

# Commercial Crop Production

## Small Fruits - Blueberry

### Integrated Blueberry Disease Management

Successful management of blueberry diseases requires an integrated approach. Choosing appropriate varieties, a well-suited planting site and good soil preparation are all important for preventing blueberry disease problems. Well-drained soil is especially important for preventing *Phytophthora* root rot, one of the most significant blueberry diseases. For protection from both frost and disease problems, it also may be beneficial to choose a site from which air can easily drain (not low sites).

**Select varieties appropriate for your region.** For variety recommendations as well as information on how to choose a suitable site and prepare the soil before planting, see LSU AgCenter publications 2363, “Commercial Blueberry Production” and 1978, “Home Blueberry Production in Louisiana” or the Mississippi State University Extension Service publication 1758, “Establishment and Maintenance of Blueberries.”

**Start with clean plants.** Use plants that have been propagated from clean (disease-free) planting material and check plants for disease symptoms before planting.

**Use good cultural practices.** Pruning is recommended to remove dead, damaged or diseased limbs so that sunlight and pesticides can penetrate the plant canopy. Pruning recommendations are provided in the LSU AgCenter publication 2363, “Commercial Blueberry Production.” Applying one inch of mulch under plants each year may help minimize the effects of mummy berry disease. Avoid using equipment that has been in orchards infected with mummy berry.

**Use crop protectants.** Prior to using chemicals, have the disease confirmed by a crop specialist. Once the disease has been confirmed, select a labeled product that has been shown to be effective in reducing disease, and apply the product at the correct stage of plant development (Table 1). Chemicals with proven efficacy against a pathogen will not reduce disease if applied at the wrong time. Always rotate between products with different modes of action (in different FRAC groups; see Table 2) to prevent the development of fungicide resistance in the pathogen (disease-causing agent). If a pathogen becomes resistant to a product, the product will no longer be effective. Although some details about chemical application are given in Table 2, always see the label for complete instructions and to determine if changes have been made to the label.

### DISEASE

#### Symptoms, source of inoculum and management of diseases of blueberry.

##### **Bacterial Leaf Scorch** (*Xylella fastidiosa*)

**Symptoms:** In susceptible Southern highbush varieties, the edges of leaves turn brown (marginal necrosis) and eventually drop off the plant, and young twigs and stems may turn yellow before plants die. Rabbiteye cultivars may show early fall color, and fruit production may decline over time.

**Source of Inoculum:** Infected plants serve as reservoirs for this bacterium. Bacteria are transmitted through propagation or by sharpshooter insects.

**Management:** No chemicals are available for disease management. Plant disease-free plants and choose resistant varieties if planting Southern highbush blueberries. See the [Southeast Regional Blueberry Integrated Management Guide](#) for insecticide recommendations for leafhoppers.

##### **Botrytis (Gray Mold)** (*Botrytis cinerea*)

**Symptoms:** The fungus attacks tender young twigs, leaves, flowers and fruit, causing them to become brown to black. Infected fruit do not rot until after harvest.

**Source of Inoculum:** The fungus survives as dormant mycelia or sclerotia. Spores are wind dispersed.

**Management:** Follow a fungicide spray schedule if needed. (See Tables 1 and 2).

##### **Exobasidium Fruit and Leaf Spot** (*Exobasidium maculosum*)

**Symptoms:** Whitish spots occur on undersides of leaves, with light green spots on the upper sides. Spots turn brown over time. Fruit also has spots, which remain unripe as the rest of the fruit ripens.

**Source of Inoculum:** The life cycle of this pathogen is still being studied, but it is thought that the fungus overwinters on the surface of the plant and/or in bud scales or bark and infects the plant in the spring.

**Management:** Plant in areas with good air movement. Prune appropriately to allow air movement and spray penetration. An application of lime sulfur has been found to be very effective when made at bud swell, 1 to 2 weeks before leaf or flower buds break. Other products can be applied from green tip through the cover spray period. (See Tables 1 and 2).

##### **Fruit Rots** (*Alternaria*, *Colletotrichum*) (including Anthracnose Fruit Rot or Ripe Rot)

**Symptoms:** A variety of rots develop on the fruit as they mature.

**Source of Inoculum:** The fungi causing fruit rots survive from year to year on or in infected twigs and for *Alternaria*, fallen debris.

# Commercial Crop Production

## Small Fruits - Blueberry

**Management:** Harvest ripe fruit regularly and cool it soon after harvest to minimize postharvest disease development. Follow a fungicide spray schedule, at the interval(s) directed on label(s), if needed. (See Tables 1 and 2).

### **Leaf Spots** (*Septoria*, rust, anthracnose)

**Symptoms:** *Septoria*: Small, circular, light-colored lesions with a purple border are produced on leaves, and sunken lesions may be formed on stems. Rust: spots develop on upper sides of leaves and change from yellow to red to brown. Orange spores are produced on the undersides of leaves.

**Source of Inoculum:** *Septoria*: The fungus survives from year to year in infected leaf debris and stems. Spores are windborne. Rust: The fungus is believed to survive on evergreen plants in the blueberry genus (*Vaccinium*).

**Management:** If needed, follow a fungicide spray schedule at the interval(s) directed on label(s). (See Tables 1 and 2).

### **Mummy Berry** (*Monilinia vaccinii-corymbosi*)

**Symptoms:** This fungus attacks and kills leaves, twigs, flowers and fruit. Infected fruit turn cream to pink as they begin to mature and then shrivel and harden into “mummies.”

**Source of Inoculum:** The fungus survives in the mummified fruit. Spores are wind-dispersed.

**Management:** Remove or bury (1-inch depth) mummified fruit. If mummy berry is an ongoing problem, then a fungicide spray schedule should be followed. See Tables 1 and 2. For mummy berry, the first recommended sprays of the season are very important.

### **Phytophthora Root Rot** (*Phytophthora cinnamomi*)

**Symptoms:** Initially, leaves become yellow and plant growth ceases. Rootlets are killed, and infected roots and crowns are discolored. Bushes may defoliate and die.

**Source of Inoculum:** The pathogen survives as chlamydospores in the soil. Disease development is favored by wet soil conditions and temperatures between 68 F and 90 F.

**Management:** Plant disease-free plants in well-drained soil or raised beds. Mefenoxam can be applied to soil while plants are dormant. Aluminum tris or “phosphite” (mono- and di-potassium salts of phosphorus acid or potassium phosphite) products can be applied to foliage during the entire growing season. (See Table 2.) If plants are severely infected, chemicals are not likely to result in a return to healthy plant growth.

### **Stem Cankers and Blights** (*Phomopsis*, *Botryosphaeria*)

**Symptoms:** *Phomopsis* twig blight: flower-bearing year-old stems die. *Botryosphaeria* canker: lesions appear on new growth and turn into cankers on susceptible varieties. *Botryosphaeria* stem blight: individual branches die.

**Source of Inoculum:** The pathogens survive from year to year in infected stems. Spores are spread by wind or rain. *Phomopsis* infects stems through flowers.

**Management:** Avoid mechanical injury to stems. Remove diseased canes/shoots. For *Phomopsis* twig blight, follow the fungicide spray schedule if needed. (See Tables 1 and 2). Fungicides are not likely to be very effective for management of *Botryosphaeria*.

# Commercial Crop Production

## Small Fruits - Blueberry

**Table 1. Seasonal fungicide spray schedule for blueberry.**

Season	Pesticide Application Timing	Disease
Early spring	At planting or, for established plants, while dormant, plus once while conditions favorable (see Table 3)	Phytophthora Root Rot
Early spring	At bud swell	Exobasidium
Prebloom	Green tip or, for mummy berry, when 1%-5% of blooms are open (whichever occurs first); repeat as directed on label	Mummy Berry Phomopsis Twig Blight Exobasidium
Bloom	10%-20% bloom through full bloom (2-3 applications, at interval specified on label)	Mummy Berry Phomopsis Twig Blight Botrytis Blight Fruit Rots Exobasidium
Petal fall and cover sprays	Immediately following bloom, followed by applications at 7- to 14-day intervals or as directed on label	Fruit Rots Exobasidium
Summer	Preharvest and harvest	Fruit Rots
Summer and Fall	Postharvest	Leaf Spots

# Commercial Crop Production Small Fruits - Blueberry

Table 2. Pesticide efficacy<sup>1</sup> and use.

Product Choices <sup>2</sup>	Mode of Action Group(s) <sup>3</sup>	Botrytis (Gray Mold)	Exobasidium Fruit and Leaf Spot	Alternaria Fruit Rot	Mummy Berry	Phomopsis Twig Blight	Phytophthora Root Rot	Ripe Rot/Anthracnose Fruit Rot (Colletotrichum)	Anthracnose Leaf Spot	Rust	Septoria Leaf Spot	Rate <sup>4</sup>	PHI <sup>5</sup>	Maximum Use <sup>6</sup>
<i>Bacillus subtilis</i> QST 713 strain (Serenade ASO <sup>OG</sup> )	BM02	F	-	F	F	-	-	F	F	F	F	2-4 qt (1-4 qt when tank mixed)	0	
<i>Bacillus subtilis</i> QST 713 strain (Serenade MAX <sup>OG</sup> )	BM02	F	-	F	F	-	-	F	F	F	F	1-3 lb	0	
copper-containing products labeled for use on blueberries, including ones with basic copper sulfate, copper hydroxide, copper copper oxychloride, copper octanoate, copper sulfate pentahydrate, or cuprous oxide – some products OMR listed <sup>(OG)</sup>	M01	-	-	-	-	-	-	-	-	F	-	see label	typically 0 - see label	see label
calcium polysulfide <sup>11</sup> (Lime-Sulfur Solution)	M02	-	E	-	-	-	-	-	-	-	-	5 - 6 gal	0	30 gal
ziram (76DF)	M03	F	-	F	P	G	-	F	F	-	-	3 lb	-- <sup>9</sup>	
captan (50 WP)	M04	F	VG	G	F	F	-	G	G	-	F	5 lb	0	70 lb
captan (80 WDG)	M04	F	VG	G	F	F	-	G	G	-	F	3.125 lb	0	43.75 lb
captan (38.75% FL, Captan 4L)	M04	F	VG	G	F	F	-	G	G	-	F	2.0-2.5 qt	0	35 qt

# Commercial Crop Production

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chlorothalonil (Bravo Weather Stik)	M05	-	-	-	-	-	-	-	VG	G	VG	3-4 pt	42 <sup>10</sup>	12 pt
aluminum tris (O-ethyl phosphonate; Aliette WDG) <sup>7</sup>	P07	-	-	-	-	P	G	P	VG	-	VG	5 lbs	0.5	4 apps
mono- and di-potassium salts of phosphorus acid (Agri-Fos, Fosphite, Fungi-Phite, K-Phite 7 LP, Rampart, others)	P07	-	-	-	-	-	VG	-	VG	-	VG	see label (rate varies by product and application method)	0	see label
potassium phosphite (ProPhyt)	P07	-	-	-	-	-	VG	-	VG	-	VG	4 pt	0	
fenbuconazole <sup>8</sup> (Indar 2F)	3	-	G	-	E	E	-	-	E	G	E	6 fl oz	30	4 apps
metconazole (Quash)	3	-	-	E	E	E	-	E	E	VG	E	2.5 oz	7	3 apps
propiconazole (Bumper 41.8 EC, Bumper ES, Tilt, others)	3	-	-	-	E	E	-	-	-	G	VG	6 fl oz	30	30 fl oz
prothioconazole (Proline 480 SC)	3	-	-	-	E	E	-	-	-	E	G	5.7 fl oz	7	2 apps
mefenoxam (Ridomil Gold SL)	4	-	-	-	-	-	G	-	-	-	-	3.6 pt	0	7.2 pt
pydiflumetofen and fludioxonil (Miravis Prime)	7, 12	-	-	-	-	-	-	E	-	-	-	13.4 fl oz	0	26.8 fl oz

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cyprodinil and fludioxonil (Switch 62.5 WG)	9, 12	E	-	E	F	G	-	E	G	-	G	11-14 oz	0	56 oz
azoxystrobin (Abound F, others)	11	-	-	E	F	F	-	ER	VG	G	VG	6.0-15.5 fl oz	0	see label
azoxystrobin and propiconazole (Quilt Xcel, others)	11, 3	-	-	E	E	E	-	ER	E	E	E	14-21 fl oz	30	3 apps
pyraclostrobin and boscalid (Pristine)	11, 7	E	FR	E	VG	E	-	ER	E	F	E	18.5-23 oz	0	4 apps
fenhexamid (Elevate 50WDG)	17	E	-	-	F	-	-	-	-	-	-	1.5 lb	0	6 lb
fluzinam (Omega 500F)	29	F	-	G	-	G	-	G	-	-	-	20 fl oz	30	120 fl oz
oxathiapiprolin (Orondis Gold 200)	49	-	-	-	-	-	G	-	-	-	-	4.8-9.6 fl oz	1	19.2 fl oz
fish oil (Organic Gem Liquid Fish Fertilizer-OG, Neptune's Harvest Organic Fish Fertilizer-OG)	NC	-	-	-	-	-	-	-	-	-	G	see product instructions		

OG: Product has been listed by the Organic Materials Review Institute (OMRI). Check with your organic certifier to ensure acceptability of a particular product.

<sup>1</sup>Efficacy ratings: E = excellent, VG = very good, G = good, F = fair, P = poor. Actual performance may vary. A superscript "R" indicates that there is a possibility of resistance to the chemical and that the chemical will not be effective, or as effective as noted, if the pathogen is resistant to it. A "." indicates that the chemical is not expected to be effective for managing the disease or that data is lacking. Ratings are based largely on the [Southeast Regional Blueberry Integrated Management Guide](#) and the [Southeast Regional Organic Blueberry Pest Management Guide](#) of the Southern Region Small Fruit Consortium.

<sup>2</sup>Chemical name (trade name). Reference to commercial or trade names is made for the reader's convenience and with the understanding that no discrimination or endorsement of a particular product is intended by LSU or the LSU AgCenter. In some cases, other brands are available.

<sup>3</sup>Mode of action groups are determined by the Fungicide Resistance Action Committee (FRAC).

# Commercial Crop Production

## Small Fruits - Blueberry

<sup>4</sup>Rates are the amount of formulation (product) per acre unless otherwise indicated. Check label for changes.

<sup>5</sup>Postharvest interval (PHI) is the minimum number of days allowed between the last application and harvest. Check label for changes and for reentry interval (REI), which is longer than PHI in some cases.

<sup>6</sup>Maximum amount per acre per year or growing season. See labels for additional restrictions and changes.

<sup>7</sup>Make sure to get the Aliette WDG that is labeled for use on blueberries. There is a product of the same name that is not labeled for blueberries.

<sup>8</sup>If fenbuconazole (Indar 2F) is used during bloom, it should be mixed with captan to prevent a higher incidence of fruit rot.

<sup>9</sup>“Do not apply later than 3 weeks after full bloom.”

<sup>10</sup>Do not apply before harvest, to avoid fruit injury.

<sup>11</sup>See labels for restrictions and recommendations regarding use at high temperatures and within given time periods before or after oil applications.

This section was updated by Mary Helen Ferguson in October 2022.