# Botrytis Bunch Rot in Commercial Washington Grape Production

*Biology and Disease Management*

WASHINGTON STATE UNIVERSITY EXTENSION FACT SHEET • FS046E

## Key Information

- Botrytis bunch rot infections can occur during bloom and/or ripening.
- Botrytis bunch rot is favored by wet conditions during moderate (60–77°F) temperature periods.
- Canopy manipulation that increases air circulation, light penetration, and spray penetration into the fruit zone, especially around flowering, can help reduce Botrytis bunch rot.
- A fungicide program, when combined with canopy manipulation, is sometimes necessary to manage Botrytis bunch rot during dry growing seasons, but is essential during wet growing seasons.
- *Botrytis cinerea* can quickly develop resistance to fungicides, so proper selection of materials, rates, and use patterns are critical to preventing control failures. Cultural practices that reduce disease pressure also reduce resistance development.

## Introduction

Botrytis bunch rot (BBR) of grapes is caused by the fungus *Botrytis cinerea*. BBR symptoms are typified by a fuzzy, gray fungal growth on ripening and mature grape berries (Fig. 1). Infections often first appear as a single berry exhibiting symptoms, but under favorable weather conditions, BBR can spread throughout the cluster. While BBR is a sporadic problem in eastern Washington vineyards, and generally limited to years characterized by wet conditions during bloom and harvest, BBR has the potential to be very destructive. The potential for severe losses on a regular basis is greater in the cool and humid climate of western Washington.

*Figure 1. Botrytis bunch rot is caused by the fungal pathogen* Botrytis cinerea*. Rot symptoms on grapes are typified by a gray fuzzy growth, berry oozing, and berry desiccation. Photos by Gary Grove.*

## Biology and Disease Development

In order to effectively manage BBR, it is important to understand the biology of the pathogen and epidemiology of the disease (Fig. 2). *Botrytis cinerea* grows on many plant species and decaying plant matter. At a practical level, there is nothing that can be done to exclude it from a vineyard. However, it is a relatively weak pathogen on grapes, infecting tissue through wounds or natural openings. Common wounds occur from hail, mechanical damage, insect feeding, splitting of grapes during ripening, and diffuse powdery mildew infections. It often infects from an established base of dead or dying tissue, making flower debris, dying stamens, flower cap scars, and other plant debris important sources of inoculum for berry infection.

Botrytis bunch rot on a cluster can result from colonization and infection that can occur at two main times during the growing season. The first is BBR resulting from early season infections that remain latent (hidden) until the end of the season. Once the fruit begins to soften and accumulate sugar, BBR can become reactivated, and rot berries. The second is BBR that results from late-season (véraison and later) infections of injured and/or ripening fruit, and subsequent spread to abutting berries within a cluster. While the latter often appears to be the more commonly manifested expression of the disease (often accompanied by insect and animal feeding, or late season rain events), latent infections can be extremely destructive, especially when not expressed until storage or in the fresh market. Often, BBR symptoms seen at the end of the season are the expression of latent infections that occurred between bloom and cluster closure.

*Botrytis cinerea* thrives under high humidity (90%+), and can grow and infect when temperatures are between

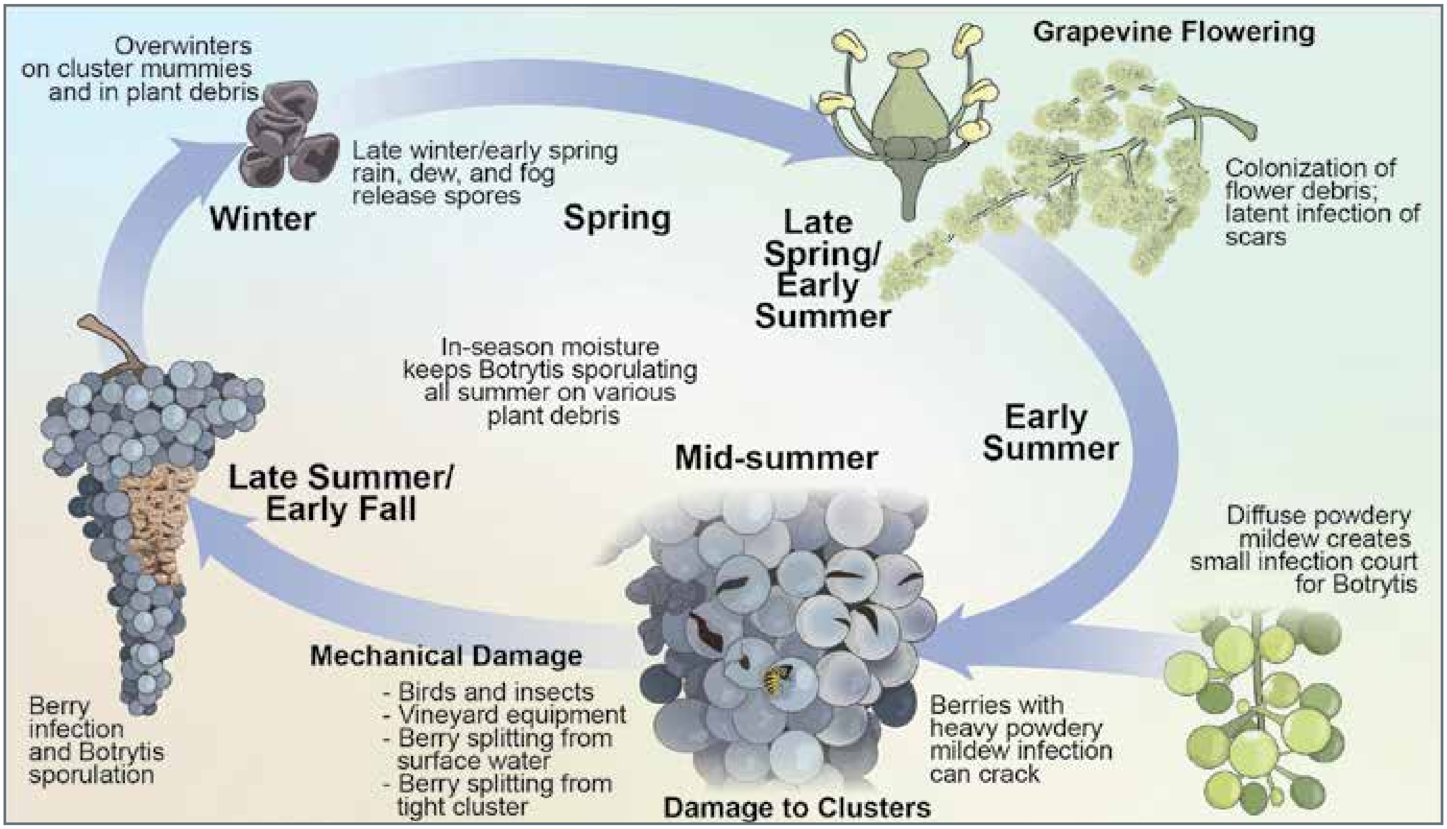


*Figure 2. The disease cycle of Botrytis blight and bunch rot has three main stages. First, the fungis overwinters as sclerotia in mummified clusters or on debris in the vineyard. During wet springs, it can directly infect growing shoots and leaves to cause Botrytis blight, which is rare in Washington State. It can also directly colonize grape flower debris and infect flower part scars, resulting in latent infections. If summer conditions are warm and wet, green fruit can express rot symptoms. If there are late summer rains or heavy dew and damage to the fruit, ripening clusters can express latent infections, or be directly infected, resulting in rot symptoms. Botrytis cinerea can reproduce very rapidly if conditions are right during the summer and fall. Figure by Charlotte Oliver, Washington State University.*

35 and 90°F, but thrives at temperatures between 60 and 77°F. Free moisture is also favorable for infection. Flower infection can occur with as little as 1.5 hours of continuous leaf wetness, whereas mature fruit infection requires a wetting duration of 14 hours.

## Cultural Practices for Disease Management

*Botrytis cinerea* can grow under a wide range of conditions, but disease pressure is greatest in the cool, damp conditions created in dense grape canopies. **Therefore, any form of canopy manipulation that increases sunlight penetration and air circulation into the canopy, and especially the fruit zone, will help in the management of BBR.** This can be done through shoot thinning, canopy vigor management (controlled nitrogen application or deficit irrigation), or the physical removal of leaves above and below the fruit clusters. In Washington vineyards, removal of one leaf below and up to two above the cluster is generally sufficient to achieve the desired benefit.

Leaf removal has proven to be a very effective way to manage BBR outbreaks. In California, leaf removal at fruit set provided better control of BBR than a standard fungicide program. Leaf removal improves spray penetration of the canopy, deposition on clusters, and air circulation around clusters. Improving air circulation during bloom is also important, as this is the period of development during which grape clusters are particularly prone to establishment of latent infections. In more humid climates (e.g., western Washington), leaf removal improves BBR management, but may not provide complete control.

If you are in the process of vineyard establishment and weather conditions are conducive for BBR development in your location, selecting clones of your desired variety that have loose cluster architecture is advised. Loose cluster architecture reduces the risk of trapping flower debris within the cluster as it closes, reduces the likelihood of berry splitting due to cluster pressure during ripening, and allows better fungicide penetration into the cluster. Compact clusters (touching berries) favor within-cluster spread of rot (Fig. 3).

*Figure 3. Cluster architecture is one determinant of a cultivar's supposed susceptibility to Botrytis bunch rot. Loose cluster architecture (left,* Vitis vinifera *'Thompson Seedless') generally reduces environmental favorability for Botrytis bunch rot compared to tighter cluster architecture (right,* Vitis vinifera *'Chardonnay'). Photos by Michelle Moyer.*

While eliminating Botrytis from a vineyard is nearly impossible, removing inoculum sources around the fruit zone can potentially reduce disease development. *Botrytis cinerea* can overwinter as sclerotia (small, durable fungal structures) in mummified clusters or rachises (Fig. 4). Therefore, removing these clusters and rachises during winter pruning may help improve management.

Research has shown that inconspicuous (diffuse) colonies of the grape powdery mildew pathogen (*Erysiphe necator*) can predispose grapes to BBR (Fig. 5). Rigorous control of powdery mildew within the window of maximum berry susceptibility (immediate prebloom to 4 weeks postbloom) will prevent these inconspicuous colonies from becoming established and providing a base for further damage due to BBR.

## Botrytis Bunch Rot vs. Sour Rot

Botrytis bunch rot can sometimes be confused with sour (or summer) rot because both diseases display rot symptoms at similar times in the vineyard and the color of infected fruit (before leaking or fungal sporulation) is the same. The major differences between the two are: (i) sour rot tends to be a "wet" rot (fungal sporulation is not seen), (ii) the sour rotting cluster tends to smell like acetic acid (vinegar), and (iii) sour rot is often accompanied by noticeable populations of fruit flies. Sour rot is caused by an assortment of endogenous yeasts and bacteria (e.g., *Acetobacter*) that are vectored to the fruit through fruit flies laying eggs, and their maggots feeding on the fruit. Fruit are prone to sour rot development after the start of véraison. While BBR can be managed with fungicides, sour rot is best managed through management of the fruit fly.

## Fungicide Programs for Botrytis Bunch Rot

Cultural practices such as proper canopy management and fruit-zone leaf removal are the first line of defense against

*Figure 4.* Botrytis cinerea *can overwinter as sclerotia in mummified clusters and rachis that are inadvertently left in the vine canopy after harvest. This position is perfectly placed to serve as a direct inoculum source in the fruit zone of the canopy. Removing these mummies during spring pruning may reduce inoculum. Photo by Catherine Jones.*

*Figure 5. Grape powdery mildew can predispose fruit to Botrytis bunch rot in two ways. First, diffuse, or light powdery mildew infections can create small necrotic spots on the grape berry skin, which are perfect avenues for* Botrytis cinerea *infection (left). Second, clusters with severe powdery mildew infection can split late in the growing season, providing a direct wound for* B. cinerea *infection (right). Photos by Michelle Moyer.*

BBR, and not only enhance chemical control, but are critical to the very sustainability of chemical control (see Managing Fungicide Resistance Development below).

Because of an overlap in the timing of grapevine susceptibility to powdery mildew and BBR, and because powdery mildew can predispose clusters to BBR, the use of dual-control fungicides from bloom to bunch closure is recommended. Recommended label rates often differ for the two diseases. Use the highest labeled rate provided for control of both. Combining these materials with wettable sulfur (or other products with low risk for fungicide resistance) is recommended to improve control and lessen the risk of fungicide resistance development to powdery mildew.

## Managing Fungicide Resistance Development

*Botrytis cinerea* can and has developed resistance to many commonly used fungicides, but the extent of this resistance has not been documented in Washington state. This process of resistance development to fungicides is accelerated when proper resistance management guidelines are not followed. Always follow label instructions on the maximum applications per site/ year and the number of sequential applications. The Fungicide Resistance Action Committee (FRAC) has developed resistance management guidelines for many of the common fungicides used against Botrytis, including FRAC 7, FRAC 9, FRAC 11 and FRAC 17 products. The best resistance management practice at this time would be to try and limit the use of a particular FRAC group to 1 time a season, and if it has to be used more than 1 time, to never use it in sequence (i.e., use another product that targets the same disease, but is of a different FRAC group, between the two applications).

Some of the formulations are prefabricated mixes of different active ingredients; ensure that you are aware of the active ingredients and their target organisms or diseases. Rotating formulations is not the same as rotating fungicide classes or FRAC groups, and many of these new formulations contain fungicides in the same chemical class. Do not use rates below the minimum specified on the label and do not practice other rate-reducing practices such as alternate row spraying. Botrytis sprays applied at véraison or later generally perform best when applied using relatively high volumes of water—up to 100 gallons per acre. Monitor weather conditions and spray using the shortest interval if conditions are conducive for BBR infection to prevent population build-up between sprays. Fungicides are ineffective for managing sour rot.

## Literature


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