

Blueberry Anthracnose

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Anthracnose or ripe rot is a common pre- and post-harvest fruit rot of highbush blueberry in British Columbia. It is caused primarily by the fungus *Colletotrichum acutatum*. Anthracnose occurs in all blueberry producing areas in B.C. The primary concern with anthracnose fruit rot is the impact of reduced shelf-life and poor quality fruit on the fresh market.



Fruit infected with anthracnose showing sunken areas near blossom-end and shrivelling



Masses of salmon-orange coloured wet spores are produced on infected ripe berries

Symptoms

The fruit is the most susceptible to anthracnose. Berries do not develop symptoms until they are mature or ripe. The initial symptoms usually appear near the calyx (blossom)-end on ripe fruit as dark, sunken areas and the infected areas may shrivel with time (Figure 1). Within a few days, bright salmon-orange coloured, wet spore masses can be seen on the shrunken areas (Figure 2). These sticky spore masses often spread to other berries by rain, irrigation, splashing water and contact during harvest, resulting in substantial pre- and post-harvest losses.

Spent fruit trusses appear to be the main site where the fungus overwinters. When trusses are infected during the growing season they do not show visible symptoms. However, in the spring it is possible to observe salmon-orange coloured spore masses produced on infected trusses. The fungus also infects leaves, buds, twigs and canes. New shoots and leaves may become blighted by the anthracnose fungus in the spring. On twigs, infections usually originate from the infected buds and may kill portions of the twig. Dark brown, canker-like lesions with fruiting bodies (spore producing structures) may develop on young canes. Anthracnose on leaves, twigs and canes has not commonly been observed in B.C.

Disease Cycle

The fungus over winters on live twigs and flower buds and also on dead twigs, spurs and trusses. In the spring, the fungus produces spores that spread by rain, over-head irrigation and water-splashes. A minimum of 12 hours of continuous leaf/fruit surface wetness and temperatures between 12 and 27 °C are required for the infection to occur. Although the fungal infection on berry is only obvious when fruit is mature, the fruit can be infected anytime from flowering to harvest. After the fungus enters the developing berry it remains dormant until the berry starts to ripen. At this point, the fungus begins to colonize the infected area and produce hydrolytic enzymes which destroy plant cell walls. Damaged cells lose their cell contents and integrity, thus the infected area becomes sunken and shrivelled. Spent fruit trusses can be infected after harvest. Recent studies also suggest that some infection may occur even at cooler temperatures.

Disease Control

Prevention

Plant resistant blueberry varieties. Avoid planting cultivars “Berkeley”, “Bluecrop”, “Blueray”, “Coville” and “Jersey” on sites prone to anthracnose. Rainy weather and over-head irrigation during bud-break and fruit development provide an environment conducive for anthracnose infection. There is nothing that one can do to avoid wet weather in B.C. However, the following cultural practices will help reduce leaf/fruit surface wetness and excess moisture in the environment.

- Prune to improve air movement where bushes have dense foliage and are planted close together. A less dense canopy encourages faster drying of foliage and fruit surfaces.
- Where over-head irrigation is needed, it should be started early in the morning so that plants can dry off during the day. Schedule pesticide spray events in the morning or early afternoon hours; this will allow ample time for excess moisture to dry off. The objective is to keep the duration of plant wetness well under 12 hours to avoid new infections.

Since the fungus overwinters on infected twigs and trusses, removal of all dead twigs and trusses is recommended. Trials in Washington State found that pruning and removal of dead twig and truss from bushes can reduce anthracnose infection by 50%. Spores can also be spread around on flats, totes, tools and machine harvesters. Make sure such items are disinfected before and after using them in fields.

Eradication & management

Follow a scheduled fungicide spray program, particularly for fields that have a history of anthracnose. Even with a fungicide spray program, expected results may not be achieved if the disease pressure is very high. Therefore, try to prevent/minimize the amount of inoculum (spores) and sources of infection in the field (see above under *Prevention*). Refer to Table 1 for information on fungicides that have been registered for anthracnose management. Strictly adhere to product label instructions when using each chemical.

To prevent resistance development in the pathogen to a fungicide:

- Never apply a fungicide below the recommended rate.
- Use fungicide at the highest recommended rate when disease pressure is high.
- Do not apply the same fungicide repeatedly or not more than 2 consecutive sprays. Rotate fungicides belonging to different chemical groups.
- Use of fungicides should be based on an IPM program

Post-harvest fruit handling

Post-harvest handling of berries is one of the most important components in preventing anthracnose on harvested berries during storage and in fresh market. Anthracnose will not develop on fruit that are promptly cooled after harvest.

Remove/screen/avoid field heat from harvest berries as soon as possible. Bring flats into the packing shed as quickly as possible after picking. Store the flats with berries in the shade if they cannot be transported to a cooler place right away. It has been demonstrated that, where berries are cooled immediately to 2°C within 2 hours of harvest, there is less rot than if berries are brought to 2°C over 48 hours. Anthracnose develops faster on overripe berries. Therefore, do not delay harvest or allow mature/ripe berries on bushes for a prolonged period. Harvest at the right time.

Useful References:

- Integrated Pest Management for Blueberries, Washington State University, Washington, USA
- Blueberry Disease Facts: Anthracnose (Ripe Rot), Cornell University, New York, USA
- Pacific Northwest Plant Disease Management Handbook: Blueberry Ripe Rot, Oregon State University
- Polashock, J.J., Ehlenfeldt, M.K., Stretch, A.W. and Kramer, M. (2005). Anthracnose fruit rot resistance in blueberry cultivars. *Plant Disease* 89:33-38.
- Wharton, P.S. and Diéguez-Uribeondo, J. (2004). The biology of *Colletotrichum acutatum*. *Anales del Jardín Botánico de Madrid* 61(1):3-22.
- Wharton, P.S. and Schilder, A.C. (2008). Novel infection strategies of *Colletotrichum acutatum* on ripe blueberry fruit. *Plant pathology* 57:122-134.

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Table 1. A brief summary of registered fungicides and label information (for detailed information on each fungicide, please read the Product Label instructions carefully).

Product Name	Chemical or Biological Ingredient	Mode of action	Chemical group	REI ¹	PHI ²	Application
Bravo 500	chlorothalonil	preventative, non-systemic	M5	48 hr	54 days	use preventatively; do not exceed 3 applications per season; apply at 10-14 day intervals; apply at green tip, pink bud and petal fall
Quash	metconazole	curative, systemic	3	3 days	7 days	use preventatively; do not exceed 3 applications per season; apply at bloom and, thereafter, 7-day intervals
Quilt	azoxystrobin & propiconazole	preventative & curative, locally systemic	3 + 11	12 hrs	30 days	use preventatively; do not exceed 4 applications per season; apply at bloom and, thereafter, 7-10 day intervals
Pristine WG	boscalid & pyraclostrobin	preventative & curative, locally systemic	7 & 11	until dry - 24 hrs*	0 days	use preventatively; do not exceed 4 applications per season; apply at 7-14 day intervals; do not apply as a tank mix
Switch WG	cyprodinil & fludioxonil	preventative, non-systemic	9 & 12	12 hrs	1 day	use preventatively; do not exceed 3 applications per season; apply at 7-10 day intervals; begin application at early bloom
Cabrio	pyraclostrobin	preventative & curative, locally systemic	11	1 day	1 day	use preventatively; do not exceed 4 applications per season; apply at 10-14 day intervals; begin application at early bloom
Allegro	fluzinam	preventative & curative, locally systemic	29	1 day	30 days	use preventatively; do not exceed 4 applications per season; apply at 7-10 day intervals; begin application at early bloom

¹REI - re-entry interval

²PHI - pre-harvest interval