

Commercial Crop Production: Small Fruits

Blackberry

Blackberries are the most commonly grown brambles in Louisiana. Blackberries are native to Louisiana and most commercial cultivars are well-adapted to growing conditions in the state. Thorny type varieties such as CVs. Brazos, Brison, Womack are very productive and early bearing in Louisiana but are susceptible to the fungal disease rosette (double blossom). These cultivars require careful attention to disease management tactics such as pruning on time and preventative fungicide spray programs. Alternatives to the thorny varieties are CVs. Navaho and Arapaho, which are thornless types. These two varieties are not as susceptible to double blossom and don't require as high a level of management as the thorny types

Disease

Symptoms, source of inoculum and management of soybean diseases.

Disease	Symptoms	Source of Inoculum	Management
Anthracnose (<i>Elsinoe veneta</i>)	Symptoms appear on canes and leaves. Both current and second-year canes can be affected. Circular, light gray spots form on canes; as the disease progresses the spots become sunken with a dark purple margin. Leaf spots start off yellow, turn grey with a purple border and eventually dry up and drop out, resulting in shot holes. Fruit may ripen abnormally and have an "off" flavor. Anthracnose can cause loss of winter hardiness.	The fungus overwinters on bark and cane lesions. In the spring spores are produced, released and spread to new canes by splashing rain and wind.	Remove and destroy infected canes. Do not compost canes. Remove and destroy wild brambles. Immediately after harvest remove floricanes to reduce overwintering fungus. Follow a fungicide spray program. Do not use lime sulfur.
Botrytis fruit rot and cane blight (<i>Botrytis cinerea</i>)	White lesions (bleaching effect) form on new canes and floricanes. Cane blight is more severe on blackberries than raspberries. Botrytis causes flowers to shrivel and turn brown. As the fruit develops and ripens, the fruit becomes soft and covered with grey tufts of fungal spores.	The fungus survives as sclerotia (overwintering structure) on infected canes and dead leaves and as spores on mummified fruit. During wet and cool conditions, sclerotia germinate and the fungus begins to sporulate. Spores are dispersed by wind, rain and overhead irrigation.	Promote good air circulation in the planting by pruning and trellising plants. Minimize the use of nitrogen fertilizer. Partial resistance is available for red raspberry varieties. Minimize fruit damage during harvest. Follow a fungicide spray schedule.
Cane blight (<i>Leptosphaeria coniothyrium</i>)	Dark red to purple lesions form on the canes around wounds. Lesions may be on one side of the cane or may girdle it and kill the shoots.	The fungus survives in infected tissues and dead canes. Spores are rain-splashed.	Prune out infected canes and remove floricanes immediately after harvest. Avoid wounding the plants.
Cane and leaf rust (<i>Kuehneola uredinis</i>)	First seen on floricanes in late spring when large yellow pustules split the bark. Small yellow pustules develop on the lower surface of leaves on the floricane and may lead to premature defoliation.	The fungus overwinters on infected canes. Spores are wind dispersed.	Prune out old diseased canes after harvest. Follow the fungicide spray schedule.

Disease	Symptoms	Source of Inoculum	Management
Orange rust (<i>Gymnoconia nitens</i>)	Disease is evident on new growth in spring as many weak, spindly shoots are formed rather than one strong shoot. Bright orange pustules form on the undersides of infected leaves, and no blooms are produced on the floricanes.	The fungus overwinters within systemically infected canes. Spores are wind dispersed.	Use only disease-free planting materials. Remove infected plants as soon as they are observed. Follow a fungicide spray schedule.
Phytophthora root rot (<i>Phytophthora</i> spp.)	Infected primocanes may rapidly wilt and die in the spring, or they (and the floricanes) may slowly become chlorotic, wilt and die in the summer. Infected roots exhibit a reddish-brown discoloration of the cortex.	The pathogen can be introduced on infected planting material, but it also survives in soil. Spreads primarily in water.	Use disease-free transplants, improve drainage and avoid low spots. Rogue out infected plants and treat surrounding plants with fungicide.
Powdery mildew (<i>Podosphaera aphanis</i>)	A whitish gray coat covers both sides of the leaves, flowers, fruit and shoots. Diseased new growth is stunted and distorted.	The fungus overwinters as mycelium or chasmothecia in dormant buds of stunted cane tips. Spores are spread by wind.	Blackberries are not susceptible to powdery mildew. Plant resistant red raspberry varieties such as Chief, Marcy and Malling Orion. Follow a fungicide spray schedule.
Rosette (double blossom) (<i>Cercospora rubi</i>)	Infected buds give rise to a proliferation of small shoots or witches' broom. Infected flower buds give rise to distorted blossoms from which fruit do not develop.	The fungus survives in wild blackberries and dewberries. Spores are wind dispersed.	Eradicate wild blackberries and dewberries in the vicinity. Remove infected blossom clusters before they open. Remove the floricanes immediately after harvest. Follow a fungicide spray schedule.
Septoria leaf spot (<i>Septoria rubi</i>)	Frogeye lesions with whitish centers and brown to purple margins are produced on leaves. Similar lesions are found on canes and petioles.	The fungus overwinters in dead leaves and stems. Spores are wind dispersed.	Follow a fungicide spray schedule for leaf spots.
Spur blight (<i>Didymella applanata</i>)	Symptoms appear in primocanes in late spring. Brownish purple lesions appear just below on the lower portion of the stem just below the leaf or bud. In late fall, the bark of infected canes splits longitudinally. Leaflets may have V-shaped brown lesions with chlorosis.	The fungus survives the winter in lesions on diseased canes. Spores are carried to new growth in the spring by splashing rain and wind.	Promote good air circulation in the planting by pruning and trellising plants. Avoid excessive nitrogen applications, which promote rapid and excessive growth of new tissue. Remove and destroy wild brambles. Follow a fungicide spray schedule.

Table 1. List of disease-resistant thorny blackberry cultivars recommended for production in Louisiana.

Type, cultivars	Anthraco-nose	Rosette (double blossom)	Orange Rust	Sunburn (abiotic)
Brazos	R	S	-	-
Brison	-	S	-	-
Cheyenne	-	S	R	-
Womack	-	S	-	-
Apache	-	S	-	-
Rosborough	-	S	-	-
Shawnee	R	S	R	-
Choctaw	-	S	R	-
Kiowa	-	S	R	-
Chickasaw	R	S	R	-

Table 1, 2 and 3 Legend

Resistance Category	Abbreviation
Susceptible	S
Moderately Susceptible	MS
Moderately Resistant	MR
Resistant	R
No data for the variety or disease	-

Table 2. List of disease-resistant thornless blackberry cultivars recommended for production in Louisiana.

Type, cultivars	Anthraco-nose	Rosette (double blossom)	Orange Rust	Sunburn (abiotic)
Arapaho	-	R	R	-
Navaho	R	MR	S	-
Apache	R	R	-	S
Ouachita	R	R	R	S

Table 3. List of disease-resistant trailing blackberry cultivars recommended for production in Louisiana.

Type, cultivars	Anthraco-nose	Rosette (double blossom)	Orange Rust	Sunburn (abiotic)
Youngberry	-	S	-	-

Table 4. Seasonal fungicide spray schedule for blackberry, raspberry and other bramble diseases.

Developmental Stage	Diseases
Delayed dormant (Bud swell to green tip)	Anthrachnose Cane blight Spur blight
Shoots 6 inches long until prebloom	Anthrachnose Cane blight Leaf spots Phytophthora root rot Powdery mildew Rusts Spur blight
Early bloom (5-10%)	Anthrachnose Botrytis gray mold Cane blight Leaf spots Rosette Rusts
Full bloom (Bramble bloom periods are protracted. Bloom and cover spray stages can be difficult to define clearly. Make sure that the pathogens indicated are addressed with a thorough fungicide program as defined by the variety but do not exceed labeled rates or spray intervals.)	Anthrachnose Botrytis gray mold Cane blight Leaf spots Rosette Rusts
Petal fall	Anthrachnose Botrytis gray mold Cane blight Leaf spots Rosette Rusts
Cover sprays	Anthrachnose Botrytis gray mold Cane blight Leaf spots Rosette Rusts

Developmental Stage	Diseases
Preharvest (14 days before anticipated harvest date)	Anthrachnose Botrytis gray mold Cane blight Leaf spots Rosette Rusts
Harvest	Anthrachnose Botrytis gray mold Cane blight Leaf spots Rosette Rusts
Postharvest	Cane blight Leaf spots Orange cane blotch Phytophthora root rot Powdery mildew Rusts

Table 5. Efficacy of selected fungicides against blackberry, raspberry and other bramble diseases.**Table Legend**

Efficacy	Rating
Excellent	5
	4
	3
	2
Poor	1
Ineffective	-

Table was reproduced from the 2023 Southeast Regional Caneberries Integrated Management Guide (https://secure.caes.uga.edu/extension/publications/files/pdf/AP%20121-3_1.PDF).

The efficacy rating could be affected by resistance development. If resistance has occurred, use of fungicides in the same class would likewise show resistance, and a substitute fungicide should be considered for pathogen management.

No data is provided for products not labeled for the specific disease or if the efficacy is unknown. These ratings are benchmarks; actual performance will vary.

Chemical name	Product Name	Anthraco	Cane blight	Spur blight	Leaf spots	Botrytis gray mold	Rusts	Powdery mildew	Rosette	Phytophthora root rot
azoxystrobin	Abound FL	5	5	5	4	-	5	5	5	-
azoxystrobin + propiconazole	Quilt Xcel	5	5	5	4	-	5	5	5	-
captan	Captan 80WDG, Captec 4L, Captan 50W	3	2	2	-	2	-	-	-	-
copper	various products	1	1	1	-	-	-	-	-	-
myclobutanil	Rally 40WSP	-	3 After pruning	-	-	-	5	5	-	-
mono and di-potassium salts of phosphorus acid or potassium phosphite	K-phite or ProPhyt	-	-	-	-	-	-	-	-	4
pyraclostrobin	Cabrio EG	5	5	5	5	-	5	5	-	-
pyraclostrobin + boscalid	Pristine WG	5	5	5	4	4 ^R	5	-	5	-
cyprodinil + fludioxonil	Switch 62.5WG	-	-	-	-	5	-	-	5	-
fenhexamid	Elevate 50WDG	-	-	-	-	5	-	-	-	-
iprodione	Rovral 4F, Nevado 4F	-	-	-	-	3	-	-	-	-
mefenoxam	Ridomil Gold SL	-	-	-	-	-	-	-	-	4
fosetyl-AL	Aliette WDG	-	-	-	-	-	-	-	-	4
sulfur	various products	-	-	-	-	-	-	3	-	-
propiconazole	Tilt 3.6EC	-	-	-	4	-	5	-	-	-
oxathiapiprolin	Orondis Gold 200	-	-	-	-	-	-	-	-	4

^R Isolates of this pathogen with resistance to this fungicide have been identified in southeastern United States.

Table 6. Recommended pesticides, rates and pesticide use restrictions for blackberry, raspberry and other bramble diseases.

Chemical Name	Product Name ¹	Product Mode of Action Group ²	Rate ³	Maximum Use	PHI ⁴	Diseases
azoxystrobin	Abound FL	11	6.0-15.5 fl oz	92.3 fl oz	0	Anthracnose, Cane blight, Leaf spots, Rosette, Rusts, Spur blight
azoxystrobin + propiconazole	Quilt Xcel	11, 3	14-21 fl oz	105 fl oz	30	Anthracnose, Cane blight, Leaf spots, Powdery mildew, Rosette, Spur blight
captan	Captan 50WP	M4	2-4 lb	10 lb ai	3	Anthracnose, Cane blight, Leaf spots, Spur blight
captan	Captec 4L	M4	0.75-1.0 qt/100 gal	10 lb ai	3	Anthracnose, Cane blight, Leaf spots, Spur blight
copper	ChampWG	M1	2-3 lb	See labels	1-2	Anthracnose, Cane blight, Leaf spots, Orange cane blotch, Spur blight
copper	Kocide 3000	M1	0.8-1.3 lb	See labels	1-2	Anthracnose, Cane blight, Leaf spots, Orange cane blotch, Spur blight
copper	Kocide 2000	M1	1.5-2.3 lb	See labels	1-2	Anthracnose, Cane blight, Leaf spots, Orange cane blotch, Spur blight
copper	Cuprofix Disperss	M1	2.5-5 lb	See labels	0.5	Anthracnose, Cane blight, Leaf spots, Orange cane blotch, Spur blight
copper	Cuprofix Ultra 40 Disperss	M1	1.25-2.5 lb	See labels	0.5	Anthracnose, Cane blight, Leaf spots, Orange cane blotch, Spur blight
fosetyl-AL	Aliette WDG	33	5 lb	20 lb	60	Phytophthora root rot
myclobutanil	Rally 40WSP	3	1.25-3 oz	10 oz	0	Powdery mildew, Rusts
phosphorous acids	Confine Extra	33	1-3 qt	See labels	0	Leaf spots, Phytophthora root rot
phosphorous acids	Fosphite	33	1-3 qt	See labels	0	Leaf spots, Phytophthora root rot
phosphorous acids	Fungi-phite	33	1-2 qt	6 app	0	Leaf spots, Phytophthora root rot
phosphorous acids	Helena Prophyt	33	4 pt	4 app	0	Leaf spots, Phytophthora root rot
phosphorous acids	Rampart	33	1-3 qt	See labels	0	Leaf spots, Phytophthora root rot
propiconazole	Bumper 41.8EC	3	6 fl oz	30 fl oz	30	Leaf spots (post-harvest only), Rusts, Powdery mildew
propiconazole	Propi-Star EC	3	6 fl oz	30 fl oz	30	Leaf spots (post-harvest only), Rusts, Powdery mildew
propiconazole	Tilt	3	6 fl oz	30 fl oz	30	Leaf spots (post-harvest only), Rusts, Powdery mildew
propiconazole	Topaz	3	6 fl oz	30 fl oz	30	Leaf spots (post-harvest only), Rusts, Powdery mildew
pyraclostrobin	Cabrio EG	11	14 oz	56 oz	0	Anthracnose, Cane blight, Leaf spots, Powdery mildew, Rusts

Chemical Name	Product Name ¹	Product Mode of Action Group ²	Rate ³	Maximum Use	PHI ⁴	Diseases
pyraclostrobin + boscalid	Pristine WG	11, 7	18.5-23 oz	92 oz	0.5	Anthracnose, Botrytis gray mold, Cane blight, Leaf spots, Powdery mildew, Rosette, Rusts, Spur blight
cyprodinil + fludioxonil	Switch 62.5WG	9, 12	11-14 oz	56 oz	0	Botrytis gray mold
fenhexamid	Elevate 50WDG	17	1.5 lb	6 lb	0	Botrytis gray mold (resistance isolates have been detected in other regions of the south)
iprodione	Iprodione 4L AG	2	1-2 pt	4 app	0	Botrytis fruit rot
iprodione	Nevado 4F	2	1-2 pt	4 app	0	Botrytis fruit rot
iprodione	Rovral 4F	2	1-2 pt	4 app	0	Botrytis fruit rot
mefenoxam	Ridomil Gold SL	4	0.25 pt/1,000 linear feet, 3 ft band	1 app	See label	Phytophthora root rot (raspberries only)
sulfur	Microfine Sulfur	M	10-30 lb	See labels	1	Anthracnose, Cane blight, Powdery mildew, Spur blight
sulfur	Microthiol Disperss	M	6-15 lb	See labels	1	Anthracnose, Cane blight, Powdery mildew, Spur blight
sulfur	Yellow Jacket Dusting Sulfer	M	3-50 lb	See labels	1	Anthracnose, Cane blight, Powdery mildew, Spur blight

¹ Reference to commercial or trade names is made with the understanding that no discrimination is intended nor endorsement of a particular product by LSU or the LSU AgCenter is implied.

² Mode of action groups are determined by the Fungicide Resistance Action Committee (FRAC).

³ Rates are the amount of formulation (product) per acre unless otherwise indicated.

⁴ Postharvest interval (PHI) is the minimum number of days allowed between the last application and harvest.

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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,” 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 blueberry diseases.

Disease	Symptoms	Source of Inoculum	Management
Bacterial Leaf Scorch (<i>Xylella fastidiosa</i>)	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.	Infected plants serve as reservoirs for this bacterium. Bacteria are transmitted through propagation or by sharpshooter insects.	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) (<i>Botrytis cinerea</i>)	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.	The fungus survives as dormant mycelia or sclerotia. Spores are wind dispersed.	Follow a fungicide spray schedule if needed. (See Tables 1 and 2).
Exobasidium Fruit and Leaf Spot (<i>Exobasidium maculosum</i>)	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.	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.	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 (<i>Alternaria</i> , <i>Colletotrichum</i>) (including Anthracnose Fruit Rot or Ripe Rot)	A variety of rots develop on the fruit as they mature.	The fungi causing fruit rots survive from year to year on or in infected twigs and for <i>Alternaria</i> , fallen debris.	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).

Disease	Symptoms	Source of Inoculum	Management
Leaf Spots (<i>Septoria</i> , rust, anthracnose)	<i>Septoria</i> : 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.	<i>Septoria</i> : 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 (<i>Vaccinium</i>).	If needed, follow a fungicide spray schedule at the interval(s) directed on label(s). (See Tables 1 and 2).
Mummy Berry (<i>Monilinia vaccinii-corymbosi</i>)	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.”	The fungus survives in the mummified fruit. Spores are wind-dispersed.	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 (<i>Phytophthora cinnamomi</i>)	Initially, leaves become yellow and plant growth ceases. Rootlets are killed, and infected roots and crowns are discolored. Bushes may defoliate and die.	The pathogen survives as chlamydospores in the soil. Disease development is favored by wet soil conditions and temperatures between 68 F and 90 F.	Plant disease-free plants in well-drained soil or raised beds. Mefenoxam or oxathiapiprolin 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 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 (<i>Phomopsis</i> , <i>Botryosphaeria</i>)	<i>Phomopsis</i> twig blight: flower-bearing year-old stems die. <i>Botryosphaeria</i> canker: lesions appear on new growth and turn into cankers on susceptible varieties. <i>Botryosphaeria</i> stem blight: individual branches die.	The pathogens survive from year to year in infected stems. Spores are spread by wind or rain. <i>Phomopsis</i> infects stems through flowers.	Avoid mechanical injury to stems. Remove diseased canes/shoots. For <i>Phomopsis</i> 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 <i>Botryosphaeria</i> .

Table 1. Seasonal fungicide spray schedule for blueberry.¹

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

¹Not all applications will be needed in every field every season. Contact your local extension agent if you need help determining if an application needs to be made.

Table 2. Pesticide efficacy¹ and use.

Chemical Name	Product Choices ²	Mode of Action Group(s) ³	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 ⁷)	Anthracnose Leaf Spot	Rust	Septoria Leaf Spot	Rate ⁴	PHI ⁵	Maximum Use ⁶
copper-containing products labeled for use on blueberries, including ones with basic copper sulfate, copper hydroxide, copper oxychloride, copper octanoate, copper sulfate pentahydrate, or cuprous oxide	some products OMRI listed ^{8G}	M01	-	-	-	-	-	-	-	-	F	-	see label	typically 0 - see label	see label
calcium polysulfide ¹¹	Lime-Sulfur Solution	M02	-	E	-	-	-	-	-	-	-	-	5 - 6 gal	0	48 gal
ziram	76DF	M03	F	-	F	P	G	-	F	F	-	-	3 lb	see note ¹⁰	
captan	50 WP	M04	F	VG	G	F	F	-	G	G	-	F	5 lb	0	70 lb

Chemical Name	Product Choices ²	Mode of Action Group(s) ³	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 ⁶)	Anthracnose Leaf Spot	Rust	Septoria Leaf Spot	Rate ⁴	PHI ⁵	Maximum Use ⁶
captan	80 WDG	M04	F	VG	G	F	F	-	G	G	-	F	3.12 lb	0	43.75 lb
captan	4L	M04	F	VG	G	F	F	-	G	G	-	F	see label	0	35 qt
chlorothalonil	Bravo Weather Stik, others	M05	-	-	-	-	-	-	-	VG	G	VG	3-4 pt	42 ¹⁰	12 pt
aluminum tris	O-ethyl phosphonate; Alette WDG ⁷	P07	-	-	-	-	P	G ¹²	P	VG	-	VG	5 lbs	0.5	4 apps
mono- and di-potassium salts of phosphorous acid	K-Phite 7LP, others	P07	-	-	-	-	-	VG ¹²	-	VG	-	VG	see label (rate varies by product and application method)	0	see label
potassium phosphite	ProPhyt	P07	-	-	-	-	-	VG ¹²	-	VG	-	VG	4 pt	0	
fenbuconazole ⁸	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	Tilt, others	3	-	-	-	E	E	-	-	-	G	VG	6 fl oz	30	5 apps
prothioconazole	Proline 480 SC	3	-	-	-	E	E	-	-	-	E	G	5.7 fl oz	7	2 apps
mefenoxam	Ridomil Gold SL, ReCon Bold SL, Ultra Flourish XHL	4	-	-	-	-	-	G	-	-	-	-	3.6 pt	0	7.2 pt
mefenoxam	Thrive 4M	4	-	-	-	-	-	G	-	-	-	-	56.5 fl oz	0	112.9 fl oz/2 apps
mefenoxam	Ultra Flourish, Vaunt	4	-	-	-	-	-	G	-	-	-	-	7.2 pt	0	14.4 pt
pydiflumetofen and fludioxonil	Miravis Prime	7, 12	-	-	-	-	-	-	E	-	-	-	9-13.4 fl oz	0	26.8 fl oz
cyprodinil and fludioxonil	Switch 62.5 WG	9, 12	E	-	E	F	G	-	E	G	-	G	11-14 oz	0	56 oz
azoxystrobin	Abound Flowable, others	11	-	-	E	F	F	-	E ^R	VG	G	VG	6.0-15.5 fl oz	0	see label
azoxystrobin and propiconazole	Quilt Xcel, others	11, 3	-	-	E	E	E	-	E ^R	E	E	E	14-21 fl oz	30	3 apps
pyraclostrobin and boscalid	Pristine	11, 7	E	F ^R	E	VG	E	-	E ^R	E	F	E	18.5-23 oz	0	4 apps
fenhexamid	Elevate 50WDG	17	E	-	-	F	-	-	-	-	-	-	1.5 lb	0	6 lb
fluazinam	Omega 500F	29	F	-	G	-	G	-	G	-	-	-	20 fl oz	30	120 fl oz

Chemical Name	Product Choices ²	Mode of Action Group(s) ³	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 ⁷)	Anthracnose Leaf Spot	Rust	Septoria Leaf Spot	Rate ⁴	PHI ⁵	Maximum Use ⁶
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.

1

Efficacy Rating	Abbreviation
Excellent	E
Very Good	VG
Good	G
Fair	F
Poor	P
Resistant	R
Not Effective	-

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,
 - = indicates that the chemical is not expected to be effective for managing the disease or that data is lacking.

Actual performance may vary. 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.

² 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.

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

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

⁵ 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.

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

⁷ 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.

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

⁹ Do not apply later than 3 weeks after full bloom.

¹⁰ Do not apply before harvest, to avoid fruit injury.

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

¹² When applied as foliar spray.

The blueberry section was revised October 2023 by Mary Helen Ferguson.

Grape

Disease

Symptoms, source of inoculum and management of grape diseases.

Disease	Symptoms	Source of Inoculum	Management
Anthracnose (<i>Elsinoe ampelina</i> = <i>Sphaceloma ampelinum</i>)	Fruit infections have light gray centers and reddish-brown borders resembling a bird's eye. Stem lesions are similar in color and sunken, with slightly raised borders. Leaf spots are gray with dark borders; later, the center of the lesion drops out, giving a ragged effect. Badly infected leaves become distorted and curl down.	The fungus overwinters in infected fruit on the ground or in infected shoots.	Follow the fungicide spray schedule for grapes. Do not apply Pristine to Concord, Worden, Fredonia, Niagara or related grape varieties because of possible injury.
Black rot (<i>Guignardia bidwellii</i>)	The black rot fungus attacks all parts of the grape plant. Leaf infection appears on the upper surface in early June as tiny reddish-brown spots. The lesions enlarge to 1/4 inch or more in diameter and become brown with black borders. A ring of black fungal bodies develops near the outer edge of the brown area. Lesions on stems and tendrils are longer and darker than those on leaves. Stem lesions are narrow, sunken and often split lengthwise on the vine. Infections begin to appear on the fruit when the berries are about half grown. Initially, a small white spot forms that enlarges rapidly until the entire berry is rotten. Affected berries soon turn black, shrivel and dry up. Minute black fungal fruiting bodies develop on the surface of the dried fruit. On muscadines, lesions on berries are small, black and scabby. The fruit does not rot.	The fungus overwinters in mummified fruit on the vine and ground and within lesions on canes.	Pruning out mummies, cankers and dead wood is very important to reduce inoculum load. Follow the fungicide spray schedule for grapes.
Botrytis bunch rot (<i>Botrytis cinerea</i>)	Infected blooms rot and dry out. Infected berries develop off-color and either dry out (during dry weather) or burst (during wet weather).	The fungus overwinters on canes or in buds. Spores are wind dispersed.	Prune out diseased tissue and destroy. Rake up fallen grapes and destroy. Follow the fungicide spray schedule for grapes.
Downy mildew (<i>Plasmopara viticola</i>)	This is primarily a disease of bunch grapes; muscadines are relatively resistant. All green parts of the vine are susceptible. Leaf lesions are yellowish- to reddish-brown and may appear angular if they are vein delimited. Infected shoot tips tend to curl. Leaves and shoots become covered with white mycelium. Berries appear grayish and are covered with the downy felt-like growth of the pathogen.	The pathogen overwinters in infected leaves. Disease development is boosted by wet weather.	Shred and remove or bury by cultivation diseased leaves. Follow the fungicide spray schedule for grapes.

Disease	Symptoms	Source of Inoculum	Management
Phomopsis cane and leaf spot (<i>Phomopsis viticola</i>)	Tiny dark spots with yellow margins form on the leaf blades and veins. Heavily infected basal leaves become distorted and may not develop to full size. Infected fruit turn brown, shrivel and drop from the cluster.	The fungus overwinters in the bark and leaf petioles. During wet springs, fungal spores exude from infected tissues and splash on to new (young) shoot tips. Spores move within the vine, causing localized infections in the vineyard. Fruit and cluster stem infections occur from bloom until the fruit are about the size of a pea.	At pruning, remove dead and diseased wood. Destroy pruned materials and debris by burning, burying or plowing them into the soil. Sanitize pruners with a registered disinfectant after each cut or between vines. Apply a dormant spray of lime sulfur to reduce overwintering inoculum.
Pierce's disease (<i>Xylella fastidiosa</i>)	This is a disease of bunch grapes. Muscadines are resistant. Symptoms may vary, but generally are characterized by a scorching of the leaf margins. Grape clusters wilt and dry; bud leaves are slow to develop and show water stress during dry periods.	The bacterium survives in infected vines and other hosts. It is transmitted by several leafhoppers.	Limiting the spread of the insect vector and destruction of wild weed hosts have had limited success. Soil applications of the insecticide Admire Pro or Scorpion 35SL are recommended. Destroy infected vines.
Powdery mildew (<i>Uncinula necator</i>)	Produces a whitish-gray, powdery-appearing growth on affected tissues. All green tissues are susceptible. Infection of young expanding leaves causes them to become distorted. Infection of blossoms results in poor fruit set. Infection of berries results in splitting or a netlike pattern on the surface.	The fungus overwinters in dormant buds or on other vine surfaces. Spores are wind dispersed.	Follow the fungicide spray schedule for grapes. Sulfur should be included in a fungicide program.

Table 1. Seasonal fungicide spray schedule for grapes

Developmental Stage	Pesticide Application Timing ¹	Diseases
Dormant	Prior to bud swell (bud is visibly swollen but no green or pink tissue is observed) and break	Anthraco-nose Phomopsis cane and leaf spot
Bud break and new shoot sprays (prebloom)	Every 7-10 days from 1-inch shoot growth to prebloom	Black rot Downy mildew Phomopsis cane and leaf spot Powdery mildew
Prebloom²	<10% bloom	Anthraco-nose Black rot Downy mildew Phomopsis cane and leaf spot Powdery mildew
Bloom	10%-20% bloom	Black rot Botrytis bunch rot Phomopsis cane and leaf spot Powdery mildew
Postbloom	First cover spray at 7-10 days after the prebloom spray	Anthraco-nose Black rot Downy mildew Phomopsis cane and leaf spot Powdery mildew
First and second cover sprays	Every 10-14 days following postbloom spray	Anthraco-nose Black rot Downy mildew Phomopsis cane and leaf spot Powdery mildew
Berry touch and bunch closure		Botrytis and other fruit rots
Third and subsequent cover sprays	Matured berries ³ Every 10-14 days until the preharvest spray	Anthraco-nose Black rot (foliar) Downy mildew (foliar) Phomopsis cane and leaf spot Powdery mildew (foliar)
Veraison	Onset of ripening	Botrytis bunch rot
Preharvest	10-14 days prior to harvest	Botrytis bunch rot Downy mildew Phomopsis cane and leaf spot Powdery mildew
Postharvest	Every 14-21 days until the first killing frost	Downy mildew Powdery mildew

¹ For more detailed information, see the 2023 Southeast Regional Bunch Grape Integrated Management Guide of the Southern Region Small Fruit Consortium (https://secure.caes.uga.edu/extension/publications/files/pdf/AP%20131-1_1.PDF).

² This is one of the most important sprays for downy mildew, powdery mildew, Phomopsis and black rot because it is the stage when grape berries become susceptible to infection by black rot, downy mildew and powdery mildew. All these pathogens become active due to warmer temperatures.

³ Mature berries are now resistant to black rot, downy mildew and powdery mildew. Sprays are applied to manage foliar infections caused by these diseases

Table 2. Efficacy of selected fungicides against grape diseases.**Table Legend**

Efficacy	Rating
Excellent Activity	EA
Good Activity	GA
Moderate Activity	MA
Limited Activity	LA
Very Limited Activity	VLA
No Significant Activity	NSA

Table is reproduced from the 2023 Southeast Regional Bunch Grape Integrated Management Guide of the Southern Region Small Fruit Consortium (https://secure.caes.uga.edu/extension/publications/files/pdf/AP%20131-1_1.PDF).

The efficacy rating could be affected by resistance development. If resistance has occurred, use of fungicides in the same class would likewise show resistance, and a substitute fungicide should be considered for pathogen management.

No data is provided for products not labeled for the specific disease or if the efficacy is unknown. These ratings are benchmarks; actual performance will vary.

Chemical Name	Product Choices	Anthraco-nose	Black Rot	Botrytis Bunch Rot	Downy Mildew	Phomopsis Cane and Leaf Spot	Powdery Mildew
Azoxystrobin			EA	MA ¹	EA ¹	MA	EA ¹
Benzovindiflupyr, isofetamid	Aprovia, Kenja	MA ²	GA	EA ²	EA ²	N/A	GA ²
Boscalid	Endura		EA ¹				GA ²
Boscalid + pyraclostrobin	Pristine	GA	EA	EA ¹	EA ¹	EA	EA
Cyazofami	Ranman				GA		
Captan	Captan, Captec, etc.	MA	MA	LA	GA	GA	NSA
Fixed coppers and bordeaux mixture	various products		MA	MA	MA	LA	LA
Cyflufenamid	Torino		NSA	NSA	NSA	NSA	GA
Cyprodinil	Vanguard		NSA	EA ¹	NSA	NSA	LA
Cyprodinil + fludioxonil	Switch			GA ¹			
Cyprodinil + difenoconazole	Inspire Super		GA	GA ¹			GA
Famoxadone + cymoxanil	Tanos				MA ¹		
Fenhexamid	Elevate		NSA	EA ¹	NSA	NSA	NSA
Ferbam	Ferbam		MA	NSA	LA	LA	NSA
Fenarimol	Rubigan		LA	NSA	NSA	NSA	GA ¹
Fluopicolide	Presidio	NSA	NSA	NSA	EA	NSA	NSA
Iprodione	Rovral, Meteor	NSA	NSA	LA ¹	NSA	NSA	NSA
Kresoxim-methyl	Sovran		EA	VLA ¹	LA ¹	MA	GA ¹
Lime sulfur	dormant application	MA		NSA	NSA	MA	LA
Mancozeb	various: Penncozeb, Dithane, etc.		EA	NSA	EA	EA	NSA
Mandipropamid	Revus	NSA	NSA	NSA	EA	NSA	NSA
Mandipropamid + difenoconazole	Revus Top		GA	NSA	EA	LA ²	GA
Mefenoxam + copper	Ridomil Gold Copper		LA	LA	EA	LA	LA
Mefenoxam + mancozeb	Ridomil Gold MZ		MA	NSA	EA	MA	NSA
Metrafenone	Vivando		NSA	NSA	NSA	NSA	GA
Myclobutanil	Rally		GA	NSA	NSA	NSA	GA ¹

Chemical Name	Product Choices	Anthraco	Black Rot	Botrytis Bunch Rot	Downy Mildew	Phomopsis Cane and Leaf Spot	Powdery Mildew
Phosphonate	ProPhyt, Phostrol, etc.				GA		
Sulfur ³	various		NSA	NSA	NSA	LA	EA
Tebuconazole	Elite		EA	NSA	NSA	NSA	GA ¹
Tetraconazole	Mettle						MA ¹
Thiophanate-methyl	Topsin M		LA	NSA	NSA	MA	GA ¹
Trifloxystrobin	Flint		EA	GA	MA	LA	GA ¹
Triflumazol	Procure and Viticure		LA ¹	NSA	NSA	NSA	EA
Ziram	Ziram		GA	LA	GA	MA	NSA

¹ Resistance (or occasional failure of control) has been observed in some southeastern states; thus, if control failure occurs, it could indicate resistance has developed.

² Insufficient data for the pathogen-chemical combination. The rating was given based on the general knowledge on the material.

³ Sulfur will cause burn on sensitive varieties, especially on hot days, >85 F.

Table 3. Recommended pesticides, rates and pesticide use restrictions for Anthracnose (*Elsinoe ampelina*) in grapes.

Product Choices ¹	Chemical Name	Product Mode of Action Group ²	Rate ^{3,4}	PHI ⁵	Maximum Use
Aprovia	benzovindiflupyr	7	8.6-10.5 fl oz	21	31.5 fl oz
Eagle 40WP	myclobutanil	3	3-5 oz	14	1.5 lb
Fosphite	phosphite ⁸ (phosphorous acid salts)	33	1-3 qt	-	-
Inspire Super ⁷	cyprodinil + difenoconazole	3, 9	16-20 fl oz	14	80 fl oz
Kenja 400SC	isofetamid	-	20-22 fl oz	14	66 fl oz
K-phite 7LP	phosphite ⁸ (phosphorous acid salts)	33	1-3 qt	-	-
Mettle 125ME	tetraconazole	3	3-5 fl oz	14	10 fl oz
Ph-D WDG	polyoxin D zinc salt	19	6.2 oz	7	3 app
Pristine ⁶	boscalid + pyraclostrobin	7, 11	8-12.5 oz	14	69 oz
Quadris Top	azoxystrobin+difenoconazole	11,3	12-14 oz	14	56 fl oz
Rampart	phosphite ⁸ (phosphorous acid salts)	33	1-3 qt	-	-
Revus Top	difenoconazole + mandipropamid	3, 40	7 fl oz	14	28 fl oz

¹ Mode of action groups are determined by the Fungicide Resistance Action Committee (FRAC).

² Reference to commercial or trade names is made with the understanding that no discrimination is intended nor endorsement of a particular product by LSU or the LSU AgCenter is implied.

³ Rates are the amount of formulation per acre of wine or sherry grapes unless otherwise indicated. See label for rates and restrictions for table or raisin grapes. Usually, 100 gallons of water are required to give good coverage with boom sprayers.

⁴ All rates refer to foliar applications unless otherwise noted. Refer to label for other application rates and directions.

⁵ Postharvest interval (PHI) is the minimum number of days allowed between the last application and harvest.

⁶ Do not use on Concord or Noiret. Possible foliar injury may also occur on Worden, Fredonia, Niagara, Steuben or Rougeon. See label for additional restrictions.

⁷ Do not use on ConCORDs or Thomcord.

⁸ Do not apply when temperatures exceed 90 F, shortly after a rain event, or during color break of the fruit.

Table 4. Recommended pesticides, rates and pesticide use restrictions for Bitter Rot (*Greeneria uvicola*) in grapes.

Product Choices ¹	Chemical Name	Product Mode of Action Group ²	Rate ^{3,4}	PHI ⁵	Maximum Use
Incognito 85WDG	thiophanate-methyl	1	0.8-1.2 lb	14	3.2 lb
Thiophanate-methyl 85WDG	thiophanate-methyl	1	0.6-1.2 lb	14	3.2 lb
T-Methyl 70WSB	thiophanate-methyl	1	0.75-1.5 lb	7	6 lb
Topsin M 70WP	thiophanate-methyl	1	0.75-1.5 lb	7	6 lb

¹ Mode of action groups are determined by the Fungicide Resistance Action Committee (FRAC).

² Reference to commercial or trade names is made with the understanding that no discrimination is intended nor endorsement of a particular product by LSU or the LSU AgCenter is implied.

³ Rates are the amount of formulation per acre of wine or sherry grapes unless otherwise indicated. See label for rates and restrictions for table or raisin grapes. Usually, 100 gallons of water are required to give good coverage with boom sprayers.

⁴ All rates refer to foliar applications unless otherwise noted. Refer to label for other application rates and directions.

⁵ Postharvest interval (PHI) is the minimum number of days allowed between the last application and harvest.

Table 5. Recommended pesticides, rates and pesticide use restrictions for Black Rot (*Guignardia bidwellii*) in grapes.

Product Choices ¹	Chemical Name	Product Mode of Action Group ²	Rate ^{3,4}	PHI ⁵	Maximum Use
Abound 2SC	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Adament 50WG ¹⁶	tebuconazole + trifloxystrobin	3, 11	3-6 oz	14	48 oz
Aframe	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Aprovia	benzovindiflupyr	7	8.6-10.5 fl oz	21	31.5 fl oz
Azoxy 2SC	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
AzoxyStar	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Captan 38.75% ¹⁷	captan	M	1.5-2 qt	0	12 qt
Captec 4L ¹⁷	captan	M	0.75-1 qt/100 gal	0	2 qt
Champ WG ¹⁰	copper hydroxide	M	2-6 lb	0	40 lb
ChamplON ¹⁰	copper hydroxide	M	0.75-1.75	0	66.7 lb
Cuprofix Ultra 40 Dispers ¹⁰	copper sulfate	M	1.25-3 lb	14	50 lb
Cuproxat ¹⁰	copper sulfate	M	2.5-6 pt	14	98.6 pt
Dithan F45	mancozeb	M	1.2-3.2 qt	66	19.2 qt
Dithan M45	mancozeb	M	1.5-4 lb	66	24 lb
Eagle 20EW	myclobutanil	3	6-10 fl oz	14	46 fl oz
Eagle 40WP	myclobutanil	3	3-5 oz	14	1.5 lb
Elite 45DF	tebuconazole	3	4 oz	14	2 lb

Product Choices ¹	Chemical Name	Product Mode of Action Group ²	Rate ^{3,4}	PHI ⁵	Maximum Use
Flint 50WG ⁷	trifloxystrobin	11	1.5-4 oz ⁸	14	24 oz
Incognito 85WDG	thiophanate-methyl	1	0.8-1.2 lb	14	3.2 lb
Inspire Super ¹¹	cyprodinil + difenoconazole	3, 9	16-20 fl oz	14	80 fl oz
ManKocide ¹⁰	copper hydroxide + mancozeb	M	2.5 lb	66	66.7 lb
Manzate Flowable	mancozeb	M	1.2-3.2 qt	66	19.2 qt
Manzate Max	mancozeb	M	1.2-3.2 qt	67	19.2 qt
Manzate Pro-Stick	mancozeb	M	1.5-4 lb	66	7.5 lb
Mettle 125ME	tetraconazole	3	3-5 fl oz	14	10 fl oz
Orius 20AQ	tebuconazole	3	8.6 oz	14	68.8 oz
Penncozeb 75DF	mancozeb	M	1.5-4 lb	66	24 lb
Penncozeb 80WP	mancozeb	M	1.5-4 lb	66	24 lb
Ph-D WDG	polyoxin D zinc salt	19	6.2 oz	7	3 app
Pristine ⁹	boscalid + pyraclostrobin	7, 11	8-12.5 oz	14	69 oz
Quadris Top	azoxystrobin+difenoconazole	11, 3	12-14 fl oz	14	56 fl oz
Rally 40WSP	myclobutanil	3	3-5 oz	14	1.5 lb
Revus Top	difenoconazole + mandipropamid	3, 40	7 fl oz	14	28 fl oz
Revus Top	difenoconazole + mandipropamid	3, 40	7 fl oz	14	28 fl oz
Roper DF Rainshield	mancozeb	M	1.5-4 lb	66	24 lb
Satori 2.08	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Sonoma 20EW AG	myclobutanil	3	6-10 fl oz	14	45.6 fl oz
Sovran 50WG	kresoxim-methyl	11	3.2-6.4 oz ⁸	14	25.6 oz
Sovran 50WG	kresoxim-methyl	11	3.2-6.4 oz ⁸	14	25.6 oz
Tebuzol 45DF	tebuconazole	3	4 oz	14	2 lb
Thiophanate-methyl 85WDG	thiophanate-methyl	1	0.6-1.2 lb	14	3.2 lb
T-Methyl 70WS ⁸	thiophanate-methyl	1	0.75-1.5 lb	7	6 lb
Topsin M 70WP	thiophanate-methyl	1	0.75-1.5 lb	7	6 lb
Willowood Azoxy 2SC	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Ziram 76DF	ziram	M	3-4 lb	21	28 lb

¹ Reference to commercial or trade names is made with the understanding that no discrimination is intended nor endorsement of a particular product by LSU or the LSU AgCenter is implied.

² Mode of action groups are determined by the Fungicide Resistance Action Committee (FRAC).

³ Rates are the amount of formulation per acre of wine or sherry grapes unless otherwise indicated. See label for rates and restrictions for table or raisin grapes. Usually, 100 gallons of water are required to give good coverage with boom sprayers.

⁴ All rates refer to foliar applications unless otherwise noted. Refer to label for other application rates and directions.

⁵ Postharvest interval (PHI) is the minimum number of days allowed between the last application and harvest.

⁶ For resistance management purposes, only 2 applications per year is recommended.

⁷ Do not use Flint on Concord.

⁸ Rates vary depending on disease. Refer to label for rates and timing.

⁹ Do not use on Concord or Noiret. Possible foliar injury may also occur on Worden, Fredonia, Niagara, Steuben or Rougeon. See label for additional restrictions.

¹⁰ See label for variety restrictions. Add hydrated lime (1-3 lb) per pound of Champ WG to minimize foliar injury.

¹¹ Do not use on Concord or Thomcord.

¹² Use a surfactant when Rubigan EC is applied alone.

¹³ Prebloom apply 2-4 fl oz/A; Postbloom apply 4-6 fl oz/A; cover sprays apply 5-6 fl oz/A.

¹⁴ Prebloom apply 3-4 fl oz/A; Postbloom apply 5-6 fl oz/A; cover sprays apply 5-6 fl oz/A.

¹⁵ Do not apply when temperatures exceed 90 F, shortly after a rain event, or during color break of the fruit.

¹⁶ See label for variety restrictions.

¹⁷ Suppression only

Table 6. Recommended pesticides, rates and pesticide use restrictions for Botrytis bunch rot (*Botrytis cinerea*) in grapes.

Product Choices ¹	Chemical Name	Product Mode of Action Group ²	Rate ^{3,4}	PHI ⁵	Maximum Use
Abound 2SC ¹⁷	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Adament 50WG ¹⁶	tebuconazole + trifloxystrobin	3, 11	3-6 oz	14	48 oz
Aframe ¹⁷	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Aprovia	benzovindiflupyr	7	8.6-10.5 fl oz	21	31.5 fl oz
Azoxystar 2SC ¹⁷	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Azoxystar ¹⁷	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Dithan F45	mancozeb	M	1.2-3.2 qt	66	19.2 qt
Dithan M45	mancozeb	M	1.5-4 lb	66	24 lb
Elevate 50WDG	fenhexamid	17	1 lb	0	3 lb
Endura 30WG	boscalid	7	8 oz	14	24 oz
Flint 50WG ⁷	trifloxystrobin	11	1.5-4 oz ⁸	14	24 oz
Gavel 75DF	mancozeb + zoxamide	M, 22	2-2.5 lb	66	15 lb
Inspire Super ¹¹	cyprodinil + difenoconazole	3, 9	16-20 fl oz	14	80 fl oz
Iprodione 4L AG	iprodione	43	1-2 pt	7	4 app
Kenja 400SC	isofetamid	7	20-22 fl oz	14	66 fl oz
Manzate Flowable	mancozeb	M	1.2-3.2 qt	66	19.2 qt
Manzate Max	mancozeb	M	1.2-3.2 qt	67	19.2 qt
Manzate Pro-Stick	mancozeb	M	1.5-4 lb	66	7.5 lb
Meteor	iprodione	43	1-2 pt	7	4 app
Nevado 4F	iprodione	43	1-2 pt	7	4 app
OSO 5%	polyoxin D zinc salt	19	3.75-13 fl oz	0	6 app
Penncozeb 75DF	mancozeb	M	1.5-4 lb	66	24 lb
Penncozeb 80WP	mancozeb	M	1.5-4 lb	66	24 lb
Ph-D WDG	polyoxin D zinc salt	19	6.2 oz	0	3 app
Pristine ⁹¹⁷	boscalid + pyraclostrobin	7, 11	18.5-23 oz	14	69 oz
Quadris Top ¹⁷	azoxystrobin+difenoconazole	11,3	12-14 oz	14	56 fl oz
Roper DF Rainshield	mancozeb	M	1.5-4 lb	66	24 lb
Rovral 4F	iprodione	43	1-2 pt	7	4 app
Satori 2.08 ¹⁷	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Scala SC	pyrimethanil	9	18 fl oz (alone) 9 fl oz (tank mix)	7	36 fl oz

Product Choices ¹	Chemical Name	Product Mode of Action Group ²	Rate ^{3,4}	PHI ⁵	Maximum Use
Sovran 50WG	kresoxim-methyl	11	3.2-6.4 oz ⁸	14	25.6 oz
Switch 62.5WG	cyprodinil + fludioxonil	9, 12	11-14 oz	7	56 oz
Topsin M 70WP	thiophanate-methyl	1	0.75-1.5 lb	7	6 lb
Vanguard WG	cyprodinil	9	10 oz (alone) 5-10 oz (tank mixtures)	7	30 oz
Vivando	metrafenone	U8	10.3-15.4 fl oz	14	46.2 fl oz
Willowood Azoxy 2SC ¹⁷	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz

¹ Reference to commercial or trade names is made with the understanding that no discrimination is intended nor endorsement of a particular product by LSU or the LSU AgCenter is implied.

² Mode of action groups are determined by the Fungicide Resistance Action Committee (FRAC).

³ Rates are the amount of formulation per acre of wine or sherry grapes unless otherwise indicated. See label for rates and restrictions for table or raisin grapes. Usually, 100 gallons of water are required to give good coverage with boom sprayers.

⁴ All rates refer to foliar applications unless otherwise noted. Refer to label for other application rates and directions.

⁵ Postharvest interval (PHI) is the minimum number of days allowed between the last application and harvest.

⁶ For resistance management purposes, only 2 applications per year is recommended.

⁷ Do not use Flint on Concorde.

⁸ Rates vary depending on disease. Refer to label for rates and timing.

⁹ Do not use on Concord or Noiret. Possible foliar injury may also occur on Worden, Fredonia, Niagara, Steuben or Rougeon. See label for additional restrictions.

¹⁰ See label for variety restrictions. Add hydrated lime (1-3 lb) per pound of Champ WG to minimize foliar injury.

¹¹ Do not use on Concorde or Thomcord.

¹² Use a surfactant when Rubigan EC is applied alone.

¹³ Prebloom apply 2-4 fl oz/A; Postbloom apply 4-6 fl oz/A; cover sprays apply 5-6 fl oz/A.

¹⁴ Prebloom apply 3-4 fl oz/A; Postbloom apply 5-6 fl oz/A; cover sprays apply 5-6 fl oz/A.

¹⁵ Do not apply when temperatures exceed 90 F, shortly after a rain event, or during color break of the fruit.

¹⁶ See label for variety restrictions.

¹⁷ Suppression only

Table 7. Recommended pesticides, rates and pesticide use restrictions for Downy mildew (*Plasmopara viticola*) in grapes.

Product Choices ¹	Chemical Name	Product Mode of Action Group ²	Rate ^{3,4}	PHI ⁵	Maximum Use
Abound 2SC	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Adament 50WG ¹⁰	tebuconazole + trifloxystrobin	3, 11	3-6 oz	14	48 oz
Aframe	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Aliette	aluminum tris	33	3-5 lb	15	7 app
Alude	phosphite ⁹	33	2.5-5 pt	NA	NA
Aprovia	benzovindiflupyr	7	8.6-10.5 fl oz	21	31.5 fl oz
Azoxystar	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Captan 38.75%	captan	M	1.5-2 qt	0	12 qt
Captec 4L	captan	M	0.75-1 qt/100 gal	0	2 qt
Champ WG ¹⁰	copper hydroxide	M	2-6 lb	0	40 lb
Champion ¹⁰	copper hydroxide	M	0.75-1.75	0	66.7 lb
Cuprofix Ultra 40 Dispers ¹⁰	copper sulfate	M	1.25-3 lb	14	50 lb
Cuproxtat ¹⁰	copper sulfate	M	2.5-6 pt	14	98.6 pt
Dithan F45	mancozeb	M	1.2-3.2 qt	66	19.2 qt
Dithan M45	mancozeb	M	1.5-4 lb	66	24 lb
Dithane F45 Rainshield	mancozeb	M	1.2-3.2 qt	66	19.2 qt
Flint 50WG ¹¹	trifloxystrobin	11	1.5-4 oz ⁸	14	24 oz
Forum	dimethomorph	40	6 fl oz	14	24 fl oz
Fosphite	phosphite ⁹	33	1-3 qt	NA	NA
Gavel 75DF	mancozeb + zoxamide	M, 22	2-2.5 lb	66	15 lb
K-phite 7LP	phosphite ⁹	33	1-3 qt	NA	NA
ManKocide ⁷	copper hydroxide + mancozeb	M	2.5 lb	66	66.7 lb
Manzate Flowable	mancozeb	M	1.2-3.2 qt	66	19.2 qt
Manzate Max	mancozeb	M	1.2-3.2 qt	66	19.2 qt
Manzate Pro-Stick	mancozeb	M	1.5-4 lb	66	7.5 lb
Penncozeb 75DF	mancozeb	M	1.5-4 lb	66	24 lb
Penncozeb 80WP	mancozeb	M	1.5-4 lb	66	24 lb
Phostrol	phosphite ⁹	33	2.5-5 pt	NA	NA
Presidio	fluopicolide	43	3-4 fl oz	21	12 fl oz

Product Choices ¹	Chemical Name	Product Mode of Action Group ²	Rate ^{3,4}	PHI ⁵	Maximum Use
Pristine ⁶	boscalid + pyraclostrobin	7, 11	8-12.5 oz	14	69 oz
Quadris Top	azoxystrobin+difenoconazole	11, 3	12-14 fl oz	14	56 fl oz
Rampart	phosphite ⁹	33	1-3 qt	NA	NA
Ranman 400SC	cyazofamid	21	2.1-2.75 fl oz	30	16.5 fl oz
Reason 500SC	fenamidone	11	2.7 fl oz	30	8.1 fl oz
Revus	mandipropamid	40	8 fl oz	14	32 fl oz
Ridomil Gold MZ WG	mefenoxam + mancozeb	4, M	2.5 lb	66	11 lb
Ridomil Gold SL, Ultra Flourish	mefenoxam	NA	3.6 pt	60	0.4 lb ai
Ridomil Gold/Copper	mefenoxam + copper hydroxide	4, M	2.5 lb	42	10 lb
Roper DF Rainshield	mancozeb	M	1.5-4 lb	66	24 lb
Satori 2.08	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Sovran 50WG	kresoxim-methyl	11	3.2-6.4 oz ⁸	14	25.6 oz
Tanos	famoxodone + cymoxanil	11, 27	8 oz	30	72 oz
Willowood Azoxy 2SC	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Zampro	ametoctradin + dimethomorph	45, 40	11-14 fl oz	14	56 fl oz
Ziram 76DF	ziram	M	3-4 lb	21	28 lb

¹ Mode of action groups are determined by the Fungicide Resistance Action Committee (FRAC).

² Reference to commercial or trade names is made with the understanding that no discrimination is intended nor endorsement of a particular product by LSU or the LSU AgCenter is implied.

³ Rates are the amount of formulation per acre of wine or sherry grapes unless otherwise indicated. See label for rates and restrictions for table or raisin grapes. Usually, 100 gallons of water are required to give good coverage with boom sprayers.

⁴ All rates refer to foliar applications unless otherwise noted. Refer to label for other application rates and directions.

⁵ Postharvest interval (PHI) is the minimum number of days allowed between the last application and harvest.

⁶ Do not use on Concord or Noiret. Possible foliar injury may also occur on Worden, Fredonia, Niagara, Steuben or Rougeon. See label for additional restrictions.

⁷ See label for variety restrictions. Add hydrated lime (1-3 lb) per pound of Champ WG to minimize foliar injury.

⁸ Rates vary depending on disease. Refer to label for rates and timing.

⁹ Do not apply when temperatures exceed 90 F, shortly after a rain event, or during color break of the fruit.

¹⁰ See label for variety restrictions.

¹¹ Do not use Flint on Concorde.

Table 8. Recommended pesticides, rates and pesticide use restrictions for Phomopsis cane and leaf spot (*Phomopsis viticola*) in grapes.

Product Choices ¹	Chemical Name	Product Mode of Action Group ²	Rate ^{3,4}	PHI ⁵	Maximum Use
Abound 2SC	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Adament 50WG ¹⁶	tebuconazole + trifloxystrobin	3, 11	3-6 oz	14	48 oz
Aframe	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Aprovia	benzovindiflupyr	7	8.6-10.5 fl oz	21	31.5 fl oz
Azoxy 2SC	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
AzoxyStar	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Captan 38.75%	captan	M	1.5-2 qt	0	12 qt
Captec 4L	captan	M	0.75-1 qt/100 gal	0	2 qt
Champ WG10	copper hydroxide	M	2-6 lb	0	40 lb
ChamplON10	copper hydroxide	M	0.75-1.75	0	66.7 lb
Cuprofix Ultra 40 Disperss ¹⁰	copper sulfate	M	1.25-3 lb	14	50 lb
Cuproxtat ¹⁰	copper sulfate	M	2.5-6 pt	14	98.6 pt
Dithan F45	mancozeb	M	1.2-3.2 qt	66	19.2 qt
Dithan M45	mancozeb	M	1.5-4 lb	66	24 lb
Flint 50WG ⁷	trifloxystrobin	11	1.5-4 oz ⁸	14	24 oz
Gavel 75DF	mancozeb + zoxamide	M, 22	2-2.5 lb	66	15 lb
ManKocide ¹⁰	copper hydroxide + mancozeb	M	2.5 lb	66	66.7 lb
Manzate Flowable	mancozeb	M	1.2-3.2 qt	66	19.2 qt
Manzate Max	mancozeb	M	1.2-3.2 qt	67	19.2 qt
Manzate Pro-Stick	mancozeb	M	1.5-4 lb	66	7.5 lb
Microthiol Disperss	sulfur	M	3-10 lb	NA	NA
Penncozeb 75DF	mancozeb	M	1.5-4 lb	66	24 lb
Penncozeb 80WP	mancozeb	M	1.5-4 lb	66	24 lb
Pristine ⁹	boscalid + pyraclostrobin	7, 11	8-12.5 oz	14	69 oz
Quadris Top	azoxystrobin+difenoconazole	11,3	12-14 oz	14	56 fl oz
Revus Top	difenoconazole + mandipropamid	3, 40	7 fl oz	14	28 fl oz
Roper DF Rainshield	mancozeb	M	1.5-4 lb	66	24 lb
Satori 2.08	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Sovran 50WG	kresoxim-methyl	11	3.2-6.4 oz ⁸	14	25.6 oz
Willowood Azoxy 2SC	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz

¹ Reference to commercial or trade names is made with the understanding that no discrimination is intended nor endorsement of a particular product by LSU or the LSU AgCenter is implied.

² Mode of action groups are determined by the Fungicide Resistance Action Committee (FRAC).

³ Rates are the amount of formulation per acre of wine or sherry grapes unless otherwise indicated. See label for rates and restrictions for table or raisin grapes. Usually, 100 gallons of water are required to give good coverage with boom sprayers.

⁴ All rates refer to foliar applications unless otherwise noted. Refer to label for other application rates and directions.

⁵ Postharvest interval (PHI) is the minimum number of days allowed between the last application and harvest.

⁶ For resistance management purposes, only 2 applications per year is recommended.

⁷ Do not use Flint on Concords.

⁸ Rates vary depending on disease. Refer to label for rates and timing.

⁹ Do not use on Concord or Noiret. Possible foliar injury may also occur on Worden, Fredonia, Niagara, Steuben or Rougeon. See label for additional restrictions.

¹⁰ See label for variety restrictions. Add hydrated lime (1-3 lb) per pound of Champ WG to minimize foliar injury.

¹¹ Do not use on Concords or Thomcord.

¹² Use a surfactant when Rubigan EC is applied alone.

¹³ Prebloom apply 2-4 fl oz/A; Postbloom apply 4-6 fl oz/A; cover sprays apply 5-6 fl oz/A.

¹⁴ Prebloom apply 3-4 fl oz/A; Postbloom apply 5-6 fl oz/A; cover sprays apply 5-6 fl oz/A.

¹⁵ Do not apply when temperatures exceed 90 F, shortly after a rain event, or during color break of the fruit.

¹⁶ See label for variety restrictions.

Table 9. Recommended pesticides, rates and pesticide use restrictions for Powdery mildew (*Uncinula necator*) in grapes.

Product Choices ¹	Chemical Name	Product Mode of Action Group ²	Rate ^{3,4}	PHI ⁵	Maximum Use
Abound 2SC	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Aframe	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Aprovia	benzovindiflupyr	7	8.6-10.5 fl oz	21	31.5 fl oz
Azoxy 2SC	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
AzoxyStar	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Champ WG ¹⁰	copper hydroxide	M	2-6 lb	0	40 lb
Champion ¹⁰	copper hydroxide	M	0.75-1.75	0	66.7 lb
Cuprofix Ultra 40 Dispers ¹⁰	copper sulfate	M	1.25-3 lb	14	50 lb
Cuproxtat ¹⁰	copper sulfate	M	2.5-6 pt	14	98.6 pt
Eagle 20EW	myclobutanil	3	6-10 fl oz	14	46 fl oz
Eagle 40WP	myclobutanil	3	3-5 oz	14	1.5 lb
Elevate 50WDG ¹⁷	fenhexamid	17	1 lb	0	3 lb
Elite 45DF	tebuconazole	3	4 oz	14	2 lb
Endura 30WG	boscalid	7	4.5 oz	14	24 oz
Flint 50WG ⁷	trifloxystrobin	11	1.5-4 oz ⁸	14	24 oz
Fosphite	phosphite ⁹	33	1-3 qt	NA	NA
Incognito 85WDG	thiophanate-methyl	1	0.8-1.2 lb	14	3.2 lb
Inspire Super ¹¹	cyprodinil + difenoconazole	3, 9	16-20 fl oz	14	80 fl oz
Kenja 400SC	isofetamid	7	20-22 fl oz	14	66 fl oz
K-phite 7LP	phosphite ⁹	33	1-3 qt	NA	NA
Liquid Sulfur Six	sulfur	M	1-2 pt/100 gal	NA	8 pt
ManKocide ¹⁰	copper hydroxide + mancozeb	M	2.5 lb	66	66.7 lb
Mettle 125ME	tetraconazole	3	3-5 fl oz	14	10 fl oz
Microfine Sulfur	sulfur	M	3.8-25 lb	NA	NA
Microthiol Dispers ¹⁰	sulfur	M	3-10 lb	NA	NA
Orius 20AQ	tebuconazole	3	8.6 oz	14	68.8 oz
OSO 5%	polyoxin D zinc salt	19	3.75-13 fl oz	0	6 app
Ph-D WDG	polyoxin D zinc salt	19	6.2 oz	7	3 app
Pristine ⁹	boscalid + pyraclostrobin	7, 11	8-12.5 oz	14	69 oz
Procure 480SC	triflumizole	3	4-8 oz	7	32 oz

Product Choices ¹	Chemical Name	Product Mode of Action Group ²	Rate ^{3,4}	PHI ⁵	Maximum Use
Quadris Top	azoxystrobin+difenoconazole	11,3	12-14 oz	14	56 fl oz
Quintec	quinoxifen	13	3-6.6 fl oz	14	33 fl oz
Rally 40WSP	myclobutanil	3	3-5 oz	14	1.5 lb
Rampart	phosphite ⁹	33	1-3 qt	NA	NA
Revus Top	difenoconazole + mandipropamid	3, 40	7 fl oz	14	28 fl oz
Rubigan EC ¹²	fenarimol	3	2-6 fl oz ¹³	21	19 fl oz
Satori 2.08	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Sonoma 20EW AG	myclobutanil	3	6-10 fl oz	14	45.6 fl oz
Tebuzol 45DF	tebuconazole	3	4 oz	14	2 lb
Thiophanate-methyl 85WDG	thiophanate-methyl	1	0.6-1.2 lb	14	3.2 lb
T-Methyl 70WSB	thiophanate-methyl	1	0.75-1.5 lb	15	6 lb
Topsin M 70WP	thiophanate-methyl	1	0.75-1.5 lb	7	6 lb
Torino	cyflufenamid	U6	3.4 oz	3	6.8 oz
Vanguard WG ¹⁷	cyprodinil	9	10 oz (alone) 5-10 oz (tank mixtures)	7	30 oz
Vintage SC	fenarimol	3	3-6 fl oz ¹⁴	21	21 fl oz
Willowood Azoxy 2SC	azoxystrobin	11	10.5-15.5 fl oz	14	92.3 fl oz
Yellow Jacket Dusting	sulfur	M	10-20 lb	NA	NA
Yellow Jacket Wettable	sulfur	M	3.8-25 lb	NA	NA

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² Mode of action groups are determined by the Fungicide Resistance Action Committee (FRAC).

³ Rates are the amount of formulation per acre of wine or sherry grapes unless otherwise indicated. See label for rates and restrictions for table or raisin grapes. Usually, 100 gallons of water are required to give good coverage with boom sprayers.

⁴ All rates refer to foliar applications unless otherwise noted. Refer to label for other application rates and directions.

⁵ Postharvest interval (PHI) is the minimum number of days allowed between the last application and harvest.

⁶ For resistance management purposes, only 2 applications per year is recommended.

⁷ Do not use Flint on Concord.

⁸ Rates vary depending on disease. Refer to label for rates and timing.

⁹ Do not use on Concord or Noiret. Possible foliar injury may also occur on Worden, Fredonia, Niagara, Steuben or Rougeon. See label for additional restrictions.

¹⁰ See label for variety restrictions. Add hydrated lime (1-3 lb) per pound of Champ WG to minimize foliar injury.

¹¹ Do not use on Concord or Thomcord.

¹² Use a surfactant when Rubigan EC is applied alone.

¹³ Prebloom apply 2-4 fl oz/A; Postbloom apply 4-6 fl oz/A; cover sprays apply 5-6 fl oz/A.

¹⁴ Prebloom apply 3-4 fl oz/A; Postbloom apply 5-6 fl oz/A; cover sprays apply 5-6 fl oz/A.

¹⁵ Do not apply when temperatures exceed 90 F, shortly after a rain event, or during color break of the fruit.

¹⁶ See label for variety restrictions.

¹⁷ Suppression only

The grape section was revised October 2023 by R. Singh.

Strawberry

Integrated Strawberry Disease Management

Strawberries are among the most challenging horticultural crops to grow in the South because of high levels of soilborne pathogens. Chemical use, from preplant to harvest, is a critical component in maintaining crop yield and producing high-quality fruit.

Traditionally, disease management in strawberries has relied on the establishment of a clean crop planted into methyl bromide-fumigated soil. With the phase-out of methyl bromide, the use of alternative, more sustainable management strategies is necessary. (For fumigant information see the [Southeast Regional Strawberry Integrated Management Guide](#).)

Rotate your planting site. Rotating where strawberries are planted is an important part of avoiding soilborne disease problems. This is especially important in the absence of fumigation. Try not to plant strawberries in a particular site more than once every three to four years.

Start with clean plants. Purchase plants from a reputable source and inspect them when they arrive. Many disease-causing agents can be brought in on plants, and clean plants are especially important for avoiding anthracnose crown rot (caused by *Colletotrichum gloeosporioides*), Phytophthora crown rot and virus problems.

Minimize plant stress during establishment. Overhead irrigation is recommended during the first one to two weeks after planting bare-root plants. It may also be helpful to provide some overhead water during the first several days after planting plug plants. Drip irrigation can be used after this time.

Correctly diagnose problems. Contact your local extension agent or the LSU AgCenter Plant Diagnostic Center for assistance, if needed. The [Strawberry Diagnostic Key](#) may also be helpful.

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 (Table 1), 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. Tests of fungal isolates from Louisiana and other states have shown that the gray mold fruit rot pathogen (*Botrytis cinerea*) is likely to be resistant to common fungicides in several FRAC groups and that the anthracnose fruit rot pathogen (*Colletotrichum* sp.) is likely to be resistant to FRAC 11 fungicides. More information is given in the respective sections. Although some details about chemical application are given in Table 3, 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 strawberry diseases.

Disease	Symptoms	Source of Inoculum	Management
Angular (Bacterial) Leaf Spot (<i>Xanthomonas fragariae</i>)	First visible as tiny, water-soaked spots on the lower leaf surface that enlarge into angular lesions delimited by leaf veins. Lesions appear translucent when held up to the light. Bacterial ooze may be found on lesions on lower leaf surfaces.	The bacterium survives in infected leaf debris or is introduced on infected planting material. Bacterial cells are spread primarily by rain splashing and wind-driven rain. Disease develops most under cool, wet conditions.	Use disease-free transplants. Spray with copper bactericide or the plant defense activator Actigard, if needed.
Anthracnose Crown Rot (<i>Colletotrichum</i> spp.)	Plants wilt suddenly and die during warm weather. Crowns have a reddish discoloration extending into the center. Black lesions occur on leaf petioles or runners. Disease development is inhibited by cool weather.	The fungus is often introduced on infected planting material and survives on infected plant parts. Fungal spores are spread by rain splashing and wind-driven rain.	Use disease-free transplants. Inspect for disease symptoms when plants are received. Dip plants in a fungicide prior to planting if problems with the plant source are identified. Scout fields for disease symptoms during post-planting period, Remove infected plants and treat surrounding plants with fungicides.
Anthracnose Fruit Rot (<i>Colletotrichum acutatum</i>)	Buds, flowers, sepals and/or flower stems (pedicels and peduncles) often turn brown. Spots on fruit are light brown to black and often begin with a water-soaked appearance and then become firm and sunken. Orange to pink spores can develop when weather is humid. Plant stunting and/or death and petiole lesions may be seen before flower blight or fruit rot occur.	The fungus is often introduced on infected planting material and survives on infected plant parts. Fungal spores can be spread by rain splashing, wind-driven rain, workers and equipment.	Use disease-free transplants. Do not use an excessive amount of nitrogen fertilizer. If the presence of <i>C. acutatum</i> has been confirmed, begin fungicide applications for fruit rot at bloom. Resistance to the FRAC group 11 fungicides has been found in the pathogen in some instances; three-quarters of 51 samples from Louisiana tested in 2016 were found to be resistant. Captan, Switch, and Miravis Prime are still expected to be effective for managing anthracnose fruit rot. See Table 2 for efficacy ratings of other products.
Botrytis Fruit Rot (Gray Mold) and Crown Rot (<i>Botrytis cinerea</i>)	This fungus attacks flowers, flower parts, fruit and leaves. On the fruit, this disease causes a rot that is at first light brown and soft (not "leaky"). As the berry rots, it becomes covered with a grayish, powdery growth, and in the final stages of rot, it becomes tough and firm in texture. Crown rot can be a problem in the winter when early blossoms are killed by frost and a warm period follows.	The fungus survives in the decaying tissues of strawberries and many other plants. Fungal spores are wind-dispersed.	Removing dying and dead leaves shortly before plants flower may be helpful. If applying fungicides, begin while flowers are in bloom; most infections that eventually affect fruit are initiated through flowers. Harvest fruit frequently, removing infected and other unmarketable fruit from the field. Fungicide resistance in <i>Botrytis cinerea</i> is a major concern. Resistance has been documented in one or more locations to many of the fungicides previously effective for managing gray mold. In tests of the fungus from five Louisiana strawberry fields in 2019, all isolates were resistant to thiophanate-methyl and pyraclostrobin, and most were resistant to fenhexamid. Some resistance to penthiopyrad, fluopyram, and, to a lesser extent, boscalid were observed, but resistance to isofetamid and pydiflumetofen was not found, even though they are in the same FRAC group as the former three. Two fields had some level of resistance to at least one of the active ingredients in Switch (cyprodinil and fludioxonil). Captan, thiram, isofetamid (Kenja), polyoxin D salts (Ph-D/OSO 5%SC), Miravis Prime, and Switch (in most cases) appear to remain effective options for gray mold. Be sure to rotate among modes of action (FRAC groups). For chemical management of crown rot, choose among captan, Switch and iprodione.

Disease	Symptoms	Source of Inoculum	Management
Common Leaf Spot (False Rust, Bird's Eye Spot) (<i>Mycosphaerella fragariae</i>)	The spots are at first less than 1/8 inch in diameter and purplish-red. Spots enlarge to about 3/16 inch. They have white or gray centers with purplish borders.	The fungus survives from year to year on infected plant parts.	Spray with fungicides if needed. While many fungicides are effective on this disease, consider using myclobutanil, a combination of thiophanate-methyl and captan, or captan alone, unless another fungicide is needed for another purpose.
Leaf Blight (<i>Phomopsis obscurans</i> or <i>Dendrophoma obscurans</i>)	First appears as large, circular, reddish-purple spots that become zonate with age (i.e., they have a dark brown center surrounded by a lighter brown area with a purplish border). Mature spots may be circular, oval or V-shaped.	The fungus lives from year to year primarily on infected plant tissue.	Use disease-free transplants. Spray with fungicides if needed. While many fungicides are effective on this disease, consider using myclobutanil, a combination of thiophanate-methyl and captan, or captan alone, unless another fungicide is needed for another purpose.
Leaf Blotch (<i>Gnomonia</i> sp. or <i>Zythia</i> sp.)	First appears as purplish to brownish blotches on young leaves. Later appears as large, light brown spots on older leaves. Also causes spots on the stem end of fruit.	The fungus lives from year to year primarily on infected plant tissue.	Spray with fungicides if needed. While many fungicides may be effective on this disease, consider using myclobutanil, a combination of thiophanate-methyl and captan, or captan alone, unless another fungicide is needed for another purpose.
Leaf Scorch (<i>Diplocarpon earlianum</i>)	The disease first appears on upper leaf surfaces as small purplish spots that enlarge rapidly into irregular purplish blotches from 1/16 inch to 3/16 inch in diameter. The spots may become numerous and coalesce. In severe cases, the edges of the leaflets curl upward and the tissue dies, giving the plant a scorched appearance.	The fungus survives from year to year on infected leaves.	Use disease-free transplants. Rotate strawberry fields, if possible. Spray with fungicides if needed. While many fungicides may be effective on this disease, consider using myclobutanil, a combination of thiophanate-methyl and captan, or captan alone, unless another fungicide is needed for another purpose.
Pestalotia Leaf Spot and Fruit Rot (<i>Neopestalotiopsis</i> sp.)	A recently identified aggressive <i>Neopestalotiopsis</i> fungus genotype causes spots on strawberry leaves and fruit. Leaf spots sometimes have a distinctive dark border. Tiny black fungal structures can often be seen within leaf and fruit spots. Plants may eventually collapse.	Possible sources include contaminated plants and crop debris remaining in fields. Where soil is fumigated under plastic mulch, the pathogen may survive in row middles. It may spread in wet conditions on clothing and equipment. It is suspected that row covers and spider mites help spread the pathogen.	Obtain plants from a reputable source and check them for symptoms. Practice crop rotation. Avoid working in the field while plants are wet. Thiram SC or a rotation of Thiram SC with Switch have been shown to suppress the disease.
Powdery Mildew (<i>Sphaerotheca macularis</i> f. sp. <i>fragariae</i>)	A white powdery growth is present on the undersurface of infected leaves and on fruit. Infected leaves have a tendency to roll up.	The fungus persists from year to year on infected strawberries and other wild hosts. Usually a problem in the spring and early summer months.	Many varieties are resistant to this disease. It is more likely to be a problem in strawberries grown under cover (e.g., high tunnels). Spray with fungicides if needed.

Disease	Symptoms	Source of Inoculum	Management
Phytophthora Crown and Root Rot (<i>Phytophthora</i> spp.)	Youngest leaves often wilt first followed by the collapse of the entire plant. Crowns often exhibit extensive brown discoloration that extends from the crown downward or from an infected stolon.	Oospores that survive in the soil or on infected transplants. Spreads primarily in water.	Use disease-free transplants, improve drainage and avoid low spots. Dip transplants in suitable fungicide prior to planting if problems with the plant source are identified. Remove infected plants and treat surrounding plants with appropriate fungicide. Do not use an excessive amount of nitrogen fertilizer.
Root-knot Nematodes (<i>Meloidogyne</i> spp.)	Affected plants are stunted, unthrifty, nonproductive and often pale green in color. Galls or knots on the roots are rather small. Numerous secondary roots may develop at the small swellings. Frequently, blackened, rotten roots are associated with root-knot problems.	Root-knot nematodes live from year to year in the soil and on the roots of strawberry plants and many weeds. Root-knot nematodes are more severe in light soil types.	Sample soil for nematodes and fumigate soil if needed. See recommendations in the Nematode Control section of this guide and in the Southeast Regional Strawberry Integrated Management Guide .
Summer Dwarf or Bud Nematodes (<i>Aphelenchoides besseyi</i>)	Affected plants are severely stunted during the summer and early fall. Older leaflets usually are darker green with a greasy appearance. Young leaflets are reduced in size, usually crinkled and somewhat elongated, with shorter petioles. Margins of leaflets may curl upward in the young leaflets and downward in the older leaflets.	Bud nematodes live from year to year on infected daughter plants and in the soil.	Fumigate fields where the disease has occurred. Obtain clean plants. There is no satisfactory treatment to eradicate these nematodes from infected plants.

Table 1. Seasonal fungicide spray schedule for strawberry.¹

Season	Pesticide Application Timing	Diseases
Preplanting	Preplanting fungicide dip ²	Anthracnose crown rot, Phytophthora crown or root rot
Postplanting until prebloom	Early postplanting	Anthracnose crown rot, Phytophthora crown or root rot, powdery mildew
Postplanting until prebloom	Warm periods following frost	Botrytis crown rot
Postplanting until prebloom	New growth	Leaf spots (bacterial and fungal), Phytophthora crown or root rot, powdery mildew
Bloom until harvest	Every 7 to 10 days or according to label	Gray mold, anthracnose fruit rot, leaf spots (bacterial and fungal, Phytophthora crown or root rot, powdery mildew

¹ Not all applications will be needed in every field every season. Contact your local extension agent if you need help determining if an application needs to be made.

² If it is known that plants from a particular source have a problem with one of the root or crown rot diseases, bare-root strawberry plants may be dipped in a fungicide suspension prior to planting to provide early season control. Prior to dipping, the plants should be washed with potable water to remove adhering soil.

Table 2. Pesticide efficacy¹ and use.

Chemical Names	Product Choices ²	Mode of Action Group(s) ³	Angular Leaf Spot	Anthrachnose Crown Rot	Anthrachnose Fruit Rot	Botrytis Crown Rot	Botrytis Fruit Rot (Gray Mold)	Common Leaf Spot	Leaf Blight	Leather Rot	Phytophthora Crown or Root Rot and Red Stele Root Rot	Powdery Mildew	Rate ⁴	PHI ⁵	Maximum Use ⁶
copper-containing products labeled for use on strawberries, including ones with basic copper sulfate, copper hydroxide, copper oxychloride, copper octanoate, copper sulfate pentahydrate, or cuprous oxide	some products OMRI listed ^{9G}	M01	P	-	-	-	-	P	-	P	-	-	see label	typically 0 – see label	see label
sulfur ¹²	Yellow Jacket Wettable II ^{9G} ; 90%	M02	-	-	-	-	-	-	-	-	-	G	3-50 lb	0	
sulfur ¹²	Microthiol Dispers ^{9G} ; 80%	M02	-	-	-	-	-	-	-	-	-	G	5-10 lb	0	
thiram	SC	M03	-	F	F	F	G	F	F	F	-	-	2.0-2.5 qt (1.5-2.5 qt for gray mold)	1	5 or 12 apps ¹³
captan	50 WP	M04	-	G	G	F	G	F	F	F	-	-	3-6 lb	0	48 lb
captan	80 WDG	M04	-	G	G	F	G	F	F	F	-	-	see label	0	30 lb
captan	4L	M04	-	G	G	F	G	F	F	F	-	-	see label	0	24 qt
acibenzolar-S-methyl	Actigard 50WG	P01	P	-	-	-	-	-	-	-	-	-	0.5-0.75 oz	0	6 oz
aluminum tris	O-ethyl phosphonate, Aliette WDG ⁷	P07	-	-	-	-	-	-	-	F	F	-	2.5-5.0 lb8 (2.5 lb/100 gal for dip)	0.5	30 lb
mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	P07	-	-	-	-	-	-	-	F	F	-	2.5 – 5.0 pt (2.5 pt/100 gal for dip)	0	
mono- and di-potassium salts of phosphorous acid	K-Phite 7LP, others	P07	-	-	-	-	-	-	-	F	F	-	see label (varies by product and application method)	0	see label
potassium phosphite	ProPhyt	P07	-	-	-	-	-	-	-	F	F	-	2-4 pt (2 pt/100 gal for dip)	0	

Chemical Names	Product Choices ²	Mode of Action Group(s) ³	Angular Leaf Spot	Anthrachnose Crown Rot	Anthrachnose Fruit Rot	Botrytis Crown Rot	Botrytis Fruit Rot (Gray Mold)	Common Leaf Spot	Leaf Blight	Leather Rot	Phytophthora Crown or Root Rot and Red Stele Root Rot	Powdery Mildew	Rate ⁴	PHI ⁵	Maximum Use ⁶
cyflufenamid	Torino	U06	-	-	-	-	-	-	-	-	-	VG	3.4 oz	0	2 apps
flutianil	Gatten	U13	-	-	-	-	-	-	-	-	-	E	6 - 8 fl oz	0	5 apps
thiophanate-methyl	Incognito 85 WDG	1	-	G ^R	-	- _R	- _R	G	G	-	-	F ^R	0.6-0.8 lb	1	3.2 lb
thiophanate-methyl	Topsin M WSB, T-Methyl 70 WSB	1	-	G ^R	-	- _R	- _R	G	G	-	-	F ^R	0.75-1 lb	1	4 lb
thiophanate-methyl	Topsin 4.5FL, others	1	-	G ^R	-	- _R	- _R	G	G	-	-	F ^R	15-20 fl oz	1	4 apps
iprodione	Rovral 4, Meteor	2	-	-	-	VG	G ^R	G	-	-	-	-	1.5-2 pt alone; 1 pt if tank mix	Do not apply after first fruiting flower.	1 app
flutriafol	Rhyme	3	-	-	-	-	-	-	-	-	-	E ^R	5 - 7 fl oz (7 fl oz for charcoal rot)	0	4 apps
myclobutanil	Rally 40WSP	3	-	-	-	-	-	VG	VG	-	-	E ^R	2.5-5 oz	0	30 oz
propiconazole	Tilt, others	3	-	F	F	P	P	G	-	-	-	VG ^R	4 fl oz	0	4 apps
tetraconazole	Mettle 125 ME	3	-	-	-	-	-	-	-	-	-	E ^R	3-5 fl oz	0	20 fl oz
triflumizole	Procure 480SC, Trionic 4SC	3	-	-	-	-	-	-	-	-	-	E ^R	4-8 fl oz	1	4 apps
propiconazole and thiophanate-methyl	Protocol	3,1	-	G ^R	G ^R	G ^R	G ^R	G	G	-	-	G ^R	1.33 pt	1	5.3 pt
difenoconazole and cyprodinil	Inspire Super	3,9	-	G	G	VG	VG	-	-	-	-	E	16-20 fl oz	0	80 fl oz
mefenoxam	Ridomil Gold SL, ReCon Bold SL, Ultra Flourish XHL	4	-	-	-	-	-	-	-	VG ^R	VG	-	1 pt ¹⁰	0	3 pt/3 apps
mefenoxam	Thrive 4M	4	-	-	-	-	-	-	-	VG ^R	VG	-	15.7 fl oz ¹⁰	0	47.1 fl oz/3 apps
mefenoxam	Ultra Flourish, Vaunt	4	-	-	-	-	-	-	-	VG ^R	VG	-	2 pt ¹⁰	0	6 pt/3 apps

Chemical Names	Product Choices ²	Mode of Action Group(s) ³	Angular Leaf Spot	Anthraco-nose Crown Rot	Anthraco-nose Fruit Rot	Botrytis Crown Rot	Botrytis Fruit Rot (Gray Mold)	Common Leaf Spot	Leaf Blight	Leather Rot	Phytophthora Crown or Root Rot and Red Stele Root Rot	Powdery Mildew	Rate ⁴	PHI ⁵	Maximum Use ⁶
metalaxyl	Metalaxyl 2E	4	-	-	-	-	-	-	-	VG ^R	VG	-	2 qt ¹⁰	0	6 qt/3 apps
metalaxyl	Xylar FC	4	-	-	-	-	-	-	-	VG ^R	VG	-	1.4 qt ¹⁰	0	4.3 qt
oxathiapoprolin and mefenoxam	Orondis Gold	4, 49	-	-	-	-	-	-	-	-	VG	-	20-62 fl oz	28	124 fl oz
isofetamid	Kenja 400SC	7	-	-	-	-	E	-	-	-	-	GR	13.5-15.5 fl oz	0	54 fl oz
penthiopyrad	Fontelis ¹¹	7	-	F	F	-	E ^R	-	-	-	-	GR	16-24 fl oz	0	72 fl oz
pydiflumetofen and fludioxonil	Miravis Prime	7, 12	-	G	G	VG	E	-	-	-	-	E	9.1 - 13.4 fl oz (11.4 – 13.4 fl oz for anthracnose)	0	26.8 fl oz
pyrimethanil	Scala SC	9	-	-	-	-	G ^R	-	-	-	-	-	18 fl oz (9-18 fl oz if tank mixed with other product for grey mold)	1	54 fl oz
cyprodinil and fludioxonil	Switch 62.5 WG	9, 12	-	G	G	VG	E	F	F	-	-	-	11-14 oz (5-8 oz/100 gal for dip)	0	56 oz
azoxystrobin	Abound Flowable, others	11	-	G ^R	E ^R	-	F ^R	F	-	VG	-	E ^R	6.0-15.5 fl oz (5-8 fl oz/100 gal for dip)	0	see label
pyraclostrobin	Cabrio EG	11	-	G ^R	E ^R	-	F ^R	F	-	VG	-	E ^R	12-14 oz	0	70 oz
trifloxystrobin	Flint Extra	11	-	G ^R	E ^R	-	F ^R	F	-	VG	-	E ^R	2.5-3 fl oz	0	18 fl oz
azoxystrobin and difenoconazole	Quadris Top	11, 3	-	G ^R	E ^R	-	F ^R	G	-	F	-	E ^R	12-14 fl oz	0	56 fl oz
azoxystrobin and propiconazole	Quilt Xcel, others	11, 3	-	G ^R	E ^R	-	F ^R	-	-	-	-	E ^R	14 fl oz	0	4 apps
pyraclostrobin and boscalid	Pristine	11, 7	-	G ^R	E ^R	-	G ^R	VG	VG	-	-	E ^R	18.5-23 oz	0	115 oz
pyraclostrobin and fluxapyroxad	Merivon	11, 7	-	G ^R	E ^R	-	E ^R	VG	VG	-	-	E ^R	see label (varies by disease)	0	3 apps

Chemical Names	Product Choices ²	Mode of Action Group(s) ³	Angular Leaf Spot	Anthrachnose Crown Rot	Anthrachnose Fruit Rot	Botrytis Crown Rot	Botrytis Fruit Rot (Gray Mold)	Common Leaf Spot	Leaf Blight	Leather Rot	Phytophthora Crown or Root Rot and Red Stele Root Rot	Powdery Mildew	Rate ⁴	PHI ⁵	Maximum Use ⁶
trifloxystrobin and fluopyram	Luna Sensation	11, 7	-	G ^R	E ^R	-	E ^R	VG	VG	-	-	E ^R	4-7.6 fl oz (6-7.6 fl oz for gray mold; 7.6 fl oz for Rhizopus fruit rot and Mycosphaerella leaf spot)	0	27.1 fl oz
quinoxifen	Quintec	13	-	-	-	-	-	-	-	-	-	E	4-6 fl oz	1	4 apps
fenhexamid	Elevate 50WDG	17	-	-	-	-	E ^R	-	-	-	-	-	1.5 lb ⁹	0	6 lb
polyoxin D zinc salt	Ph-D	19	-	-	F	-	G	-	-	-	-	-	6.2 oz	0	6 apps
polyoxin D zinc salt	OSO 5%SC ^{OG}	19	-	-	F	-	G	-	-	-	-	-	6.5 – 13.0 fl oz	0	78 fl oz

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

¹

Efficacy Rating	Abbreviation
Excellent	E
Very Good	VG
Good	G
Fair	F
Poor	P
Resistant	R
Not Effective	-

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,
- = indicates that the chemical is not expected to be effective for managing the disease or that data is lacking.

Actual performance may vary. 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.

² 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.

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

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

⁵ 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.

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

⁷ Make sure to get the Aliette WDG that is labeled for use on strawberries. There is a product of the same name that is not labeled for strawberries.

⁸ Do not apply more than 3.75 lb product per acre per application in Livingston or Rapides parishes.

⁹ "When plastic mulch is used, do not apply within 16 feet...of naturally vegetated or aquatic areas."

¹⁰ When the product is applied through drip irrigation equipment, adjust the rate according to label instructions for banded applications.

¹¹ Do not apply to cvs. 'Clancy,' 'Jewel,' or 'L'Amour.'

¹² See labels for restrictions and recommendations regarding use at high temperatures and within given time periods before or after oil applications.

¹³ Five applications per year of Thiram SC are allowed in locations west of the Mississippi River, and 12 applications per year are allowed east of the Mississippi River.

The strawberry section was revised October 2023 by Mary Helen Ferguson.