

OHIO FRUIT NEWS

Research and Recommendations from Experts at The Ohio State University

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Summer Fungal Fruit Rots and Their Management

By Lianna M. Wodzicki- Graduate Research Assistant

* This article was first published as a blog on the <u>Smart Apple Spray</u> website.

As the final cover sprays are applied in apple orchards, you may notice some unsightly spots on your fruit. Fungal fruit rots can cause significant losses in yield and reduce fruit quality. These diseases often appear just prior to harvest, during harvest, or in storage.



Bitter rot (*C. acutatum*) symptoms on the apple surface (top) and internally (bottom).

If these rots are not prevented through the integration of sanitation and cultural practices, and often fungicides, they can cause severe losses. The expression "one bad apple spoils the whole barrel" is a good description of what fruit rot can do. Bitter rot, black rot, and white rot are the three disease that cause the most damage to fruit, often rendering them unsalable.

Bitter rot (caused by the *Colletotrichum acutatum* fungal complex) is characterized by brown, sunken spots. After rain periods, these spots can develop masses of orange spores on the surface. Internally, the discoloration of the flesh tapers down to the core in a V shape. The discolored flesh is corky or spongy to the touch. Bitter rot is a major problem in Ohio due to prevalence of warm and humid summers. Diseased fruit, infected twigs and mummified fruit (in the tree and on the ground) are the primary

sources of these fungi.

Black rot (caused by the fungus *Botryosphaeria obtusa*) is a dry rot that almost always starts at the calyx (blossom end) of the fruit. The spots are dark brown and black in color with black specks (fungal fruiting structures) scattered over the lesions. Unlike bitter rot lesions, black rot lesions are not sunken. In addition to fruit symptoms, this fungus can cause a leaf spot (frogeye) and/or sunken cankers on branches.

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Inside This Issue:



Grower's Corner

How can I control robins in the vineyard?

This question comes from an Ohio grape grower who has been struggling to keep robins away from his grapes. Members of the IPM Great Lakes Fruit Workers Group (GLFW) provided the response to this question.

Robins, starlings and grackles are probably the most common bird pests in Ohio vineyards. There are several strategies that can be used to deter birds. Netting, visual or auditory scare devices, chemical deterrents, lasers, and birds of prey (such as falcons) are some of the options available to growers.

The most consistently effective method to keep birds from pecking the berries is bird netting. However, net installation and removal can be a large undertaking, and is costly.

Scare devices such as mylar tape, cannons or distress calls can provide short term bird control. Air dancers, such as those used by car dealerships to attract attention to their sales lot, are a newly tested scare tactic that have been shown to be effective on small fruit farms in New York state. Moving the scare devices around the vineyard every two weeks is recommended as birds will soon learn that these tactics won't hurt them!

The use of lasers and drones to deter birds in the vineyard are in their infancy. Both methods mimic predator movement and induce anti-predator avoidance responses in the bird. Wine grape growers in California, Washington, Canada and Australia have reported decreased losses using lasers and growers in Australia are finding success with drones. Drones and lasers are expensive and may not be cost effective for small- to medium scale vineyards.



Image courtesy of the Wall Street Journal

The chemical deterrent methyl anthranilate (active ingredient in Avian Control) is another tactic that can be used in the vineyard to deter birds. Methyl anthranilate is a food additive that tastes bad to birds but does not harm them. Methyl anthranilate should be applied every 6-8 days or after a rain event. Similar to the scare tactics success using methyl anthranilate has been inconsistent.



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Black rot: Sporulating cankers (areas of infected and dead bark), diseased leaves and mummified fruit are all sources of the fungus, although cankers are the primary source of new infections in the spring.



Black rot (*B. obtusa*) spots on apple fruit starting at the calyx.



Frogeye Leaf Spot (*B. obtusa*) on an apple leaf.

White rot is caused by a similar fungus to black rot - *Botryosphaeria dothidea*. However, unlike black rot, white rot is a soft rot. Infected fruit quickly turn to mush and have a strong sour smell. Light tan lesions form on the fruit and lesions on light skinned varieties can have a reddish halo. White rot lesions on red skinned varieties appear bleached. Internally, the lesions are soft and extend all the way to the core. The disease frequently appears after periods of hot and wet weather in mid-summer. The fungus also causes a stem canker that girdles the branches. While fruit on the orchard floor can serve as a source of spores, cankers are the primary source of new infections in the spring.

Fruit Rot Management: The fungi that cause bitter rot, black rot and white rot can be stealthy, infecting the fruit without showing symptoms until environmental conditions are just right. Because

there are no resistant fruit varieties and infections can occur anytime from petal drop through storage, prevention is key to successful management.

Any practice that helps to maintain trees in a healthy, vigorous condition is critical for controlling the canker phases of fruit rot diseases. Cankers generally develop only on stressed or weakened trees, especially winter-injured trees. Prune trees annually and maintain a balanced fertility program based on soil and foliar nutrient analyses.

Orchard and tree sanitation are critical to preventing new infections in the late spring. Dormant season removal of dead wood and mummified fruit in the tree as well as



White rot (*B. dothidea*) lesion on light skinned apple.



Image 5. Internal white rot (*B. dothidea*) symptoms of apple.

cleaning up the orchard floor after harvest will reduce inoculum levels in the orchard and ultimately reduce the amount of fruit rot. However, during Ohio growing seasons warm temperatures, high humidity, and rain promote infections and disease development, necessitate fungicide sprays.

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Rot Management: Fungicides* Fruit are recommended from petal fall through harvest. When frequent rains and warm weather persist leading up to harvest, it's advisable to apply a fungicide that targets all three diseases and that will protect the fruit after harvest and during Fungicides in FRAC group 11 (i.e. storage. Pristine or Luna Sensation) are Merivon. particularly effective at this stage of production. One of these fungicides mixed with Captan is recommended for the last cover spray of the season. Because growers will often use FRAC 11 fungicides for primary scab management early in the season, they may need to use a fungicide with a different FRAC code (i.e. FRAC 7 or 9) to manage primary scab in order to meet fungicide registration requirements for the total number of applications permitted in a season. In addition to a late season application of a FRAC 11 fungicide, postharvest fruit rots can be managed using best sanitation and handling practices.

Harvesting practices that minimize bruising or wounding, clean and sanitized harvest bins, and storage temperatures below 40 F with low humidity will reduce the risk of fruit rot infections and rot development.



Diseased apples left on orchard floor are a primary source of inoculum.

*Product information including FRAC codes, Preharvest Interval (PHI), and rates are provided in the Midwest Fruit Pest Management Guide. Before using fungicides consult the product label and follow all usage requirements.

Marssonina Leaf Blotch of Apple

By Amy Miller- Graduate Research Assistant



Irregular leaf lesions of Marssonina Leaf Blotch

Marssonina leaf blotch (MLB), caused by the fungus *Marssonina coronaria*, is an apple leaf disease unknown to many Ohio growers. The disease was first reported in Japan in 1971 and has been spreading around the globe, with serious outbreaks at different points in time in East Asia, Europe, South America, and North America.

Detection of and attention to this disease in eastern North America has only occurred within the last 5 years, with reports of outbreaks from Connecticut in 2016, Pennsylvania in 2017, New York in 2018, and North Carolina in 2019. This year we observed leaf symptoms on apple seedlings grown in eastern Ohio for research purposes that at first glance appeared to be those of frogeye leaf spot or Glomerella leaf spot. However, upon further investigation (spore shape and size) we diagnosed the disease as MLB.

Marssonina Leaf Blotch of Apple continued from page 4

This disease has NOT been reported or confirmed in any commercial apple orchard in Ohio as of this publication date. We are now working to confirm the diagnosis using DNA-based methods.

Disease symptoms: Early symptoms appear as small reddishpurple spots on the upper surfaces of leaves in mid-to-late summer. These initial symptoms be confused can for frogeye leaf spot (caused by Botryosphaeria obtusa), but MLB lesions are often more irregularly shaped. As MLB lesions age, they coalesce into irregular brown necrotic patches that are similar in appearance to Glomerella leaf spot (GLS; caused by Glomerella cingulata). At this stage of infection GLS and MLB can only be distinguished at the microscopic level. Eventually the leaf tissue will vellow around the necrotic areas, and the leaves will prematurely drop. In eastern North America only leaves are affected however, fruit symptoms have been reported in other parts of the world.



Marssonina Leaf Blotch affects mature leaves, not new growth.

Management: All known apple cultivars are reported to be susceptible to MLB; however, variation in susceptibility has been observed among cultivars in North Carolina and Connecticut. True cultivar resistance across different climates remains to be seen. Hot and humid weather conditions are correlated with higher disease incidence. For chemical control, fungicides such as Captan easily control the disease, and intensive apple scab spray programs can also control MLB. It is possible that MLB is present in Ohio apple orchards but has not been observed because fungicide spray programs for scab are controlling it. MLB has the potential to be an issue for growers who have scab resistant apple cultivars and thus don't use an intensive spray program or grow organically. The same orchard sanitation cultural practices used to combat apple scab can also be effective against MLB, such as flail mowing downed leaves in the fall and applying urea.



A. A fruiting body (acervulus) of Marssonina Leaf Blotch observed under a dissecting microscope. **B.** Spores of *Marssonina coronaria* observed at 400x magnification.

For now, growers in Ohio should be aware of this disease and consider it when trying to diagnose leaf diseases. However, growers should not consider it more of a threat to crop management than other common fungal leaf diseases if fungicide and best sanitation practices are being used. We will keep growers informed as new data are available for this emerging disease.

Invitation to Participate in Soilless Potting Mix Survey

Soilless substrate is synonymous with growing media, potting mix, or components of solids used in hydroponics.

In fruit production, soilless substrates are commonly used in container grown blueberries or strawberries and in producing plug plants of fruit crops. In vegetable production soilless substrates are common in greenhouse production. However, the use of soilless substrates can be expanded in many directions.

A team of researchers at various universities (including the LSU AgCenter, USDA, NC State, University of Georgia, UC Davis, Virginia Tech and University of Guelph) have recently been awarded with a national planning grant to identify the needs of specialty crop producers when growing in soilless substrates. They would love to know if you have ever grown fruit or vegetable crops in soilless substrates. What information do you need? What is holding you back from using or growing with soilless substrates?

The survey is available online through the link (https://bit.ly/2ZLNIkn) or QR code provided. To learn more about the project visit their website at www.soillesssubstrates.org.

Fruit Tree Dormancy

By Dr. Diane Doud Miller- Tree Fruit Extension and Research Specialist

Fruit trees are becoming dormant now during this 'fall side' of winter. In response to the days becoming shorter and the night temperatures cooler, fruit trees drop their leaves and enter a state called 'endo-dormancy'. Endo-dormancy is an internal dormancy which prevents the trees from growing no matter what the outside temperature is. This synchrony between plant and environment is present in all our temperate zone woody plants, enabling trees to survive the winter. In endo-dormancy, as the weather becomes progressively colder, the trees become able to withstand the colder weather due to internal changes in physiology. We can consider that the trees are hibernating (although the deer, rabbits and voles considering the shoots, bark and roots as food are not \bigcirc so please apply protective measures to guard the trees). Also consider applying white latex paint to trunks of fruit trees to prevent winter sunscald. Although this is more common with thin-barked species such as peach, any fruit trees with trunks very exposed to winter sun heating can split when nighttime temperatures drop rapidly.

Apple trees are quite hardy to Ohio winters assuming the fall temperature declines slowly, allowing the trees to fully become dormant. Fortunately, in Ohio that is our normal situation. But in the upper Midwest (Iowa, Minnesota) apple growing has been limited by such fall freeze events, e.g. a 60 degree drop over 24 hours or so. What we are seeing in Ohio, as our winters become milder, is what we might call a longer fall, shorter winter, and longer spring; calendar dates aside. A longer fall allows trees to enter endo-dormancy just fine.



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Fruit trees differ by species and variety in how much chilling is required to satisfy 'endo-dormancy' and enable the tree to respond to warming temperatures on the 'spring side' of winter. For apple trees around 1000-1500 hours of chilling at 40 degrees F ends endo-dormancy. For peach, the amount of chilling required is less, perhaps 600-800 hours.

Amount of chilling is measured within the tree by the gradual degradation of the growth-inhibiting substances which built up during fall into dormancy. entry That degradation occurs most rapidly at 40 degrees F. So, to satisfy endodormancy most rapidly hold a tree at 40 degrees F for 1500 hours, put it environment conducive an to growth, and it will grow. As a scientist doing research on fruit trees, we do such tricks with container grown apple trees. Put potted trees in a cooler held at 40 degrees F for 1500 hours in the late fall and then bring them back into the greenhouse in late January to begin experiments. 1500 hours is just 62 days.



Dormant grapevines

Outdoors, fortunately, it takes a few months to meet that 1500 hours at 40 degrees F, as temperatures above 40 and below 40 are less effective at degrading growth-inhibiting substances. It might take 4 or more months before the endo-dormancy is satisfied, and the tree can begin to grow when outside temperatures warm. But, the shorter the innate chilling requirement (e.g. peaches) and/or the more time our calendar fall/winter is warming (milder winters), the sooner the chilling requirement is met and then trees are dormant only by 'ecto-dormancy' – the outside temperature effect. In 'ecto-dormancy', the warmer the outside temperature, the sooner the trees begin to grow. And once 'spring growth' is initiated, the tree starts the dance of stage of development and lowest temperature that stage can survive. Our goal as fruit growers is a full crop of fruit on those trees.

I speak of it quite often I realize, but mild winters mean our fruit trees satisfy endo-dormancy sooner and we are at the mercy of the outside temperature longer in the 'spring side' of winter to successfully get a crop of fruit (our income). Just to give you the perspective of my concern and weather watching in support of your success as orchardists. This pandemic year has shown the value of local agriculture, and increased the appreciation that Ohioans have for what you do.

Ohio Hop Industry and Research Update

By Brad Bergefurd, Melanie Ivey, Steve Cullman, Thom Harker, Anna Adams, Wayne Lewis, and Becky Colon- OSU Hop Research and Education Team

Since The Ohio State University South Centers began hops research and educational programming in 2012, more than 200 Ohio farmers have become attracted to hop growing because of the continued high market demand for Ohio-grown hops from the local craft brewing industry and the high-income opportunity that hops offer to small acreage landowners.

To advocate for, and educate, the state's hop farmers, more than 100 growers have joined the Ohio Hop Growers Guild, which conducts educational programming, hop analysis workshops, and annual educational farm tours of Ohio hop farms. They conducted the annual Ohio Hops Conference in Springfield in February, when more than 100 attended the two day, inperson event. Several university hop researchers from Ohio and Michigan and hop farmers presented updates on integrated pest and crop management, marketing, processing, and safe handling practices.

OSU conducted a series of virtual hop-growing trainings in March, and three virtual hop field days and one face-to-face field day (sponsored by the Agricultural Incubator Foundation) were conducted in August. Several county-based hops programs were taught virtually throughout the state in 2020.

Bergefurd and the other members of the OSU Hop Research and Education Team have been conducting field research on hops since 2013. Current OSU hop field research includes a fertility and nutrition management study being conducted by Dr. Steve Cullman and Brad Bergefurd. In addition, Dr. Melanie Ivey and Bergefurd are conducting hops downy а mildew management study. The three hop variety trials at Piketon, Wooster, and Bowling Green locations also continue.

Hop quality is normally verified using laboratory wet chemistry methods that require reagents such as toluene, but these methods can be time-consuming and affect the cycle time of a facility. Due to the importance of harvest timing, and to ensure a high-quality crop for brewers, the



Erin Lizotte IPM Educator, Michigan State University Extension teaches growers hops IPM strategies at the Ohio Hop Growers Conference in Springfield, Ohio.

research partnership between The Ohio State University and the international, Ohiobased company Eurofins QTA (a subsidiary of Eurofins Scientific) continues to research technology that provides a method of hop analysis that has been adopted by most west coast hop farms. This new technology allows for hops to be tested for multiple parameters, such as alpha and beta acids, in 60 seconds using the latest in infrared technology; this is in stark contrast to the current practice that takes three total days to collect, mail, and test hops in a laboratory setting. This enhanced hop quality analytics equipment and procedures allow farmers to determine prime harvest times quicker, and this can lead to increased hop quality for brewers.

Ohio Hop Industry and Research Update continued from page 8

This new hop analysis technology is housed in the hop and small fruit quality analysis lab at the OSU South Centers in Piketon. Test data from quality analytics of hops harvested from the OSU hop research yards, Ohio farmer-cooperator hop yards, and west coast hop yards indicates this new technology provides similar results to the current laboratory hop testing procedures within minutes instead of days.



The 2020 Ohio Hop Harvest was one of the best on record for many Ohio growers, (Photo courtesy of Ohio Valley Hops)

The 2020 season brought about new issues problems faced by growers and and researchers; however, with the seasons harvest beginning to wind down, the overall yield, quality, and demand being reported by growers is some of the best we have had since 2013. Ohio experienced a late season (early May) freeze and frost, which set back some plantings. Possible disease and virus samples have been submitted to Dr. Ivey's lab for positive diagnosis. Those growers who have ramped up their disease control program and spray schedules are reporting better disease control and higher yields.

By all accounts, the 2020 season was a positive one for Ohio hop farmers. Although brewers' retail establishments were closed due to COVID, beer sales continued and the demand for Ohio beers and hops continues to grow. So long as the brewing industry keeps pouring, bottling, and canning craft ale, the future is bright for Ohio-grown hops.



New hop analytic testing technology being tested at OSU South Centers.



The 2020 OSU Hops Field Nights went virtual with good attendance during the three evenings and many viewing the recorded presentations.

Grower Resources:

- 2019-2020 Midwest Fruit Pest Management Guide
- 2020 Grape Disease Management Guide (u.osu.edu/fruitpathology/spray-guides/)
- 2020 Hop Disease Management Guide (u.osu.edu/fruitpathology/spray-guides/)
- OSU Fruit Pathology website (u.osu.edu/fruitpathology)
- OSU Fruit and Vegetable Safety website (https://producesafety.osu.edu)
- OSU Fruit and Vegetable Pest Management website (entomology.osu.edu)
- OSU Fruit and Vegetable Diagnostic Laboratory (u.osu.edu/vegetablediseasefacts/)
- OSU Bramble: Production Management and Marketing Guide (Bulletin 782) (extensionpubs.osu.edu)



Sour rot is disorder of grapes caused by a complex interaction of yeast, bacteria and the common fruit fly. Sour rot is initiated by a wound and results in oozing cracked grapes that have a strong sour smell and a bitter flavor. Sour rot prevention requires the use of well-timed antimicrobials and insecticides. For more information on sour rot control refer to the 2019-2020 Midwest Fruit Pest Management Guide, page 90.

OSU Upcoming Events-2020

October 15 – Welcome to Co-ops Online Training; Link here October 16 – Webinar on Household Food Waste Measurement: Alternatives to Diaries and Digs; Link here October 20 – Story Time on the Farm (Stratford Ecological Center); Link here October 22 – Working with Emotional Vampires; Link here October 28 – 2020 Ohio Master Urban Farmer Workshop; Link here November 4, 11, 18 – 2020 Ohio Master Urban Farmer Workshop; Link here November 12 – Wood Destroying Insect Inspection - Online Webinar ; Link here December 1 – 2020 Ohio Online Pesticide and Fertilizer Recertification; Link here January 11 – 2021 Private and Fertilizer Recertification; Link here January 19 – 2021 Commercial Recertification; Link here

For a list of all CFAES events and schedule changes go to the CFAE Events Page

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