigation and nitrogen if feeder roots are present. Focus your disease control strategies early in the following season.

For more information, see www.nepenthe.com.au/go/viticulture/contract-services/cordon-shredder

The Grapevine: from the science to the practice of growing vines for wine

The recently published book *'The Grapevine: from the science to the practice of growing vines for wine'* explores the links between the scientific principles and the practice of viticulture.

This text will be of great interest to anyone involved in viticulture and winemaking as, while it focuses on theory, it also contains practical aspects of growing vines for wine, along with many case studies demonstrating the practical implications of management decisions.

This is one of the most comprehensive books published on vine physiology since 'Biology of the Grapevine' that was published in 1992.

For more information, see www.piwpwinebooks.com.au/

Websites

The following additional resources may be useful in assessing vineyard profitability and producing fruit 'fit for purpose'.

- WGGa's VineBiz Financial 'Ready Reckoner', see www.wgga.com.au/programs/vinebiz-financial-management-tool
- The Grape and Wine Research and Development Corporation (GWRDC) publish a range of 'Innovators Network' resources including topical seasonal information and management options, see www.gwrdc.com.au/site/page.cfm?u=115
- The Australian Wine Research Institute (AWRI) provide a broad range of wine grape growing and wine making information, advice and services, see www.awri.com.au

Email Mary Retallack at mary@viti.com.au or visit www.viti.com.au for more information. 



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