

# Hail and severe storms

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## Introduction

Storms are usually short, localised, destructive and mostly unpredictable; a storm can destroy a crop in a few minutes. The latter is the main problem for vineyard managers, as once a storm is detected, it can often be too late to protect the vineyard. Most storms can be accompanied by hail. Hailstone size (Figure 31) and the effect on the vineyard, will depend on different factors including elevation, lower freezing zones, wind shear and the developmental stages of the grapevines and bunches when the storm occurs.



Figure 31. Hailstone size will influence the severity of the damage to grapevines. Photo: Kevin Dodds.

## Hail damage and the effect on grape berries and wine

Much information exists on how hail affects grapevines in the current and following seasons (Dry 1986), although it may take a couple of years to assess the total impact. Most of the information is about the reduced crop that occurs after hail, and thus the loss of income in the winery (Spellman 1999; Grainger and Tattersall 2008). However, the information relating to berry damage is usually brief.

Hail can affect the whole vineyard (Krstic et al. 2014) including leaves (Figure 32), fruit, shoots (Figure 33) and trunks, and damage can range from total crop destruction (Figure 34) to minor berry damage (Figure 35).



Figure 32. Hail can strip leaves from the vines. Photo: Darren Fahey.



Figure 33. Hail-damaged shoots. Photo: Darren Fahey.

Some storm damage, including split trunks and arms, can provide the ideal entry point for *Agrobacterium*, the bacteria inducing crown gall. These bacteria are always present but stay latent until suitable conditions arise. It generates tumours that destroy the vine's vascular system and can induce grapevine death, especially in younger plants. The only solution is to eliminate and burn the affected organs (Bonafant, 1984).





Figure 34. Hail can cause total crop destruction. Photo: Dr Bob Emmett.



Figure 35. Hail might only cause minor berry damage. Photo: Dr Aude Gourieroux.

### Storm damage before flowering

Plants receiving damage at inflorescence usually recover by growing laterals that might bear fruit at a later stage (Figure 36). Fruit quality is likely to be reduced because of the delayed development, lack of nutrients from the damaged leaves, and possibly a loss in yield, due to a lower rate of fruit set and other issues that can arise from the 'second cropping'.

### Storm damage before veraison

Storm damage before veraison will affect the whole plant, including the developing berries. Usually, the berries will either dry or drop (they will not be present at harvest) or heal by themselves (Fiola and DeMarsay 2013). For those that heal, they will have an uneven shape but will follow the normal development and ripening processes. Apart from the reduction in yield, the important thing with storms before veraison is to keep the canopy dry to avoid the inception of diseases such as mildew and rots.

### Storm damage after veraison

A storm during berry ripening will most likely cause the berries to suffer skin splitting (Figure 37). This is caused by two main factors:

1. mechanical injury from a hailstone
2. a sharp increase in berry moisture

Skin splitting increases the risk of infection by Botrytis and other rots. There are different vineyard techniques for 'drying' the berries and avoiding or controlling these infections, however, the critical success factor is timing; if the damage occurs during the weeks before harvest, some growers might recommend sequencing harvest. This means to pick the damaged bunches before infection occurs, even though they have not quite reached the expected maturity. Then at the estimated harvest time, pick the remaining 'healthy' bunches as usual.

After veraison, if the berries do not drop, the split skin will release some of the sugary pulp and juice which might increase the risk of infection, especially Botrytis, ripe, sour or bitter rot (Fiola and DeMarsay 2013).



Figure 36. Hail-damaged plants recover by growing laterals that might bear fruit at a later stage. Photo: Darren Fahey.

### Limiting the damage

Several prevention methods such as anti-hail bombs, canons and rockets have been implemented over the years, but they do not completely protect the vineyard from damage (Bonal, 1984). In some locations, generators of silver iodine crystals have been used to reduce the size of hailstones.

A more effective method is using nets to slow down the hailstones before they reach the vines. Netting will not completely prevent the damage but will reduce it. However, it is labour intensive to set the net over the rows just in case the storm comes and it is always possible that the nets might not be set on the right block.



Figure 37. Hail can cause skin splitting and this increases the risk of infection. Photo: Darren Fahey.

## Microbiome

Microbiome is a term that includes all the microorganisms (yeasts, bacteria, fungi) in a particular environment. Another term is microbiota, which corresponds to the microorganisms of a particular site, habitat or geological period.

Wine grapes are known to host a wide range of microorganisms (Barata et al. 2012) that are dependent on their growing environment. Many of these organisms are recognised for their role in grapevine health and wine quality. They contribute to the terroir that is essential for grape growing and winemaking, although the terroir is mainly influenced by the region or site, cultivar and climate where the grapes are grown (Bokulich et al. 2014), as well as the health status of the grapevine (Barata et al. 2012).

Wet and cooler weather after a storm is generally ideal for the majority of 'bad' microorganisms and these are the ones to keep an eye on. If the weather conditions are not favourable for their growth, the damage to the berries should be confined. It is important to note that the perceived expression of the terroir in the wines still needs to be experimentally tested using sensory methods.

## Take home messages

Before doing anything, assess the extent of the damage and check with your insurance company.

## Before veraison

After a storm, assessing the damage and removing the injured shoots and buds will tidy the vines, keep the undamaged bunches clear of infection and can promote some new growth. Applying a fungicide will reduce the occurrence of bunch rots and help damaged stem tissue heal.

## After veraison

Unfortunately, there is not much that can be applied after veraison to prevent bunch rots. It might still be possible to harvest the grapes, as long as the weather remains dry, and thus slows down the inception of *Botrytis* or *Aspergillus* (most commonly found). Removing damaged bunches will also help reduce infection spread.

If the storm happens within a couple of weeks of scheduled harvest, some people would recommend to sequence harvest.

## At the winery

Once the grapes have arrived at the winery, there is not much that can be done. The grapes should be sorted to remove as much of the obviously damaged berries/bunches as possible to ensure a better quality final product, i.e. wine. Test for the presence of *Botrytis* or *Aspergillus*, and then process the grapes as you would normally do with any 'infected' wine.

## References

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