



## SPECIAL EDITION – Hailstorm report & actions

### INTRODUCTION

This edition of VitiWatch aims to provide a comprehensive review of the recent hailstorm event in Barossa, with **sections covering what happened, damage assessment and potential actions so that readers can, if you wish, only absorb what is relevant to you in the interests of your time.**

Growers unaffected by this hailstorm may wish to skip this bulletin entirely or just read the section on **Downy Mildew** consequential to this recent storm.

Growers whose vineyards have suffered moderate-to-severe damage may wish to jump straight to the actions. Whilst some growers will be eager to act very quickly – or already have – holistic and thoughtful actions are more likely to deliver the best outcomes than singular solutions.

On complex issues such as this, opinions will also vary widely on relevance, significance and best practice. There is a very wide range of circumstances with this event, and what is portrayed and suggested in this bulletin won't necessarily align or suit everyone's situation, but hopefully it provides information that can help those affected.

BGWA members should have already received from BGWA via email, an **AWRI advice bulletin** which provides generalist advice on some potential actions to take after a hailstorm. This VitiWatch bulletin provides **more detailed coverage of this topic with reference to this specific event and Barossa viticulture.**

As always, **talk to your agronomist/adviser/agricultural supplier and your grape purchaser(s)/winemaker as soon as practical if there has been moderate-to-severe hail damage in your vineyard.** This dialogue should also be more frequent for the remainder of this season as things become clearer on how each block is behaving and what practices should (and shouldn't) be put into place so that each party can best manage the needs of their respective enterprises. Whilst this is also against a backdrop of heightened market uncertainty and other global disruptions, **past experiences with 'mother nature' events of this kind tend to show that people come together more than ever to achieve the best possible mutual outcomes.** The key is open and **two-way communication** that supports good understandings and relationships, and the avoidance of surprises and assumptions. When significant plans are made and agreed it is also good practice to **confirm these in writing** (eg email).

### BACKGROUND

Everyone involved in agriculture knows that springtime weather is inherently the most variable of the year, and which can bring risks or rewards depending on the crop type, timing and nature of each weather event. **In relative terms, Barossa' climate is very reliable for viticulture, although we do accept the inherent risks of some low-frequency but high-consequence weather events every year** – most notably spring frosts and summer heatwaves. Hail is more common in Australia during the spring months when surface temperatures are warm enough to develop intense thunderstorms with strong updraughts, and the upper atmosphere is still cool enough to support hail growth. Elevation also plays a big part due to more wind shear and updraft in those landscapes. Winter thunderstorms have weaker updrafts and smaller hail.

Some growers reading this bulletin will have personally experienced narrow-banded spring hailstorms in their lifetimes and especially in the Eden Valley region. A review of the BGWA vintage reports ([www.barossawine.com/barossa-vintages/barossa-vintage-reports/](http://www.barossawine.com/barossa-vintages/barossa-vintage-reports/)) indicates the most significant hailstorm events occurred in 1962, 1979, 1983, 1987 and 1993 in the ranges/Eden Valley region. There are personal reports of other isolated hailstorms over that time which also demonstrates the usually random and 'cruel' nature of hailstorms. Some research has been undertaken overseas on longer-term hailstorm patterns but there is no research as yet in Australia that points to higher future incidence in this part of Australia.

## 28 OCTOBER HAILSTORM

Unfortunately, the hailstorm on the morning of Thursday 28 October 2021 exposed for the first time many Barossa Valley growers and vineyards to the major impacts that hailstorms can have on their vineyards, property and livelihoods. This was no isolated event. The same storm also subjected many people in Barossa and some northern metropolitan areas to the serious effects of hail (and heavy rain) on their homes, vehicles, businesses and state of mind. Some isolated parts of the southern Riverland area also suffered strong wind and hail damage to vineyards later in the day, but nowhere near the scale and severity of the storm they endured in November 2019. Vineyards in the nearby wine regions of Adelaide Hills, McLaren Vale and Clare Valley were for the most part unaffected by this weather pattern. A relatively brief pattern of very strong winds also passed through these areas and Barossa later in the day. Insurance claims totalling many millions of dollars are expected from this event. Crop insurance is very costly and largely uncommon in viticulture, and whilst there are tools to mitigate against the impacts of frost and heatwaves (to an extent), it is virtually impossible to mitigate against the risk of hail damage.

This hailstorm occurred from about 10am onwards within the Barossa wine zone. Based on observed and reported damage in Barossa, the majority of the hail fell within a generally west-to-east moving band from Sheoak Log to Keyneton. The width and shape of the most damaging parts of the hail band – as evidenced by considerable vineyard damage - was quite varied but appears to have been anywhere between 5 and 11 kilometres wide. It also appears to have been roughly skirted between Gomersal road and the Sturt Highway. It went over the Barossa ranges between about Nuriootpa and Kaiser Stuhl, hitting Angaston, and then approximately skirting Mt McKenzie to the south and Moculta to the north just past Keyneton in the east. No reliable estimates or GIS mapping are available (as yet) on how many hectares of Barossa vineyard have been affected. Any early estimates quoted on tonnages lost are purely arbitrary and at best it will be several weeks before we could attempt to objectively estimate this. It is considerable, but in reality, we will never know for sure.

Reports on exactly where hail landed and caused damage will undoubtedly vary from this, but in the context of vineyard hail damage, it was generally minimal outside this approximate band. Vineyards south of Rowland Flat and further north of Nuriootpa were mostly untouched but some areas did experience heavy rain and strong winds that caused some shoot damage. Some northern parts of the defined Eden Valley region did receive severe hail damage, however a large part to the south and east of approximately Kaiser Stuhl generally received more minor hail damage. Heavy rain also fell at the same time in some areas which intermixed with smaller hail may 'soften' the impact compared to hail alone.

In some cases, observed shoot breakage was more-so due to sheer 'pressure' upon the shoots from a combination of heavy rain, wind and some smaller hail. This was evidenced by shoot tops broken at internodes but with very little shoot bruising and was more prevalent in N-S orientated rows and where young shoots were damaged against catch wires.

Very strong winds (89kmh max gust recoded at Nuriootpa) occurred later in the day and caused some shoot breakage, but in relative terms was largely minor. That these strong winds broke some previously storm-damaged shoots has added insult to injury for some growers, but badly fractured shoots often tend to fail at a later date anyway.

Numerous reports indicated that hailstone size varied from ~5mm to 20mm with a small percentage up to 25mm in some areas although hailstone size is rarely uniform with these spring storms.

The reported duration of when hail fell varied from ~2 minutes to 7 minutes and came from a mostly westerly direction.

### Barossa Weather stations summary: 28 October Hailstorm

Sources: <sup>1</sup> Bureau of Meteorology, <sup>2</sup> Greenbrain Barossa

Weather station	28-29 October rainfall (mm)
Nuriootpa BOM <sup>1</sup>	8
Gomersal west <sup>2</sup>	2
Gomersal east <sup>2</sup>	25
Lyndoch north (Altona) <sup>2</sup>	22
Steingarten Rd <sup>2</sup>	19
Bethany west <sup>2</sup>	26
Vine Vale (east) <sup>2</sup>	13
Marananga north <sup>2</sup>	12
Greenock <sup>2</sup>	9
Moppa (hills) <sup>2</sup>	6
Koonunga west <sup>2</sup>	7
Ebenezer (east) <sup>2</sup>	6
Keyneton (south) <sup>2</sup>	13
Wilton <sup>2</sup>	12
Kaiser Stuhl <sup>2</sup>	22
Craneford <sup>2</sup>	11
Eden Valley south <sup>2</sup>	12

## DAMAGE OBSERVATIONS

Below is a summary of general observations and reports from numerous growers and viticulturists. Some of these are expected and have obvious reasons behind them, but they are worth keeping in mind when assessing damage levels and deciding on actions.

- Hail damage to shoots, leaves and inflorescences (bunches) was more pronounced in N-S oriented rows than E-W, and generally more pronounced in cane pruned vines than spur.
- Higher inflorescence damage and crop-loss reported in cane pruned vines than spur pruned vines due to more pronounced damage and higher average crop weight per shoot.
- Varying degrees of leaf 'tearing' occurred in hail-affected vineyards. Small hail generally caused low damage. Leaf tearing and complete removal became increasingly severe with increasing hail size more so than the duration of the hailstorm.
- More damage on west-facing aspects than others.
- Considerable canopy rolling in cane pruned and young-cordon vines.
- Less shoot breakage and potential crop-loss in Grenache when compared to neighbouring Shiraz, although very open bush-vine Grenache was very vulnerable.
- Damage to Cabernet Sauvignon appeared less in some vineyards due to shorter shoots.
- No specific reports for other varieties, but more advanced canopies fared better.
- Hail size was the key determinant of vineyard damage, and hailstones larger than ~10mm caused increasing levels of shoot damage and inflorescence destruction and removal.
- Hailstones larger than ~15mm also caused damage to exposed canes and spurs. At 20mm+, whole shoots were removed, and younger vine cordons and trunks were also potentially wounded where there wasn't enough canopy protecting the cordon or canes. Larger stones also caused significant damage to other property (eg broken skylights, some solar panels and many dented vehicles).
- Rainfall from the Greenbrain Barossa weather stations showed large variations across the region. The table on page two provides a summary of rainfall over the 24hr period.



An example of extreme hail damage:

*100% of shoots broken at top + bruised, ~90% leaf-loss, >95% bunch loss*

## ASSESSING HAILSTORM DAMAGE IN VINEYARDS

The first step is to assess what damage has occurred in the vineyard and across each block. These are suggested factors to assess and keep in mind. Our first inclination is often to just look at how much crop has been lost, however in cases of moderate to severe damage it is also very important to consider everything in order to arrive at the most appropriate actions for the situation.

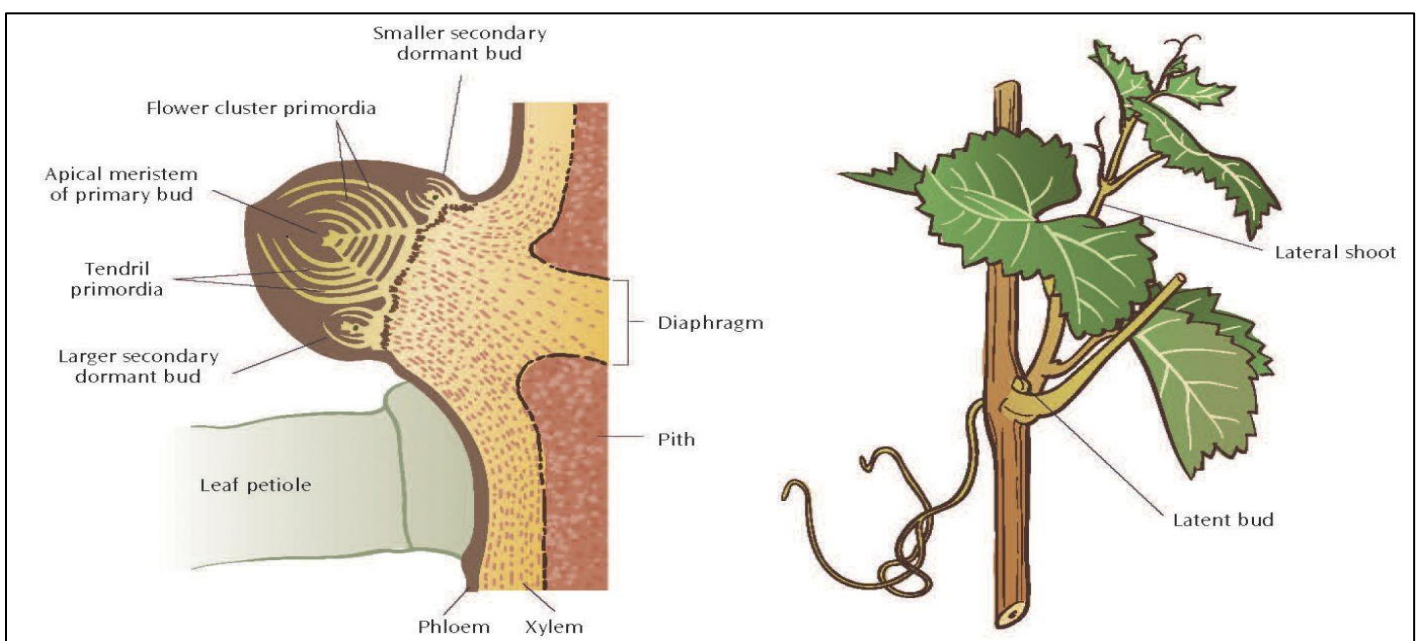
- aim to fully understand and **quantify the types and locations of damage on the vines** – eg leaves, shoot tips, shoot bruising, inflorescences, bunch stems, canes, spurs, cordon, trunk, canopy roll
- assess any **variations in damage across each vineyard block**
- assess current **growth stage and the uniformity** of this across vines. How far away is flowering?
- consider the **variety** and the **inherent vigour of the vines/site**
- what are or were the **goals of the block/vineyard for vintage 2022?** How critical is it these are still achieved if at all possible? - eg a high-end single vineyard wine. **What is the next best option?**
- what are the most important **goals of the block/vineyard after 2022?** These may affect actions now and at pruning next year and beyond
- It's well known that the complete extent of **hail damage can take 3 or more days to become clearer due to tissue bruising and cracking.** In moderate-severe cases, damage will need reviewing over several weeks to support a 'layered' approach to decision-making and actions

Where a lot of inflorescence damage has occurred, it can be helpful to take a random sample (a bit like a maturity sample) and assess each one closely to ascertain more accurately the potential extent of inflorescence damage and to provide some sense of changes in potential bunch weights. Looking at the most obviously damaged bunches on the vine and those lying on the ground can tend to over-estimate the real bunch and berry loss.

Careful assessment of shoot integrity and bruising over at least 20 vines will provide a more objective average than any quick visual scan of the vineyard. This can be helpful if more radical action is being considered such as shoot removal/pruning.

From a business and emotional point of view though, the time will quickly come when we will be best served by focusing on what we have - and not on what we have lost.

Grapevine shoot and bud structures *Source: Lodi Growers*



## BOTRYTIS

Botrytis risk is often the first issue or concern after a hailstorm, however **applying a botrytis spray immediately after a hailstorm will not *always* be merited or be the best economical decision in every case.** Botrytis and bunch-rots often create more diversity of concerns than any other fungal disease in winegrapes. Risk perception and the desire to 'do something' can also influence how we deal with the often indefinable and dynamic risks that botrytis can present.

Botrytis can colonise damaged shoots and leaves and can also grow or be harboured on dead plant tissue, but significant infection is rarely an immediate or one-time process as it requires extended periods of warm and high-humidity conditions.

The hailstorm period itself saw only a very short period of leaf wetness under cool conditions. There was tissue wetness that night, but this was relatively short (~6hrs) and at low temperatures (usually <12°C) at most sites. Whilst early season botrytis can increase inoculum that may provide the basis for higher risk of disease later in the season, that will only transpire into grape infections if the weather and infection-site conditions are highly favourable after veraison.

Significant botrytis/bunch-rot infections are rare in red varieties in Barossa and the BOM outlook does not suggest that the 2022 summer and vintage will be anything like 2011 was. Weather forecasts for later this week may provide conditions favourable to botrytis, but in open vine canopies the risk of later problematic infections would be low.

In congested vine canopies and where there is a lot of dead tissue from the hailstorm trapped inside, the risk of inoculum build-up is higher. Another point to keep in mind is that high rates of foliar nitrogen, especially under wet conditions, can actually increase botrytis growth.

The variety, bunch compactness, canopy characteristics, botrytis history and meso-climate will invariably have a much greater influence on bunch-rot risk than tissue damage in Barossa's climate. Wine regions with regular warm-wet summers (eg Upper Hunter Valley) would certainly need to take a different approach.

Hail damage in Eden Valley Riesling could certainly be a different case though. In some cases, one or more botrytis sprays would normally be built into the annual spray program, especially to mitigate the risk of latent infection establishing at flowering. The merits of botrytis sprays in Riesling will still be site and situation specific.

There are several botrytis-active products that could *potentially* be applied now and/or at 80% capfall, however it is well known that some of these won't be available this season. Some of these are also very expensive per hectare so it's important to consider their merits, especially if only very low yields remain. *Chlorothalonil* is a potentially good option at this time to provide some botrytis protection to damaged shoots and leaves, depending on assessed risk and the risk-aversion of the decision-maker. This active also provides DM protection although it's efficacy against botrytis is not high nor systemic like some other actives.

**If you don't have product in your shed, first seek advice from your agronomist/agrochemical supplier on what options are available – then talk to your grape purchaser.**

**If you do have product in your shed, first consider if now is the best time to apply this product?** It may be better to save this product for an 80% capfall application (subject to your grape purchasers' spray policy) to get more optimal control and benefit from what are often the most expensive fungicides. The biological products are amongst these options, however it's important to be aware of the pros and cons of these (some can be very high cost per hectare).

The best and most cost-effective botrytis control will invariably be a holistic and 'layered' approach to control options. This AWRI video is worth watching if you want to know more about these biological products in particular, and how to get the best from them <https://www.youtube.com/watch?v=bt-RQJAp0vA>

And lastly, if a botrytis spray is going to be applied now to protect damaged green tissue, very good coverage is paramount and especially with protectant-only actives. Don't assume that all shoot wounds are being covered just because the canopy is open. Dead tissue stuck inside congested canopies will be even harder to cover. Use test strips to make sure you are getting 'bang for buck' from these sprays.

## DOWNY MILDEW

Assessment of data from the Greenbrain Barossa weather stations network shows that **there is a significant *but conditional* risk that a Downy Mildew Primary infection (DMP) event could have occurred across some Barossa vineyards** on 28-29 October. A key determinant of this risk is **if there was sustained ground surface wetness** from when the storm started and all the way through to rainfall occurring in the early hours of Friday morning. This condition could have been met where there was hail and rainfall that led to surface pooling of water (eg in vineyard wheel tracks and gullies) into the night. Many areas had further rainfall and leaf wetness at >8°C around 1am to 3am to create potential DMP conditions *if* the prior conditions provided at least 16hours of continual ground wetness.

**The chances of a DMP having occurred is very low in the more northern parts of Barossa Valley due to very little rain** (eg Ebenezer, Kalimna and Koonunga). If a DM protectant had been applied within ~5days before this event, the risk of a DMP having occurred would be very low. The 'washing-off' effect of DM sprays from rain and hail can be a factor, although most sprays are more persistent on the leaf than we may think. **The weather forecast for this coming week may possibly bring the risk of a new DMP** also, however there is no risk of secondary infection by then even if a DMP had occurred on the 29<sup>th</sup>.

If a DMP did occur on the 29<sup>th</sup>, first generation oilspots would be expected to appear from about 7 November onwards based on forecast average temperatures. Maintaining DM protectant cover before oilspot appearance will in most cases prevent any significant and subsequent generations of oilspots or crop damage occurring if a warm wet night occurs after their appearance. As stated in previous bulletins, the first DMP of a season is often not found and presents low risks anyway. At this stage there is no real merit for the use of a DM eradicant spray, but **ongoing monitoring for oilspots is strongly recommended**.

Another important **spray program consideration** is that hail affected vineyards that do generate a **second crop** from new shoots (discussed below) will require a protectant spray program for DM and PM further into this growing season, **BUT** this must also give consideration to the EL stage of any primary crop present. This will require careful spray choice and timing to ensure adherence to spray policies. **In these cases, it is recommended to plan your spray program in conjunction with your grape purchaser(s)**.

This storm has not significantly changed the risk of Powdery Mildew (PM) at this time, but an ongoing PM program should of course be maintained, and monitoring kept up. If congested canopies do develop then spray coverage should also be reviewed to avoid late-season PM. Wettable sulphur at frequent intervals with good coverage can provide excellent PM control later into the season due to its 30-day withholding period, and at moderate rates has low risk of hot weather burn if humid weather application is avoided.

## TRUNK DISEASES (TD)

**Very large hail** can cause wounding to permanent parts of the vine (ie spurs, cordons and trunks) which **may create entry points** for *Eutypa lata* and *Botryosphaeria spp.* Whilst this is possible, there have been very few observations or reports of this being a significant or widespread issue. This could however be significant on younger cordons and trunks and **if there was minimal canopy to protect the cordon from large hail impacts**. Damage of concern is much less likely in older/old vines with many layers of bark.

This TD risk factor would also be of **less relevance to damaged canes which are going to be removed via pruning in the next 1-2 years** unless that damage is deep and on a significant percentage of wood that will be retained in the longer term. In these cases, it **might be advised to apply within 5-7 days a spray with activity against these fungi** - such as *tebuconazole* which may also be applied as part of a normal Powdery Mildew control program. Whilst not registered for use against *Eutypa*, *pyraclostrobin* may also have a place in this regard (and has activity against DM). However, **thorough coverage** of all damaged wood would be necessary for this **to be a truly effective strategy**.

**Very young vines** (eg 1-3 yrs old) **should be carefully assessed as soon as possible for permanent shoot/ wood damage** and action taken if large hail has caused concerning wounding.

**If complete shoot removal/pruning is undertaken in response to severe hail damage, it is recommended to apply a *Eutypa* spray within 5-7 days of completion**. More research is needed to better understand and quantify the risks of TD entry via green wounds, and to what extent sapflow ('bleeding') may mitigate this risk. However, until we have more data on this - and in view of the relatively low cost of *tebuconazole* products - this action would be wise. An exception to the merit of this spray could be in vineyards which are going to be reworked at least 15cm below major wounds within the next 2 years.

## SHOOT, CANE & CANOPY MANAGEMENT – AND 2022 PRUNING

There will be an assortment of different damage to vines after hailstorms depending on the factors discussed above. There are no one-size-fits-all solutions, however in the interests of trying to provide some useful tips, damage and potential actions have been categorized into three main groups.

### Severe-to-extreme damage

This is loosely defined as damage from large hailstones that has severely damaged and/or removed the majority of shoots; has removed in excess of half the leaf area and has removed in excess of ~80% of the original crop. In extreme cases, there may be nothing left but shoot stumps with almost no leaf or bunches. The picture on page 3 is an extreme example. These cases appear to be very much in the minority from reports to-date but are devastating both financially and emotionally. There are four possible options here:

- a) the radical measure of removing/pruning back all the remaining shoots to their base to promote all new growth from basal buds – with spur pruning. This option would need to be executed quickly, ideally within about 7 days. This is typically done by hand which is of course very labour-intensive and costly. The ability to find labour to do this would however be problematic for anything other than a small area. Another possible option is to undertake this with a machine pruner/hedger, or possibly even with a machine harvester. Neither of these machine options would do a neat job, but they might in some cases be the best option. It is better to cut the shoots – rather than break them out. If breaking, you run the risk of removing the secondary bud.

The purpose of this radical approach is to two-fold; 1) to ensure more normal and consistent canes for 2022 pruning, and 2) to provide a uniform and higher quality 2022 crop without a mix of primary and secondary crop (ie green and over-ripe berries) which may not be accepted, or would need selective handpicking. New growth will emerge from basal buds and some secondary or tertiary buds where the primary shoot has been broken out or cut. The fruitfulness of basal buds will vary across different varieties and vineyards. This is generally quite reasonable in Shiraz; can be good in Mataro and Semillon, but poor in Riesling. Basal buds also tend to be reasonably fruitful in Grenache and Cabernet Sauvignon, but this can vary greatly between vineyards. A realistic expectation would be to hope for about 50% of the normal crop (with spur pruning). A Eutypa spray should be applied after pruning, and the nutrition program should be stepped up to support new shoot growth. Flowering will of course occur later than normal, and harvest should be expected to be about 4 weeks later than normal. The diagram on page 4 demonstrates shoot and bud structures.

- b) do nothing in terms of shoot correction, but then be prepared to deal with two stages of crop. How much there will be of each will depend on what new buds burst, vine vigour, the variety, the fruit-set in each case, the season, and the nutrition and irrigation program. Selective hand-harvesting would likely be required, and the spray program would need to be adjusted to ensure spray compliance with the primary crop and enough protection for the secondary crop.
- c) the same as option b, but cut-off the primary crop bunches now – which might be acceptable if it's very small and there is confidence in pushing new shoots and a viable second crop.
- d) do nothing and put the vineyard into 'caretaker' mode for the remainder of this season, with minimal sprays but maintain vine health and then bring it back in crop for 2023. If the vigour of the block is inherently low and regrowth is unlikely to produce a viable crop even with added nutrition and water - and if there is no assured sale of the crop - this maybe the most economical option. Pruning would be challenging in 2022, and the 2023 crop could be limited. Another consideration is if the block has these traits and was being planned for replanting anyway, then abandoning it for this season could be another option.

None of these are attractive options of course, but it's worth considering all options; doing some sums on the economics, and to talking to others who may have been through any of these to help decide what's best.

These options would be potentially possible in a severely damaged cane pruned vineyard also, although option a) would be unlikely to deliver a decent crop due to limited bud numbers - and especially not if the laid-down cane also has significant damage which could inhibit strength and sap-flow. The challenge here would be decide if action needs to be taken now to ensure there are good canes for next year (eg remove some shoots to drive new ones). If there was a lack of suitable canes next year it may mean the vineyard needs to be spur pruned as best it can for one year and then returned to cane pruning in 2023.

### **Moderate-to-severe damage**

This is loosely defined as damage from medium-to-large hailstones that have damaged about a third of the shoots and leaf area and removed about half the crop. There are numerous cases of this kind. Crop-loss % is the most difficult and contentious to measure across these many variable cases. Whether the vineyard is spur pruned or cane pruned will also make a huge difference to how damage is quantified in these cases, and also have a large bearing on what the best actions will be. For the most part, these cases will be about supporting vine health and the remaining crop. It's also worth remembering that there can be some crop-loss compensation in grapevines when crop-load components are changed – such as higher fruit-set and/or larger berries.

Some very selective shoot thinning may be merited in some cases to drive shoot/cane growth where desired, especially if aiming to cane prune next year and/or if there is an imperative and reward to achieve the highest possible wine quality.

In all cases, there will be a surge of lateral growth from the top of broken shoots which will provide the continuation of shoot extension and leaf-area expansion necessary to drive growth, fruit development and ripening. In higher vigour spur pruned vineyards, and/or if nitrogen and irrigation inputs are too high, this lateral growth is likely to create quite congested vine canopies and possibly lower wine quality. Such vineyards may also push dormant buds on spurs that lead to further congestion and the potential to create second crop that could be very problematic to wine quality and disease control – or this may require green-thinning/removal at a later date.

In these higher vigour cases, it is recommended to avoid immediate and high nitrogen inputs via drippers. Higher vigour varieties such as Shiraz and Cabernet Sauvignon on moderate-to-high-capacity sites, and which had already developed good leaf area prior to hail damage, will likely have enough reserves to continue developing sufficient leaf area from laterals from hereon. In moderate-to-low-vigour spur and especially cane pruned vines which have lost significant leaf area, supporting development of undamaged shoots and new lateral tops with smaller frequent doses of nitrogen via drippers may be merited.

Foliar nitrogen in the form of multi-nutrient products generally won't promote unexpected extra shoot growth as the net inputs are relatively small compared to what can be input via fertigation. Nonetheless, there is no point applying a lot of foliar nutrients if the leaf area is low due to leaf loss or the vines are still in an early growth stage (eg late-pruned Cabernet Sauvignon). Some young vines (eg 1-2 yrs old) have also suffered damage and these will certainly benefit from more nutrients and stimulants via fertigation, and some foliar inputs once they have enough leaf area. Shoots will need to be closely inspected for damage when vine training, and an alternative shoot brought up where required.

Hail damage can also lead to brush-like vine canopies in spur pruned vineyards. These may make spray penetration more difficult later in the season and create more MOG with machine harvesting.

The hailstorm has also caused canopy-roll in some vineyards via sheer pressure and shoot loss. This may be especially evident in cane pruned vines and/or younger vines. This can have implications to fruit heat exposure, executing summer trimming and machine harvesting efficiency. It's also worth noting that shoots are devigorated when downward pointing, which may require extra work to rectify in reworked and/or cane pruned vineyards to promote the desired shoot growth and vine structure.

### **Low-level or minor damage**

This is loosely defined as damage from small-to-medium hailstones (or some sporadic larger hailstones) that have damaged less than 20% of shoots and removed less than about a third of the crop.

In regard to contemplating potential crop-loss and any actions it's also worth remembering: What is the targeted yield and how far away is the vineyard from that now?

The lower-level-damage vineyards tend to be on the fringes of the main hail band and for the most part won't require a great deal of change to their normal management programs. Crop compensation in bunch/berry size may in some cases see these vineyards return closer than expected to the originally estimated yield potential. Unless leaf-loss is significant, these vineyards should not need specific addition of nitrogen via drippers but would benefit from some foliar micronutrients and other stimulants such as kelp/seaweed. Once again, too much nitrogen could create congested canopies and other issues.



## VINE NUTRITION – CONSIDERATIONS AFTER HAILSTORM DAMAGE

Generalist advice after the significant loss of shoots and leaves after a hailstorm is to step-up nutrient inputs, however this should be **carefully considered with regard to the inherent vigour of the vines and site, and what you're hoping to achieve.**

**Immediately applying a big dose of nitrogen (N) via irrigation will not *always* be merited and in some cases could create more problems than what it hopes to achieve.** In higher vigour vineyards that have a high percentage of shoot tip damage and still have a significant amount of primary crop remaining, excessive N could lead to second crop formation which can bring with it a range of cost, disease and grape merchantability risks. This is less likely with more advanced canopies and vines nearer flowering but might be an issue with previously late-pruned vineyards. High rates of N can drive more lateral growth which may be desired in some cases, however higher vigour vineyards and especially Shiraz will push plenty of new and existing laterals where shoot tops are broken, even without adding more N.

**Vine balance has been seriously derailed in some vineyards** and just applying N, or too much and too soon, could tip the balance even more in the wrong direction. Vines that had a good amount of mature leaf area before hail damage would have already built some energy reserves that will support new regrowth.

The other consideration is that where there is the risk of canopy congestion/shading by flowering (eg mainly shoot tip and outer leaf damage), **very high rates of N may actually disrupt flowering and fruit-set processes.** Flowering processes require considerable carbohydrate energy derived from the leaves and roots but that isn't just about N. If flowering is near and leaf-loss has been severe, flowering could be affected by reduced energy. Where flowering is further away, formation of new mature leaves will help mitigate this.

**Lower vigour vineyards and those which had formed less canopy before severe hailstorm damage would more likely benefit from some N in the next two weeks,** but again it depends on what crop is remaining, if second crop formation is a risk, and how that would be managed.

As discussed above, **where full shoot removal is undertaken** and the goals are to drive re-growth for new crop *and* pruning wood next year, **fertigation with some N will be merited.** This doesn't necessarily need to be applied immediately as vine uptake will be quite low until leaf area starts to re-form.

Foliar applied products with higher N% isn't always the best option either. Where N inputs are absolutely sought to drive shoot growth, it is hard to get significant amounts of N into vines via foliar – foliars provide grams per hectare not kilograms. Foliar products are good for supporting leaf health. Also as previously noted, **too much foliar N may favour botrytis under ideal disease conditions,** and these should generally be avoided after veraison if there is any weather/disease risk. Lush growth is also more susceptible to Powdery Mildew.

What can be good practice after hailstorm damage is **foliar micro-nutrients** and other products that may **support plant health and resilience.** Physical damage from hail and wind is not the same though as oxidative-type stress from very low or high temperatures. **Foliar kelp/seaweed products** are another good option to support plant metabolic processes but there needs to be a reasonable amount of leaf area for these to be effective. It's best to **seek expert advice** with all these products and consider the health of the vineyard and the potential cost-benefits of all products.

Other key nutrients will be **Zinc and Manganese** in many Barossa Valley soils, but less so manganese in some Eden Valley soils (in lower pH soils). Supporting plant energy formation and micro-nutrient needs **prior to flowering** will need to be a priority in more damaged vineyards. This will likely require more than one foliar application. There are many multi-nutrient products with varying arrays of biostimulant-type compounds built-in also. **Talk to your agronomist/supplier about these.** If seeking to significantly boost specific elements up from known low levels (eg history of low zinc), it's often best to use nutrient-specific and chelated products for this instead of just relying on multi-nutrient products that may have low levels of everything. Potassium and Phosphorus are of course other very important macronutrients. These are common in many foliar products, however root uptake provides the vast majority of these and deficiencies of these aren't common in mature Barossa vineyards.

Another very important nutrient under these circumstances can be **Calcium** which is **important to cell wall structure** in plant tissues. Calcium may also support botrytis resistance in the grapes. **Past petiole tests** where available, or a knowledge of the soils and site attributes, will provide insight on whether this vital element should be boosted via foliar, or possibly using *AquaCal* via drippers (or an equivalent) and where some nitrogen is also merited.