

## **A Multifaceted Approach to the Management of Blueberry Diseases**

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This presentation is the second part of a two-part discussion on blueberry diseases and their management. In the first part (in Blueberry I), Dr. Frank Caruso provides a description of the diseases most important to the region, their symptoms, the causal agents and some specifics on the epidemiology. This part will focus on multiple strategies for managing these diseases.

### **Introduction**

The demand for blueberries worldwide continues to increase as the nutraceutical benefits of blueberries are becoming well known. However, blueberry growers continuously have to contend with a variety of insect pests and diseases that reduce yield and quality of fruit for the fresh as well as the processed market. Marketers and processors have high standards for blueberry quality, including a zero tolerance for mummy berry disease and certain insects, which means that an entire load can be rejected if one of these organisms is detected. Even though growers are keen to incorporate integrated pest management methods, highly effective alternatives may not always be available or cost-effective. In practice, blueberry growers rely heavily on chemical crop protection products to produce high yields of high quality blueberries. An integrated approach to disease management, where possible, will generally increase the level of control and reduce the need for chemical intervention.

### **General principles of disease management**

In disease control, prevention is the magic word, because once you see symptoms, the infection cannot be stopped. The best way to prevent diseases from getting established is avoidance: choose sites that do not have a history of diseases and purchase plants that are virus-tested and disease free. The latter is a very important and worthwhile investment. Also make sure not to bring in soil or plant debris from infested sites on equipment or boots. One can also consider control of insect vectors of viruses a way of avoiding disease by killing or repelling the insects before they are able to transmit the viruses to plants.

Growers can also try to make their fields inhospitable to disease organisms. The easiest way to do this is to grow resistant varieties. If it is not possible to choose a resistant variety, at least avoid highly susceptible varieties to spare yourself an uphill battle for the lifetime of the planting. Since most fungi love moisture, anything that can be done to increase air flow and decrease humidity will be beneficial. For instance, choosing a site that is not surrounded on all sides by woods, using proper plant spacing, pruning bushes regularly to create a more open canopy, avoiding excessive fertilization, good weed control, and eliminating standing water by improving drainage. Limiting overhead irrigation or timing irrigation such that the plants stay wet the least amount of time (e.g., by irrigating during the night when dew may be present anyway) may also be helpful. Furthermore, you can help the plants defend themselves against pathogens by making sure they are not stressed. Stresses that can predispose plants to disease are drought stress, herbicide injury, waterlogging, improper soil pH, frost damage, etc. Some products on the market may help boost the plants' natural defenses, but results are variable.

Another very important disease control method is "sanitation" or the removal of pathogen inoculum from the field. For instance, in the case of Phomopsis canker, pruning out diseased

canes and removing them from the field will reduce the abundance of fungus spores for future infections. Removing virus-infected bushes is very important, especially early in the life of the planting, to prevent any further spread of the virus. Another approach is to make the inoculum that is present ineffective, e.g., by covering it up with mulch or plowing it into the soil so that it breaks down quickly, killing the pathogen. This can be done, for instance, with mummy berry mummies.

Lastly, we can fight pathogens head on by using chemical fungicides which are toxic or biofungicides which are antagonistic to pathogens. Most of the time, when we apply chemical fungicides, we try to prevent the germination of fungal spores which land on the plant surface: these are protectant fungicides. There are some fungicides that can enter the plant and stop the infection process in the early stages: these are systemic fungicides. There are no fungicides which can kill a fungus in the later stages of the infection process, especially after symptoms have already begun to appear. The only exception to this is the use of salts or oils to kill powdery mildew colonies which are exposed on the plant surface. Spray coverage is very important, especially for fungicides that are strictly protectants. This means that using appropriate spray equipment that delivers most of the spray to the target, higher spray volumes, slower driving speed, spraying more row middles, and having open canopies will aid disease control. Aerial application should be avoided unless the fields are inaccessible.

Knowing the critical periods when infection risk is highest can be very helpful in timing the applications of fungicides. Unfortunately disease prediction models are not available for most blueberry diseases, except for mummy berry in lowbush blueberries. Disease prediction models are based on environmental conditions (temperature, leaf wetness, relative humidity) that are known to favor infection and disease development. In the absence of disease prediction models, growers can still use weather forecasts as a “seat-of-the-pants” approach to estimating disease risk.

Lastly, I would like to stress that a correct disease diagnosis is very important for effective control. You first have to know what is wrong with your plants before you can do anything about it. An incorrect assessment can lead to a waste of money if unsuitable control methods are used and also to further losses. Possible control options for specific blueberry diseases are discussed below. Remember that the more control methods you integrate in your management program, the better control you are likely to achieve.

#### Mummy berry:

- Plant resistant or less susceptible cultivars
- Don't plant in heavily wooded and shaded areas
- Remove mummies from field by raking or cover mummies with 1-2 inches of soil or mulch to prevent spore release
- Remove wild blueberries from vicinity
- Apply urea fertilizer on exposed mushroom trumpets in spring
- Create open canopy to reduce moisture and increase fungicide penetration
- Good weed control in the row to expose mummies to drying
- Use effective fungicides, particularly in period from green tip to the end of bloom
- Make sure plants are protected with fungicides during frost and right after frost events

#### Botrytis blight:

- Plant resistant or less susceptible cultivars

- Create open canopy to reduce moisture and increase fungicide penetration
- Prune out and destroy infected plant parts
- Time irrigation to overlap with dew events to reduce wetness duration
- Use effective fungicides, particularly in period from green tip to the end of bloom

Phomopsis twig blight and canker:

- Plant resistant or less susceptible cultivars
- Buy disease-free plants or remove dead twigs or branches from planting material before planting
- Prune out and destroy dead and diseased canes
- If bush-hogging pruned canes, try to work the debris into the soil
- Avoid wounding canes by equipment or herbicides
- Irrigate as needed to reduce plant stress, including during dry periods after harvest and before leaf drop
- Time irrigation to overlap with dew events to reduce wetness duration
- Good weed control in the row to reduce humidity around bases of canes
- Create open canopy to reduce moisture and increase fungicide penetration
- Use effective fungicides, particularly in period from green tip to petal fall. Application of fungicides after harvest may help to protect wounds caused by mechanical harvesting and protect newly forming fruit buds from infection

Fusicoccum (Godronia) canker:

- Plant resistant or less susceptible cultivars
- Buy disease-free plants or remove diseased canes from planting material before planting
- Prune out and destroy dead and diseased canes
- If bush-hogging pruned canes, try to work the debris into the soil
- Good weed control in the row to reduce humidity around bases of canes
- Use effective fungicides, particularly in period from green tip to petal fall.

Anthracnose:

- Plant resistant or less susceptible cultivars
- Prune regularly to remove canes with lots of old fruiting wood
- Time irrigation to overlap with dew events to reduce wetness duration
- Create open canopy to reduce moisture and increase fungicide penetration
- Use effective fungicides, particularly in period from green tip to petal fall. Applications when berries first turn blue and close to harvest may reduce post-harvest rot.
- Timely harvest and rapid cooling of fruit
- Sanitation of sorting line, maintain bleach concentration in tank

Powdery mildew:

- Plant resistant or less susceptible cultivars
- Create open canopy to reduce humidity
- Use fungicides only if disease is very severe, focus on period from bloom to harvest and possibly post-harvest

Phytophthora root rot:

- Select sites with good drainage or improve drainage by tiling or raised beds
- Plant tolerant cultivars
- Prevent movement of soil from affected blueberry fields and cranberry beds on equipment or by run-off; cultivate infected fields last
- Use effective fungicides in spring and fall; moderately to severely diseased plants cannot be revived
- Rotate out of blueberries for 5-10 years

Armillaria root rot:

- Do not plant in an infested site (survey site for dead trees and signs of the fungus before clearing)
- Remove all tree stumps including roots
- Remove infected bushes including roots
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Witches' broom:

- Eradicate fir trees within 1500 feet of blueberries
- Remove or kill infected bushes with an herbicide
- Use effective fungicides

Scorch:

- Buy virus-tested planting stock
- Plant resistant or less susceptible cultivars
- Remove and destroy infected plants
- Practice good aphid control
- Wash harvesting equipment between fields to remove aphids
- Harvest infected fields last

Tomato ringspot:

- Buy virus-tested planting stock
- Plant resistant or less susceptible cultivars
- Fumigate affected areas before replanting with blueberries
- Remove and destroy infected plants, including non-symptomatic plants nearby
- Use nematicides to control nematode vectors

Stunt:

- Buy disease-free planting stock
- Remove and destroy infected plants
- Practice leaf hopper control